

**Sources of Export Earnings Instability in
Yemen: An Econometrical Study**



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1. Introduction

Instability of export earnings has been a major problem for the economies of less developed countries (LDCs), as it has a number of potentially detrimental effects to economic stability, growth and development. In addition to the generation of uncertainty in the planning process and the decision making of different economic agents, these effects can take place via impairing import capacity, government revenue and expenditure, level and efficiency of investments, balance of payments position, and level and distribution of income¹.

Despite the fact that export earnings instability problem faced both LDCs and developed countries (DCs), there has been a widely held view that LDCs are subject to greater degree of instability than are DCs due to several structural characteristics of their economies such as, the heavy dependence on producing and exporting a limited range of products of primary nature. The prices of these products are volatile and unpredictable due to several factors, amongst which, their poor elasticities of demand and supply. Moreover, a large number of uncontrollable factors appear to affect both demand and supply of these products which causes their markets to be unstable. Consequently, LDCs try to tackle the problem of export earnings instability. DCs as well appear to have interests in reducing instability in prices, quantities, and thus export earnings of LDCs exports, as it causes disturbances in the supply of raw materials and the demand for exports from DCs².

Several studies investigated the causes or sources of export earnings instability in LDCs since the 1960s. In doing so, commodity and geographic concentration of exports, and the specialization in exporting primary products had received most attention.

As will be seen later, the results of the pioneering empirical cross-country studies,

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- (1) Several empirical studies found evidence on these adverse effects of export instability. See, for example: Alfred Maizels, «Export Instability and Economic Development: A Review,» *American Economic Review*, vol. 58, no. 3 (June 1968), pp. 575-580; Constantine Glezakos, «Export Instability and Economic Growth: A Statistical Verification,» *Economic Development and Cultural Change*, vol. 21, no. 4 (July 1973), pp. 670-673; Kwabena Gyimah-Brempong, «Export Instability and Economic Growth in Sub-Saharan Africa,» *Economic Development and Cultural Change*, vol. 39, no.4 (July 1991), pp. 815-828; Teame Ghirmay, Subhash C. Sharma, and Richard Grabowski, «Export Instability, Income Terms of Trade Instability and Growth: Causal Analysis,» *Journal of International Trade and Development*, vol. 8, no. 2 (1999), pp. 209-229, and Dipendra Sinha, «Effects of Volatility of Exports in the Philippines and Thailand,» Munich Personal RePEc Archive (MPRA), Paper no. 2563 (2007), < <http://mpr.a.uni-muenchen.de/2563/> > .
 - (2) The concern over LDCs export instability from the part of developed countries and multinational organizations resulted in some arrangements and schemes, which mostly said to be insufficient, such as the IMF's Compensatory Financing Facility (CFF) which was introduced in 1963 and adjusted in 1988 and 2000, and the System for Stabilization of Export Earnings (STABEX) which the European Community introduced in 1975 to African, Caribbean, and Pacific countries in case of shortfalls of exports due to swings in export prices or domestic supplies of primary commodities. For elaborated review and evaluation of these systems and others, See: Jayant Parimal, *Rethinking Policy Options for Export Earnings*, South Centre Research Paper, no.5 (Geneva: South Centre Research, 2006), and Adrian Hewitt, «Compensatory Finance: Options for Tackling the Commodity Price Problem,» iisd2010 (November 2007), < <http://www.iisd.org/PUBLICATIONS/pub.aspx?id=913> > .

in the 1960s and 1970s, regarding the relationship between export earnings instability and its sources, in particular commodity concentration, were inconclusive as some revealed evidence that support the assumed theoretical positive effects and others concluded the opposite. These contradicted results induced attempts for identifying the limitations of the analytical framework used, particularly the reliance on cross-country studies and thus, the generalization of their results to the individual-country level for policy formulation purposes. First of all, it is recognized that the arguments concerning the relationship between export instability and its sources such as commodity and geographic concentration, are formulated at the level of individual country³. Second, these studies suffer from some shortcomings concerning the identification and estimation of export earnings instability and the independent variables (sources of instability). For instance, export instability indexes were calculated as a summary statistic of deviation from trend over some period of time whereas, explanatory variables (sources of instability) were calculated for an arbitrary chosen year. Therefore, the results are influenced by the period upon which the instability index based, the arbitrary chosen year for the independent variables, and the particular sample chosen. Moreover, the inclusion of an unusual case may distort the result of the whole sample⁴. Accordingly, to judge the effects and importance of various sources of export earnings instability, taking into consideration the peculiarities of each economy, country-specific studies or time series analysis is perceived to be the best alternative. Accordingly, from the 1980s until today focus has been altered towards investigating export earnings instability at the individual-country level.

As one of the least developed economies, Yemen encounters a serious problem of export instability, which may find its origin in the narrow and weak export base dominated by oil exports (represent more than 90% of total commodity export earnings). The sharp and persistent swings in the world market prices of oil substantially affect the government revenue and expenditure and thus, aggregate consumption, investment, demand and output of the economy. Furthermore, the unsustainable position of the balance of payments and the continuous pressures on the Yemeni Rial's value are intensified with the fluctuations of export earnings.

Besides the absence of any published study that measures the instability of export earnings in Yemen and econometrically examines its sources, this study comes at a critical time during which the adverse consequences of the declining export earnings, caused by the collapse of oil prices due to the current world crisis, are increasingly deepened. As a response to the fall down of oil revenue, the government decided to cut all kinds of public expenditure, except salaries and wages, during 2009 by 50% of what was already planned.

In addition to measuring the instability of export earnings and export concentra-

(3) James Love, «Export Instability: An Alternative Analysis of Causes,» *Journal of Development Studies*, vol. 21, no. 2 (January 1985), pp. 244-252.

(4) *Ibid.*, p. 245.

tion in Yemen, the main objective of this study is to examine the relationship between export earnings instability and its potential sources. The study employs regression analysis in estimating and testing the relationship between export earnings instability and the likely sources.

For the study to achieve its objective, it is organized as follows: section 2 gives a brief overview of Yemen economy and its export structure, and section 3 introduces the meaning and measurement of export instability. The intuitively well-argued sources of export earnings instability that have been investigated by different economists will be introduced in section 4. Section 5, however, investigates the effects of different sources on export instability in Yemen. Finally, section 6 offers some concluding remarks.

2. Overview of Yemen Economy and its Commodity Export Structure

As a least developed economy, Yemen has been struggling with several structural handicaps and bottlenecks amongst which, the weak and inflexible productive capacity (agricultural, manufacturing, and service). Oil and gas sector dominates the whole economic activity as a GDP generator, a source of government finance, and a contributor to total exports. On average, agriculture, oil and gas, manufacturing sectors contributed by 12.4%, 32.6%, and 6.7% of GDP respectively over the period 2000-2006⁵. As against this, the growing aggregate demand pressures, fueled by the high population growth, render the country, with some exceptions, a net importer of different types of goods and services. On average, oil and gas sector provided the government budget with 69.3% of total public revenues and grants during 2000-2006 period and the government expenditure reached 32.76 % of GDP for the same period⁶. The weak and narrow productive capacity of various sectors, especially manufacturing one, means a very narrow and limited base of exports. Mineral fuels exports (crude oil and fuel products) represented, as revealed by table (1), 92.32 % of total commodity export earnings per year over 2000-2006. Manufactures⁷ exports (chemicals and manufactures), however, has not reached more than 1.88 % of total commodity export earnings. This tiny share of manufactures exports takes the form of simple products such as biscuits, beverages, plastic products, and cleaning materials. Food and beverages and crude materials (almost agriculture) averaged 4.72 % during the same period. It has to be pointed out that the domination of oil in export structure reflects the weak and inflexible productive capacity more than being a result of abundant oil wealth⁸.

(5) See: Appendix table (1).

(6) See: Appendix table (1).

(7) Machinery and transports exports were not included as manufactures exports since they are merely reexports and therefore, they don't reflect the productive capabilities of the economy.

(8) Yemen is considered as a minor producer in oil market with an estimated proven reserve and production of 0.6 % and 1.8 % respectively of the Middle East total. This limited proven reserve and the non appearance of substantial new discoveries caused production to start declining after 2001. According to the available information, the proven reserve can be exhausted, with a very low production scenario, during 2017-2019 =

Consequently, export earnings in the economy depend heavily on the price movements of oil and the fluctuation of oil output and thus export quantities.

Table (1)
Commodity Exports structure by SITC 2000-2006

year	2000	2001	2002	2003	2004	2005	2006	average
Food & beverages	2.04	3.15	4.98	4.38	5.34	4.31	4.3	4.07
Crude materials	0.57	0.64	0.84	0.85	0.8	0.33	0.49	0.64
Mineral fuels	96.51	95.13	90.5	90.32	90.25	92.04	91.48	92.31
Chemicals	0.28	0.28	0.32	0.31	0.38	0.37	0.37	0.34
Machinery & transp	0.27	0.39	2.23	2.24	1.59	1.85	2.28	1.55
Manufactures	0.33	0.41	1.13	1.54	1.49	0.54	0.65	0.87
Others	0	0	0	0.36	0.15	0.56	0.43	0.22
Total	100	100	100	100	100	100	100	100

Sources: Arab Monetary Fund (AMF), «Foreign Trade Statistics,» different tables, < <http://www.amf.org.ae> > .

3. Export Instability: Meaning and Measurement

Export earnings instability of a country refers to the degree of the short-run, year-to-year, fluctuations in its export earnings. It is usually expressed as an index of deviations from a time trend in view of the fact that the total change over time of any variable can be divided into two forces : long-run forces, which determine the trend, and short-run forces which determine fluctuations around the trend. Thus, measuring instability around the trend separates the two forces and, in consequence, allows capturing the degree of export earnings instability.

The empirical studies done by various economists used a number of statistical indexes of export instability but, the most widely used, especially in the time-series studies, is the absolute percentage deviation from a trend value expressed as follows:

$$I_t = \left| \frac{E_t - \hat{E}_t}{\hat{E}_t} \right|$$

where I_t is the index of export earnings instability in year t , E_t stands for actual value of commodity exports in year t , and \hat{E}_t is the estimated value of commodity exports in year t . Several types of functional forms (linear, polynomial, or exponential) for estimating the trend can be chosen according to theoretical and empirical reasons.

= unless new significant discoveries take place. See: International Monetary Fund (IMF): *Republic of Yemen: From Unification to Reform*, Occasional Paper; no. 208 (Washington, DC: IMF, 2002), and *Republic of Yemen: Statistical Appendix*, Country Report; no. 05/110 (Washington DC: IMF, 2005).

4. Theoretical and Empirical review of Export Instability Sources

The conventional hypothesized sources of export earnings instability either in cross-country or individual-country studies are commodity and geographic concentration and the specialization in exporting primary products⁹. Some other factors usually added in single-country studies to reflect the specific characteristics of each case.

A - Commodity Concentration

Commodity concentration in exports refers to the tendency of a country's exports to be a limited range of products. Usually this concentration reflects limited production capabilities. Commodity concentration is measured by an index called the Gini-Hirschman coefficient of commodity concentration which calculated using the following formula:

$$C_t = 100 \sqrt{\sum_{i=1}^n \left[\frac{X_{it}}{X_t} \right]^2}$$

where C_t is the coefficient of commodity concentration of exports in year t expressed in percentage form, X_{it} is the value of exports of commodity i in year t , X_t is the total export earnings for the same year, and n is the number of commodities. The smaller the number of commodities exported the larger (near 100) will the value of the coefficient of commodity concentration be.

It is commonly argued that concentration of a country's exports on a small number of products increases the instability of its export earnings. This is to say, the export earnings of a country tend to be more stable, the larger the number of commodities it exports. This is because, the more the export base is diversified, the more the chances for the fluctuations in individual commodity exports to offset one another and thus generate more stability in total export earnings.

As earlier mentioned, the results of the empirical cross-country studies concerning the relationship between commodity concentration and export earnings instability were not conclusive. Studies like those of Michaely, Massell, Knudsen and Parnes, Sheehy, and Brundell, Horn and Svedberg found a significant positive effect of commodity concentration on export earnings instability¹⁰. On the other hand, studies like those done by

(9) Cross-country studies examined other factors that possibly differentiate between groups of countries such as, the level of economic development, the economic size, and the openness of the foreign trade system. for example, See: Joseph David Coppock, *International Economic Instability: The Experience after World War II*, Economics handbook series (New York: MacGraw-Hill, 1962), and Michael Michaely, *Concentration in International Trade*, Contributions to economic analysis; 28 (Amsterdam: North Holland Publishing Company, 1962).

(10) Michaely, Ibid., Benton F. Massell, «Export Instability and Economic Structure,» *American Economic Review*, vol. 60, no. 4 (September 1970), pp. 618-630; Odin Knudsen and Andrew Parnes, *Trade Instability and Economic Development: an Empirical Study* (Lexington, Mass.: Lexington Books, 1975); Edmund Sheehy, «Levels and Sources of Export Instability: Some Recent Evidence,» *Kyklos*, vol. 30, no. 2 (1977), pp. 319-324, and Peter Brundell, Henrik Horn and Peter Svedberg, «On the Causes of Instability in Export Earnings,» *Oxford Bulletin of Economics and Statistics*, vol. 43, no. 3 (August 1981), pp. 301-313.

Coppock, MacBean, Kingston, and Naya concluded that there is no significant effect or correlation between commodity concentration and export instability¹¹.

Attempts were made, as already pointed out, to explain these contradicted results, and as a result attention has been altered towards individual-country studies. Tahir examined the effects of commodity and geographic concentration on export earnings of Jordan for the period 1959-1979 and found no significant effect of commodity concentration on export earnings instability¹². Sources of export earnings instability in Pakistan, during the period from 1960-1970 through 1990-1991, were studied by Tariq and Najeeb, and their analysis showed a significant positive effect for commodity concentration on export instability at the 5% level¹³. Another study, by Asheghian and Saidi (1999), devoted to the causes of export earnings instability in Venezuela over the period of 1975-1996, supported the assumed positive effect of commodity concentration on export instability at 7% level¹⁴. The case of Nepal, studied by Devkota, confirmed the significant positive effect of commodity concentration at 2.7% level¹⁵.

B - Geographic (Market) Concentration

The second assumed source of export earnings instability in LDCs is the geographic concentration of their exports. It refers to the degree of concentration of a country's exports on different destinations to which commodities are exported. In addition to the concentration of LDCs exports in few commodities of primary nature, it is widely believed that these countries also have a tendency to regionally concentrate their exports to certain destinations. The index of geographic concentration is similar to that of commodity concentration (Gini-Hirschman coefficient) as follows:

$$G_t = 100 \sqrt{\sum_{j=1}^n \left[\frac{X_{jt}}{X_t} \right]^2}$$

where G_t is the coefficient of geographic concentration in year t expressed in percentage form, X_{jt} is the value of exports to the country or region j in year t, X_t is the to-

(11) Coppock, Ibid.; Benton F. Massell, «Export Concentration and Fluctuations in Export Earnings,» *American Economic Review*, vol. 54, no. 2 (March 1964), pp. 47-63; Alasdair I. MacBean, *Export Instability and Economic Development*, foreword by Professor Edward Mason, Social and Economic Studies; 9, and University of Glasgow social and economic studies; 9 (London: George Allen and Unwin, 1966); Jerry L. Kingston, «Export Instability in Latin America: The Postwar Statistical Record,» *Journal of Developing Areas*, vol. 7, no. 3 (April 1973), pp. 381-395, and Seiji Naya, «Fluctuations in Export Earnings and Economic Patterns of Asian Countries,» *Economic Development and Cultural Change*, vol. 21, no. 4 (1973), pp. 629-640.

(12) Jamil M. Tahir, «Concentration of Exports and Export Earnings Instability: The Case of Jordan,» *Studies in Economic Analysis*, vol. 9, no. 1 (Spring 1985), pp. 65-81.

(13) Ahmed Tariq and Qazi Najeeb, «Export Earnings Instability in Pakistan,» *Pakistan Development Review*, vol. 34, no. 4 (Winter 1995), pp. 1181-1189.

(14) Parviz Asheghian and Reza Saidi, «Commodity Concentration and Export Earning Instability: The Case of Venezuela,» *Development Policy Review*, vol. 17 (December 1999), pp. 419-427.

(15) Satis Chandra Devkota, «Causes of Export Instability in Nepal,» *Economic Journal of Nepal*, vol. 26, no. 1 (2003), pp. 55-67, < <http://129.3.20.41/eps/it/papers/410/410002.pdf> > .

tal value of exports to the world during the same year, and n is the number of countries or regions.

A high degree of geographic concentration of a country's exports is commonly considered to be a source of greater instability in its export earnings. This can be attributed to the fact that fluctuations in demand within one importing country will have a greater impact than if the exports were more diversified among importing countries. In other words, the export earnings of the country will depend on economic and non economic conditions in one or few countries.

Generally, most empirical studies failed to support the above mentioned hypothesis. In his prominent study of economic instability in 78 countries, Coppock showed that correlation between geographic concentration and export instability was low with a wrong sign (negative)¹⁶. Massell, in his study on 36 countries, found a similar result, i.e., insignificant effect at 5% level with a negative sign for the regression coefficient¹⁷. In a later study which covered 55 countries, Massell reached similar results but, with a positive sign and thus, concluded that geographic concentration is unimportant as an explanatory variable for the variation in export instability index¹⁸. Brundell, Horn, and Svedberg examined the data of 139 countries for the 1970s and found insignificant positive effect of geographic concentration at 5% level¹⁹. At the level of single-country studies, Leith investigated the relationship between export concentration and export instability in Ghana and found that geographic concentration and export earnings instability were not significantly correlated²⁰. On the other hand, Tahir found a positive significant effect from geographic concentration on export instability in Jordan²¹. Tariq and Njeeb found apposite but, insignificant effect of geographic concentration on export instability in Pakistan²². In the case of Nepal, geographic concentration found to be of positive but, insignificant effect at 10% level in one regression and a positive and significant in the other²³.

C - Specialization in Primary Products

The general assertion here is that LDCs experience greater instability in their export earnings due to their specialization in exporting primary products of low price and income elasticities of demand and supply. Therefore, changing export composi-

(16) Coppock, *International Economic Instability: The Experience after World War II*.

(17) Massell, «Export Concentration and Fluctuations in Export Earnings».

(18) Ibid.

(19) Brundell, Horn and Svedberg, «On the Causes of Instability in Export Earnings».

(20) J. Clark Leith, «Export Concentration and Instability: The Case of Ghana» *Economic Bulletin of Ghana*, vol. 1, no. 1 (1971), pp. 45- 55, < <http://www.eb.scohost.com> > .

(21) Tahir, «Concentration of Exports and Export Earnings Instability: The Case of Jordan».

(22) Tariq and Najeeb, «Export Earnings Instability in Pakistan».

(23) In the second regression the instability index of the agricultural production was removed compared with the first regression. See: Devkota, «Causes of Export Instability in Nepal».

tion towards manufactures would help alleviating this instability. However, some economists contend that it is not exporting primary products per se that gives rise to higher degrees of export instability in these countries but rather exporting the more volatile primary products²⁴. Consequently, among primary products, it is often distinguished between food exports and raw material exports and argued that food exports experience less instability compared with raw material exports since they are relatively inelastic income in the short-run²⁵. In his study, Massell found that the regression coefficient of the proportion of export earnings derived from food exports is highly significant but with a negative sign, and that of the raw material export earnings is insignificant, which led him to conclude that «there is no tendency for primary product to be more unstable than manufactures»²⁶.

This conclusion is opposite to that of his earlier study and that of MacBean which found a significant positive relationship between the ratio of primary products earnings to total export earnings and export earnings instability²⁷. The already mentioned single-country studies related to Jordan, by Tahir, and Pakistan, by Tariq and Najeeb, found no significant effect of primary products ratio on export earnings instability²⁸.

5- Empirical Evidence

A - Model and Data

$$I = \beta_0 + \beta_1 C + \beta_2 G + \beta_3 R_p + \beta_4 P + \epsilon$$

The above linear multiple regression model can be considered as a general model used for investigating sources of export earnings instability in single-country studies. Where I is the index of export instability, C is the coefficient of commodity concentration, G is the coefficient of geographic or market concentration, R_p is the ratio of primary export earnings to total export earnings, P is the level of domestic prices, and ϵ is error term. Some other variables may be added, such as R_m (ratio of manufactures exports), or R_{ex} (real exchange rate) depending on the exports nature and composition in the country under consideration. Sometimes variables like R_p is introduced in various ways such as breaking it down into R_r (ratio of raw material exports) and R_f (ratio of food exports).

The model used in the empirical analysis regarding the case of Yemen is as follows:

$$(1) I_t = \beta_0 + \beta_1 C_t + \beta_2 G_t + \beta_3 I_{ot} + \beta_4 I_{ag} + \epsilon$$

where I_t represents the index of export instability which was measured, for the

(24) See: Knudsen and Parnes, *Trade Instability and Economic Development: an Empirical Study*, p. 21.

(25) Massell, «Export Concentration and Fluctuations in Export Earnings», p. 627.

(26) Ibid, p. 628.

(27) Ibid., and MacBean, *Export Instability and Economic Development*.

(28) Tahir, «Concentration of Exports and Export Earnings Instability: The Case of Jordan».

period 1990-2007, as the absolute percentage deviation of actual values of total commodity export earnings from the estimated values of the same using exponential trend. The justification of using the exponential functional form for trend correction in the case of Yemen is that exponential trend line provides a better fit than the linear trend line. The theoretical justification lies in the believe that «countries tend to plan in terms of the growth rate, not in terms of absolute increments»²⁹. So, first we estimate the following exponential trend regression:

$$\text{Log } E_t = \beta_0 + \beta_1 t + \epsilon$$

and get the following estimation:

$$\text{Log } E_t = 6.81 + 0.11t$$

$$\text{S.E} \quad 0.095 \quad 0.009$$

$$t \quad 71.92 \quad 12.08$$

$$R^2 = 0.96$$

The trend values calculated, thereafter, by taking the antilog of the exponential trend values :

$$\hat{E}_t = \text{antilog}(6.81 + 0.11t).$$

Consequently, the values of I_t for the period 1990-2007, were calculated as shown in appendix table(2).

C_t is the coefficient of commodity concentration measured using an adjusted formula of the Gini-Hirschman coefficient of commodity concentration that was employed by Asheghian and Saidi in their study on Venezuela³⁰. The values of commodity concentration coefficient for the period 1990-2007 are showed in appendix table(2).

G_t is the Gini-Hirschman coefficient of geographic concentration measured by the already mentioned formula³¹. The resulting values of G_t for the period 1990 through 2007 are showed in appendix table (2).

I_{ot} is the instability of oil export earnings to reflect the dominance of oil exports in the composition of commodity exports in Yemen. It is measured as the absolute percentage deviations of actual oil export earnings³², from the estimated

(29) Massell, Ibid., p. 619.

(30) Asheghian and Saidi used the formula $C_t^2 = X_p^2 + X_o^2$ thus, $C_t = \sqrt{X_p^2 + X_o^2}$ where C_t is the coefficient of commodity concentration in year t, X_p is the ratio of oil export earnings to total export earnings, and X_o is the ratio of other export earnings to total export earnings.

(31) G coefficient calculations used the data of the most important 20 importing countries from Yemen during 1990-2007. The Geographic direction of Yemen exports changed after 1995 as the share of oil exports increased substantially and thus, major importers before 1995, such as USA, Italy, and France, became minor importers in the rest of the period in favor of other countries such as China, Thailand, and India.

(32) Data of crude oil exports were used.

values of oil export earnings using exponential trend as follows:

$$I_{ot} = \left| \frac{O_{xt} - \hat{O}_{xt}}{\hat{O}_{xt}} \right|$$

where O_{xt} is the actual value of oil exports in year t , and \hat{O}_{xt} is the estimated value of oil export earnings in the same year using exponential trend. The following exponential trend regression was estimated :

$$\log O_{xt} = \beta_0 + \beta_1 t + \epsilon$$

therefore, we got the following estimation :

$$\log O_{xt} = 6.61 + 0.118t$$

$$\text{S.E} \quad 0.114 \quad 0.011$$

$$t \quad 57.7 \quad 11.19$$

$$R^2 = 0.887$$

\hat{O}_{xt} values were calculated by taking the antilog of the exponential trend values.

The measurements of I_{ot} for the period 1990-2007 are displayed in appendix table (2).

I_{agt} stands for the instability index of real agricultural production as a proxy for the instability index of agriculture export earnings due to the unavailability of consistent and detailed data of agricultural exports for the whole period of study. It is measured as the absolute percentage deviations of actual real agricultural GDP from the estimated values of real agricultural GDP using exponential trend as follows:

$$I_{agt} = \left| \frac{g_t - \hat{g}_t}{\hat{g}_t} \right|$$

where g_t is the actual value of real agricultural production in year t , and \hat{g}_t is the estimated trend value of real agricultural production in year t using exponential trend. The following exponential trend regression was estimated :

$$\log g_t = \beta_0 + \beta_1 t + \epsilon$$

therefore, we got the following estimation :

$$\log g_t = 3.59 + 0.036t$$

$$\text{S.E} \quad 0.027 \quad 0.003$$

$$t \quad 132.2 \quad 14.2$$

$$R^2 = 0.926.$$

After that, the values of I_{agt} were calculated by taking the antilog of the exponential trend values. The measurements of I_{agt} for the period 1990-2007 are presented in appendix table (2).

Annual data covering the period of 1990-2007 were collected from various statistical publications and reports, issued by government agencies in Yemen, and thereafter used to calculate the required data of the dependent and explanatory variables as already explained.

B - Empirical Estimation Results

The results of the above stated regression model are presented in table (2). Estimation was carried out in linear formation. Tests were performed to insure the nonexistence of severe multicollinearity and autocorrelation problems. The high value of R^2 (0.956) suggests that the independent variables in the model have considerable explanatory power to the instability of export earnings in Yemen. All explanatory variables have the expected signs except that of G_t , which is similar to many empirical studies.

T- value is significant for the coefficient of C_t at 9.2 % level which supports the argument that commodity concentration exerts a significant positive effect on export earnings instability in LDCs. The coefficient of I_{ot} is highly significant at less than 1% which indicates the high influence that fluctuations in oil export earnings have upon the instability of total commodity exports in Yemen. Regarding I_{agt} , table (2) shows that its coefficient is significant at 8.7% level which reflects the influence exerted by agricultural export earnings as they represent the second contributor, after oil exports, to the total export earnings.

The negative and insignificant coefficient of G_t can be attributed to the nature of oil marketing, as a major export commodity, which, to some extent, is less dependent on specific markets and its geographic distribution changes over time. To make sure that this negative sign of G_t was not a result of multicollinearity between dependent variables, particularly between C_t and G_t , correlation coefficients between all dependent variables were examined and found to be very weak (-0.03 between C_t and G_t) and collinearity statistics like VIF examined and found to be not more than 1.1 for C_t , G_t , I_{ot} , and I_{ag} . Consequently, the insignificant and unexpected sign of G_t coefficient suggests that G_t seems to be unimportant in explaining the variations in export earnings instability in Yemen. This irrelevance of G_t appeared clearer if we exclude it from the regression model (1) and thus, reestimate the following regression :

Table (2)
Estimation Results of Models (1) and (2)

Variables	Coefficient		Std. Error		t taste value		Sig. level	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	-25.624	-28.120	15.2	14.789	-1.686	-1.901	0.116	0.078
C	0.305	0.300	0.168	0.166	1.821	1.809	0.092	0.092
G	-0.075	-	0.087	-	-0.865	-	0.403	-
I_{ot}	0.828	0.834	0.052	0.051	16.069	16.475	0.000	0.000
I_{agt}	0.378	0.349	0.204	0.199	1.851	1.749	0.087	0.102
Model 1	$R^2 = 0.956$ adjusted $R^2 = 0.942$ F - value = 69.962 F - sig = 0.000 D-W = 1.861 N = 18							
Model 2	$R^2 = 0.953$ adjusted $R^2 = 0.943$ F - value = 94.733 F - sig = 0.000 D-W = 2.010 N = 18							

$$(2) I_t = \beta_0 + \beta_1 C_t + \beta_2 I_{ot} + \beta_3 I_{agt} + \epsilon$$

Estimation results of model (2), as shown in table(2), reveal that removing G_t , has not affected the coefficients' signs of the remaining independent variables, and

very slightly affected the values of regression coefficients, their standard errors, and t- values. Therefore, except that of I_{ag} , the significance levels of the remaining explanatory variables were not affected. Table (2) shows that the regression coefficient of I_{ag} in model (2) became less significant (10.2% level, compared with model (1), or insignificant at 10% level which may replicate the tiny importance of agricultural exports in the structure of exports and thus their influence on the instability of total exports. Interestingly, the overall fit of the regression, expressed in terms of adjusted R^2 , improved slightly from 0.942 to 0.943 after the exclusion of G_t . Model (2) appears free of autocorrelation problem as D-W value (2.01) locates at the acceptance region of the null hypothesis that no positive autocorrelation exists³³.

6 - Concluding Remarks

Appendix Table (1)
Some Economic Indicators, 2000-2006

Year	2000	2001	2002	2003	2004	2005	2006	Average
Agriculture sect %	13.77	14.12	13.34	12.88	11.73	10.55	10.15	12.36
Oil and gas sect %	35.52	31.02	29.91	30.24	30.96	35.61	35.07	32.62
Manufacturing sec %	5.73	6.05	6.39	6.47	7.37	7.13	7.76	6.7
Others %	44.98	48.81	50.36	50.41	49.94	46.71	47.02	48.32
GDP total	100	100	100	100	100	100	100	100
Oil revenue/total revenue	73.61	69.15	67.5	69.77	69.21	73.97	61.89	69.3
Oil revenue/GDP	24.13	20.12	18.17	22.22	22.59	26.25	29.57	23.29
Govt expenditure/GDP	32.19	31.01	30.14	34.06	33	34.92	34.01	32.76

Sources: Central Organization of Statistics: *National Accounts 1990-2006* (Sana'a: Central organization of Statistics, 2007), and *Ministry of Finance*, Bulletin of Government Finance Statistics, no. 2734 (Sana'a: Ministry of finance, 2007 and 2008).

Our analysis of sources of export earnings instability in Yemen shows a positive and significant effect of commodity concentration on export earnings instability. Therefore, besides its urgency from the view point of growth and development, a policy of export diversification towards manufactures seems to be unavoidable if the problem of export earnings instability is to be, at least, mitigated. The doubt that sometimes surrounds the ability of export diversification to reduce export instability in LDCs³⁴, seems to be very weak in Yemen's case due to the fact that a very limited range of primary commodities dominate the composition of export. It follows that despite the insignificance

(33) Model (1) also does not reveal a problem of autocorrelation as its D-W value (1.861) approaches 2 and very near to the acceptance region ($d_l = 0.82$ $d_u = 1.87$).

(34) Among the conditions under which a policy of diversification said to be of little use are: when there is a wide dispersion of instability in the sample of commodities of a country exports, and when the policy of diversification involves increase in the shares of commodities whose export proceeds are highly unstable.

of the geographic concentration of exports as a source of export earnings instability in Yemen, a successful strategy of export diversification towards manufactures in the future may bring about the need for market diversification too. As the analysis shows a highly significant role played by oil export earnings in explaining instability in the total export earnings in Yemen, it confirms the urgent need to diversify the export base away from oil, bearing in mind the fact that Yemen is a price taker in the world oil market and is experiencing a continuous decline in oil production. The extent to which instability in export earnings affects the growth of Yemen economy and disrupts the process of development planning, which might be the subject of a future study, would help weighing the potential cost and benefits of export diversification policy.

Appendix Table (2)
Data for dependent and explanatory variables

Year	I_t	C_t	G_t	I_{ot}	I_{agt}
1990	36	87.89	45.24	44.18	3.27
1991	1.5	85.91	63.51	7.7	6.91
1992	15.7	82.23	40.08	19.08	0.19
1993	18	76.98	32.44	29.92	1.27
1994	12.8	90.27	32.79	20.29	3.33
1995	11.2	88.94	30.07	15.11	1.56
1996	13.5	88.27	35.68	16.48	0.89
1997	2.1	86.74	40.84	1.85	2.11
1998	39.7	83.72	36.8	42.83	10.63
1999	11.1	87.13	41.89	11.9	8.12
2000	22.1	90.11	36.06	24.83	7.16
2001	3.5	87.38	34.31	5.2	5.94
2002	5.6	86.63	34.74	8.78	3.98
2003	10.1	88.93	41.67	10.91	1.69
2004	4.2	92.38	43.75	1.53	2.52
2005	16.9	93.09	42.26	21.01	3.73
2006	19.8	92.37	37.23	21.62	3.61
2007	4.4	87.18	36.11	1.51	9.91

Sources: - I_t , C_t , and I_{ot} calculated based on: Central Bank of Yemen: 2004, *Balance of Payment Reports for 2000 and 2003* (Sana'a: Central Bank of Yemen, 2001 and 2004); Central Bank of Yemen, *Annual Reports for 2005 and 2007* (Sana'a: Central Bank of Yemen, 2006 and 2008).

- G_t Calculation based on: Central Bank of Yemen: *Financial Statistical Bulletin*, vo.7, no.4, (Sana'a: Central Bank of Yemen, 1996), and Central Bank of Yemen, *Financial Statistical Bulletin*, vol. 12, no. 2 (Sana'a: Central Bank of Yemen, 2001); and Central Statistical Organization, *Foreign Trade Statistics for years 2003 and 2007* (Sana'a: Central Statistical Organization, 2004 and 2008).

- I_{agt} Calculation based on: Central organization of Statistics, *National Accounts 1990-2006*, (Sana'a: Central organization of Statistics, 2007), and Central Organization of Statistics, *Statistical Year Book for 2007* (Sana'a: Central Statistical Organization, 2008).