ERAF

Center For Economic Research on Africa
School of Business
Montclair State University
Upper Montclair, New Jersey 07043

Commodity Concentration
and Export Earnings Instability:
Evidence fromAfrican Countries

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Abebe Tegegne
Economic Research Service
U.S. Department of Agriculture
1301 New York Avenue, N.W.
Washington, D.C. 20005-4788

Abstract

Policies to promote diversification from dependence on primary commodity export earnings in developing countries are based on the underlying premise that such dependence is a major contributor to developing country earnings fluctuations. Based on a study of export earnings fluctuations and commodity concentration in 29 African countries for the 1960-1982 period, such policies for commodity diversification may or may not lead to reduced fluctuations in export earnings. Key determinants of export earnings fluctuations include not only commodity concentration, but also the relative importance of a country's major commodity, world-demand conditions affecting the major commodity, internal supply conditions, and the relative effectiveness of various commodity agreements.

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Introduction

A major concern of less developed countries (LDC's) is the problem associated with fluctuations in their export earnings. Export earnings of LDC's depend on only a few number of commodities and their sales are geographicall` concentrated. There has been a widely held view that such commodity and geographic concentration is the major cause for the instability in their export earnings.[1]

The empirical evidence on the relationship between commodity concentration and a\port instability appears inconclusive.[2] However. despite the empirical evidence. the view that commodity concentration results in export earnings instability still persists among policy makers as evidenced by their export diversification efforts and it is also a familiar argument in international forums on trade [Adams and Behrman, 1982, p. 6].

This paper tries to give a possible explanation for the lack of positive association between export earnings instability and commodity concentration in the earlier empirical studies and shows that while commodity concentration does not necessarily lead to export instability, under some conditions there can be a positive and strong association between them. In particular, it is concluded that for those countries for which the major commodity disportionately contributes to the instability of total export receipts, there is a positive association between concentration and export earnings instability. The contribution of the major export to instability of export earnings depends on the relative instability of the major commodity and on the correlation between the year-to-year fluctuations about their trends of the major export commodity and other export items consistituting the total export. The conclusion is supported by empirical evidences using data from twenty-nine African countries.

The Model

Following the tradition in this area of research. a cross-county regression analysis where an instability index is regressed on some index of concentration and some other explanatory variables is employed. In all of the studies concerned with commodity concentration and instability, instability is measured as deviations from the trend. Measuring the instability around the trend is necessary to separate export growth over the period as a whole from year-to-year deviations from the growth path, the latter constituting instability.[3]

The most widely used measure of commodity concentration is the Gini-Hirschman coefficient which defines the degree of concentration in a country's exports as:

$$G = \sqrt{\sum_{j=1}^{n} (\frac{X_{jt}}{X_t})2} \qquad (1)$$

where $X_{j,t}$ is the value of exports of commodity j in year t and X, is total export receipts in that year. One problem that arises is that while any of the instability indices gives one summary statistic as an index of instability over the sample period, the Gini-Hirschman index of commodity concentration uses a one-year data to give the index. Thus, the choice of the year used to compute the concentration index may influence the results, especially if the country has diversified its exports over the sample period. In this study, Gini-Hirschman index for each year in the sample is computed and the average of the series of coefficients is taken to be the index of concentration.

In this section, we will show that commodity concentration does not necessarily result in export earnings instability. Suppose a country's total export earnings come from two commodities: a major commodity and a minor commodity.[4] The major commodity is the commodity whose share in total export earnings is the highest.

Let X_t, X_{1t}, and X_{2t}, represent earnings from total exports, the major commodity and the minor commodity, respectively. The trend-corrected coefficient of variation can be computed as follows. By definition $X_t = X_{1t} + X_{2t}$. Let x_t, x_{1t} and x_{2t} denote the deviations from a linear trend of total exports earnings, export earnings from the major export and earnings from the minor export, respectively. Then $x_t = x_{1t} + x_{2t.}$ The variance of the deviations of total export earnings from its trend can be written as:

$$\text{Var} (x_t) = \text{Var} (x_{1t}) + \text{Var} (x_{2t}) + 2\,\text{COV}(x_{1t}, x_{2t});$$

or $\qquad \sigma^2 = \sigma_1^2 + \sigma_2^2 + 2\sigma_{12} \qquad (2)$

The trend-corrected coefficient of variation can be expresses as:

$$\text{C.V} = (\frac{\sigma^2}{\overline{X}})^{1/2} = (\frac{\sigma_1^2}{\overline{X}^2} + \frac{\sigma_2^2}{\overline{X}^2} + \frac{2\sigma_{12}}{\overline{X}^2})^{1/2} \qquad (3)$$

where $\overline{X} = \dfrac{X_t}{T}$; T is the sample size. Let $\overline{X}_1 = \dfrac{X_{1t}}{T}$; and $\overline{X}_2 = \dfrac{X_{2t}}{T}$, then equation (3) can be written as:

$$I = (C.V)^2 = \frac{2}{\overline{X}^2} = [(\frac{1}{\overline{X}_1})^2 \ ?W_1^2 + (\frac{2}{\overline{X}_2}) \ ?W_2^2 + 2W_1W_2 \ _1 \ _2 \qquad (4)$$

where $W_1 = \dfrac{\overline{X}_1}{\overline{X}}$ and $W_2 = \dfrac{\overline{X}_2}{\overline{X}}$ are the weights (shares) of the major and the minor exports; is the correlation coefficient between x_{1t} and x_{2t}; I is a measure of instability of total earnings.

It is clear from equation (4) that the instability of each export commodity, the shares of the individual commodity in total exports (Wi), and the correlation between the deviations of the export commodities from their trends. p. If the fluctuations of the major commodity and the minor commodity from their trends are in opposite directions (p < 0: i.e. offsetting fluctuations). then total export shows relatively smaller fluctuations and the instability index, I. will have a smaller value. However, if p> 0 (the deviations from their trends of the major and minor exports move in phases rather than offsetting each other). the fluctuations of total export earnings would be large and I. the instability index. will have a larse value.

Thus the instability index for total export earnings depends not only on the share of the major export item in total exports. but also on the instability of the major export about its trend, among other things. A country can have a higher commodity concentration (as measured by Gini-Hirschman index) and have smaller instability index than another if its major export is relatively stable.

Countries differ in the demand-and-supply conditions affecting the major commodity. the effectiveness of trade agreements which affect the stability of the major export, the degree to which the major and the minor export item fluctuate about their trends, and the correlation between these fluctuations. These differences mean that greater concentration need not necessarily be associated with greater instability. If these differences are not accounted for in a cross-country regression model the results might not show any positive relationship between instability and concentration. This could be one explanation for the lack of strong association between the two in most of the earlier studies on the subject.

The above argument implies that if the contribution of the major export to total export instability is larger than its share in total exports, then concentration results in higher instability. From equation (4), the contribution of the major export to instability in total exports earnings can be computed as:

$$C = (\frac{1}{\overline{X}_1})^2 W_1^{\ 2} + W_1 W_2 \quad _1 \quad _2 \qquad (5)$$

Following Love (1979), the proportional contribution of the major export to instability (proportional contribution statistic) may be computed as:

$$P = \frac{C}{I} \qquad (6)$$

where C and I are as defined in equations (4) and (5) respectively. The case for diversification rests on the argument that the major export may contribute disproportionately to the fluctuations in total exports earnings. Thus we compute the percentage:

$$R = \frac{P}{W_1} \quad 100 \qquad (7)$$

while P is as defined in (6) and W_1, is the share of the major export in total export earnings. If R is small (< 100), then the country is able to achieve greater stability by exporting larger amounts of the major commodity. rather than diversifying its exports to larger number of commodities. That is, ereater stability is associated with concentration. On the other hand. if R is large (> 100, i.e.. earnings from the major commodity are highly volatile), commodity concentration leads to instabilitv and diversification of export offers prospect of lower export earnings instability. This observation points to the need to examine fluctuations in the major export on an individual country basis or should cross-country analysis be employed, differences in the stability of the major exports be accounted for. In the section that follows. we test these propositions with data drawn from a sample of African countries.

Empirical Results

The sample contains twenty-nine African countries for the period 1960-1982.[5] Commodity concentration is measured by the GiniHirschman index as given by equation (1)[6] and instability is measured as deviations from the exponential trend.[7]

In order to examine the contribution of the major export commodity to total instability of export earnings, the total export for each country is decomposed in receipts from the major commodity and from the minor commodities (total export receipts minus receipts from the major export). Equation (8) (see footnote 7) is run for each country for

receipts from total export, the major export and the minor export and the instability indices for each variable is computed. Using the results from these regressions and equations (4) and (5). the contribution of the major export to total export instability is computed.

Table 1 shows the ratio of the proportional contribution statistic (P) to the major export share (W_1), R. for each country in the sample. Inspection of the table shows that for seventeen of the twenty-nine countries the major export disproportionately contributes to the instability of the export earnings of these countries. For these countries there seems to be a positive association between concentration and instability. On the other hand, for the remaining twelve countries. the major exports are relatively stable and contribute. in relation to their share in total export earnings. less to overall instability of export earnings. For this latter group of countries. there does not seem to be strong positive association between concentration and instability and. therefore, diversification of exports may not lead to more stability.

Table 2
Ratio of Proportional Contribution Statistic
to Export Share of the Major Commodity

Country	R	Country	R
Cameroon	87.80	Mauritius	101.50
Cent. Afr. Rep.	98.21	Morocco	178.34
Chad	146.66	Nigeria	109.46
Congo	16.56	Reunion	112.67
Egypt	22.60	Senegal	208.04
Ethiopia	124.46	Sierra-Leone	115.49
Gabon	157.84	Somalia	59.85
Gambia	78.07	Sudan	232.62
Ghana	104.83	Tanzania	466.30
Cote d' Ivoire	152.81	Togo	42.10
Kenya	147.78	Tunisia	61.06
Liberia	171.16	Uganda	93.61
Madagascar	165.23	Zaire	99.01
Malawi	85.19	Zambia	106.75
Mali	93.40		

In a sample of countries in which there are vast differences in the contribution of the major export commodity to instability, a cross-country regression analysis may not show any positive association between concentration and instability. Therefore, the regression:

$$I_j = {}_0 + {}_1 C_j + {}_2 G_j + e_j \tag{9}$$

where I, C, and G are instability index for total exports, proportional contribution statistic (equation 5), and concentration index (equation 11 is estimated for three sets of samples: (1) the whole sample of 29 countries: (2) a sample of 17 countries for which R > 100: and (3) the remaining 12 countries for which R < 100. The results are reported in table 2.

Lines 1, 2 and 3 of table 2 show the results of equation (9) for the sample of 29, 17 and 12 countries, respectively. As can be seen from table 2, the results of lines 1 and 3 are quite similar - in both cases the coefficient of G is not significant and C and G account for about 20% of the variation in instability indices. On the other hand, in line 2, $\overline{R}^2 = .80$ and the coefficient of G is significant at _ = 5%; i.e.. for this group, there is evidence for a strong and positive association between commodity concentration and instability.

Although in 17 of the 29 countries there is evidence of significant positive association between concentration and instability, the positive correlation for these countries is obscured in the regression consisting of the whole sample of 29 countries. The implication of line 1, the results for the whole sample, is similar to the results reported in the studies cited earlier where small or no association are reported between commodity concentration and instability. Thus, the observed weak or no positive correlation in empirical studies between commodity concentration and instability could be due to the particular procedure followed to measure the indices and their relationship rather than inherent absence of positive association between the two.

Conclusion

Although there seems to be a consensus among policy makers of LDC's that the fluctuations in their export earnings is due to their dependence on only a small number of primary commodities, many empirical studies have tailed to show strong correlation between the two. Previous empirical studies have employed cross-country regressions analysis where an index of instability is regressed on concentration index and some other variables. In this paper we argue that countries differ in the relative importance of the major commodity, the world-demand conditions affecting the major commodity, the internal supply conditions, the relative effectiveness of various commodity agreements.

etc, which intern affect the relation between concentration and instability. Thus, to investigate the relationship between commodity concentration and instability, one has to look into not only the share of the major product in total exports but also in the relative stability of the major product and to covariance with other export items. The empirical results reported in table 2 support this argument.

Two implications of this paper deserve mentioning. First, the efforts of policy makers to diversify exports could be misguided unless consideration is also given as to how the various commodities fluctuate about their trends and to the relationship in these fluctuations. If a country tries to diversify its exports into many commodities whose fluctuations move in phases, total export instability may actually increase rather than decrease." Second, since countries differ in the stability of the major product and the factor affecting its stability, empirical cross-country regression analysis may not show the true picture unless the analysis is made to capture these differences. Focusing the analysis on individual country basis is one way to tackle the problem; the procedure followed in this paper could be an alternative route.

Table 2
Regression Explaining Export Earnings Instability
(t-statistics in Parenthesis)

Line	Intercept	C	G	$\overline{R}^2$	DW	T
1	.0045	.68	.00036	.22	2.06	29
	(2.65)	(3.03)	(1.08)			
2	.0019	.69	.0015	.82	1.94	17
	(2.66)	(7.80)	(2.12)			
3	.0018	.66	.00028	.20	1.88	12
	(2.86)	(1.26)	(0.67)			

$\overline{R}^2$ is the corrected R^2; DW is the Durbin-Watson statistic; and T is the sample size.

Notes

1. Similarly. it is argued that geographic concentration of -export sales results in export instability because fluctuations in demand within a given importing country will have a relativelv greater impact than if sales were diversified. Apart from empirical results contrary to this argument. there are also theoretical grounds why geographical concentration may not lead to export instability (see for example. Charette. 1985).

2. Although few researchers (for example. Massel, 1970: Knudsen and Parries. 1975: Sheehey, 1977) have found a weak positive relationship between commodity concentration and export instability. the majority of the empirical studies (for example, Coppock. 1962; Michaely. 1962: :tassel, 1964: MacBean. 1964; O'Brien. 1972: Souter, 1977), have reported results to the contrary.

3. Studies differ in the choice of the trend correction (linear and exponential being the most often used) and in the indices of the instability (the variance or the standard deviation from the trend, the coefficient of variation, the percentage deviation from the trend etc). Although these different procedures produce different instability indices for the same data set: the results obtained show a high degree of association (J. Love, 1979).

4. The minor commodity could be the sum of the export earnings from all other export items other than the major product.

5. Data on each country's value of exports (total export earnings and earnings by commodity) were obtained from various issues of the United Nation's *Yearbook of Trade Statistics* and FAO's *Trade Yearbook*. Exports are based on the three-digit standard International Trade Classification (SITC) categories.

6. The number of export items (n in equation 1) differs across countries. A commodity which consistitutes at least 5% of the total export earnings during the first five years of the sample period is included in the computation of the concentration index.

7. In all cases the exponential trend gave a better fit than the linear trend. Thus a regression of the form:

$$\log Z = {}_0 + {}_1 t + U \tag{8}$$

where t = 1. 2. . . . is time; U is an error term: is run and the standard error of the regression (normalized by the mean of log Z) is taken to be a measure of instability for the variable Z.

8. This does not mean to imply that countries should not try to diversify exports to the development of new non-traditional primary product lines and of industrial and service sector exports (including tourism). and more processing of traditional commodity lines.

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