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Export and Import Instability in Africa, 1960-69 and 1970-79: A Statistical Analysis

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The purpose of this paper is to analyze the problem of instability in exports and imports in selected African countries over the decades of the 1960s and the 1970s. The substantial decrease in instability in the 1960s was seriously halted by the oil crisis of the 1970s accompanied by a sharp acceleration in worldwide inflation rates. The study examines the statistical evidence regarding instability levels and assesses the role of a number of factors traditionally regarded as critical determinants of export instability in the African context.

I. The Problem of Instability

In the post-war period, increasing attention has been paid to the existence and consequences of export (and to a lesser extent import) instability, but no conclusive results have been produced to date. The results vary according to the sample of countries selected, and the time period covered. The controversy has ranged from the choice of the appropriate index for instability, the relative incidence of export (and import) instability between developed countries (DCs) on the one hand and less developed countries (LDCs) on the other, the causes and the consequences of instability and, finally, the appropriate solutions for the problem (assuming its existence). 1/

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1/ See Stein, 1977.

It has been argued that an index of export instability should incorporate two specific aspects of the economic theory designed to be tested: the effects of shortfall in export earnings, and the effects of uncertainty. The uncertainty effect has received predominant attention in the literature, and a number of indices for measuring it have been constructed. At least two problems 1/ arise in constructing an index: the selected trend should approximate as closely as possible to the actual trend form (linear, log linear, polynomial, etc.), and the estimated trend must correctly apply to the entire time period. The alternative indices of instability that can be constructed therefore depend on (i) the level of export earnings (or imports) from which the deviations are measured; and (ii) the specific way the deviations are measured. 2/

Given the proliferation of instability indices, it is not surprising that differing conclusions are obtained simply as a result of the (arbitrary) choice of one given index by different analysts. The results presented in this study must therefore be placed in the context of the disagreements surrounding the appropriate index to measure instability. The choice of a different sample of countries covering a different time period only may compound even further the apparent inconsistency of the results.

The present study is concerned with a statistical analysis of export and import instability in selected African countries over two different decades, 1960-69 and 1970-79. The choice of the sample was governed by two considerations: firstly, all the countries in the African Department of the International Monetary Fund were chosen on the grounds that data and other documents were more readily available; Libya and Sudan were the other two countries selected. Secondly, only those countries are considered for which a country page already existed in the Fund's International Financial Statistics, to enable easy access to the data from a computer terminal. The sample, therefore, included 38 countries over the 1970-79 period, and 37 countries over the 1960-69 period, the Seychelles being omitted from the latter period.

There is no particular justification for the choice of the two time periods specified but, again, two criteria were applicable. There was a need for the study to be as up-to-date as possible, and 1979 was considered suitable for this purpose without involving too many incomplete data series. Secondly, it was felt necessary to compare the 1970s (or part of the 1970s, which has been dominated by strong structural shifts in the pattern of world trade, largely as a result of oil price increases) with an earlier period, to determine whether exports (and imports) have become more or less unstable, and the causes of recent instability. As noted below, most studies have established that instability in both exports and imports declined sharply over the postwar period (until the late 1960s) in the case of a very wide spectrum of countries.

1/ Stein, op. cit., p. 279.
2/ See Yotopoulos and Nugent, 1977.

The problem of instability can relate to different export (or import) variables: prices, volume, or earnings. Traditionally, export earnings and the value of imports have been the focus of analysis, and this is the variable considered here. A number of studies 1/ have included both goods and services in the analysis of instability; this was not possible in the case of the sample of African countries chosen, and only goods were considered because of data limitations. As far as exports are concerned, the exclusion of services should not affect the results significantly because of their relatively small contribution; in the case of imports, however, the c.i.f. values were used, which would leave out a relatively small proportion of services imported. In particular, lines 70 and 71 were used from the International Financial Statistics for the analysis of export and import instability, respectively. The instability indices obtained were therefore based on the use of domestic currencies. 2/

Finally, the methodology and approach adopted in this paper closely follow Coppock's studies. 3/ The instability index is obtained by calculating deviations from a trend line, which, in this case, is the linear least-squares line through the natural logarithms of the actual export and import values. There are three advantages to using the average of percentage deviations of the actual values from the trend values as shown by the linear logarithmic trend line: firstly, it is conceptually straightforward and allows ready comparison between different countries and different periods (being in percentage form); secondly, the coefficient of the time variable indicates the constant percentage rate of growth (or decline) over the period. Thirdly, the exponential relationship would appear to describe the pattern of growth of exports and imports more accurately than other types of relationship over the periods considered, as was revealed by a comparison of exponential with semi-logarithmic or linear relationships.

II. Export Instability of Selected Countries, 1970-79 and 1960-69

For the period 1970-79, the export instability index values ranged from 5.41 (Liberia) to 24.51 (Gabon), giving a range of 19.10. The arithmetic mean index (unweighted) for the 38 countries was 14.63, compared with a median value of 14.23. The most striking feature over the period was the rather small degree of variation between the countries around the mean (or median) instability index; the standard deviation was 5.61, and the coefficient of variation was 38.34 per cent. A comparison of the top third and bottom third of the instability index values confirms the picture: the mean index value for the top third of countries was 21.10, and for the bottom third 8.33; the corresponding median values were 21.96 and 8.09. More detailed calculations are given in Table 1 below.

1/ See, for example, Coppock, 1962, and MacBean, 1966.

2/ See Appendix A for a discussion of instability indices obtained by using different numeraires.

3/ See Coppock, 1962, and Coppock, 1977.

For the 37 countries covered over the period 1960-69, the export instability index values ranged from 3.24 (Kenya) to 72.62 (Libya), giving a range of 69.38. The arithmetic mean index (unweighted) was 13.86, compared with a median value of 10.07, reflecting the strong unward bias contained in the mean by the inclusion of two highly unstable countries. If these two countries are excluded (the index for Mauritania was 66.58), the arithmetic mean for the remaining 35 countries becomes 10.67, a decline of over 23.0 per cent. Again, because of the inclusion of Libya and Mauritania, the dispersion around the mean (and the median) turns out to be large: the standard deviation of the 37 export instability index values was 14.55, and the coefficient of variation was 104.95 per cent. The median is clearly the better indication of average export instability, given a distribution which is rather positively skewed; the mean instability index for the top third of the 37 countries was 25.21, and for the bottom third 5.32, while the corresponding median values were 16.91 and 5.54, respectively.

A familiar result of existing studies on export instability is the evidence of a marked decline in instability in the 1960s relative to the 1950s, whether one examines the world as a whole, or developed countries on the one hand, and developing countries on the other. 1/ The 1960s are generally regarded as a decade of sustained growth in world output and world trade, and tend to indicate a better overall performance of the world economy than do the 1950s. Table 1 provides some comparative information on export instability between the two periods under study, which indicates a significant increase in average instability in the 1970s. A detailed discussion of the comparative data follows.

Firstly, the dispersion around the mean (or median) instability index value has declined sharply over the 1970-79 period; the range between the maximum and the minimum values is only 0.27 of the 1960-69 range value, reflecting a decline in the maximum value of over 66 per cent over the 1970-79 period. But if the two most unstable countries are excluded from the 1960-69 period (Libya and Mauritania), it can be seen that the maximum value has fallen by less than 5 per cent, while the minimum value has risen by over 66 per cent over the 1970-79 period, making the range over the two periods quite comparable. Examination of the standard deviation and the coefficient of variation of the instability index values confirms the above conclusion: the variation around the mean value over the 1970-79 period appears to be only 0.37 of the value for 1960-69. Again excluding Libya and Mauritania, the standard deviation of the instability index for the remaining 35 countries over the 1960-69 period turns out to be 5.51 (compared with 5.61 for the whole sample for the 1970-79 period), and the coefficient of variation becomes 51.64 per cent (compared with 38.34 per cent for the 1970-79 period).

Comparison of the mean export instability index values shows a rise of 6 per cent in the mean index for the 1970-79 period; if we exclude the two

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1/ See, for example, Erb and Schiavo-Campo, 1969, and Coppock, 1977.

Table 1. Export Instability Index, 1970-79, and 1960-69

		1970-79 (1)	1960-69 (2)	Ratio (1)/(2)=(3)
1.	Number of countries	38	37	
2.	Largest value	24.21	72.62	0.33
3.	Smallest value	5.41	3.24	1.67
4.	Range	18.80	69.38	0.27
5.	Mean instability index	14.63	13.86	1.06
6.	Median instability index	14.23	10.07	1.41
7.	Mean index of top third	21.10	25.21	0.84
8.	Mean index of middle third	13.99	10.12	1.38
9.	Mean index of bottom third	8.33	5.32	1.57
10.	Median index of top third	21.96	16.91	1.30
11.	Median index of middle third	14.09	10.00	1.41
12.	Median index of bottom third	8.09	5.54	1.46
13.	Variation (10-12)	13.87	11.37	1.22
14.	Relative variation (13/11)	94.44%	113.70%	0.83
15.	Semi-interquartile range	6.94	5.69	1.22
16.	Standard deviation	5.61	14.55	0.39
17.	Coefficient of variation (16/5)	38.34%	104.95%	0.37

most unstable countries from the 1960-69 period sample, however, the mean index for the 1970-79 period reveals a rise of over 37 per cent. The result is confirmed by a comparison of the respective median values, which indicates a rise of 41 per cent in the median value for 1970-79, using the two complete samples. If both samples are divided into three groups to identify high-instability, medium-instability, and low-instability countries, respectively, the mean and median values reveal an interesting phenomenon: the low-instability countries became relatively more unstable in the 1970-79 period relative to the high-instability countries, although all three groups experienced an increase in absolute instability levels. The mean index of the top third of the countries in the 1970-79 sample increased by 23 per cent compared with the 1960-69 period top third countries (excluding Libya and Mauritania); the increases for the middle and bottom thirds were 38 per cent and 57 per cent, respectively. The corresponding increases for the median index values for the top third, middle third, and bottom third of the countries in the two samples were 30 per cent, 41 per cent, and 46 per cent, respectively.

Table 2 presents the country data over the two periods studied, together with a number of comparative statistics. Column (7) shows the ratio of the 1970-79 export instability index to the corresponding 1960-69 index for each country. The results can be summarized as follows:

1970-79 Instability Index as a Ratio of 1960-69 Index	Number of Countries
Over 4.00	3
3.00 to 3.99	3
2.00 to 2.99	3
1.00 to 1.99	14
Below 1.00	14
	37

Only 14 countries out of 37 (38 per cent) experienced a decline in export instability over the 1970-79 period; the instability index at least doubled in the case of 9 countries (24 per cent), while the ratio exceeded 4.00 for Morocco (4.92), Senegal (4.76), and Gabon (4.07). Of the countries experiencing marginal changes in export instability, 5 countries had a ratio of between 0.95 and 1.05, and 8 countries a ratio of between 0.90 and 1.10. As would be expected, the two most unstable countries over the 1960-69 period experienced the sharpest declines in instability over the 1970-79 period, with ratios of 0.20 for Mauritania, and 0.23 for Libya. Other countries with low ratios were Liberia (0.44), Sierra Leone (0.51), Benin (0.55), and Ghana (0.61). Overall, export instability increased to some degree in 62 per cent of the African countries in the sample, reversing

Table 2. Export and Import Instability Indices, by Country, 1970-79, and 1960-69

(Ranked in descending order; other ranks in parentheses)

Country and Rank	1970-79 Export instability index (1)	1970-79 Import instability index (2)	1960-69 Export instability index (3)	1960-69 Import instability index (4)	Comparisons (1)/(2) (5)	Comparisons (3)/(4) (6)	Comparisons (1)/(3) (7)	Comparisons (2)/(4) (8)
1. Gabon	24.51	15.63 (5) 1/	6.02 (30)	6.46 (26)	1.57	0.93	4.07	2.42
2. Togo	23.94	13.97 (8)	9.47 (23)	8.54 (19)	1.71	1.11	2.53	1.64
3. Mauritius	23.42	16.33 (4)	12.69 (12)	4.91 (32)	1.43	2.58	1.85	3.33
4. Zaire	22.96	12.02 (15)	15.85 (9) 5/	14.27 (4) 5/	1.91	1.11	1.45	0.84
5. Algeria	22.32	14.74 (7) 1/	19.50 (5)	24.89 (2)	1.51	0.78	1.14	0.59
[illegible] Nigeria	22.13	22.82 (1)	9.75 (21)	8.88 (17)	0.97	1.10	2.27	2.57
[illegible] Senegal	21.96	7.51 (34) 1/	4.61 (34)	5.06 (31)	2.92	0.91	4.76	1.48
8. Rwanda	20.40	14.90 (6)	6.34 (28) 7/	10.86 (12) 7/	1.37	0.58	3.22	1.37
9. Gambia	19.96	8.81 (23)	10.49 (18)	8.07 (20)	2.27	1.30	1.90	1.09
10. Burundi	19.81	12.43 (11)	25.75 (3) 5/	10.98 (11) 5/	1.59	2.35	0.77	1.13
11. Zambia	19.11	9.32 (19)	9.70 (22)	12.14 (7)	2.05	0.80	1.97	0.77
12. Congo	17.36 2/	4.30 (38) 1/	18.28 (6)	3.80 (35)	4.04	4.81	0.95	1.13
13. Morocco	16.74	17.54 (2)	3.40 (36)	2.75 (37)	0.95	1.24	4.92	6.38
14. Libya	16.57	16.66 (3) 1/	72.62 (1)	5.66 (28)	0.99	12.83	0.23	2.94
15. Seychelles	15.80	6.75 (35)	—	--	2.34	—	—	--
16. Tunisia	15.43	9.22 (21)	4.69 (33)	6.76 (22)	1.67	0.69	3.29	1.36
17. Uganda	15.25	12.71 (9) 1/	8.00 (25)	6.49 (25)	1.20	1.23	1.91	1.96
18. Upper Volta	14.93	8.33 (26)	15.86 (8)	20.16 (3)	1.79	0.79	0.94	0.41
19. Mali	14.36	12.20 (12)	16.91 (7) 4/	14.13 (5) 4/	1.18	1.20	0.85	0.86
20. Niger	14.09 2/	12.13 (13) 2/	13.89 (10)	13.16 (6)	1.16	1.06	1.01	0.92
21. Mauritania	13.12	8.80 (24)	66.58 (2) 4/	25.67 (1) 4/	1.49	2.59	0.20	0.34
22. Benin	12.95 1/	6.32 (36) 1/	23.69 (4)	10.33 (14)	2.05	2.29	0.55	0.61
23. Ivory Coast	12.61	9.25 (20)	5.77 (31)	5.86 (27)	1.36	0.98	2.19	1.58
24. Kenya	12.30	8.21 (27)	3.24 (37) 6/	4.46 (33) 6/	1.50	0.73	3.80	1.84
25. Cameroon	12.27	7.95 (29)	7.54 (26) 5/	3.65 (36) 5/	1.54	2.07	1.63	2.18
26. Botswana	12.15	7.83 (30)	11.70 (14)	11.63 (8)	1.55	1.01	1.04	0.67
27. Swaziland	12.11	7.72 (31)	10.07 (19)	6.71 (24) 8/	1.57	1.50	1.20	1.15
28. Chad	10.27 3/	9.58 (18) 3/	11.47 (15)	9.78 (15)	1.07	1.17	0.90	0.98
[illegible] Central African Republic	10.01	9.10 (22)	10.56 (17)	5.55 (29)	1.10	1.90	0.95	1.64
[illegible] Somalia	9.84	6.06 (37)	9.93 (20)	11.00 (10)	1.62	0.90	0.99	0.55
31. Malawi	8.45	7.63 (32)	5.30 (32) 7/	8.58 (18) 7/	1.11	0.62	1.59	0.89
32. Tanzania	8.14	8.78 (25)	8.94 (24)	5.35 (30) 7/	0.93	1.67	0.91	1.64
33. Ethiopia	8.03	7.63 (32)	6.97 (27)	6.72 (23)	1.05	1.04	1.15	1.14
34. Sudan	7.15	12.09 (14)	6.17 (29)	11.29 (9)	0.59	0.55	1.16	1.07
35. Sierra Leone	7.06	10.73 (17)	13.78 (11)	7.56 (21)	0.66	1.82	0.51	1.42
36. Ghana	6.93 2/	12.68 (10) 1/	11.33 (16)	9.57 (16)	0.55	1.18	0.61	1.32
37. Madagascar	6.51	10.99 (16)	3.76 (35)	4.10 (34)	0.59	0.92	1.73	2.68
38. Liberia	5.41	8.11 (28)	12.31 (13)	10.59 (13)	0.67	1.16	0.44	0.77

1/ 1970-78.
2/ 1970-77.
3/ 1970-76.
4/ 1961-69.
5/ 1962-69.
6/ 1963-69.
7/ 1964-69.
8/ 1965-69.

the results of most of the earlier studies. Despite the increases in the majority of cases, there was little evidence that countries maintained their relative positions: the Pearson correlation coefficient between the two sets of instability index values was only 0.06, statistically insignificant even at the 25 per cent level.

A number of writers 1/ have attempted to indicate a benchmark level of export instability as evidence of the existence of a problem. If this benchmark index is 10.00, then 19 countries experienced the problem over the 1960-69 period, compared with 29 countries over the 1970-79 period, representing an increase of 49 per cent in the number of countries (after adjusting for different sample sizes). Further, 5 countries had an instability index of less than 5.0 over the 1960-69 period, compared with none over the 1970-79 period. A significant number of countries--16--had export instability index values of 10.00 or more over both periods.

Country	Export Instability Index 1970-79	1960-69	Ratio
	(1)	(2)	(1)/(2)=(3)
Mauritius	23.42	12.69	1.85
Zaire	22.96	15.85	1.45
Algeria	22.32	19.50	1.14
Gambia	19.96	10.49	1.90
Burundi	19.81	25.75	0.77
Congo	17.36	18.28	0.95
Libya	16.57	72.62	0.23
Upper Volta	14.93	15.86	0.94
Mali	14.36	16.91	0.85
Niger	14.09	13.89	1.01
Mauritania	13.12	66.58	0.20
Benin	12.95	23.69	0.55
Botswana	12.15	11.70	1.04
Swaziland	12.11	10.07	1.20
Chad	10.27	11.47	0.90
Central African Republic	10.01	10.56	0.95

On the other hand, 6 countries had export instability indices below 10.00 over both periods; these "low-instability" countries were Somalia, Malawi, Tanzania, Ethiopia, Sudan, and Madagascar--all countries on the eastern half of Africa.

1/ See, for example, Coppock, 1977.

III. Import Instability of Selected Countries, 1970-79 and 1960-69

The import instability index values for the 1970-79 period ranged from 4.30 (Congo) to 22.82 (Nigeria), giving a range of 18.52. The arithmetic mean index (unweighted) was 10.84 for the sample of 38 countries, compared with a median value of 9.32, reflecting the slight upward bias on the mean caused by the large index value for Nigeria. In fact, Nigeria's instability index was over 30 per cent above the next most unstable country (Morocco). The degree of variation around the mean (or median) index was very low, with a standard deviation of 3.81, and a coefficient of variation of 35.16 per cent. The mean index of the top third countries (in order of instability) was 14.98, compared with a mean value of 7.30 for the bottom third; the corresponding median values were 14.74 and 7.68, respectively. More detailed calculations are given in Table 3.

For the 37 countries covered over the period 1960-69, the import instability index value ranged from 2.75 (Morocco) to 25.67 (Mauritania), giving a range of 22.92. The arithmetic mean index (unweighted) was 9.36, compared with a median value of 8.54. 1/ If the two most unstable countries (Mauritania with an index of 25.67, and Algeria with an index of 24.89) are excluded from the sample, the mean falls to 8.45, a reduction of nearly 10 per cent compared with the mean for the whole sample. 2/ The dispersion around the mean (or median) index is strongly affected by the inclusion of the three most unstable countries; the standard deviation was 5.30, and the coefficient of variation was 56.57 per cent. But the mean of the top third countries in the sample (at 14.67) was nearly 21 per cewnt above the median index (at 12.14) for the same group of countries. The mean and median values for the bottom third countries were 4.80 and 4.99, respectively.

Comparison of the import instability index values over the two periods indicates that the dispersion around the mean (or median) index declined significantly over the 1970-79 period; though the maximum value fell by 11 per cent, the minimum rose by 56 per cent, leading to a fall in the range of about 19 per cent. If the most unstable countries are excluded (Nigeria for the 1970-79 period, and the three most unstable countries for the 1960-69 period), the picture is largely reversed. For the complete samples, the standard deviation appears to have fallen by over 28 per cent, and the coefficient of variation by 38 per cent over the 1970-79 period; but exclusion of the most unstable countries significantly reduces this difference.

1/ This reflects the fact that the distribution is slightly skewed (positively); the mean index for the three most unstable countries was 23.57, which was 65 per cent above the instability index for the fourth most unstable country (Zaire).

2/ If the third most unstable country (Upper Volta with an index of 20.16) is also excluded, the mean index for the rest of the sample falls to 8.11, a decline of over 13 per cent compared to the mean for the whole sample.

Table 3. Import Instability Index, 1970-79, and 1960-69

		1970-79 (1)	1960-69 (2)	Ratio (1)/(2)=(3)
1.	Number of countries	38	37	
2.	Largest value	22.82	25.67	0.89
3.	Smallest value	4.30	2.75	1.56
4.	Range	18.52	22.92	0.81
5.	Mean instability index	10.84	9.36	1.16
6.	Median instability index	9.32	8.54	1.09
7.	Mean index of top third	14.98	14.67	1.02
8.	Mean index of middle third	9.89	8.17	1.21
9.	Mean index of bottom third	7.30	4.80	1.52
10.	Median index of top third	14.74	12.14	1.21
11.	Median index of middle third	9.29	8.31	1.12
12.	Median index of bottom third	7.68	4.99	1.54
13.	Variation (10-12)	7.06	7.15	0.99
14.	Relative variation (13/11)	76.00%	86.04%	0.88
15.	Semi-interquartile range	3.52	3.58	0.98
16.	Standard deviation	3.81	5.30	0.72
17.	Coefficient of variation (16/5)	35.16%	56.57%	0.62

Examination of the mean import instability index values shows a rise of 16 per cent in the mean index for the 1970-79 period; if we exclude the two most unstable countries from the 1960-69 sample, the mean index for the period 1970-79 reveals a rise of 28 per cent. 1/ We can again divide both samples into three groups, to identify the high-instability, medium-instability, and low-instability countries. The mean index values for the three groups indicate that the import instability of the low-instability countries of the 1960-69 sample increased more rapidly over the 1970-79 period relative to the high-instability countries. The mean instability of the top third countries increased by only 2 per cent over the 1970-79 period; that of the middle third countries by 21 per cent, while the bottom third countries experienced an increase in the mean index of 52 per cent. The median instability values also indicated absolute increases for all three groups of countries, but not in any systematic direction: an increase of 21 per cent was registered for the top third countries over the 1970-79 period, compared with increases of 12 per cent and 54 per cent for the middle and bottom third countries, respectively. Note that, as for exports, the top, middle, and bottom third countries, respectively, would include different countries from the 1960-69, and the 1970-79 samples.

If we analyze column (8) in Table 2, indicating the ratio of the 1970-79 import instability index to the corresponding 1960-69 index for each country, we obtain the following frequency distribution:

1970-79 Instability Index as a Ratio of 1960-69 Index	Number of Countries
Over 3.00	2
2.00 to 2.99	5
1.00 to 1.99	17
Below 1.00	13
	37

Only 13 countries out of 37 (35 per cent) experienced a decline in import instability over the 1970-79 period; the instability index at least doubled in the case of 7 countries (19 per cent), while the ratio exceeded 3.00 for Morocco (6.38), and Mauritius (3.33). Only one country had a ratio of between 0.95 and 1.05 (Chad), while 4 countries had a ratio of between 0.90

1/ If, in addition, Nigeria is excluded from the 1970-79 sample, the mean index for 1970-79 would reveal a rise of over 24 per cent; exclusion of Upper Volta from the 1960-69 sample further raises the ratio of the 1970-79 mean to the 1960-69 mean to 1.34.

and 1.10. Again, the three most unstable countries of the 1960-69 period had the largest relative declines in instability, with ratios of 0.34 for Mauritania, 0.41 for Upper Volta, and 0.59 for Algeria. Other countries with low ratios included Somalia (0.55), Benin (0.61), and Botswana (0.67). Overall, import instability increased in nearly 65 per cent of the countries in the sample, contrary to the results contained in earlier studies. However, there was no significant evidence that countries maintained their relative positions: the Pearson correlation coefficient between the instability index values for the two periods was only 0.01, statistically insignificant even at the 25 per cent level.

If we again apply the benchmark index value of 10.00 as indicating the existence of a problem of instability, we find that 7 countries had index values exceeding 10.00 in both periods: 1/

Country	Import Instability Index 1970-79	1960-69	Ratio
	(1)	(2)	(1)/(2)=(3)
Rwanda	14.90	10.86	1.37
Algeria	14.74	24.89	0.59
Burundi	12.43	10.98	1.13
Mali	12.20	14.13	0.86
Niger	12.13	13.16	0.92
Sudan	12.09	11.29	1.07
Zaire	12.02	14.27	0.84

On the other hand, over 35 per cent of countries sampled (13 countries) 2/ had import instability indices below 10.00 over both periods; of these, Malawi, Tanzania, and Ethiopia also had export instability indices below 10.00.

IV. Comparison of Export Instability and Import Instability, 1970-79 and 1960-69

For a number of developing economies, one would intuitively expect export instability to exceed the instability in imports; the major export items are generally agricultural commodities and minerals, and these are subject to the vagaries of the weather and the trade cycle in the major

1/ Note that Algeria, Burundi, Mali, Niger, and Zaire were also on the corresponding list for exports.

2/ These countries were: Senegal, Gambia, Congo, Tunisia, Ivory Coast, Kenya, Cameroon, Swaziland, Chad, Central African Republic, Malawi, Tanzania, and Ethiopia.

industrial countries. On the other hand, developing countries generally are committed to the importation of a minimum level of foodstuffs and capital equipment, which helps to maintain imports along a rather steadier trend. Examination of Table 4 confirms this preliminary impression completely. 1/

The data for the 1970-79 period indicate that the mean export instability index for the sampled countries was 35 per cent above the mean import instability index; the corresponding median index was 53 per cent greater. Although, in principle, there is no necessary relationship between export and import instability, the Pearson correlation coefficient between the two indices was 0.477, which is significantly different from zero at the 1 per cent level. As columns (1) and (2) in Table 2 show, Gabon had the highest export instability index, and the fifth highest import instability index, while the respective ranks for Mauritius were third and fourth, and for Nigeria sixth and first. At the other end of the spectrum, Liberia had the lowest export instability index, and the tenth lowest import instability index; the respective ranks for Ethiopia were sixth lowest and seventh lowest, and for Malawi eighth lowest and seventh lowest.

Overall, only 9 countries out of 38 (24 per cent) had a lower export instability index relative to their import instability index; of these 9 countries, 3 had an export/import instability index ratio greater than 0.95, and the lowest ratios were obtained for Ghana (0.55), Sudan (0.59), and Madagascar (0.59). Of the remaining countries, 6 had export/import instability index ratios exceeding 2.00, topped by Congo (4.04), Senegal (2.92), and the Seychelles (2.34). Finally, of the 31 countries with the highest export instability index values, only 3 countries had relatively greater instability in their imports (but by less than 5 per cent in all 3 cases).

Apart from being more unstable relative to imports over the 1970-79 period, exports were found to be more widely dispersed around the mean (or median) value, irrespective of which measure of dispersion was employed. The values given in the table for the standard deviation and the coefficient of variation suggest a greater dispersion for exports by 47 per cent, and by 9 per cent, respectively. If the two samples are divided into three groups, both the mean and the median index values indicate that the average instability index for exports for the high- and medium-instability countries exceeded the corresponding index for imports by between 40 and 50 per cent; the low-instability countries shows a rather smaller export/import instability index ratio.

Support for the hypothesis of greater export volatility relative to imports is further contained in the data for the 1960-69 period, shown in columns (3) and (4) of Table 2 and in Table 5. The mean export instability

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1/ Not all studies unambiguously support the above hypothesis, however. See, for example, Coppock, 1977.

Table 4. Export and Import Instability Index, 1970-79

		Export Instability (1)	Import Instability (2)	Ratio (1)/(2)=(3)
1.	Number of countries	38	38	
2.	Largest value	24.21	22.82	1.06
3.	Smallest value	5.41	4.30	1.26
4.	Range	18.80	18.52	1.02
5.	Mean instability index	14.63	10.84	1.35
6.	Median instability index	14.23	9.32	1.53
7.	Mean index of top third	21.10	14.98	1.41
8.	Mean index of middle third	13.99	9.89	1.41
9.	Mean index of bottom third	8.33	7.30	1.14
10.	Median index of top third	21.96	14.74	1.49
11.	Median index of middle third	14.09	9.29	1.52
12.	Median index of bottom third	8.09	7.68	1.05
13.	Variation (10-12)	13.87	7.06	1.96
14.	Relative variation (13/11)	98.44%	76.00%	1.30
15.	Semi-interquartile range	6.94	3.52	1.97
16.	Standard deviation	5.61	3.81	1.47
17.	Coefficient of variation (16/5)	38.43%	35.16%	1.09

index exceeded the mean import index by 48 per cent, while the corresponding median index was larger by 18 per cent. Again, the relationship between the two sets of instability index values was quite strong: the Pearson correlation coefficient was found to be 0.415, statistically significant at the 1 per cent level. Countries with relatively high index values for both exports and imports included Zaire, Algeria, Upper Volta, Mali, and Niger; Mauritania had the largest import instability index, and the second largest export index. Relatively low index values for both exports and imports were obtained for Senegal, Morocco, Kenya, and Madagascar. In particular, Morocco had the lowest import instability index, and the second lowest export index.

Over the 1960-69 period, 13 out of the sample of 37 countries (35 per cent) had a lower export instability index relative to their import instability index; of these 13 countries, 5 had an export/import instability index ratio greater than 0.90. Of the 24 countries with a larger export instability index relative to the import index, 4 countries had a ratio below 1.10. The lowest ratios were obtained for Sudan (0.55), Rwanda (0.58), Malawi (0.62), Tunisia (0.69), and Kenya (0.73). At the other extreme, 7 countries had an export/import instability index ratio exceeding 2.00: they were headed by Libya (12.83), Congo (4.81), Mauritania (2.59), and Mauritius (2.58). Libya and Mauritania had by far the largest export instability index values, while the level of instability of imports was relatively very low for Congo and Mauritius. Finally, of the 30 countries with the highest export instability index values, only 6 countries had relatively greater instability in their imports.

Again, irrespective of which measure of dispersion was employed, exports were found to be more widely dispersed around the mean (or median value) than imports; the ratios of the standard deviations and the coefficients of variation were 1.86 and 2.75, respectively. Dividing the two samples into three groups helps us to identify a striking phenomenon: whether we use the mean or the median as a measure of the average level of instability, high-instability countries had a higher export/import instability index ratio than middle-instability countries, and the latter had a higher corresponding ratio relative to low-instability countries. In other words, countries with high levels of instability in their exports over the 1960-69 period were likely to have more unstable imports relative to low-instability countries.

V. Causes of Instability

The major determinants of export instability have generally been held to be commodity and geographical concentrations in exports, and the degree of specialization in primary production. The concentration indices are

Table 5. Export and Import Instability Index, 1960-69

		Export Instability (1)	Import Instability (2)	Ratio (1)/(2)=(3)
1.	Number of countries	37	37	
2.	Largest value	72.62	25.67	2.83
3.	Smallest value	3.24	2.75	1.18
4.	Range	69.34	22.92	3.03
5.	Mean instability index	13.86	9.36	1.48
6.	Median instability index	10.07	8.54	1.18
7.	Mean index of top third	25.21	14.67	1.72
8.	Mean index of middle third	10.12	8.17	1.24
9.	Mean index of bottom third	5.32	4.80	1.11
10.	Median index of top third	16.91	12.14	1.39
11.	Median index of middle third	10.00	8.31	1.20
12.	Median index of bottom third	5.54	4.99	1.11
13.	Variation (10-12)	11.37	7.15	1.59
14.	Relative variation (13/11)	113.70%	86.04%	1.32
15.	Semi-interquartile range	5.69	3.58	1.59
16.	Standard deviation	14.55	5.30	2.75
17.	Coefficient of variation (16/5)	104.95%	56.57%	1.86

usually measured by the Gini-Hirschmann formula; 1/ the coefficient of commodity concentration of exports of country j, denoted by COMCONX, is then defined as:

$$COMCONX = 100 \sqrt{\sum_i \left[\frac{X_{ij}}{X_j} \right]^2}$$

where X_{ij} refers to the value of country j's exports of comodity i to the rest of the world in the reference period, while X_j represents the total value of country j's exports to the rest of the world in the same period. The coefficient of commodity concentration of imports, COMCONM, is defined in a completely analogous manner. Given that the number of products at the three-digit SITC level is 182, COMCONX will range from a minimum value of 7.41 ($100/\sqrt{182}$) to a maximum value of 100 ($100/\sqrt{1}$). Another measure of concentration, based on the absolute deviation of the country commodity shares from the world structure, called (rather misleadingly) the "diversification index," DIVIX, was devised by UNCTAD, 2/ as follows:

$$DIVIX = \frac{\sum_i |S_{ij} - S_i|}{2}$$

where S_{ij} = share of commodity i in total exports of country j;

S_i = share of commodity i in total world exports.

Finally, country j's coefficient of geographical concentration of exports (or imports), represented by GEOCONX (or GEOCONM), can be defined as

$$GEOCONX = 100 \sqrt{\sum_s \left[\frac{X_{sj}}{X_j} \right]^2}$$

where X_{sj} refers to exports of country j to country s. The export instability debate is generally concerned with the value of COMCONX, rather than COMCONM, or GEOCONX, or GEOCONM. The argument is that the higher COMCONX is, the greater the dependence of country j on one (or a few) export goods, and therefore the greater the risk of instability in export earnings.

A number of other explanations for high export instability levels have been suggested and subjected to empirical investigation; these range from a tendency for less developed countries to export only or mainly primary products, or for their exports to be concentrated on a relatively small

1/ See M. Michaely, Concentration in International Trade, North Holland Publishing Company, Amsterdam, 1962.

2/ See UNCTAD, Handbook of International Trade and Development Statistics, Geneva, 1979.

number of products, to a tendency for prices of primary products on world markets to be relatively more unstable than manufactures, or for export volumes to be rendered unstable because of external market factors. The empirical results below highlight the contribution of some of these possible explanations.

The analysis of the causes of differences in import instability levels across countries has been of a limited nature. Economic theory does not suggest any clear cut explanations; again, commodity and geographical concentration in imports are held to be important causes, along with instability in import prices or volume, and in export earnings. These hypotheses will be tested below to determine if a common pattern of causes emerges that explains import instability variations.

The empirical analysis of the causes of export instability relates to the period 1970-79 for 38 African countries; correlation and regression analysis (ordinary least squares method) was applied to the whole sample initially, and then separately to the top third (13 countries), middle third (13 countries), and bottom third (12 countries) of the selected countries ranked according to the level of export instability, in order to identify whether similar factors are influential irrespective of the absolute levels of instability. The analysis of the causes of import instability is rather less detailed.

1. Export instability

Table 6 shows the correlation matrix between the export instability index, XII, for the 38 countries under study and a number of explanatory variables. The results are expanded in Appendix Table 4, where the regressions are ranked in order of explanatory importance, and the significance levels specified. The general conclusion that emerges is that no single variable can be regarded as the critical factor in determining variations in export instability. Nevertheless, by far the most important cause would appear to be the instability of unit price of exports; this last variable explains over 36 per cent of the variation in export instability across countries, the relationship being statistically significant at the 0.1 per cent level. The result suggests that international prices are more responsible for the instability in export earnings of African countries over the 1970-79 period than other factors, and international commodity agreements that aim for relative price stabilization would simultaneously generate greater stability in export earnings.

The second most important variable is the growth rate of exports, which explains nearly 18 per cent of the variation in XII, with a significance level of 1 per cent. A distinction must, however, be made between acceptable instability, where a strong growth in exports is the result of, say, development of new natural resources, or exporter-controlled prices (oil), and unacceptable instability, where export earnings rise and fall according to changes in international prices or domestic production largely beyond the control of the authorities.

Table 6. Export Instability: Correlation Matrix, 1970-79, for 38 Countries

	XII	XUPI	GRX	AVGDP	AGX	XVOLI	AVX
XII	1.000						
XUPI	0.615	1.000					
GRX	0.444	0.151	1.000				
AVGDP	0.257	0.543	0.290	1.000			
AGX	-0.363	-0.386	-0.230	-0.427	1.000		
XVOLI	0.314	0.237	0.155	0.174	-0.250	1.000	
AVX	0.295	0.575	0.306	0.939	-0.493	0.255	1.000

Several of the countries which had the highest export instability index figures (Gabon, Algeria, Nigeria, and the Congo, among others) had nevertheless a very healthy and rapid overall growth rate in their exports, while some of those which had a low instability index figure (Sudan, Sierra Leone, and Liberia, for example) had a very low growth rate in their exports. The former situation would seem to be more desirable than the latter, notwithstanding the much higher export instability index.

Exports of less developed countries are often considered to be subject to severe fluctuations because of their high commodity concentration. This hypothesis was tested by using a number of explanatory variables: in all cases, the results suggest a positive, but weak, relationship between export instability and commodity concentration. Variations in COMCONX, the commodity concentration index, explained only 14 per cent of the variations in XII, which is significant at the 2 per cent level; using ONECOM (the proportion of export earnings accounted for by the most important commodity) as the explanatory variable resulted in slightly over 13 per cent of the variations in XII being explained, which was again significant at the 2 per cent level. Using TWOCOM (the proportion of export earnings accounted for by the two most important commodities) reduced the explanatory power of the regression to just over 11 per cent, while the variable THRCOM (reflecing the proportion accounted for by the three most important commodities) showed a very weak association with XII, explaining less than 10 per cent of the variations in the dependent variable, though still statistically significant at the 5 per cent level. The other indices of concentration of exports in terms of commodities failed to establish meaningful relationships; the regression was clearly insignificant when either NOCOM (the number of

commodities exported at the three-digit SITC level) or DIVIX (the "diversification index" of commodity exports) was used as a regressor.

Of the other possible explanatory variables, only three explained 10 per cent or marginally more of the variations in XII: the share of agricultural products in total exports (AGX), the share of mineral products in GDP (MINGDP), and the share of mineral products in total exports (MINX). All the other major variables widely regarded in the literature as important determinants of export instability failed to yield relationships which were significant at the 5 per cent level. In particular, instability in export volume (XVOLI) was not a significant element in export earnings instability, and concentration of exports in specific geographical areas (GEOCONX) hardly explained any of the variations in XII.

The above results were significantly improved when a multiple regression analysis was performed. The result obtained was:

XII	=	3.615	+	0.555XUPI	+	0.263GRX	-	0.0002AVGDP
(t-value)		(1.894)		(4.889)		(3.360)		(1.602)
(t-probability)		(93.32)		(99.99)		(99.81)		(88.15)

$\bar{R}^2 = 0.499$ F = 13.27 D.W. = 1.183

The signs of the coefficients conform to a priori expectations, but AVGDP turns out to be statistically insignificant even at the 10 per cent level. The equation explains nearly 50 per cent of the variations in XII, and the overall goodness of fit is significant at the 0.1 per cent level. The addition of AGX as one of the regressors raises the explanatory power to 51.5 per cent, but the variable itself is not statistically significant.

An analysis of the causes of export instability for the 13 most unstable countries (the "top third") reveals little association between XII and the traditional explanatory variables. Variations in GEOCONX, the geographical concentration of commodity exports, explained nearly 22 per cent of changes in XII (see Appendix Table 5), which was significant only at the 10 per cent level. All the other explanatory variables used generated insignificant relationships. The best result obtained from multiple regression analysis was as follows:

XII	=	3.459	+	0.3479GEOCONX	+	0.166MINGDP		
(t-value)		(0.651)		(3.696)		(2.634)		
(t-probability)		(46.46)		(99.22)		(96.64)		
		- 0.200GRX	-	0.096COMCONX	+	0.118THRCOM		
(t-value)		(1.903)		(2.103)		(1.811)		
(t-probability)		(90.13)		(92.65)		(88.70)		

$\bar{R}^2 = 0.494$ F = 3.34 D.W. = 2.257

The two coefficients which were statistically significant at the 5 per cent level had the expected positive sign; the variable MINGDP turns out to be a significant factor to underline the fact that a number of the countries in the "top third" instability category were important producers and exporters of minerals (including oil). These countries were found to have a high value of XII resulting from the rapid increase in the share of minerals in GDP. The addition of the variable ONECOM as an extra regressor raised the explanatory power of the regression to 0.542, but hardly affected the significance of the overall goodness of fit.

Regression analysis of the causes of export instability in the "middle third" of unstable countries yielded more satisfactory results. The most important determinant of instability in this group of countries was the coefficient of commodity concentration of exports, COMCONX; this variable explained over 46 per cent of the variations in XII (see Appendix Table 5), with a significance level of 1 per cent. If this commodity concentration variable was replaced by either ONECOM or TWOCOM to reflect concentration in exports, the explanatory power of the regression fell to between 26 and 28 per cent, with a significance level of 5 per cent. The use of NOCOM, the number of commodities exported, as a regressor resulted in only 20 per cent of the variation in XII being explained, which was only significant at the 10 per cent level. Again, instability in export prices appeared to generate instability in earnings far more significantly than instability in export volume did; variations in XUPI were responsible for over 18 per cent of the fluctuations in XII.

The best result obtained from the application of the step-wise multiple regression procedure was:

XII	=	12.375	+	0.075COMCONX	+	0.058AGGDP	-	0.077MINGDP
(t-value)		(11.879)		(3.982)		(2.322)		(1.853)
(t-probability)		(100.00)		(99.68)		(95.47)		(90.320)

$\bar{R}^2 = 0.597$ F = 6.92 D.W. = 2.062

The regression explains nearly 60 per cent of the variation in XII, and the overall goodness of fit is significant at the 1 per cent level. A rather surprising result lies in the sign of the coefficients of both AGGDP, the share of agriculture in GDP, and MINGDP, the share of mineral products in GDP. It appears that for this group of "moderately" unstable countries, the higher the share of agriculture and/or minerals in GDP, the lower the instability of exports to be expected. The inclusion of the variable AGX, the share of agricultural products in total exports, to the regression increases the explanatory power to nearly 62 per cent, but at the cost of significantly increased multicollinearity amongst the regressors. Further, the coefficient of AGX is itself not statistically significant, even at the 25 per cent level.

The regression results were also relatively satisfactory for the 12 countries classified as least unstable in the "bottom third" category. The share of agriculture in exports, AGX, explained over 25 per cent of the

variation in XII, but the relationship was barely significant at the 5 per cent level. An apparently puzzling result was obtained when XII was regressed against DIVIX, the "diversification index" of exports (see Appendix Table 5). The relationship was found to be negative, with DIVIX explaining nearly 24 per cent of the variation in the dependent variable, but the relationship was only significant at the 6 per cent level. This would suggest that the less diversified countries had a greater likelihood of smaller instability levels in their exports. It is quite true that diversification of agricultural products is not likely to reduce instability if the main problem is a cycle of droughts and good harvests. Indeed, given that the existing products are probably selected for their abilities to withstand climatic variations, the degree of instability might be increased by diversification. Equally, if the main destabilizing influence is the business cycle in developed countries, the demand for all primary products is likely to move in line, so that diversification will have no marked effect. The real advantage of diversification lies in its shielding effect on the economy from supply-induced changes in price, when the supply variations come from other developing countries. But, assuming that the existing export goods are those in which the country has its greatest comparative advantage, diversification of export goods can only be achieved at some cost of reduced income. Whether or not diversification can achieve any significant decrease in export instability without imposing substantial costs is an empirical question which may be expected to produce different answers for different countries.

With the application of multiple regression analysis, the following result was obtained:

XII =	20.293 +	0.028AGX +	0.003AVX -	0.148DIVIX
(t-value)	(2.875)	(1.852)	(2.019)	(2.001)
(t-probability)	(97.94)	(89.89)	(92.19)	(91.97)

$\bar{R}^2 = 0.616$ F = 5.81 D.W. = 1.929

Nearly 62 per cent of the variations in XII is explained by the three regressors. If the above explanation for the negative sign of the coefficient of DIVIX is accepted, then the signs of all the coefficients conform to a priori expectations. The larger the share of agricultural products in exports, the greater the likelihood of higher instability in exports. However, countries with very large exports (in absolute terms) are likely to suffer less from instability. The overall goodness of fit is clearly significant at the 5 per cent level, but all the coefficients are barely significant at the 10 per cent level in spite of the low level of multicollinearity among the regressors.

2. Import instability

Table 7 shows the correlation matrix between the import instability index, MII, and a number of explanatory variables. The results are expanded in Appendix Table 6, where the explanatory variables are listed in order of importance, and the significance levels specified. The most important

determinant of import instability for the cross-section sample of 38 countries appears to be the size of GDP; changes in this variable explained over 45 per cent of the variations in MII, a relationship which was found to be significant at the 0.1 per cent level. Since imports and GDP are highly correlated (the correlation coefficient was 0.973), the use of imports as a proxy for GDP would generate similar results. The same reasoning would apply to explain the strong relationship between MII and the level of exports. The results indicate that the larger these macro aggregates (AVGDP, AVM, or AVX) are, the greater the likelihood of high import instability levels.

The inclusion of export variables as regressors is justified by the observation that the capacity of a country to import is often constrained by its export earnings (and by its accumulated reserves). Severe variations in export earnings, prices, or volumes may induce serious instabilities in imports; the effects on imports of capital goods would be expected to differ from those on imports of other goods. (This hypothesis was not, however, tested.) The variations in the instability of unit export prices, XUPI,

Table 7. Import Instability: Correlation Matrix, 1970-79, for 38 Countries

	MII	AVGDP	XII	XVOLI	MVOLI	XUPI	AVX	GRM	AVM	MUPI
MII	1.000									
AVGDP	0.684	1.000								
XII	0.477	0.257	1.000							
XVOLI	0.341	0.174	0.314	1.000						
MVOLI	0.329	0.268	0.096	-0.029	1.000					
XUPI	0.619	0.543	0.615	0.237	0.289	1.000				
AVX	0.645	0.939	0.295	0.225	0.316	0.575	1.000			
GRM	0.416	0.395	0.446	0.284	-0.084	0.202	0.427	1.000		
AVM	0.653	0.973	0.300	0.156	0.222	0.557	0.909	0.428	1.000	
MUPI	0.558	0.753	0.174	0.212	0.129	0.548	0.757	0.309	0.816	1.000

accounted for nearly 37 per cent of the changes in MII, whereas changes in MUPI explained 29 per cent of the variations in MII. Both relationships were statistically significant at the 0.1 per cent level. As expected, fluctuations in export earnings channelled their effects into imports: the variable XII was found to explain over 20 per cent of the variations in MII, and this relationship was significant at the 1 per cent level. The contribution of the two concentration indices to the explanation of import instability was rather minimal. Only 11 per cent of the variation in MII was explained by CONCONM, the coefficient of commodity concentration in imports, but the relationship was clearly significant at the 5 per cent level. Of course, few countries are as concentrated in their imports (in terms of commodities) as they are in their exports. The variable GEOCONM, the coefficient of geographical concentration in imports, hardly explained any of the variations in MII, and was clearly not a significant factor.

Multiple regression analysis yielded the following significant relationship:

MII	=	5.404	+	0.0003AVGDP	+	0.216XII	-	0.104MVOLI
(t-value)		(3.927)		(4.769)		(2.785)		(1.287)
(t-probability)		(99.96)		(99.99)		(99.13)		(79.33)

$\bar{R}^2 = 0.549$ F = 16.03 D.W. = 1.897

Countries with larger GDP values would appear to be better placed to cushion the effects of instability in their imports, and are therefore prepared to accept greater instability levels. The instability in expenditure on imports is also due to variations across countries in the instability index of their import volumes, MVOLI. Countries have different levels of import volume instabilities to reflect, for example, their varying susceptibilities to droughts and floods, which would increase their import volumes in poor harvest years, and decrease the amounts imported in good harvest years. A breakdown of causes of import instability in the three categories (ranked by their instability levels) is not attached here because the results for the subsample largely confirmed the above results.

VI. Summary and Conclusions

The aim of the study was to estimate the instability indices for exports and imports for 38 African countries for the period 1970-79, and for 37 African countries for the period 1960-69, and to determine the causes of different levels of fluctuations in exports and imports over the 1970-79 period. The empirical evidence supported the hypothesis of significantly increased export and import instability in the 1970s compared to the 1960s. The important results obtained were as follows:

	1970-79	1960-69
Export instability index		
Mean	14.63	13.86
Median	14.23	10.07
Range	18.80	69.38
Standard deviation	5.61	14.55
Import instability index		
Mean	10.84	9.36
Median	9.32	8.54
Range	18.52	22.92
Standard deviation	3.81	5.30

In general, average instability was found to increase over the 1970-79 period in the case of both exports and imports. The indices given above for the 1960-69 period were more strongly biased upward by the inclusion of two or three highly unstable countries, giving an impression of greater dispersion in instability values for that period.

The empirical results obtained from regression analysis are rather inconclusive regarding the causes of export instability, given its existence in the selected sample of countries. The post-war literature and international discussions have stressed the importance of commodity and geographical concentration of exports and specialization in primary production. Even when empirical results have shown significant positive relationships between instability indices and commodity concentration indices (or indices of specialization in primary production), the association has been invariably weak, with a low explanatory power displayed by the relationship. Further, the empirical studies have not only been contradicted by subsequent results, but methodological and/or statistical objections have weakened their reliability.

In the present study, export unit prices appear to be responsible for a significant proportion of instability in export earnings, contrary to many studies which have established a significant (but weak) relationship between export volume instability and instability in export earnings. The policy implications are clear: attempts to stabilize international prices for commodities exported by African countries would reduce instability in export earnings--for example, by international commodity agreements which maintain or defend "agreed" prices through the use of buffer stocks or export quotas. A number of the other factors conventionally regarded as important causes of export instability--for example, commodity and geographical concentration in exports--were found to be much less important than generally assumed.

Few studies have attempted to estimate the instability levels of imports, and much less to determine the causes. The above results indicate that imports are much more unstable than generally supposed; the countries

which were most susceptible to instability, curiously enough, were those with relatively large levels of imports (in absolute terms) and, by implication, with large levels of exports. The study did not determine whether import instability affected the import of capital goods to the same extent as other imports; the implications would be important for development planning and investment in those sectors of the economy requiring imported capital goods as inputs.

Comparison of Instability Levels Obtained by Using Different Numeraires

This appendix briefly examines the results obtained for instability levels when the unit of measurement of exports and imports is changed. The values obtained when domestic currencies are used (XIIDC and MIIDC) are compared with the values obtained when dollars are used (XIID and MIID), and with the values obtained when SDRs are used (XIISDR and MIISDR), for both sample periods, 1960-69 and 1970-79. The results are summarized in Appendix Tables 1 and 2.

As the results indicate, the absolute magnitudes obtained are extremely similar, as well as the variation amongst the instability levels. For the period 1970-79, the Pearson correlation coefficient was equal to 0.881 between XIIDC and XIID, 0.921 between XIIDC and XIISDR, and 0.950 between XIID and XIISDR, all statistically significant at the 1 per cent level. Amongst the import instability indices, the Pearson correlation coefficient was equal to 0.868 between MIIDC and MIID, 0.923 between MIIDC and MIISDR, and 0.929 between MIID and MIISDR. The two other variables included in Appendix Table 1 measure the instability of the exchange rate of domestic currencies vis-a-vis the dollar (XRID) and vis-a-vis the SDR (XRISDR). The values indicate very low instability levels combined with small variances (in absolute terms) in exchange rate instabilities.

The results for the period 1960-69 confirm even more strongly the above conclusion of insignificant differences existing in the instability levels obtained from using different currencies. Given the existence of fixed exchange rates in general in the 1960s, it is not surprising that the correlation coefficient between XIIDC and XIID was equal to 0.990, and the corresponding coefficient between MIIDC and MIID was 0.951. These coefficients are not significantly greater than the values obtained between the corresponding variables for the period 1970-79, despite the generalized existence of a floating exchange rate system for most of that period.

Appendix Table 1. Export and Import Instability Index: 1970-79

	XIIDC	XIID	XIISDR	MIIDC	MIID	MIISDR	XRID	XRISDR
Mean	14.64	14.38	14.07	10.73	11.44	11.09	3.56	3.05
Standard deviation	5.62	5.61	5.23	3.82	3.94	4.03	5.24	5.95
Coefficient of variation	38.42	38.99	37.13	35.58	34.41	36.28	147.41	194.97
Minimum value	5.41	5.43	5.15	4.30	5.60	5.16	0.00	0.43
Maximum value	24.51	24.05	23.01	22.82	22.23	24.82	27.50	31.97
Range	19.10	18.62	17.86	18.52	16.63	19.66	27.50	31.54
Median	14.23	14.04	13.13	9.29	11.06	10.62	1.73	1.17

Appendix Table 2. Export and Import Instability Index, 1960-69

	XIIDC	XIID = XIISDR	MIIDC	MIID = MIISDR
Mean	13.86	13.84	9.35	9.56
Standard deviation	14.55	14.58	5.30	5.59
Coefficient of variation	104.95	105.37	56.65	58.45
Minimum value	3.24	3.24	2.75	2.75
Maximum value	72.62	72.61	25.65	24.93
Range	69.38	69.37	22.90	22.18
Median	10.07	10.07	8.54	8.19

Appendix Table 3. List of Variables Used in Regression Analysis

AGGDP	Share of agriculture in GDP
AGX	Share of agriculture in exports
AVGDP	Average GDP (in millions of U.S. dollars)
AVM	Average imports (in millions of U.S. dollars)
AVX	Average exports (in millions of U.S. dollars)
COMCONM	Coefficient of commodity concentration in imports
COMCONX	Coefficient of commodity concentration in exports
DIVIX	Diversification index of exports
GEOCONM	Coefficient of geographical concentration in imports
GEOCONX	Coefficient of geographical concentration in exports
GRM	Growth rate of imports (in domestic currency)
GRX	Growth rate of exports (in domestic currency)
MII	Import instability index (in domestic currency)
MINGDP	Share of minerals in GDP
MINX	Share of minerals in exports
MUPI	Import unit price instability index (using dollar prices)
MVOLI	Import volume instability index
NOCOM	Number of commodities exported (at the three-digit SITC level)
ONECOM	Share of largest commodity in total exports
THRCOM	Share of three largest commodities in total exports
TRDSHR	Total trade as a share of GDP
TWOCOM	Share of two largest commodities in total exports
XII	Export instability index (in domestic currency)
XUPI	Export unit price instability index (using dollar prices)
XVOLI	Export volume instability index

Notes: The period covered is 1970-79. The variables COMCONM, COMCONX, DIVIX, GEOCONM, GEOCONX, ONECOM, THRCOM, TWOCOM were calculated for the year 1976. The variables relating to averages (AGGDP, AGX, AVGDP, AVM, AVX, MINGDP, MINX) were sometimes based on data for the year 1976 if the series were incomplete to an unacceptable degree.

Appendix Table 4. Causes of Export Instability, 1970-79, for 38 African Countries

				$\bar{R}^2$	F	D.W.
XII =	8.071	+ 0.504	XUPI	0.361	21.874	0.728
	(5.100)	(4.677)				
	(99.99)	(99.99)				
XII =	9.795	+ 0.286	GRX	0.175	8.856	0.433
	(5.360)	(2.976)				
	(100.00)	(99.48)				
XII =	8.212	+ 0.111	COMCONX	0.143	7.161	0.376
	(3.224)	(2.676)				
	(99.73)	(98.89)				
XII =	8.581	+ 0.102	ONECOM	0.130	6.512	0.340
	(3.401)	(2.552)				
	(99.83)	(98.49)				
XII =	4.816	+ 0.134	TWOCOM	0.113	5.712	0.336
	(1.147)	(2.390)				
	(74.10)	(97.78)				
XII =	17.988	- 0.055	AGX	0.108	5.471	0.252
	(10.770)	(2.339)				
	(100.00)	(97.50)				
XII =	13.181	+ 0.184	MINGDP	0.101	5.145	0.238
	(12.221)	(2.268)				
	(100.00)	(97.06)				
XII =	12.901	+ 0.052	MINX	0.097	4.982	0.221
	(11.065)	(2.232)				
	(100.00)	(96.81)				
XII =	2.211	+ 0.152	THRCOM	0.095	4.862	0.328
	(0.388)	(2.205)				
	(29.94)	(96.61)				
XII =	10.754	+ 0.439	XVOLI	0.073	3.928	0.147
	(5.005)	(1.982)				
	(99.99)	(94.49)				
XII =	13.876	+ 0.0008	AVX	0.062	3.434	0.158
	(14.222)	(1.853)				
	(100.00)	(92.79)				
XII =	11.302	+ 0.050	TRDSHR	0.061	3.407	0.187
	(5.613)	(1.846)				
	(100.00)	(92.68)				
XII =	18.008	- 0.109	AGGDP	0.060	3.375	0.145
	(8.848)	(1.837)				
	(100.00)	(92.55)				
XII =	13.884	+ 0.0002	AVGDP	0.040	2.55	0.119
	(13.725)	(1.598)				
	(100.00)	(88.13)				
XII =	10.743	+ 0.087	GEOCONX	0.004	1.147	0.077
	(2.863)	(1.071)				
	(99.30)	(70.86)				
XII =	23.169	- 0.097	DIVIX	0.002	0.511	0.036
	(1.937)	(0.715)				
	(93.93)	(52.08)				
XII =	14.313	+ 0.0096	NOCOM	0.001	0.104	0.018
	(10.418)	(0.322)				
	(100.00)	(25.08)				

N.B. The first set of figures in parentheses are the t-values, and the second set of figures are the t-probability values for each coefficient estimate.

Appendix Table 5. Causes of Export Instability, 1970-79, for Selected African Countries

					$\bar{R}^2$	F	D.W.
(i)	"Top third" countries (13)						
XII =	14.417	+	0.144	GEOCONX	0.217	4.317	1.072
	(4.390)		(2.078)				
	(99.89)		(93.81)				
XII =	18.962	+	0.029	TRDSHR	0.027	1.330	0.435
	(9.518)		(1.153)				
	(100.00)		(72.67)				
XII =	19.222	+	0.092	GRX	0.004	1.040	0.464
	(9.700)		(1.022)				
	(100.00)		(67.13)				
(ii)	"Middle third" countries (13)						
XII =	11.156	+	0.054	COMCONX	0.461	11.268	1.280
	(12.422)		(3.357)				
	(100.00)		(99.36)				
XII =	12.015	+	0.037	ONECOM	0.278	5.615	0.732
	(13.266)		(2.370)				
	(100.00)		(96.28)				
XII =	10.098	+	0.055	TWOCOM	0.260	5.222	0.668
	(5.804)		(2.285)				
	(99.99)		(95.69)				
XII =	14.898	-	0.023	NOCOM	0.200	3.995	0.492
	(25.206)		(1.999)				
	(100.00)		(92.91)				
XII =	12.603	+	0.133	XUPI	0.180	3.627	0.563
	(15.363)		(1.905)				
	(100.00)		(91.67)				
XII =	13.683	+	0.0003	AVX	0.127	2.745	0.251
	(31.560)		(1.657)				
	(100.00)		(87.42)				
XII =	13.531	+	0.0002	AVGDP	0.127	2.749	0.298
	(28.215)		(1.658)				
	(100.00)		(87.45)				
(iii)	"Bottom third" countries (12)						
XII =	5.155	+	0.041	AGX	0.252	4.698	0.878
	(3.351)		(2.167)				
	(99.26)		(94.46)				
XII =	25.802	-	0.195	DIVIX	0.236	4.389	0.304
	(3.088)		(2.095)				
	(98.85)		(93.74)				
XII =	8.913	-	0.035	MINX	0.192	3.619	0.691
	(15.269)		(1.902)				
	(100.00)		(91.37)				
XII =	9.373	-	0.0033	AVX	0.189	3.562	1.009
	(12.590)		(1.887)				
	(100.00)		(91.16)				

N.B. The first set of figures in parentheses are the t-values, and the second set of figures are the t-probability values for each coefficient estimate.

Appendix Table 6. Causes of Import Instability, 1970-79, for 38 African Countries

					$\bar{R}^2$	F	D.W.
MII =	9.365	+	0.0004	AVGDP	0.454	31.72	1.446
	(18.077)		(5.632)				
	(100.00)		(100.00)				
MII =	9.366	+	0.0016	AVM	0.410	26.72	1.498
	(17.216)		(5.170)				
	(100.00)		(99.99)				
MII =	9.596	+	0.0011	AVX	0.400	25.63	1.724
	(18.115)		(5.062)				
	(100.00)		(99.99)				
MII =	6.244	+	0.344	XUPI	0.366	22.33	1.736
	(5.835)		(4.725)				
	(100.00)		(99.99)				
MII =	6.487	+	0.636	MUPI	0.292	16.28	1.685
	(5.525)		(4.035)				
	(100.00)		(99.97)				
MII =	5.988	+	0.324	XII	0.206	10.62	2.127
	(3.847)		(3.259)				
	(99.95)		(99.76)				
MII =	6.370	+	0.220	GRM	0.150	7.55	1.935
	(3.776)		(2.747)				
	(99.94)		(99.07)				
MII =	2.447	+	0.206	COMCONM	0.111	5.64	1.504
	(0.692)		(2.375)				
	(50.65)		(97.70)				
MII =	7.865	+	0.324	XVOLI	0.092	4.732	1.867
	(5.447)		(2.175)				
	(100.00)		(96.38)				
MII =	8.411	+	0.233	MVOLI	0.083	4.364	1.631
	(6.681)		(2.089)				
	(100.00)		(95.62)				
MII =	13.653	-	0.071	GEOCONM	0.021	1.78	1.583
	(6.009)		(1.335)				
	(100.00)		(80.98)				

N.B. The first set of figures in parentheses are the t-values, and the second set of figures are the t-probability values for each coefficient estimate.

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