Friedman UNCTAD files - Draft Policy Paper on Suppl. Finance Nov 1969

FORM NO. 58 | INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Irving S. Friedman

DATE: November 10, 1969

FROM: R. M. Sundrum and Bimal Jalan

SUBJECT: Supplementary Finance

We are enclosing herewith another note, describing a probabilistic estimate of the gross shortfalls of export earnings from expectations, namely the magnitude described as "A" modified by the Compensatory Financing Facility element of "B", as defined in our Note 1 of November 7.

INTERNATIONAL BANK FOR
RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

INTERNATIONAL FINANCE CORPORATION

OFFICE OF THE PRESIDENT

NOV 7 - 1969

Mr. Friedman:

Herewith the Supplementary Finance drafts. Included also (if it's ready in time) it is a briefing paper from Owen on Spain. Mr. Owen also phoned with the following message:

> "The three attachments were being excluded from country papers sent to the Fund. Willoughby said Mr. Lipkowitz has taken it up with Cope and Baum and that the last page "future lending program" should not go to the Fund. Willoughby said that Program & Budgeting have no strong feelings but lean somewhat to including it."

Here remain pages for Spain (1) (2) (3) - attached

Mr. Lipkowitz phoned this morning & asked if you could call him back on Monday -- I suppose now it was all about the above.

Hope you're feeling much better -- Mr. Knapp said to let you know he was wondering how you were (I told him that all you had was a cold).

Daphne

P.S. Ruby has retyped the page you sent this morning - it is attached.

FORM NO. 57 | INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Irving S. Friedman

DATE: November 7, 1969

FROM: R. M. Sundrum and Bimal Jalan

SUBJECT: Supplementary Finance: Draft Paper

1. We are enclosing a draft of a policy paper on Supplementary Finance, written in the form of a paper for the Board.

2. The paper proposes a scheme which, we believe, meets the requirements of a discretionary scheme. At the same time, we believe that the present proposal takes full account of the basic objectives of the 1964 Resolution and will contribute to meeting the problems arising from unexpected export shortfalls. Because of the great flexibility of the present proposal, the scheme can be set up very soon after a decision is reached.

3. Apart from revision of the paper itself, the additional work that has to be done is the following:

(i) Revision of the two alternative versions of Table 1 to include more countries and bring up to date;

(ii) Completion of Table 2;

(iii) Drafting of Annex 3 on "Summary of Revised Simulation Exercise, 1968";

(iv) Preparation of legal opinion for paragraph 42.

This work may be entrusted to Legal Department, Mr. Macone and the Statistics Division.

4. Apart from the above annexures, which will be part of the paper, we enclose two notes which might be useful in drafting your forwarding memorandum to the President. Some parts of these notes may later on be used for the Board discussion also.

5. In your forwarding memorandum to the President, you may also wish to refer to the three studies by Sundrum on:

(i) Relative Significance of Export Shortfalls,
(ii) Measurement of Export Instability,
(iii) Shortfalls in the IMF Compensatory Finance Facility.

They are not concerned with the type of scheme to be set up or with the cost aspects. They are more concerned to indicate the problem of instability and its relationship with the development process. Although they do not yield any definitive conclusions, they contain quantitative evaluations of some of the factors relevant to these issues.

DRAFT

RELATIVE SIGNIFICANCE OF EXPORT SHORTFALLS IN THE DEVELOPING COUNTRIES

Contents

R. M. Sundrum

June 7, 1967

I. Introduction

1.1. This study has been prepared in the World Bank at the request of the Intergovernmental Group of Experts on Supplementary Financial Measures, convened by the Committee on Invisibles of the United Nations Trade and Development Board. The purpose of this study is to assess the relative significance of export shortfalls, amongst other causes, of the disruption of development programs of the less-developed countries.

1.2. From the outset, an important distinction must be made between two approaches to the problem. One approach, which may be described as the "planning approach" is to compare actual values of certain variables with their expected values. This approach is essentially forward looking. From this approach, we may say that there is a shortfall in a variable when the actual value of that variable falls short of its expectation. The nature and magnitude of shortfalls depend heavily on the ways in which expectations are formulated, but such expectations have to be made in countries which adopt a "planning" approach to their development efforts. Indeed, it is only within the context of such an approach that there is any meaning to the concept of the "disruption" of development programs. Countries which attempt to plan their development are, therefore, particularly vulnerable to shortfalls in various sources of foreign exchange.

1.3. The other approach, which may be described as the "trend approach" is mainly concerned with the relationship between actual values of certain variables with the trend values underlying past time series of such values. The principal concern of this approach is with fluctuations, considered as deviations from trends. Because such trends can only be determined from actually observed data, this approach tends to be dominated by past experience.

This approach is particularly useful for countries which aim to promote their economic progress along pre-existing trends, for the development efforts of these countries will be particularly affected by fluctuations around such trends.

1.4. Although it is very useful to make this conceptual distinction between these two approaches to the analysis of the problems faced by the developing countries, there is also a great deal of interaction between the two approaches. In the first place, an important element in formulating future expectations about any variable is the past trend in the values of that variable. But in addition to extrapolating the past trend, the planning approach can also take account of the effect of various contemplated policy actions to influence that trend. In fact, an extrapolation is often the first step in showing the need for such policy actions and indicating the nature of the policy actions that have to be undertaken to achieve certain desired results. Thus, the study of the growth and fluctuation of certain variables in the past is very useful in the planning approach also to show the interrelationships of various factors that must be taken into account in formulating development programs. In the second place, if a variable shows large fluctuations around its trend in the past, this also suggests that there are likely to be considerable shortfalls from expectations in the future, insofar as these expectations depend on the trend. Here also there is a difference between the two approaches, for there may be cases in which a fluctuation around a trend may be predictable, so that such a fluctuation will not give rise to shortfalls, as interpreted here. The essential feature of a shortfall is that it is an unexpected downward deviation whether the expectation from which it is measured follows the trend of past experience

or not, whereas a fluctuation is a deviation from a trend, whether such a trend was expected to continue in the future or not, or whether such a fluctuation itself was expected or not. Finally, from a policy point of view, measures to reduce fluctuations around a trend enable countries to follow a smooth path of development; this is clearly of great benefit to some countries to maintain the momentum of their development efforts once they have achieved a satisfactory rate of growth and development. On the other hand, measures to reduce shortfalls from expectations would help countries to adhere to planned development programs, even where these programs involve a break from past trends, or where these programs take account of deviations from trend which can clearly be foreseen.

1.5 This study is limited to the less-developed countries for which some of the basic information needed for this analysis was available. The study has therefore been affected by the limitations of the data. The required data were available only for a few countries, and for a short period, and even when available, the data has been of doubtful validity. A number of adjustments had to be made to the data in order to make international comparisons among the less-developed countries; while it is not possible to devise a 'perfect' method of making such international comparisons, the adjustments for various countries have varied in quality, depending on the available information. Therefore, the results obtained here have to be interpreted with some caution.

1.6 The statistical approach has been used in this study and has concentrated on bringing out key relationships for the 'average' less-developed country. Great reliance cannot therefore be placed on the results obtained for particular countries. The main object of the exercise was to consider

if there was a problem calling for international cooperative action, and if so, to indicate the nature of international policies that may be required to deal with the problem.

1.7 In Chapter 2, the concept of shortfalls from expectations of various types of foreign exchange receipts is broken up into three components. An attempt is made to quantify one of these components on the basis of some simple assumptions, while some general considerations are set out regarding the relative magnitudes of the other components. While the principal concern of this study is with shortfalls, extensive use has been made of the analysis of trends and fluctuations in past data, partly because this is needed in any case for understanding the inter-relationships of various factors, and partly also because of serious statistical problems in determining the extent of shortfalls, which depend so heavily on the methods by which expectations about the future are made in various contexts in the developing countries. The fluctuations around trends of foreign exchange receipts are considered in Chapter 3 and the fluctuations in foreign exchange expenditures are considered in Chapter 4. In Chapter 5, we consider the various links in the chain of relationship connecting foreign exchange variables with investment activity in the less-developed countries, by examining the correlation of growth rates and annual fluctuations in these variables. The main conclusion on the relative significance of the various types of shortfalls from expectations in foreign exchange receipts in contributing to the disruption of development programs is reported in Chapter 6.

Chapter 2. Shortfalls in Foreign Exchange Receipts

2.1. Introduction In this chapter, an attempt is made to compare actual values with certain projections of exchange receipts of the less-developed countries in order to get some idea of the relative magnitude of the shortfalls of these types of receipts, from what might have been expected of them. Most of the analysis is based on the annual balance of payments data and export data as reported in the IMF International Financial Statistics (in millions of U.S. dollars) for 35 less-developed countries for the period 1956-65. The foreign exchange receipts of these countries were classified in three categories, namely:

X: Value of exports of goods (f.o.b.)

A: Transfers and capital inflow on government account (being items 71b and 72b of the IFS balance of payments data)

P: Transfers and capital inflow on private account (being items 71a and 72a of the IFS balance of payments data)

E: = X+A+P the total foreign exchange receipts.

For the interpretation of the results of this analysis, certain qualifications of the above classification of foreign exchange receipts are in order. The magnitude X refers to export of goods only; the foreign exchange earnings on services and other invisible items are netted out against corresponding expenditures and are considered as an item of foreign exchange expenditure. Generally, the expenditures on invisible items were greater than receipts for the less-developed countries considered here; in only 8 out of the 35 countries for which data were available were receipts greater on the average for the period 1956-65.

The magnitude A, transfers and capital movements on government account may be considered an approximation to the flow of aid, but is not exactly the same as the net inflow of official aid, because it includes other types of receipts and expenditures of the government, such as expenditures on diplomatic offices abroad. The classification of this item of the balance of payments is based on the nature of the agency in the reporting country. Therefore, this item includes the results of transactions of the government with foreign private institutions, such as receipts and expenditures on bonds floated in foreign private capital markets, which have been important for a few countries, especially Israel. This item was positive, on the average for the period considered, for all countries, except Venezuela.

The magnitude P includes all transfers and capital movements on private account. This item was positive, on the average for the period, for 28 of the 35 countries for which data were available.

2.2. The Estimation of Shortfalls from Expectation

Shortfalls from expectation of these items of receipts in the balance of payments can be calculated for any period, by comparing the actual values with expected values, if the values expected for that period were known. Further, to be relevant as basis of policies to reduce or overcome the disadvantages flowing from such shortfalls, the expectations must be made in some reasonable manner. But, however reasonably such expectations are made, they cannot be made in an entirely objective manner and necessarily involve subjective estimates of a number of factors. Therefore, if the actual expectations held before a period are not known, there is no way in which the expectations appropriate for that period can be derived, because there is no purely technical method of doing so, independently of the subjective estimates which might have been made before the event.

Such expectations about export earnings of a number of less-developed countries were, in fact, available for the period 1957-63 from World Bank reports on those countries, where such export projections were made as a part of the World Bank's study of the country's development prospects and evaluation of the country's development programs. These projections of export earnings were made the basis of estimates of export shortfalls in the World Bank's report on Supplementary Financial Measures, especially in a simulation exercise described in detail in Appendix IV of that report. Similar expectations about the other items in the balance of payments, however, are not available and there is no way of calculating in any exact method the shortfalls from expectation of these other items with which to compare the shortfalls from expectation of export earnings. An attempt is, however, made in this chapter to arrive at some rough indications of the shortfalls from

expectations of the three categories into which the receipts items of the balance of payments of the less-developed countries can be classified.

The shortfall from expectation of any item of the balance of payments for any country can be broken up into the following three constituents:

(i) The shortfall from, or excess over, expectation for that country due to the deviation of actual values from expectations for a whole group of countries. This is the share of a particular country in what may be called the "global shortfall" or "global excess".

(ii) The shortfall from, or excess over, expectation for a particular country, assuming that there is no global shortfall or excess and assuming that the expectation of all countries, comprising the whole group, are made in a uniform manner. This may be described as the country shortfall from a uniform expectation. By this definition, the sum of all such shortfalls and excesses for the whole group would be exactly zero.

(iii) The shortfall or excess of a particular country due to the divergence between the uniform projection and that which would have been appropriate for that country, in the light of its own special circumstances and the policies followed or to be followed in that country. This may be described as the shortfall from, or excess over, the particular expectation for that country.

Of these three constituents of the divergence of actual from expected values of any item of the balance of payments, there is no way of quantifying the first and third elements after the event. The relative magnitudes of these elements can only be determined on the basis of judgment; some comments on this subject are made later in this chapter. The second element of such divergences may be quantified in various ways; the results of some methods are described below.

2.3. Method I of Estimating Shortfalls from Uniform Expectation

The data on the three categories of foreign exchange receipts of 35 less-developed countries (i.e. all the less-developed countries for which balance of payments data are available in the IMF International Financial Statistics for the period 1956-65) are summarized in Table 2.1 below.

Table 2.1. Foreign Exchange Receipts of 35 Less-Developed Countries in 1956-65 (in millions of US dollars.)

Item of Receipts	1956-60	1961-65
X	69,725	87,103
A	9,464	14,826
P	8,042	6,503
E	87,231	103,432

Some idea of the extent to which the sample of 35 countries covers all less-developed countries is given by the following Table 2.2 based on the data for exports for the period 1956-60.

Table 2.2. Sample Coverage of Less-Developed Countries on Basis of Export Data for 1956-60.

Region	Sample	Total	Percentage of Total Covered by Sample
Latin America	37,862	45,930	82
Asia	16,362	31,450	52
Middle East (including Turkey)	11,673	22,860	51
Africa	3,828	21,610	18
Total	69,725	121,850	57

Table 2.1 shows that between the periods 1956-60 and 1961-65, X for all sample countries increased by 24.92%; A increased by 56.67%; and P declined by 19.14%. Therefore, a simple method of making a uniform projection of these

three items, for the period 1961-65 based on the values for the period 1956-60, which will be correct for the group as a whole, is to adjust the values for each country by the above percentages of change. The shortfalls and excesses for individual countries, obtained by comparing actuals with these projections for the period 1961-65, are shown in Table 2.3 below. This table shows that total export shortfalls (equal to total export excesses) were largest, and shortfalls in private transfers and capital inflows were smallest.

The table also shows the shortfalls from, or excesses over, expectations of total receipts E. In deriving these figures, the expectation of E for particular countries was defined simply as the sum of the expectations of X, A and P. The effect of a shortfall in any item on the total receipts E varies from country to country, because a shortfall in one item may be compensated for by an excess, or aggravated by a shortfall, in other items. Table 2.4 below shows the effect of such adjustments on the divergence of total receipts E from its expectation.

Table 2.3. Shortfalls and Excesses in Exchange Receipts

1961 - 65: Method I

(in millions of U.S. Dollars)

	Country	X	A	P	E
1.	Argentina	201	128	- 586	- 257
2.	Bolivia	- 11	- 10	6	- 15
3.	Brazil	-1282	1002	- 289	- 569
4.	Chile	- 71	468	- 44	353
5.	Colombia	- 706	55	175	- 476
6.	Costa Rica	- 0	- 18	129	102
7.	Dominican Republic	- 85	157	- 6	66
8.	Ecuador	- 105	- 1	15	- 91
9.	El Salvador	30	36	84	150
10.	Guatemala	15	- 117	71	- 31
11.	Haiti	- 29	- 36	44	- 21
12.	Honduras	34	0	36	70
13.	Mexico	169	72	728	969
14.	Nicarauga	121	- 1	33	153
15.	Paraguay	9	11	20	40
16.	Peru	845	172	- 226	791
17.	Burma	- 183	- 250	- 1	- 434
18.	Ceylon	- 375	3	28	- 344
19.	India	- 317	1210	- 35	858
20.	Pakistan	165	670	229	1064
21.	Philippines	211	- 200	- 408	- 397
22.	Thailand	334	- 19	276	591
23.	Ghana	- 178	- 29	98	- 109
24.	Jordan	26	- 120	16	- 78
25.	Morocco	- 181	66	- 156	- 271
26.	Sudan	- 23	71	1	49
27.	Syria	- 21	- 83	12	- 92
28.	U.A.R.	- 446	532	152	238
29.	China	701	- 402	108	407
30.	Korea	332	-1348	221	- 795
31.	Turkey	2	- 551	63	- 486
32.	Israel	696	- 549	1326	1473
33.	Iran	932	- 391	290	831
34.	Iraq	531	136	- 250	417
35.	Venezuela	-1332	- 664	-2160=	-4156
		± 5354	± 4789	± 4161	± 8622

Table 2.4. Adjustments among Shortfalls and Excesses of Various Items of Foreign Exchange Receipts: Method I.
(in millions of U.S. Dollars)

Countries with:	Total Shortfalls and Excesses in: X	A	P	E
X-shortfalls	-5354	+2473	-2031	-4912
A-shortfalls	+1502	-4789	+ 139	-3148
P-shortfalls	-1663	+2225	-4161	-3599
E-shortfalls	-3616	-2155	-2851	-8622

Table 2.4 indicates a tendency for compensatory shortfalls and excesses between X and A, and between A and P, and a tendency for shortfalls in X to be aggravated by shortfalls in P. X-shortfalls are still the largest, as shown both by the magnitude of these shortfalls in countries with E-shortfalls, and by the total E-shortfall in countries with the various other types of shortfalls. However, after taking account of the interactions between various types of shortfalls and excesses, the shortfalls in P tend to be greater than the shortfalls in A, both in countries with E-shortfalls and in the effect on E-shortfalls in countries with the various types of shortfalls.

2.4. Method II of Estimating Shortfalls from Uniform Expectation

Method I of estimating shortfalls in 1961-65 is based only on the total values of X, A and P in 1956-60. It does not take account of the trends of these values for individual years in the period 1956-60. Such trends are useful indications of probable future developments, and are, in fact, often taken into account in making projections. Therefore, we consider another method of making uniform expectations for the period 1961-65 of the various categories of foreign exchange receipts in the less-developed countries, by considering trends within the period 1956-60. A wide variety of trends can be fitted to any given time-series, the choice depending considerably on a statistical judgment of the type of trend appropriate in particular cases. Only the simplest method, extrapolation of a linear trend, will be used, because we are considering a uniform method of projection for a number of countries and because the short period for which data is available does not permit the search for more suitable trends. The extrapolation of linear trends will, however, not give a correct projection for the total; therefore the results of a linear extrapolation are adjusted by suitable percentage factors so that the total projection of each item will agree with actual values for the whole group of countries. The percentage factors are derived in Table 2.5 and the results of this method of estimating shortfalls and excesses are shown in Table 2.6.

Table 2.5 Comparison of Linear Extrapolation with Actual Values of Foreign Exchange Receipts in 1961-65 for 35 Less-Developed Countries (in millions of U.S.dollara)

Item	Estimates based on Linear Extrapolation	Actual Values	Percentage Deviation
X	76,788	87,103	+13.43
A	8,583	14,826	+72.74
P	4,755	6,503	+36.77

Table 2.6. Shortfalls and Excesses in Exchange Receipts for 35 Less-Developed Countries: Method II
(in millions of U.S. Dollars)

	Country	X	A	P	E
1.	Argentina	- 87	- 70	- 3979	-4136
2.	Bolivia	238	92	- 79	251
3.	Brazil	1004	1576	- 370	2210
4.	Chile	394	415	- 516	293
5.	Colombia	442	285	943	1670
6.	Costa Rica	- 53	- 31	96	12
7.	Dominican Republic	- 251	118	130	- 3
8.	Ecuador	- 207	- 28	21	- 214
9.	El Salvador	147	91	21	259
10.	Guatemala	138	3	- 61	80
11.	Haiti	59	- 61	- 60	- 62
12.	Honduras	119	- 60	113	172
13.	Mexico	950	208	977	2135
14.	Nicarauga	165	- 5	22	182
15.	Paraguay	90	38	- 44	84
16.	Peru	365	665	171	1201
17.	Burma	96	- 193	62	- 35
18.	Ceylon	- 326	- 122	- 59	- 507
19.	India	460	-4590	- 837	-4967
20.	Pakistan	166	- 277	108	- 3
21.	Philippines	- 390	- 718	- 902	-2010
22.	Thailand	377	- 43	42	376
23.	Ghana	- 599	- 804	7	-1396
24.	Jordan	67	- 450	77	- 306
25.	Morocco	- 92	- 192	61	- 223
26.	Sudan	5	- 491	124	- 362
27.	Syria	336	- 43	- 153	140
28.	U.A.R.	- 980	1157	- 429	- 252
29.	China	500	- 427	- 372	- 299
30.	Korea	306	- 259	172	219
31.	Turkey	67	- 409	- 588	- 930
32.	Israel	55	- 239	- 325	- 509
33.	Iran	- 899	- 124	241	- 782
34.	Iraq	- 859	517	- 200	- 542
35.	Venezuela	-1803	4471	5586	8254
		± 6546	± 9636	± 8974	±17538

Table 2.6 shows that, in spite of the small amounts of A and P, compared with X, the total shortfalls in these two magnitudes were greater than for X. This indicates the effect of the great instability over time of the A and P types of foreign exchange receipts in individual countries. Table 2.7 below shows the extent of adjustments among the three types of exchange receipts.

Table 2.7. Adjustments among Shortfalls and Excesses of Various Items of Foreign Exchange Receipts : Method II. (in millions of U. S. Dollars)

Countries with:	Total Shortfalls and Excesses in: X	A	P	E
X-shortfalls	- 6546	+ 4174	+ 573	- 1799
A-shortfalls	+ 125	- 9636	- 6129	- 15640
P-shortfalls	+ 699	- 2881	- 8974	- 11156
E-shortfalls	- 3215	- 7403	- 6920	- 17538

Table 2.7 shows that X-shortfalls were the smallest, both in their effect on countries with E-shortfalls and by their effect on E-shortfalls on countries with the various types of shortfalls. On the whole, X-shortfalls tended to be compensated by excesses in A and P, while shortfalls in A and P tended to be aggravated.

2.5 Estimation of Shortfalls by Method II, excluding Oil Countries.

Less-developed countries, which are major exporters of petroleum, are in a special category by themselves, both because of the special features of international trade in that commodity, and because they generally have large reserves of foreign exchange. Three countries in the sample - Iran, Iraq and Venezuela, are in this category. It would be interesting to compare the relative magnitudes of the various types of shortfalls in the 32 less-developed countries of the sample, excluding these three countries. Table 2.8 shows the comparison of the linear extrapolation based on the values of 1956-1960 with the actual values of 1961-1965 for the 32 countries, and derives the percentage factors by which the linear extrapolation must be adjusted for each item. Table 2.9 shows the results of applying method II to these 32 countries.

Table 2.8. Comparison of Linear Extrapolation with Actual Values of Foreign Exchange Receipts in 1961-1965 for 32 Less-developed countries (in millions of U.S. dollars)

Item	Estimates based on Linear Extrapolation	Actual Values	Percentage Deviation
X	53,951	64,759	+ 20.03
A	11,403	14,833	+ 30.08
P	9,705	7,647	- 21.20

Table 2.9. Shortfalls and Excesses in Exchange Receipts for 32 Less-Developed Countries, 1961-1965 : Method II
(in millions of U.S. Dollars)

Country	X	A	P	E
1. Argentina	- 468	- 1	- 2192	- 2661
2. Bolivia	230	110	16	324
3. Brazil	653	1406	84	2143
4. Chile	249	440	- 220	469
5. Colombia	326	236	664	1226
6. Costa Rica	- 85	- 16	118	17
7. Dominican Republic	- 312	124	75	- 113
8. Ecuador	- 261	- 6	32	- 235
9. El Salvador	110	81	50	241
10. Guatemala	103	12	26	141
11. Haiti	52	- 39	- 21	- 8
12. Honduras	99	- 37	73	135
13. Mexico	717	171	1149	2037
14. Nicaragua	145	0	38	183
15. Paraguay	83	38	- 9	112
16. Peru	217	561	149	927
17. Burma	31	- 124	27	- 66
18. Ceylon	- 456	- 58	- 49	- 563
19. India	29	- 2270	- 284	- 2525
20. Pakistan	42	282	190	514
21. Philippines	- 604	- 489	- 472	- 1565
22. Thailand	246	26	167	439
23. Ghana	- 717	- 524	34	- 1207
24. Jordan	65	- 247	64	- 118
25. Morocco	- 210	- 47	- 26	- 283
26. Sudan	- 54	- 329	85	- 298
27. Syria	309	- 25	- 72	212
28. U.A.R.	- 1186	1100	- 214	- 300
29. China	434	- 247	- 115	72
30. Korea	296	40	233	569
31. Turkey	- 44	- 155	- 298	- 497
32. Israel	- 39	- 13	730	678
	± 4436	± 4627	± 3988	±10439

Table 2.9 shows that for the 32 less-developed countries (excluding the oil-countries), export shortfalls are greater than shortfalls in P, but less than shortfalls in A. The extent to which the various shortfalls compensate or aggravate one another is shown in Table 2.10 below.

Table 2.10. Adjustments among Shortfalls and Excesses of Various Items of Foreign Exchange Receipts : Method II applied to 32 Less-Developed Countries (in millions U.S. Dollars)

Countries with:	Total Shortfalls and Excesses in :			
	X	A	P	E
X-shortfalls	- 4436	- 2177	- 414	- 7027
A-shortfalls	- 1919	- 4627	- 2366	- 8912
P-shortfalls	- 1582	- 1643	- 3988	- 7213
E-shortfalls	- 4135	- 3065	- 3239	- 10439

In the 32 less-developed countries, excluding the oil-countries, all types of shortfalls tended to occur for the same countries, so that the effect on E-shortfalls were aggravated. Countries with X-shortfalls tended to have the smallest E-shortfalls, but in countries with E-shortfalls, the main contribution appears to be through X-shortfalls.

2.6 Estimation of Shortfalls by Method II, excluding Countries with Large Private Capital Transactions

The previous calculations have shown that the magnitudes A and P have been so unstable that in 1961-65 they tend to show large shortfalls from uniform expectation derived by a linear extrapolation of the experience of 1956-60. The flow of private capital and transfers is, however, limited to a few countries. In the sample, such transactions were mainly concentrated in 6 countries, namely Argentina, Brazil, Mexico, Peru, Israel and the Philippines. In 1956-60, the flow of such private funds for these 6 countries was 76% of the total of such flows to all the less-developed countries (excluding oil-countries), whereas their exports amounted to only 39%, and their share in A was only 12%. As a result, it might be expected that the effect of P-shortfalls is also highly concentrated and limited to these countries. This is shown by a comparison of the various types of shortfalls in 26 less-developed countries, excluding the oil countries and the countries with a high concentration of private transactions. Table 2.11 compares the linear extrapolations of various items of foreign exchange receipts with actuals, for the period 1961-65, and derives the percentage adjustments of the linear extrapolation in order to arrive at a uniform expectation, for these 26 countries. The results of applying such an expectation are shown in Table 2.12.

Table 2.11. Comparison of Linear Extrapolation with Actual Values of Foreign Exchange Receipts in 1961-65, for 26 Less-Developed Countries (in millions of U.S. Dollars).

Item	Estimates based on Linear Extrapolation	Actual Values	Percentage Deviation
X	32,426	38,446	+ 18.57
A	10,903	12,549	+ 15.09
P	3,016	2,927	- 2.94

Table 2.12 : Shortfalls and Excesses in Exchange Receipts for 26 Less-Developed Countries

1961 - 1965 : Method II.

(in millions of U.S. Dollars)

Country	X	A	P	E
1. Bolivia	232	117	- 36	313
2. Chile	281	449	-313	417
3. Colombia	352	218	752	1322
4. Costa Rica	- 78	- 11	111	22
5. Dominican Republic	- 298	126	92	- 80
6. Ecuador	- 249	2	29	- 218
7. El Salvador	119	77	40	236
8. Guatemala	111	15	- 2	124
9. Haiti	53	- 32	- 33	- 12
10. Honduras	103	- 28	86	161
11. Nicaragua	150	2	33	185
12. Paraguay	84	37	- 20	101
13. Burma	45	- 100	38	- 17
14. Ceylon	- 428	- 36	- 52	- 516
15. India	126	-1456	-457	-1787
16. Pakistan	69	478	164	711
17. Thailand	275	50	127	452
18. Ghana	- 691	- 425	25	-1091
19. Jordan	65	- 174	68	- 41
20. Morocco	- 183	4	2	- 177
21. Sudan	- 41	- 270	97	- 214
22. Syria	315	- 18	- 98	199
23. U.A.R.	-1140	1080	-282	- 342
24. China	449	- 183	-196	70
25. Korea	298	144	214	656
26. Turkey	- 19	- 66	-389	- 474
	+ ———	+ ———	+ ———	+ ———
	- 3127	- 2799	- 1878	- 4969

From Table 2.12, X-shortfalls are found to be the largest for the 26 less-developed countries, excluding the oil countries and the countries with large private transactions. The interactions of the various types of shortfalls and excesses are summarised in Table 2.13 below.

Table 2.13. Adjustments among Shortfalls and Excesses of Various Types of Foreign Exchange Receipts: Method II applied to 26 Less-Developed Countries (in millions of U.S. Dollars).

Countries with :	Total Shortfalls and Excesses in :			
	X	A	P	E
X-shortfalls	- 3127	+ 404	- 367	- 3090
A-shortfalls	- 101	- 2799	- 800	- 3700
P-shortfalls	+ 64	- 93	- 1878	- 1907
E-shortfalls	- 2760	- 1347	- 862	- 4969

In the smaller sample, excluding the oil-countries and the countries with large private transactions, export shortfalls have contributed most in countries with E-shortfalls. However, E-shortfalls have been largest in countries with A-shortfalls, mainly because the A-shortfalls were seriously aggravated by P-shortfalls also.

2.7 Comparison with Shortfalls due to Consumer Goods Imports.

The analysis so far has been concerned with shortfalls and excesses in various items of foreign exchange receipts. But from a developmental point of view, account should also be taken of items of expenditures for non-developmental purposes, which might affect the availability of foreign exchange for development. To study this, an attempt is made here to estimate shortfalls and excesses in the imports of consumer goods into the less-developed countries, and to compare these with shortfalls and excesses in items of foreign exchange receipts. A magnitude, E*, is introduced as a rough measure of exchange availability for developmental purposes, and is defined as

$$E^* = X + A + P - M_c.$$

Data on M_c is available for the period 1956-1963 only for 17 countries, excluding oil-countries and countries with large private transation. This data is derived from trade statistics, and is therefore not strictly comparable with the values of A and P, which are derived from balance-of-payments statistics. Expectations of the four items are again derived for the period 1961-63 on the basis of a linear extrapolation of trends observed in the period 1956-60. Table 2.14 shows the results of the linear extrapolation, and derives the percentage adjustments needed to equal the actual values for the entire group of 17 countries.

Table 2.14. Comparison of Linear Extrapolation with Actual Values of X, A, P and M_c during 1961-1963 for 17 Less-Developed Countries (in millions of U. S. Dollars).

Item	Estimates based on Linear Extrapolation	Actual Values	Percentage Deviation
X	13,323	15,458	+ 16.02
A	4,779	4,954	+ 3.66
P	1,189	1,380	+ 16.06
M_c	5,147	5,214	+ 1.30

Table 2.15 shows the estimates of shortfalls and excesses arrived at, by using a linear extrapolation with the adjustments derived from Table 2.14. Shortfalls due to M_c are defined as actual imports of consumer goods in excess of the expectation defined by this method, as such an excess leads to exchange availability for developmental imports less than might be expected.

Table 2.15. Shortfalls and Excesses in Exchange Receipts and Expenditures for 17 Less-Developed countries : 1961-1963 : Method II. (in millions of U. S. Dollars).

Country	X	A	P	M_c	E*
1. Bolivia	68	47	- 10	- 35	70
2. Chile	24	243	- 240	13	40
3. Colombia	18	88	375	- 117	364
4. Costa Rica	- 54	- 52	- 34	39	- 13
5. Dominican Republic	- 120	46	53	- 78	- 99
6. Ecuador	- 132	1	4	6	- 121
7. El Salvador	230	32	6	- 1	267
8. Guatemala	15	7	- 44	- 9	- 31
9. Honduras	22	- 10	46	- 8	50
10. Nicaragua	33	1	17	- 9	42
11. Burma	49	- 42	15	12	34
12. Ceylon	- 246	- 36	- 16	226	- 72
13. China	88	- 37	- 122	- 19	- 90
14. India	- 119	- 738	- 348	250	- 955
15. Korea	83	147	94	- 134	190
16. Pakistan	- 4	240	65	- 73	228
17. Thailand	45	13	71	- 33	96
Total	+ - 675	+ - 865	+ - 780	+ - 516	+ -1381

Table 2.15 shows that M_c -shortfalls for this sample of countries is less than for the other types of shortfalls. The interaction of the various types of shortfalls is shown in Table 2.16 below.

Table 2.16. Interaction among Shortfalls and Excesses of Various Types of Foreign Exchange Receipts and Expenditures: Method II applied to 17 Less-Developed Countries
(Millions of U.S. Dollars)

Countries with:	Total Shortfalls and Excesses in : X	A	P	M_c	E*
X-shortfalls	- 675	- 489	- 208	+ 340	- 1032
A-shortfalls	- 260	- 865	- 391	+ 470	- 1046
P-shortfalls	- 170	- 514	- 780	+ 426	- 1038
M_c-shortfalls	+ 478	574	551	-516	+ 1087
E*-shortfalls	- 568	- 759	- 439	385	- 1381

Table 2.16 shows that M_c-shortfalls tend to compensate for shortfalls of all other types, though this compensation is not sufficient to overcome the effects of the other shortfalls of exchange availability for developmental purposes.

2.8. Conclusions about Shortfalls from Expectations

The export earnings of the less-developed countries depend on a greater variety of circumstances and the decisions of a greater number of persons, than the flow of governmental and private foreign exchange funds. This has two types of consequences in estimating the relative magnitude of global shortfalls. On the one hand, the fluctuations in export earnings are more likely to be subject to the operation of the law of large numbers, so that even simple methods of projection will be more reliable. On the other hand, the fact that decisions about A and P are limited to few persons implies that the governments of the less-developed countries are likely to have better information in advance of the actual amounts of such funds likely to be available. Thus, the more erratic variations in A and P are likely to be foreseen to a greater extent and thus lead to smaller shortfalls from expectations than otherwise.

With respect to relative magnitudes of shortfalls from particular expectations, the same considerations as for global shortfalls apply with greater force, with one additional factor affecting export earnings. In addition to other factors affecting total export earnings of all less-developed countries, the earnings of individual countries are likely to have greater shortfalls from expectations because of expected changes in the shares of individual countries in the markets for particular commodities.

We may therefore conclude that shortfalls from expectations in foreign exchange receipts of particular countries are likely to be greatest in the case of export earnings.

Chapter 3. Fluctuations in Foreign Exchange Receipts

3.1 Introduction

In the last chapter, we studied an aspect of the instability of various types of foreign exchange receipts of the less-developed countries in the form of the shortfalls of each of these types of receipts in one period from expectations derived from the experience of an earlier period. In this chapter, we shall consider another aspect of the instability of these types of foreign exchange receipts.

3.2 A Measure of Fluctuation

One measure of fluctuations in a time series, often used in statistical practice, is the standard error of estimate; this is the root-mean-square of the deviations of the actual values of a time series from a trend, fitted by least squares. It is more convenient to use the square of the standard error of estimate, because this gives us an additive measure of fluctuations. To illustrate, let x and y be two variables, whose sum is z. Then, if $S^2(x)$, $S^2(y)$, and $S^2(z)$ are the squares of the standard errors of estimates, and if $C(x,y)$ is the partial covariance of x and y, eliminating the influence of time trends, i.e., if $C(x,y)$ is the covariance of the residuals of the two variables from their linear time trends, then we have

$$S^2(z) = S^2(x) + S^2(y) + 2\,C(x,y).$$

This method is used in this chapter to measure the fluctuations in the three types of foreign exchange receipts distinguished before, and to study their interrelations.

3.3. Fluctuations in Foreign Exchange Receipts

Table 3.1 below shows the average of the three types of foreign exchange receipts of various groups of countries over the period 1956-65, and the annual growth of these receipts for the same period.

Table 3.1. Average Values and Annual Growth of Foreign Exchange Receipts of Less-Developed Countries: 1956-65
(in millions of U.S. Dollars)
(Percentages to total average values in brackets)

Receipts	35 Countries	3 Oil Countries	6 Countries with Large Private Transactions	26 Other Countries
	(a) Average Annual Values			
X	15,683 (80)	4,012 (98)	4,671 (78)	7,000 (74)
A	2,429 (13)	58 (1)	334 (6)	2,037 (21)
P	1,454 (7)	6 (-)	988 (16)	460 (5)
E	19,566 (100)	4,076 (100)	5,993 (100)	9,497 (100)
	(b) Annual Growth			
X	713	195	237	281
A	192	-34	37	189
P	-49	-82	-18	51
E	856	79	256	521

Table 3.1 shows the relative magnitudes and rates of growth of the three components of exchange receipts. Export earnings are the largest part of these receipts, contributing 80% for all 35 countries, and 74% for the 26 other countries. A-receipts were mostly in these other countries, where they constituted 21% of all receipts, P-receipts were mostly concentrated in the 6 countries with large private transactions where they constituted 16% of all receipts, compared with only 5% in the 26 other countries. Most of the growth in exchange receipts were accounted for by exports. The growth in A-receipts were mostly in the 26 other countries, where they contributed substantially to the growth of total receipts.

Table 3.2 shows the extent of fluctuations in X,A,P and E, and their interrelationships for the period 1956-65 for various groups of less-developed countries.

Table 3.2. Fluctuations in Foreign Exchange Receipts in Less-Developed Countries: 1956-65

Variation:	35 Countries	3 Oil-Countries	6 Countries with large private transactions	26 other Countries
$S^2(X)$	63,389	9,674	27,332	26,383
$S^2(A)$	86,833	45,411	11,333	30,089
$S^2(P)$	173,467	111,116	45,594	16,757
2C(X,A)	12,636	8,642	3,086	908
2C(X,P)	19,797	27,841	-11,591	3,547
2C(A,P)	92,762	100,521	-1,908	-5,851
$S^2(E)$	448,884	303,205	73,846	71,833

These results can also be presented in al alternative form, which brings out the effect of each of the variables on the fluctuations in total exchange receipts, E, by using the equations:

$$C(X,E) = S^2(X) + C(X,A) + C(X,P);$$

$$C(A,E) = C(X,A) + S^2(A) + C(A,P);$$

$$C(P,E) = C(X,P) + C(A,P) + S^2(P); \text{ and}$$

$$S^2(E) = C(X,E) + C(A,E) + C(P,E)$$

This is shown in Table 3.3 below for various groups of countries.

Table 3.3. Analysis of Fluctuations in Total Exchange Receipts Due to Various Factors in Less-Developed Countries: 1956-65

(a) 35 Countries

$S^2(X)$: 63,389 + C(X,A): 6,318 + C(X,P): 9,898 = C(X,E): 79,606

C(X,A): 6,318 + $S^2(A)$: 86,833 + C(A,P):46,381 = C(A,E):139,532

C(X,P): 9,898 + C(A,P):46,381 + $S^2(P)$:173,467 = C(P,E):229,746

C(X,E):79,606 + C(A,E):139,532 + C(P,E):229,746 = $S^2(E)$:448,884

(b) 3 Oil Countries

$S^2(X)$: 9,674 + C(X,A): 4,321 + C(X,P): 13,920 = C(X,E): 27,915

C(X,A): 4,321 + $S^2(A)$: 45,411 + C(A,P): 50,260 = C(A,E): 99,993

C(X,P):13,920 + C(A,P): 50,260 + $S^2(P)$:111,116 = C(P,E):175,297

C(X,E):27,915 + C(A,E): 99,993 + C(P,E):175,297 = $S^2(E)$:303,205

(c) 6 Countries with Large Private Transactions

$S^2(X)$: 27,332 + C(X,A): 1,543 + C(X,P): -5,795 = C(X,E): 23,080

C(X,A): 1,543 + $S^2(A)$:11,333 + C(A,P): -954 = C(A,E): 11,922

C(X,P):-5,795 + C(A,P): -954 + $S^2(P)$: 45,594 = C(P,E): 38,844

C(X,E):23,080 + C(A,E):11,922 + C(P,E): 38,844 = $S^2(E)$: 73,846

(d) 26 Other Countries

$S^2(X)$: 26,383 + C(X,A): 454 + C(X,P): 1,773 = C(X,E): 28,610

C(X,A): 454 + $S^2(A)$: 30,089 + C(A,P): -2,926 = C(A,E): 27,618

C(X,P: 1,773 + C(A,P): -2,926 + $S^2(P)$: 16,757 = C(P,E): 15,605

C(X,E):28,610 + C(A,E): 27,618 + C(P,E): 15,605 = $S^2(E)$: 71,833

Table 3.2 shows that most of the fluctuations in total exchange receipts were accounted for by fluctuations in P, for all 35 countries, the least being due to exports. For all 35 countries, these fluctuations were aggrevated considerably by interrelations among the various types of receipts. However, the fluctuations in A and P were mostly in the oil countries and the 6 countries with large private transactions. As a result, the fluctuations in P receipts were least in the 26 other countries, where in fact there was some compensation between fluctuations in A and P. In Table 3.2, the variance due to A was greater than in X. However, if the variance in E is allocated into three parts, as in Table 3.3, it is found that in the 26 other countries, the largest part was due to factors associated with X, both by its own variance and by the interactions between X and the other factors.

The variances and covariances in Tables 3.2 and 3.3 are the sums of the variances and covariances for each country; and therefore involve a weighting according to the size of countries. Table 3.4 below shows the relationship between E and its components, in the form of an unweighted average of the partial correlation coefficients (eliminating the trend) between these variables, in each of 29 countries (i.e., excluding 6 countries, namely Iran, Iraq, Jordan, Sudan, Syria and U.A.R., for which the covariance matrix could not be calculated for lack of some information).

Table 3.4. Average Partial Correlation Coefficients Between E and its Components in Less-Developed Countries: 1956-63

Tabl Variable:	Average of Partial Correlation Coefficients of E with Variable:
X	0.7010
A	0.5524
P	0.5086

This table also shows that the year-by-year variations in X have had the strongest influence on the year-by-year variations in E.

3.4. Variations in Growth Rates of Foreign Exchange Receipts

In the previous section, we analysed the total fluctuations in various types of exchange receipts in the less-developed countries, after eliminating a linear trend from all the variables. In this section, we compare the inter-country variations in the growth rates in the three types of exchange receipts. The growth rates for the various types of exchange receipts could not be calculated in the usual manner, because the average values of A and P were negative for a number of countries. In order to remove the influence of the size of the country, the average annual amounts of change in each variable was divided by the average values of E in each country, to get a rough indication of the "rates of growth" of each variable. An incidental advantage of this procedure was that the growth rates so calculated for each country satisfied the equation

$$g(X) + g(A) + g(P) = g(E)$$

where g(X) stands for the growth rate of X and so on. The variance and covariance of the growth rates can therefore be exhibited in a form similar to Table 3.3. This is shown in Table 3.5 for two groups of countries, derived from the whole sample of 35 countries, and the group of 26 other countries, by excluding Haiti, Jordan, Morocco, Paraguay and Turkey for which data is not complete. In this table, the symbols x,a,p and e are used to represent growth rates of X,A,P, and E and the symbols S^2 and C denote unweighted inter-country variances and covariances.

Table 3.5. Analysis of Variations in Growth Rates of Total Exchange Receipts in Less-Developed Countries due to Various Factors (1956-65)

(i) 30 Countries

$s^2(x)$:	6,7978	+ c(x,a):	-1.5595	+ c(x,p):	0.2142	= c(x,e):	5.4525
c(x,a):	-1.5595	+ s^2(a) :	5.4578	+ c(a,p):	-0.9084	= c(a,e):	2.9899
c(x,p):	0.2142	+ c(a,p):	-0.9084	+ s^2(p0:	3.7910	= c(p,e):	3.0968
c(x,e):	5.4525	+ c(a,e):	2.9899	+ c(p,e):	3.0968	= s^2(e) :	11.5392

(ii) 21 Countries

$s^2(x)$:	6.3214	+ c(x,a):	-1.7456	+ c(x,p):	0.8423	= c(x,e):	5.4181
c(x,a):	-1.7456	+ s^2(a) :	7.2106	+ c(a,p):	1.2008	= c(a,e):	4.2642
c(x,p):	0.8423	+ c(a,p):	-1.2008	+ s^2(p) :	1.5079	= c(p,e):	1.1494
c(x,e):	5.4181	+ c(a,e):	4.2642	+ c(p,e):	1.1494	= s^2(e) :	10.8317

From Table 3.5, we can calculate the correlation coefficients of the growth rate in exchange receipts with that of each component. This is shown in Table 3.6 below.

Table 3.6. Correlation of Rate of Growth Exchange Receipts with Rates of Growth of Components in Less-Developed Countries (1956-65)

Correlation with	correlation of e in 30 Countries	21 Countries
x	0.6156	0.6548
a	0.3768	0.4825
p	0.4682	0.2844

These results show that the growth of exports have been the strongest influence in determining the growth of total export earnings in the less-developed countries in this period. While the growth of private inflow of exchange funds have been more important than governmental transactions in determining growth of total receipts for all 30 countries, the reverse was true for the 21 countries, excluding the oil countries and the countries with large private transactions.

Chapter 4. Fluctuations in Foreign Exchange Expenditures

4.1. The Uses of Exchange Receipts

The IFS data on balance of payments shows a classification of the uses of exchange receipts on an annual basis. With a slight modification, they can be shown as follows:

$$E = N + V + B + Q$$

where:

N: expenditure on imports of goods, being X (IFS data on exports of goods, from trade statistics) minus the trade balance, mostly on an f.o.b. basis (being item 70a of the IFS classification of balance of payments)

V: expenditure on invisible items, being the trade balance (item 70a of IFS balance of payments data) minus balance on goods and services account (item 70 of the IFS classification).

B: net addition to assets of monetary authorities (being minus item 75 of the IFS classification), and

Q: miscellaneous items, i.e. net errors and omissions, and changes in assets and liabilities of commercial banks and other private institutions (being minus items 74a, 74b, and 76 of the IFS classification).

The results of such a classification in the less-developed countries, in the period 1956-65, are summarized in Table 4.1 below.

Table 4.1. Average Annual Values and Annual Growth of Foreign Exchange Expenditures of Less-Developed Countries: 1956-65

(in millions of U.S. Dollars)
(percentages of total average values shown in brackets.)

Expenditure:	35 Countries	3 Oil-Countries	6 Countries with Large Private Transactions	26 Other Countries
	(i) Average Annual Values			
N	16,680 (85)	2,295 (56)	5,159 (86)	9,226 (97)
V	2,631 (14)	1,624 (40)	654 (11)	353 (4)
B	- 163 (-1)	28 (1)	42 (1)	- 233 (-3)
Q	419 (2)	130 (3)	138 (2)	151 (2)
E	19,566(100)	4,077(100)	5,993(100)	9,497(100)
	(ii) Annual Growth			
N	634	72	138	424
V	153	35	40	78
B	119	- 15	75	59
Q	- 50	- 14	3	- 39
E	856	79	256	521

4.2. Fluctuations in Foreign Exchange Expenditures

The fluctuations in the various items of foreign exchange expenditures can be studied in the same way as for foreign exchange receipts. They are shown in Table 4.2 below.

Table 4.2. Fluctuations in Foreign Exchange Expenditures in Less-Developed Countries: 1956-65.

Variation:	35 Countries	3 Oil-Countries	6 Countries with Large Private Transactions	26 Other Countries
$S^2(N)$	185,581	47,398	51,845	86,338
$S^2(V)$	46,343	33,973	7,190	5,180
$S^2(B)$	223,553	77,405	94,210	51,938
$S^2(Q)$	68,597	27,529	26,496	14,572
2C(N,V)	22,718	22,825	- 3,462	3,355
2C(N,B)	-200,982	-28,261	-88.417	-84,304
2C(N,Q)	3,492	1,589	-11,770	13,673
2C(V,B)	49,178	54,593	2,510	- 7,925
2C(V,Q)	17,632	23,156	- 4,290	- 1,234
2C(B,Q)	32,772	42,998	- 466	- 9,760
S (E)	448,884	303,205	73,846	71,833

The results of Table 4.2 can be analyzed in two different ways. One way is to see the effect of the fluctuations in E on each of the components of foreign exchange expenditures. This can be done by the use of the following equations:

$$C(N,E) = S^2(N) + C(N,V) + C(N,B) + C(N,Q)$$

$$C(V,E) = C(N,V) + S^2(V) + C(V,B) + C(V,Q)$$

$$C(B,E) = C(N,B) + C(V,B) + S^2(B) + C(B,Q)$$

$$C(Q,E) = C(N,Q) + C(V,Q) + C(B,Q) + S^2(Q)$$

$$S^2(E) = C(N,E) + C(V,E) + C(B,E) + C(Q,E).$$

The values of these components of variation are shown in Table 4.3 below.

Table 4.3 Analysis of Fluctuations in Foreign Exchange Expenditures in Less-Developed Countries: 1956-65.

Variation:	35 Countries	3 Oil-Countries	6 Countries with Large Private Transactions	26 Other Countries
C(N,E)	98,195	45,475	20	52,700
C(V,E)	91,107	84,259	4,569	2,279
C(B,E)	164,037	112,070	51,024	943
C(Q,E)	95,545	61,401	18,233	15,911
S (E)	448,884	303,205	73,846	71,833

The analysis of Table 4.3 shows that the influence of the fluctuations in E was most strongly felt in B, reserve changes, in the three oil-countries and the six countries with large private transactions, and on N, the expenditure on imports of goods, in the twenty-six other countries.

Another way of analyzing the results of Table 4.2 is to consider the contribution of E and the other items of foreign exchange expenditures on the fluctuations in N. This can be done by the equation:

$$S^2(N) = C(N,E) - C(N,V) - C(N,B) - C(N,Q).$$

The relative magnitudes of these influences are shown in Table 4.4 below.

Table 4.4 Analysis of Fluctuations in Expenditure on Imports of Goods in Less-Developed Countries: 1956-65.

Variation:	35 Countries	3 Oil-Countries	6 Countries with Large Private Transactions	26 Other Countries
C(N,E)	98,195	45,475	20	52,700
C(N,V)	11,359	11,413	-1,731	1,677
C(N,B)	-100,491	-14,131	-44,209	-42,151
C(N,Q)	1,746	795	- 5,885	6,836
$S^2(N)$	185,581	47,398	51,846	86,338

Except in the six countries with large private transactions, a great part of the fluctuations in N were due to fluctuations in E, but a considerable part was also due to the use of reserves. In the next chapter, we use a different method to study the relationship between the various types of foreign-exchange receipts and a number of variables including expenditure on imports, N, and the use of reserves, B.

Chapter 5. Foreign Exchange Receipts and Investment Variables

1. The Investment Variables

Having considered the relative magnitude of shortfalls and fluctuations in the various types of foreign exchange receipts and expenditures, we now investigate their significance in relation to the possible disruption of development programs in the less-developed countries. The concept of disruption of development programs belongs essentially to the planning approach. A complete study of this subject would involve a consideration of actually planned development programs for a number of countries for certain past periods, the degree to which these programs were disrupted, and the extent to which such disruption can be attributed to shortfalls in the various types of foreign exchange receipts. Unfortunately, this cannot be done for a sufficiently large number of countries to yield results useful for the consideration of international policies to deal with this problem. As an alternative approach to this problem, we consider in this chapter, the links between various types of foreign exchange receipts and a number of variables connected with the investment process in the less-developed countries. It is hoped that the study of these links in the chain of relationships between foreign exchange receipts and the investment process would provide an indirect method of judging the extent to which various types of shortfalls tend to disrupt development programs. This indirect approach will be more reliable, the more closely the formulation of development programs is based on such links between foreign exchange and investment. It may be that, in the past, development programs were not so formulated in many less-developed countries. But as the techniques of formulating development plans

are progressively improved, the present study of the foreign exchange links with development will be more useful as an indication of the extent to which foreign exchange shortfalls are likely to lead to disruption of development programs.

For the purpose of the present study, data was collected for the period 1956-63 on the following variables connected with investment in a number of less-developed countries.

R: The stock of foreign exchange reserves (in U.S. dollars) at the beginning of calendar years, as reported in the International Financial Statistics under the heading of 'International Liquidity', i.e. including gold holdings, foreign exchange holdings, and reserve positions in the Fund. The data was available for 30 of the less-developed countries considered in the present study.

M : Total Imports of Goods.

M_c: Imports of Consumer Goods.

M_k: Imports of Capital Goods.

M_{k+r}: Imports of Capital Goods, Intermediate Products and Raw Materials.

Data on these four variables, from trade statistics, were compiled for 23 countries. The classification of imports into various categories is mostly based on the compilation in the reports of the U.N. Regional Economic Commissions. All values were converted to U.S. dollars.

G_r: Government Revenue. (22 countries)

G_c: Government Current Expenditures. (22 countries)

G_s: Government Savings. (22 countries)

I : Total Investment expenditures (27 countries)

I_g: Government Investment Expenditures. (23 countries)

I_{nc}: Non-construction Investment Expenditures. (17 countries)

Data on the above six variables were compiled from the U.N. Yearbook of National Accounts Statistics, the reports of the U.N. Regional Economic Commissions, and the country Reports of the World Bank. The data, mostly in local currencies, were converted to constant U.S. dollars, on a 1960 basis, by using adjusted figures where available, or by adjusting them for price changes on the basis of GDP or GNP deflators and other price indices.

2. Correlation of Growth Rates.

The links between pairs of variables were measured by their correlation coefficients. The correlation between any pair of variables may be divided into two parts, the correlation between annual growth rates along linear time trends, and the correlation between fluctuations around these linear trends. This relationship can be written as follows:

Let x and y represent the time series of two variables in a country, measured from their mean values. Then the annual growth of these variables as given by least squares regression coefficients may be written as

$$B = \frac{\Sigma xt}{\Sigma t^2} \quad \text{and} \quad C = \frac{\Sigma yt}{\Sigma t^2}$$

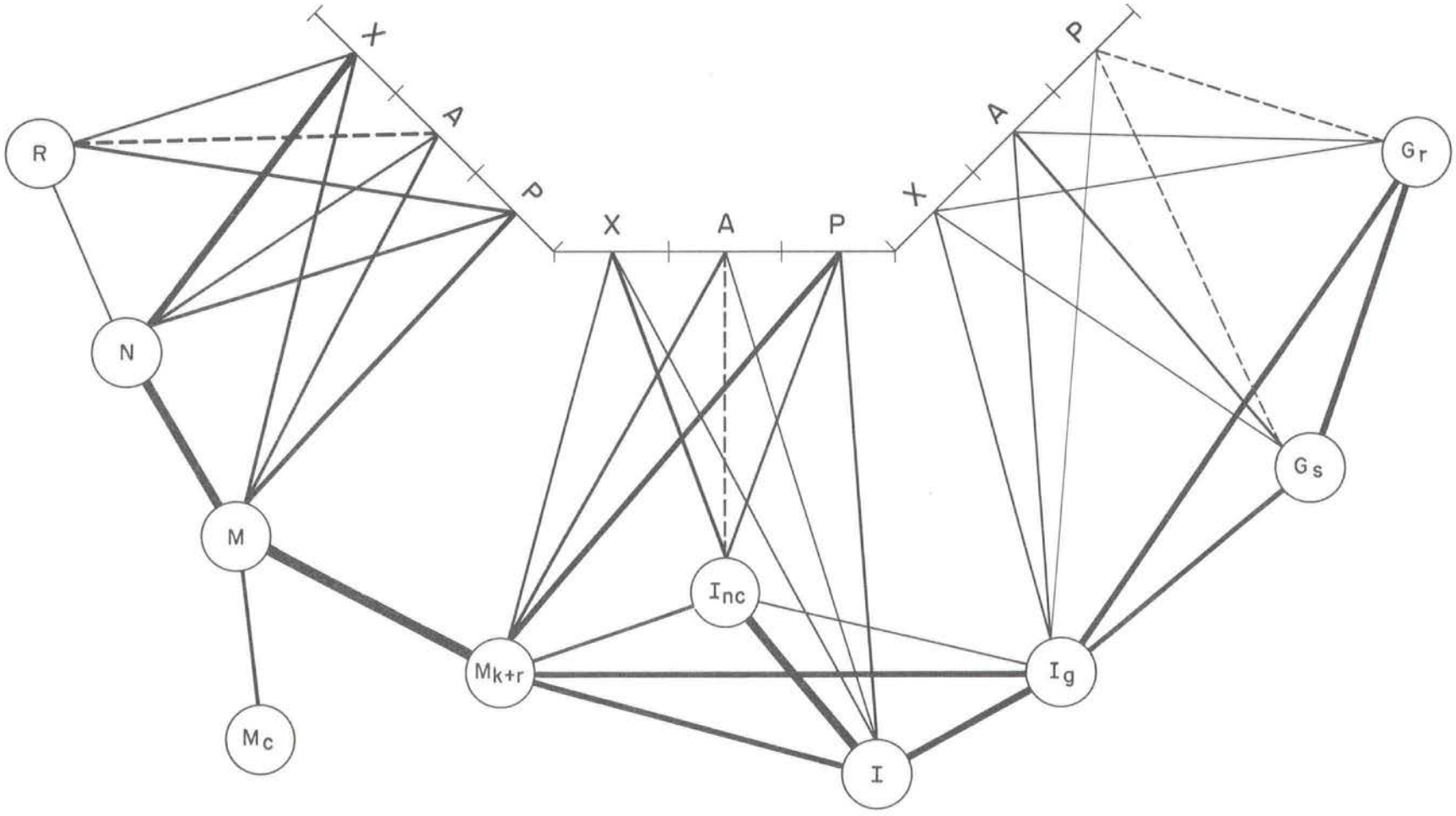
where the time-variable t is also measured from its mean. Then, the total covariance between x and y may be separated into two parts, as

$$\frac{\Sigma xy}{n} = BC\frac{\Sigma t^2}{n} + \frac{\Sigma(x-Bt)(y-Ct)}{n}$$

where n is the number of years. Such a relationship can be derived for each country. The average value of terms such as BC for a number of countries then indicates an inter-country correlation coefficient between growth rates. The second term on the right-hand side of the above equation gives us an intra-country correlation of fluctuations in the two variables around their linear trends, i.e. a partial correlation coefficient between the two variables, eliminating the time trends. The relationship for a group of countries may be indicated by the average of such intra-country correlation coefficients for those countries.

For the present analysis, the growth rates were obtained by dividing the annual amounts of change in each variable, as given by a least squares estimate of the regression coefficient on time, divided by the average annual value of the variable for the whole period. As mentioned above, the growth rates of the variables X, A, P, N and B were calculated by dividing the annual amounts of change by the average values of E, to overcome the difficulty of dividing by negative values, which occurred for these variables in some cases. The inter-country correlation coefficients were calculated for as many countries as the data permitted. The results are shown in Tables 5.1 and 5.2. Table 5.1 shows the correlation coefficients between the foreign-exchange receipts and the various investment variables. Table 5.2 shows the correlation coefficients between pairs of the investment variables. The correlation coefficients have been calculated for the period 1956-63 except for the correlation between N and the various foreign exchange receipts, for which data was available for 1956-65. The relationships shown by these correlation coefficients are illustrated in Figure 1.

CORRELATION OF GROWTH RATES OF FOREIGN EXCHANGE AND INVESTMENT VARIABLES IN LESS-DEVELOPED COUNTRIES



---- Negative correlation

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FIGURE 1

Table 5.1 Inter-Country Correlation Coefficients Between Growth Rates of Foreign Exchange and Investment Variables In the Less-Developed Countries.

Investment Variable:	Foreign Exchange Variable X	A	P	E	Number of Countries
(i) N	0.48	0.23	0.49	0.80	30
(ii) N	0.69	0.27	0.35	0.88	21
R	0.31	- 0.41	0.36	0.18	30
M	0.37	0.44	0.54	0.77	23
M_c	0.21	0.22	0.16	0.34	23
M_k	0.34	0.27	0.55	0.66	23
M_{k+r}	0.32	0.39	0.57	0.73	23
G_r	0.08	0.07	- 0.19	0.03	19
G_s	0.13	0.31	- 0.12	0.27	19
I	0.18	0.07	0.27	0.32	23
I_g	0.20	0.16	0.03	0.27	19
I_{nc}	0.42	- 0.19	0.29	0.38	17

Table 5.2 Inter-Country Correlation Coefficients Between Growth Rates of Investment Variables in the Less-Developed Countries.

Investment Variables	Correlation Coefficient	Number of Countries
N,R	0.17	30
N,M	0.77	23
M,M_c	0.41	23
M,M_k	0.68	23
M,M_{k+r}	0.94	23
M_k,I	0.77	21
M_{k+r},I	0.63	21
M_k,I_{nc}	0.70	14
M_{k+r},I_{nc}	0.35	14
M_k,I_g	0.69	18
M_{k+r},I_g	0.57	18
G_r,G_s	0.57	19
G_r,I_g	0.62	19
G_s,I_g	0.47	19
I,I_{nc}	0.79	16
I,I_g	0.74	18
I_g,I_{nc}	0.15	15

3. The Correlation of Fluctuations

As mentioned above, the relationship between fluctuations in any two variables may be indicated by the partial intra-country correlation coefficient. Such correlation coefficients have been calculated for pairs of variables for as many countries as data permitted and the average values of the correlation coefficients for these countries are given in Tables 5.3 and 5.4. Table 5.3 shows the correlation coefficient between fluctuations in the foreign exchange variables and the investment variables. The influence of the foreign exchange variables on the investment variables may be felt in the same year or with a time-lag. Therefore, all correlation coefficients with investment variables, except N and B, were calculated both for the same year and with a time-lag of one year, and the larger value of correlation was taken as the measure of the relationship for each country, in calculating the average for the group of countries. Table 5.4 shows the correlation coefficient of fluctuations between pairs of the investment variables. The relationships shown by these correlation coefficients is illustrated in Figure 2.

CORRELATION OF FLUCTUATIONS OF FOREIGN EXCHANGE AND INVESTMENT VARIABLES IN LESS-DEVELOPED COUNTRIES

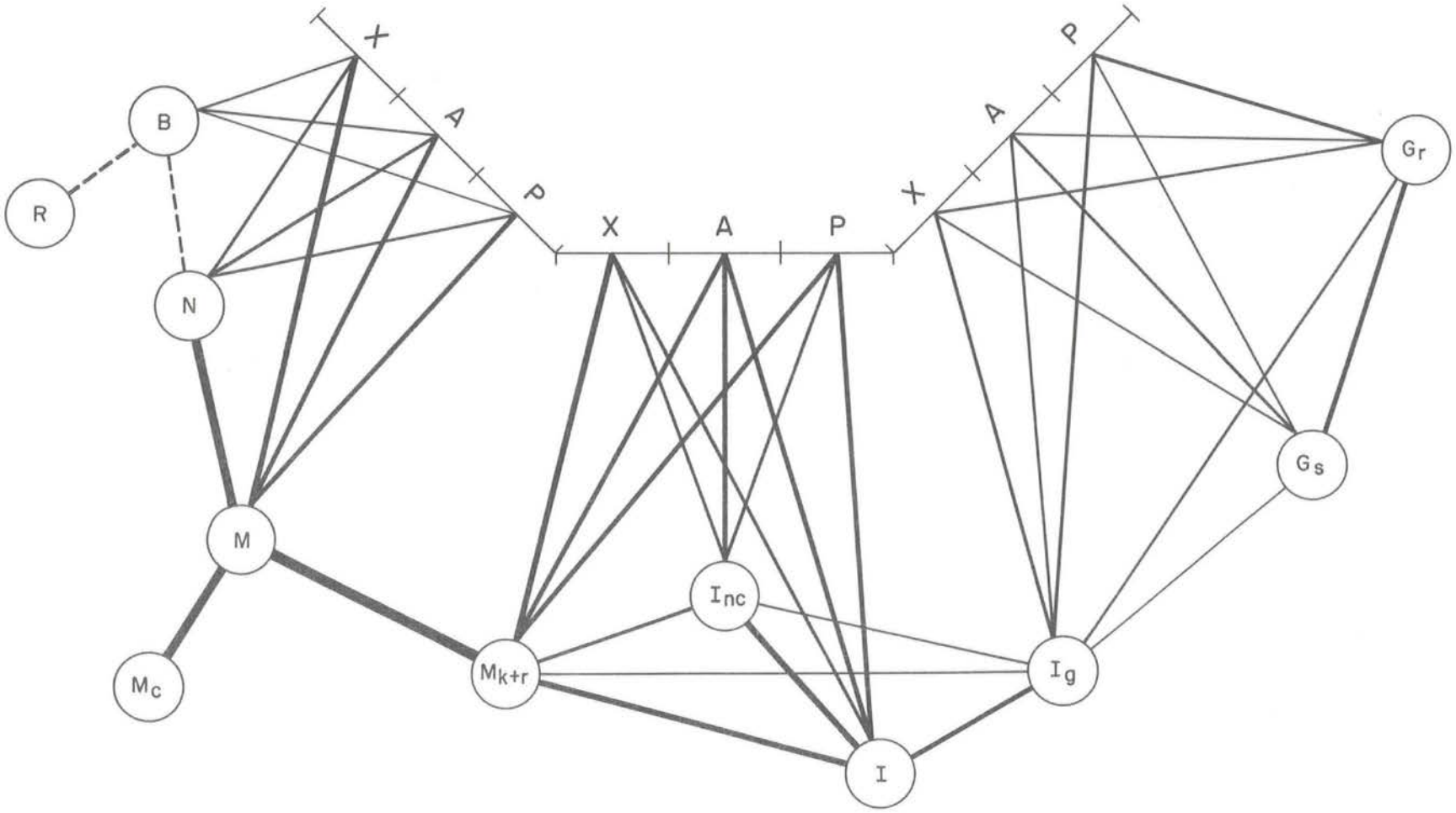

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FIGURE 2

Table 5.3 Average Correlation Coefficients Between Fluctuations in Foreign Exchange Receipts and Investment Variables in Less-Developed Countries.

Investment Variable:	Foreign Exchange Variable: X	A	P	E	Number of Countries
N	0.40	0.39	0.29	0.54	29
B	0.23	0.19	0.11	0.32	29
M	0.57	0.49	0.55	0.63	22
M_c	0.48	0.47	0.42	0.58	22
M_k	0.51	0.49	0.57	0.56	24
M_{k+r}	0.57	0.49	0.55	0.62	22
G_r	0.29	0.25	0.42	0.34	25
G_c	0.23	0.35	0.41	0.43	22
G_s	0.21	0.27	0.19	0.25	22
I	0.42	0.48	0.48	0.55	27
I_g	0.43	0.31	0.42	0.52	23
I_{nc}	0.42	0.49	0.45	0.56	17

Table 5.4 Average Correlation Coefficients Between Fluctuations in Investment Variables in Less-Developed Countries

Investment Variables:	Correlation Coefficients	Number of Countries
N,B	- 0.25	29
B,R	- 0.40	29
N,M	0.83	23
N,M_c	0.72	23
N,M_k	0.65	23
N,M_{k+r}	0.79	23
M,M_c	0.79	23
M,M_k	0.83	23
M,M_{k+r}	0.94	23
I,M_k	0.63	17
I,M_{k+r}	0.57	17
I_g,M_k	0.20	17
I_g,M_{k+r}	0.18	17
I_{nc},M_k	0.52	17
I_{nc},M_{k+r}	0.38	17
G_r,G_c	0.27	22
G_r,G_s	0.50	22
G_r,I_g	0.27	2
G_s,I_g	0.10	20
I,I_g	0.50	23
I,I_{nc}	0.56	23
I_g,I_{nc}	0.22	15

4. Expenditure on Imports of Goods

The variable N, defined in Chapter 4 as the sum of the value of exports in any year and the excess of payments for merchandise imports over receipts from merchandise exports for the same year, may be taken as an approximation to the expenditure on imports of goods in any year, combining both trade and balance of payments statistics. The growth rate in N is highly correlated with the growth rate in E. It is equally correlated with the growth rate in X and in P, with a correlation coefficient of about 0.50, in a sample of 30 countries, but in a smaller sample of 21 countries, excluding the oil countries and the countries with large private transactions in foreign exchange, the growth rate in N is most highly correlated with that of X. The annual fluctuations in N are also most highly correlated with those in X, but there is also an equally high average correlation in annual fluctuations of N and A.

5. The Role of Reserves

During this period, the less-developed countries drew upon their reserves to finance about 2.5% of their foreign exchange expenditures. This tendency can be seen clearly in the following table of reserves as a percentage of imports, taken from the Annual Report of the International Monetary Fund for 1966.

Table 5.5 Reserves as Percentage of Imports 1951-65

Year	Group of Ten	Other Developed Countries (excl. U.S.A.)	Less-Developed Primary Producing Countries	Less-Developed Countries with Initial High Reserves
1951	27	46	64	118
1952	30	46	60	95
1953	36	59	72	128
1954	40	55	66	135
1955	37	46	64	126
1956	34	45	61	94
1957	30	44	47	60
1958	42	48	46	56
1959	40	50	50	55
1960	43	44	44	41
1961	45	47	41	34
1962	43	50	39	30
1963	40	52	43	27
1964	38	48	40	21
1965	37	41	42	22
Average	37	48	52	69
Annual Change:	0.72	-0.25	-2.24	-8.67

The growth in reserves was positively correlated with the growth of X and P; i.e. the higher the growth rate in X and P, the faster the growth, or slower the decline, in reserves. The converse was the case with A; the main explanation for this seems to be the higher than average growth rate of A

in countries with initially high reserves, which have been drawing down their reserves to finance their current expenditures at a high rate during this period.

The correlation between the growth of reserves and the growth in N for the entire sample of countries was small and positive. This suggests that the growth in N was not mainly at the expense of R, but that the growth in total foreign exchange earnings contributed to the faster growth of N, as well as the faster growth (or smaller decline) in R.

The fluctuations in B, the annual additions to reserves, was most highly correlated with the fluctuations in X, but correlations with all types of foreign exchange receipts were low. The fluctuations in B were negatively correlated with the fluctuations in reserves R, showing that there were larger drawings from reserves in years in which reserves were at a higher level. The fluctuations in B were also negatively correlated with the fluctuations in N, indicating that the greater the drawing down of reserves in any year, the higher the level of N in that year. However, the use of reserves fluctuated greatly year by year, as shown in Table 4.4 of the last chapter, so that the fluctuations in N were greater than those in E for the 26 countries, excluding the oil countries and the countries with large private transactions in foreign exchange. Hence the results suggest that the use of reserves did not absorb any of the fluctuations in E, and hence, did not contribute to greater stability of N.

6. Imports

The variable M was highly correlated with N, both in growth rates and in annual fluctuations. The growth rate of imports, M, was most highly correlated with the growth rate of P and least with the growth rate of X. This

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was particularly true of imports of capital goods, M_K, and of capital goods and raw materials, M_{k+r}. The correlation of growth rates with consumer goods imports, M_c, was least with P and about equally strong with X and A. This suggests that, for the period as a whole, the flow of P was mostly directed to finance capital goods imports, compared with other types of foreign exchange recipts.

The annual fluctuations in M were most highly correlated with those in X, though the correlation with fluctuations in P was almost equally high. The correlation of annual fluctuations between foreign exchange receipts and with M_k and M_{k+r} was about the same as with M; the correlation of fluctuations with consumer goods imports M_c were slightly smaller.

There was a very high correlation of growth rates and annual fluctuations between M and M_{k+r}, suggesting that the changes in M were mainly due to changes in M_{k+r}.

7. Government Revenue, Expenditure and Savings

The correlation of growth rates between government revenue, G_r, and government savings, G_s, was high at 0.57. There was an equally high correlation, 0.50, in the annual fluctuations in these variables.

The correlations of growth rates between foreign exchange receipts and government revenue, G_r, government expenditure, G_c, and government savings, G_s, were generally low and even negative, in the case of P. There were higher correlation of fluctuations between these variables.

8. Investment

The growth rate in total investment, I, was highly correlated with that of non-construction investment, I_{nc}, and with that of government investment, I_g, but the correlation of growth rates between I_g and I_{nc} was small. This was true also for the correlation of fluctuations in these variables.

The correlations of growth rates between I and the foreign exchange receipts were low, the highest correlation being 0.27 with P, the lowest, 0.07 with A, and the correlation with X was 0.08. However, when only non-construction investment was considered, the highest correlation was 0.42 with X; the correlation with P was 0.29, and the correlation with A was negative. The correlations of annual fluctuations between I and I_{nc} on the one hand, and the foreign exchange receipts, on the other, were higher, being between 0.4 and 0.5; the correlations with X were the lowest, but those with A and P were not much higher.

High correlations of growth rates and annual fluctuations were observed between investment and capital goods imports, the lowest of these correlations was between I_{nc} and M_{k+r}, being 0.35 for growth rates and 0.38 for annual fluctuations.

The correlations of growth rates in government investment, I_g, and foreign exchange receipts, were low, the highest correlation, 0.20, being with X. The correlations of annual fluctuations were higher, the highest again being between I_g and X.

The strongest influence on I_g was from G_r, both in growth rates and annual fluctuations. This influence was even stronger than between I_g and G_s. Equally high correlations of growth rates were observed between I_g and capital goods imports, but the correlations of annual fluctuations were low, but still around 0.4.

Chapter 6. Conclusions

We have seen that the shortfalls from expectations of individual countries have been greatest in the case of export earnings than in other types of foreign exchange receipts. We have also examined the correlation between these foreign exchange variables and a number of investment variables. In interpreting the results of such a correlation analysis, we must bear in mind that the flow of funds such as A and P to the less-developed countries is primarily oriented towards investment, whereas the export earnings of the less-developed countries have to be used for a greater variety of purposes, both for investment and consumption. It would therefore not have been surprising if the investment variables had been more highly correlated with A and P than with X. In fact, we have found that while the correlation of the investment variables with X has been weaker than with A and P, it has not been much smaller; this suggests that the investment activity in the less-developed countries has been dependent on export earnings to a considerable extent, both with regard to its growth rate and with regard to its annual fluctuations.

In considering the extent to which shortfalls from expectations of the various types of foreign exchange receipts have contributed to the disruption of development programs, another factor must also be taken into account, in addition to the correlation analysis of the previous chapters. This is the fact that much of the A and P funds flowing into the less-developed countries are likely to be earmarked for particular investment purposes, so that the correlation between fluctuations in these variables represents the fluctuations in such receipts corresponding to fluctuations in planned investment expenditures. The consequence is that the fluctuations

in A and P are less likely to be associated with a disruption of development programs. Insofar as a disruption of development programs can be shown by fluctuations in investment activity, this is more likely to be related to fluctuations in export earnings of the less-developed countries. It may therefore be concluded that shortfalls from expectations in export earnings were most significant in contributing to disruption of development programs. This influence is likely to be even more important in the future, as less-developed countries improve their methods of formulating development programs on the basis of anticipated foreign exchange earnings.

DRAFT

THE MEASUREMENT OF EXPORT INSTABILITY

Contents

R. M. Sundrum

June 9, 1967

THE MEASUREMENT OF EXPORT INSTABILITY

1. Introduction

In recent years, a number of studies have appeared which make a statistical measurement of economic instability, especially of exports, and investigate its causes and consequences. On the basis of these essays in statistical economics, the authors have made a number of comments on the policy implications of their results. The attempt to quantify the concepts of economics is, of course, an admirable one but in dealing with concepts involving complex relationships and with data of doubtful validity, it is prudent to proceed with some caution. In academic circles, it is perhaps customary to advance propositions in a tentative way as a way of pushing the "burden of proof" on protagonists of alternative views, and as this game proceeds in its leisurely fashion, there may be a gradual progress of knowledge. In this game, the prize goes to those who are able to reach novel conclusions, for as Keynes said in regard to another problem, "that (the Classical theory) reached conclusions quite different from what the ordinary uninstructed person would expect added to its intellectual prestige." /5,p.32/ But this game is not played in isolation; there are always bystanders, innocent or otherwise, who are only laymen in the tricks of the trade, but who, for good or bad, have influence in the management of the world's affairs. Because of this, especially in economic affairs, nations have suffered enough misery in the past, in the costly process of unlearning our mistakes. It therefore behoves the academic profession to exercise particular caution, especially when they claim a 'scientific' basis for their policy recommendations. In this paper, we review some of the methods used in the statistical

study of export instability, and the validity of the conclusions reached in some recent publications.

This is not the occasion to deliver a homily on the use and abuse of statistical evidence in scientific investigations, but the neglect or ignorance of developments of statistical techniques from an operational point of view, already several decades old, by economists aspiring to new discoveries of economic wisdom by the use of statistical techniques provokes some comments. In the light of these developments, it is not sufficient to have gathered some evidence, tested a null hypothesis, and finding results below a particular level of significance, to reject the alternative hypothesis. It is even more irresponsible to find results beyond a chosen level of significance, and still not accept the verdict of one's evidence. Life is full of uncertainties, but action cannot wait till elegant hypotheses are established beyond all doubt. There must be an intelligent balancing of risks, and in this difficult choice, there is nothing sacrosanct about a 5% level of significance. A test based on such a level of significance only ensures that the probability of rejecting a null hypothesis, when it is in fact true, is less than 5%; in the language of the Neyman-Pearson theory of statistical inference, it ensures that the probability of Type I error is less than 5%. It, however, tells us nothing about the probability of Type II error, i.e. the probability of rejecting the alternative hypothesis, when it is in fact true. This can only be done when the alternative hypothesis is clearly formulated and its probabilistic consequences derived for various courses of action, from which the policy maker has to choose an appropriate one, on the basis of the available evidence. It is no help to the policy maker for the academic investigator to apply statistical tests to the evidence, carefully controlling the Type I error,

but heedless of the Type II errors of his tests. All too often, the null hypothesis may be accepted, not because it is more credible than the alternative, but simply because the evidence is not sufficient or even relevant to discriminate between the two hypotheses. It is only by a consideration of the alternatives against which a null hypothesis is being tested that one can even be sure that one has applied an adequate statistical test on the basis of which to draw conclusions, with any pretensions to be practical relevance. More recent developments of statistical techniques, in the form of statistical decision functions, have been concerned with the balancing of the errors involved in statistical inference, when their consequences in terms of loss of welfare can be specified with sufficient precision. Above all, these recent developments have emphasized the need for human judgment about the credibility of various hypotheses, in the light of which, to examine the weight of relevant evidence. The application of routine statistical tests in a mechanical manner can no more advance human knowledge in economic affairs than in any other branch of science.

2. The Problems of Instability

It is, of course, a great convenience to construct some statistical index, call it an index of instability, and then to define instability as that which is measured by such an index. But to be relevant to practical affairs, we must take some effort to understand what is, in fact, the sort of instability that people are worried about. The central problem of instability is the divergence of economic time-series from their trends in various ways. However, it may not be possible to capture the essence of such instability in any single measurement, for there seem to be at least three aspects of such instability which create serious problems for public policy, especially in the less developed countries of the world.

The first aspect of instability may be described roughly as the 'amplitude' of fluctuations about the trend, the sheer magnitude of the divergences of actual from trend values, whether in the positive or negative direction. In theory, there may be a clear distinction between the trend and deviations from the trend, but in dealing with almost any practical problem, it is a formidable undertaking to decide what is, in fact, the trend, especially when the usable data consists of very short time-series. This is an important part of the statistical problem, for some divergence of views about the instability of various types of exports can in fact be traced to different ways of determining the underlying trend in these variables.

A second aspect of instability may be described as the periodicity or frequency of fluctuations, corresponding to the number of times a time-series changes direction, either in its origianl form or after a trend factor has been removed. This aspect was intensively studied in connection with the trade cycle in the industrial countries, but now, when these countries

are increasingly taking measures to stabilize their economies, there are still some attempts to explain economic changes in terms of cyclical behaviour, and even to recommend policy measures appropriate to such behaviour.

A third aspect of instability may be described as the 'irregularity' of fluctuations. Fluctuations which have constant amplitude and periodicity are of the cyclical variety; we may consider the irregularity aspect of instability as the extent to which the fluctuations in a time-series fail to have constant amplitude or frequency. This aspect of instability becomes more important as the efforts to tame the cycle in the industrial countries become more successful.

Given these aspects, which cannot all be summarized in any single measurement, we must also take account of the fact that different types of instability have different sort of effects, especially from a policy point of view. In this context, an important question is the extent to which instability can be predicted. Economic variables which are mainly affected by the first two aspects of instability are much more predictable than those mainly affected by the third aspect. This is not to say that predictable fluctuations do not create problems, and that only unpredictable fluctuations do. Even if fluctuations are predictable, as e.g. when they are of a strictly cyclical or seasonal pattern, they create a heavy cost to the economy, which has to maintain a considerable amount of excess capacity, between periods of peak levels of activity, if the amplitude of these fluctuations are large. To some extent, contra-cyclical measures can be taken, which will either iron out the cycles or at least, ameliorate the disadvantages flowing from such cyclical disturbances to the economy. Even so, the investment process,

which has to be undertaken on a large and coordinated basis to meet the problems of the less developed countries, may suffer a loss of momentum if it is periodically interrupted by cyclical fluctuations.

The effects of instability become compounded when it cannot be foreseen, so that nothing can be done to meet these effects in advance. The main consequence of such unpredictable instability, in the less developed countries, is to reduce the planning horizon, for investment programs over even a medium-term planning period cannot be maintained, in the face of great uncertainty about resources, unless a country has abundant reserves or access to external sources of assistance. A measure of the uncertainty due to such instability is the divergence between actual values of a variable in a given period, and the values expected to occur in that period, on the basis of the information available at the beginning of that period. An attempt has been made in the World Bank report on "Supplementary Financial Measures" [3] to estimate the magnitude of such shortfalls in the export earnings of a number of less developed countries, for which export projections were available.

3. A Simple Measure of Instability

It is not easy to devise completely satisfactory statistical measures of these aspects of instability, especially when the data consists of short-time series. In this section, some simple measures, most readily suggested by common statistical practice, will be considered.

Suppose the data consist of values X_{it} (i+1, 2, ... k; t+ 1.2..n) where X_{it} stands for the value of a variable X for the i+th commodity or i-th country in the t-th year. Write $X_{.t}$ for the average over all commodities or countries, in the t-th year, and $X_{i.}$ for the average over all years for the i-th commodity or country. As a way of making the analysis comparable over all commodities or countries, all values may be expressed as percentages of the average over all years for each commodity or country, i.e. instead of the values X_{it}, we shall work with

$$x_{it} = 100 \frac{X_{it}}{X_{i.}} \quad .... \quad .... \quad . \quad (3.1)$$

Given such values, the simplest measure of their dispersion is the variance, given by

$$S_i^2 = \frac{1}{n} \sum_t^n (x_{it} - x_{i.})^2 \quad .... \quad .... \quad . \quad (3.2)$$

This, however, is not useful as a measure of instability, because it includes the variation due to growth with the variation that can be ascribed to instability. The simplest model of a time-series which separates the growth factor from fluctuations is

$$x_{it} = \alpha_i + \beta_i t + \varepsilon_{it} \quad .... \quad .... \quad . \quad (3.3)$$

in which the growth factor is in the form of a linear trend, and the instability or fluctuation term appears as an additive 'error' term. It is convenient to measure the time variable from the mid-point of the period for which the data are available; this is done in the following discussion. If the linear trend is estimated by the method of least squares, the estimate

of equation (3.3) is given by

$$x_{it} = a_i + b_i t + e_{it} \quad \ldots \quad \ldots \quad \ldots \quad (3.4)$$

where

$a_i = x_{i.} = 100$ by the definition in (3.1), and

$$b_i = \frac{\sum t x_{it}}{\sum t^2} \cdot \quad \text{xxx}$$

On the basis of this model, the instability in the time series may be indicated by the standard error of estimates, defined by

$$s_i^2 = \frac{i}{n} \sum e_{it}^2 \quad \ldots \quad \ldots \quad \ldots \quad (3.5)$$

As a consequence of the least squares method used to fit the trend, we also have

$$s_i^2 = S_{\underline{i}}^2 - b_i^2 \sigma_t^2 \quad \ldots \quad \ldots \quad .(3.6)$$

where σ_t^2 is the variance of the time variable. This equation shows the way in which the variation due to 'instability' is obtained from the total variation by subtracting the variation due to growth.

The quantity, s, is one of the measures of instability used by B. F. Massell in his study of export instability. [7 , p. 6]

A weakness of this approach is the assumption of a linear trend, whereas in fact the trend may not be linear. Generally, a straight line is a close approximation to any smooth non-linear trend over a short period. If there is any indication that the trend belongs to a particular non-linear type, then a similar procedure could be used to fit such a trend and to measure instability from such a trend. For instance, a modification of the measure defined in (3.5) is to convert all values to logarithums and thus to calculate the standard error of estimate from a linear trend fitted to the logarithums. It is defined as:

$$L_i = \text{antilog} \sqrt{\frac{1}{n} \sum (\log x_{it} - c_i - d_i t)^2} \quad (3.7)$$

where $c_i + d_i t$ is the linear trend fitted to logarithums of x_{it}, by least squares. A rough guide to choose between an arithmetic or a logarithmic trend is to see with which of these trends a given time series is better correlated.

Perhaps more important than the distinction between linear and non-linear trends is the distinction between that part of the fluctuation or variation which affects a whole group of commodities or countries and that which affects an individual commodity or country. It would be useful to find a measure of the part of the total variation affecting a whole group, which may, for convenience, be described as the "g-factors." A method of doing this, suggested by the analysis of variance techniques, is described below. The g-factors derived in this way will also include any non-linearities in the trends underlying the data time-series, insofar as they are common to a whole group. Averaging equation (3.4) over a whole group, we have

$$x_{.t} = \bar{a} + \bar{b}\, t + e_{.t} \quad \ldots \quad \ldots \quad \ldots \quad (3.8)$$

where

$$\bar{a} = \frac{1}{k} \sum a_i = 100;$$

$$\bar{b} = \frac{i}{k} \sum b_i \; ; \quad \text{and}$$

$$e_{.t} = \frac{1}{k} \sum e_{it}$$

For further convenience, we write g_t for $e_{.t}$ in the following, to refer to our estimate of the fluctuations common to a group of commodities or countries. Then, equation (3.4) may be re-written

$$x_{it} = a_i + b_i t + g_t + (e_{it} - g_t) \quad \ldots \quad \ldots \quad (3.9)$$

A measure of the variation, which may be ascribed to an individual commodity or country, is then given by p_i, where

$$p_i^2 = \frac{1}{n} \sum_t^n (e_{it} - g_t)^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.10)$$

It follows, from the identities of the analysis of variance, that

$$\sum_i^k p_i^2 = \sum_i^k s_i^2 - \frac{k}{n} \sum_t^n g_t^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.11)$$

The ratio

$$G = \frac{k_t \sum g_t^2}{n_i^k \sum s_i^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.12)$$

can be taken as an indication of the relative magnitude of the variation due to the g-factors.

The measure considered here is not necessarily the 'correct' one for measuring instability as it arises in practical problems confronting national and international policies. But it is a reasonable one and we should expect that a dependable generalization about instability, its causes and consequences should be supported by such a measure, and that any generalization that cannot be supported by this measure is suspect, or at least merits further investigation. We shall accordingly test some of the results announced in recent publications by using this measure. Before doing this, however, we shall consider some other measures of instability, which have been suggested in these publications, and which have been used to derive their results.

4. Some New Measures of Instability

A number of new measures of instability have been used in some recent studies. They are described here, with a brief discussion of their properties:

(a) Average Percentage Deviation from Previous Value

This measure was used by M. Michaely [8, p.68] primarily as a measure of price instability. It is defined by:

$$M = \frac{100}{n-1} \quad \frac{|P_t - P_{t-1}|}{P_{t-1}} \quad \ldots\ldots\ldots\ldots \quad (4.1)$$

when P_t is the price-index at time t, and n is the number of years for which data is available.

(b) Average Percentage Change in Terms of Larger Value

This measure was used in a U.N. Study [9, p.77] of export instability in under-developed countries. As described in that study, the measure is defined as follows:

$$U_1 = \frac{100}{n-1} \quad \frac{|X_t - X_{t-1}|}{\max(X_{t-1}, X_t)} \quad \ldots\ldots\ldots\ldots \quad (4.2)$$

In a later U.N. study, [11, p.40] purporting to describe this measure of fluctuations, it is said that "trend was eliminated by the least squares method". There is, however, no reference to trend elimination in the original study. For convenient reference, two variants of this measure may be distinguished as U_1 (without trend elimination) and U_2 (with linear trend eliminated). The measure U_2 has also been considered by B. F. Massell [7, p.6] who describes it by the symbol I^*.

(c) Average Percentage Deviation from Linear Trend

This measure was used in another U.N. Study [10, p.11] and is defined by:

$$V = \frac{100}{n} \left| \frac{X_t - a - bt}{a + bt} \right| \quad \ldots\ldots\ldots\ldots \quad (4.3)$$

where $a + bt$ is the linear trend fitted to X_t by least squares method.

(d) Average Percentage Deviation from Exponential Trend

This measure was used by L. J. Zimmerman [14, p.165] and is defined by:

$$F = \frac{100}{n} \left| \frac{X_t - X(1+r)^t}{X(1+r)^t} \right| \quad \ldots\ldots\ldots\ldots \quad (4.4)$$

where $X(1+r)^t$ is the exponential trend fitted to X_t.

(e) Average Percentage Deviation from Moving Average

This measure was introduced in an IMF Study [4, p. 6] and has been used also by A. I. MacBean [6, p.40-1]. It is defined by

$$W = \frac{100}{n-4} \left| \frac{X_t - MA}{MA} \right| \quad \ldots\ldots\ldots\ldots \quad (4.5)$$

where MA stands for a five-year moving average of X_t.

(f) Log-variance Index of Instability

This measure was introduced by J. D. Coppock [1, p.23-4] and is defined by:

$$C = \text{anti-log} \sqrt{\frac{1}{n-1} \sum \left(\log \frac{X_{t+1}}{X_t} - m \right)^2} \quad \ldots\ldots \quad (4.6)$$

where $m = \frac{1}{n-1} \sum \log \frac{X_{t+1}}{X_t}$

Of these measures, M and U_1 do not make any allowance for the trend factor. It appears that both of them were intended mainly for the study of price fluctuations, where, as Michaely states, the growth trends are likely to be small. The Coppock measure C allows for an exponential trend to some extent, but the quantity m in the definition of this measure depends only on the initial and final values. This can be seen easily, because

$$m = \frac{1}{n}\sum_{2}^{n} (\log X_t - \log X_{t-1}) = \frac{1}{n-1} (\log X_n - \log X_1). \quad . \quad . \quad (4.7)$$

Th measure V allows for a linear trend fitted by least squares, while the W measure allows for growth in the form of a moving average.

It is interesting to compare the measure L, defined in (3. 7) and the measure C, defined in (4.6), because they are both constructed as the root-mean-square deviations of the logarithms of certain ratios. The difference between them can be seen most clearly in Figure 1. The ratios involved in L are shown by the dotted vertical lines in Figure 1 (a), connecting the actual values to the least-squares trend line MN, on a semi-logarithmic chart. The ratios involved in C are shown by dotted vertical lines in Figure 1 (b), connecting actual value,to lines C_1D_1, C_2D_2, etc., drawn parallel to AB joining the terminal values. This shows clearly how the measure C tends to be greatly influenced by the terminal points.

There appears to be a confusion about the use of the moving average of a time-series as an estimate of the underlying trend. A p-year equally weighted moving average is an estimate of the trend of a time-series, if the time series consists of a <u>linear</u> trend, a <u>constant</u> cycle of periodicity p, and randomly distributed error terms. If the trend is non-linear, and is

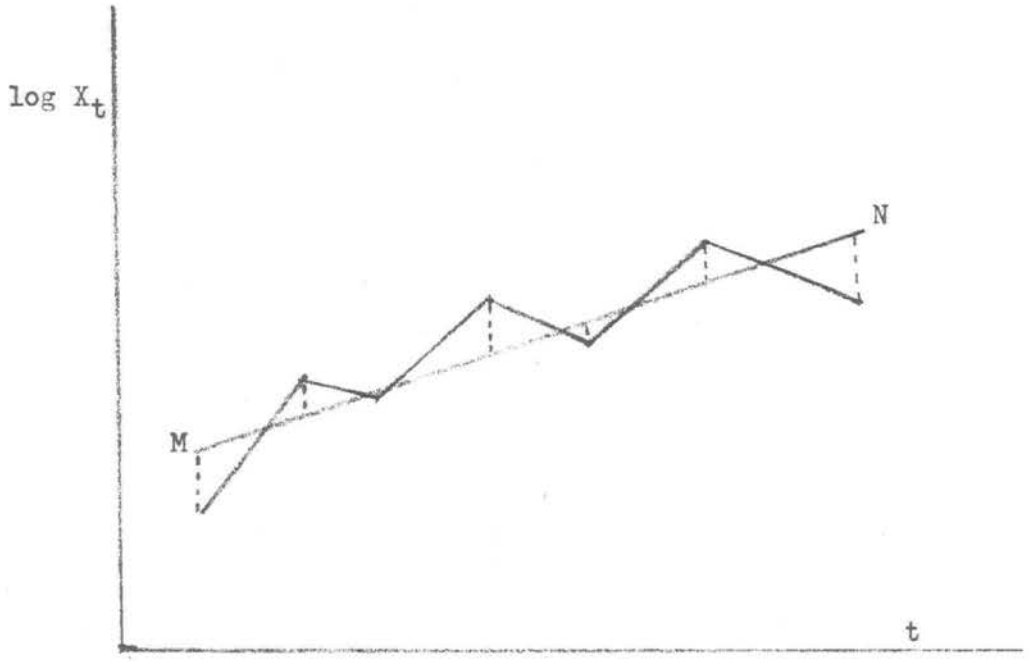

Fig.1(a) illustrating measure L.

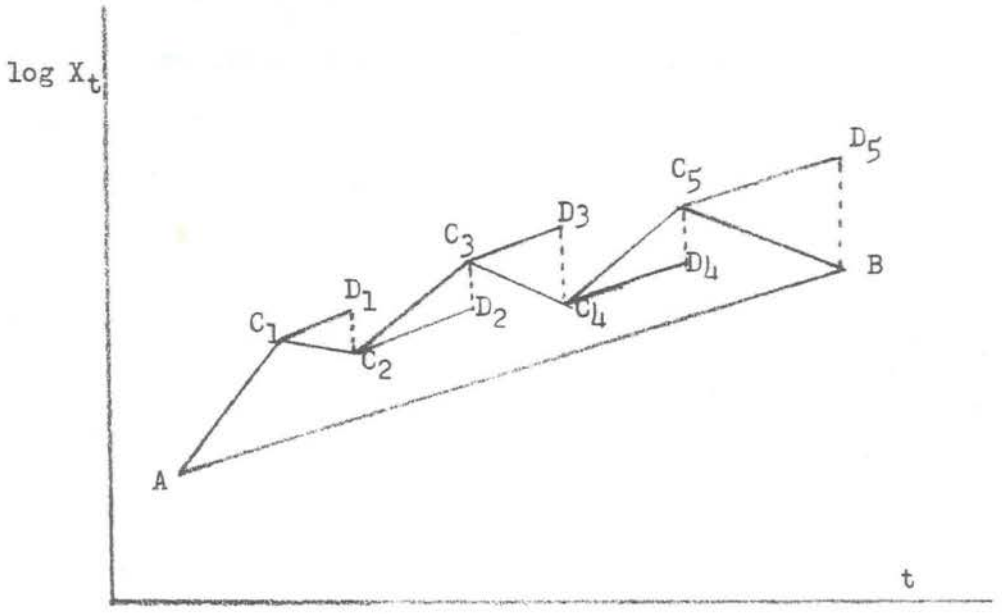

Fig.1(b) illustrating measure C.

in fact, polynomial of known degree, then a moving average with unequal weights can be devised to estimate the trend. If, however, there is no cycle of constant periodicity around a linear trend, then the moving average only performs a smoothing function. Then, the moving average is smoother than the original time-series but it also absorbs some of the fluctuations in its estimate of the trend, and is therefore not particularly suitable as a method of separating growth factors from fluctuations. The result is that the instability measured from a moving average tends to be smaller than that measured from a linear trend. This effect can be seen in some of the applications of this measure, discussed in later sections.

5. Primary Goods and Manufactures

On the basis of his method of measuring instability, Coppock has asserted that "Contrary to widely held views, export proceeds were decidely more stable for primary goods than for manufactured goods." (1 , p. 35; author's italics). This opinion has already gained some currency among economists. Coppock arrives at his conclusion by considering total world exports of primary goods and of manufactures.

The 'widely held views', which Coppock disputes, were not arrived at by dint of great intellectual effort in an ivory tower, but rather by painful and bitter experience over decades, in which the instabilities of international trade in primary goods have caused great hardship in countries specialising in those goods. These 'widely held views' contain two propositions: one, given any disturbance of international trade of a global character, such as cyclical fluctuations of economic activity in the major industrial countries, or those connected with political events such as the Korean and the Suez crises, the effect on exports of primary goods, especially on their prices, is more violent than for manufactured goods. This is the sort of effect which will be revealed by groups of primary goods. The other proposition is that the elasticities of demand and supply of individual primary commodities are so low that changes such as those caused, e.g., by crop yield fluctuations, have large effects on their export trade; this effect is not necessarily revealed by the study of groups of primary commodities, for there may be a great deal of compensatory factors affecting different commodities. The relative strengths of these two types of effects depend on the circumstances of particular historical periods, and the extent to which remedial actions have been taken, e.g., to tame the business cycle in the industrial countries or to adopt measures for the stabilization

of commodity trade in other countries. These propositions are not therefore shaken, by statistical evidence based on the total world trade of goods grouped into two broad classes for a particular historical period.

According to Coppock, the instability index for the exports of primary goods as a whole for the period 1948-1958 was 3.8 and for manufactures was 6.8. However, there appears to be an arithmetical error in his computations, for these figures cannot be derived from the data he has cited. The correct values calculated from his data (in his Table 3.3, p.34) are shown in Table 5.1 below. Here, the Coppock measure of instability for manufactures is only marginally higher than for primary goods. Further, this result is not supported by a number of other measures of instability calculated from the same data and shown in the table below.

Table 5.1 : Instability of World Exports of Primary Goods and Manufactures

Measure of Instability	Exports of Primary Goods	Exports of Manufactures
C	5.6	5.7
s	4.128	3.565
U_i	6.328	7.154
M	6.762	7.963
V	3.604	2.679
W	3.004	2.551

Only the C, U and M measures show a higher instability for manufactures; of these, we have seen that the U and M measures do not make any attempt to separate the variation due to growth from the total variation of a time series. In fact, for this period, the arithmetic rate of growth, expressed as a percentage of the average of the time series for the period, was 4.75% per annum for primary goods and 7.15 for manufactures. Therefore, the higher instability

for manufactured goods, shown by the U and M measures is most probably due to the fact that they include a part of the higher growth rate of exports of manufactures.

Apart from the theoretical weakness of the C measure, and the arithmetical error in Coppock's calculation of the C-measure for primary goods and manufacturers' exports, the data for primary goods and for manufactures in the form of index-numbers in his Table 3.3 (p. 34) is inconsistent with the data of Table 3.4 in dollar values, although the same C measures are given. Some other data is available on export values of primary goods and of manufactures for the period 1957-1965 from recent GATT annual reports on International Trade [2]. This is shown in Table 5.2 below, with some measures of instability.

Table 5.2. World Exports of Primary Goods and Manufactures: Index Numbers (1953 = 100) and Measures of Instability

Year	All Goods	Primary Goods	Manufactures
1957	140	127	155
1958	135	119	154
1959	145	125	168.5
1960	161	134	193
1961	168	139	203
1962	178	143	219
1963	194	156	238
1964	217	170	272
1965	235	177	303
Annual Rate of Growth: (%)	7.19	4.96	9.06
Measures of Instability:			
C	4.47	4.64	4.44
L	3.52	3.99	2.37
Correlation with:			
(1) Arithmetic Trend	.8592	.9508	.9768
(2) Logarithmic Trend	.9812	.9543	.9946

Table 5.2 gives some indication that a logarithmic trend fits the data more closely and that the measures calculated from such a trend indicate the greater instability of primary goods, even on the basis of total world exports.

6. Export Instability of Individual Primary Commodities

It is useful to supplement the study of export instability of broad classes of commodities by the study of individual commodities, for it may well happen that, although the exports of individual commodities are highly unstable, they tend to compensate one another, so that the exports of groups of such commodities are more stable. Coppock has compiled data on world export values of 29 primary commodities for the period 1950-58 [Table 3.6, p.43]. These commodities may be grouped into three classes, minerals (including petroleum), agricultural raw materials, and foodstuffs. Table 6.1 below shows the g-factors of these three classes; they are illustrated in Figure 2.

Table 6.1 g-factors of Three Groups of Primary Commodities (1950-58)

Year:	g-factor of World Exports of: Minerals	Agricultural Raw Materials	Foodstuffs
1950	-10.42	- 8.82	-13.91
1951	3.93	33.39	5.31
1952	16.28	-11.14	2.52
1953	- 6.44	-13.12	7.08
1954	- 9.48	- 9.89	5.10
1955	0.61	- 2.08	- 0.73
1956	11.65	3.71	2.07
1957	3.15	7.99	1.27
1958	- 9.28	0.0	- 8.71

Coppock has calculated the C measure for these commodities; for comparison with his results, the measures s and p have been calculated for the same data, and are shown in Appendix Table 1. A summary is given in Table 6.2 below.

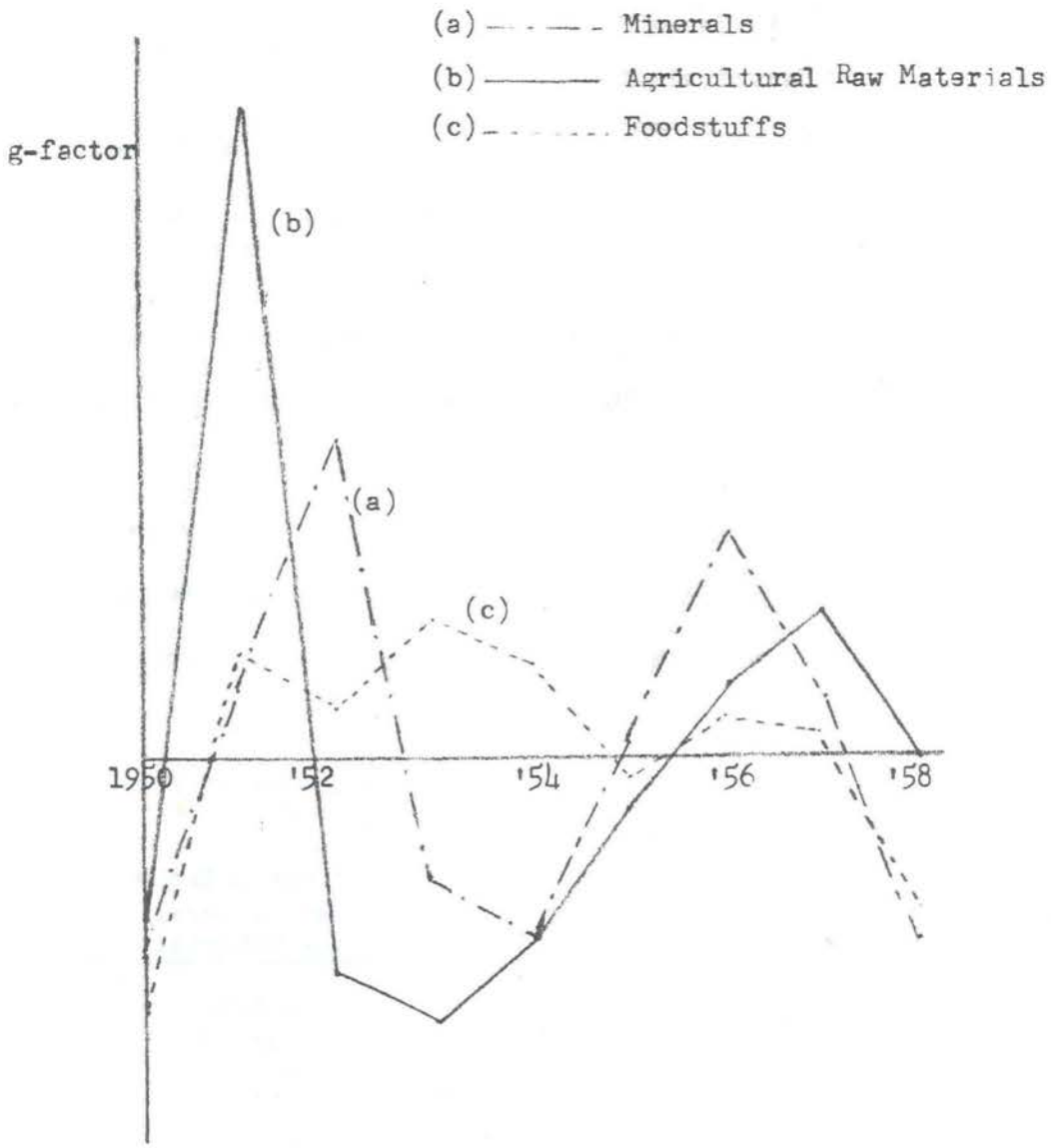

Fig.2. g-factors of Exports of Groups of Primary Commodities.

Table 6.2 Growth and Instability of Primary Commodities
Average Values of Groups of Commodities

		Minerals	Agricultural Raw Materials	Food	Total
1. Rate of Growth		4.31	-0.20	1.37	1.70
Average Measure of Instability					
2.	C	21.17	27.54	17.67	20.90
3.	s	12.88	16.10	12.35	13.38
4.	p	9.66	10.88	10.99	
Correlation of Growth rate with:					
5.	C	0.2770	-0.5418	-0.5262	-0.2560
6.	s	-0.1941	-0.1054	-0.5880	-
7.	p	-0.0207	-0.0016	-0.4595	-
	G^2	0.4310	0.5988	0.2359	0.4238

Table 6.2 shows that there is considerable variation in the instability of the three groups of commodities as measured by the average values of C and s, but the p measure of instability is fairly uniform. This suggests that the differences in the instability of the three classes may be attributed largely to the influence of the g-factors.

7. Instability of Export Proceeds of Individual Countries

Coppock has calculated the C measure of export instability of 83 countries, mostly covering the period 1946-58. For comparison with his results, the measures s and p have been calculated from the same data and are shown in Appendix Table 2. For the calculation of the p measure, the g-factors were calculated separately for four groups of countries: (A) 31 developed countries; (B) 21 Latin American countries; (C 18 African and Middle Eastern countries, including Turkey and excluding South Africa, and (D) 12 Asian countries, excluding Japan. The g-factors were calculated separately for these groups and are shown in Table 7.1 for the period 1946-58, and illustrated in Figure 3. As the exports data were not available for the whole period for some countries, the g-factors were also calculated for shorter periods from the data for those periods for all countries for which such data was available for a longer period; these g-factors are shown in Appendix Table 3.

Table 7.1 g-factors for Exports for Groups of Countries (1946-58)

Year	g-factors for country group: A	B	C	D
1946	- 6.00	- 6.24	-13.68	-23.07
1947	0.13	1.02	-11.79	-14.64
1948	+ 4.36	4.04	1.21	- 1.79
1949	- 1.91	- 8.23	- 2.48	-10.69
1950	- 4.64	- 0.87	12.38	17.39
1951	13.16	9.61	33.43	50.02
1952	3.58	4.03	8.17	14.59
1953	- 2.77	- 0.58	- 1.91	- 1.84
1954	- 5.12	2.73	- 3.57	- 5.98
1955	- 2.26	- 0.78	- 2.55	4.42
1956	1.62	3.23	- 6.89	- 0.65
1957	5.48	0.73	- 8.57	- 3.60
1958	- 5.63	- 8.69	- 1.33	-24.16

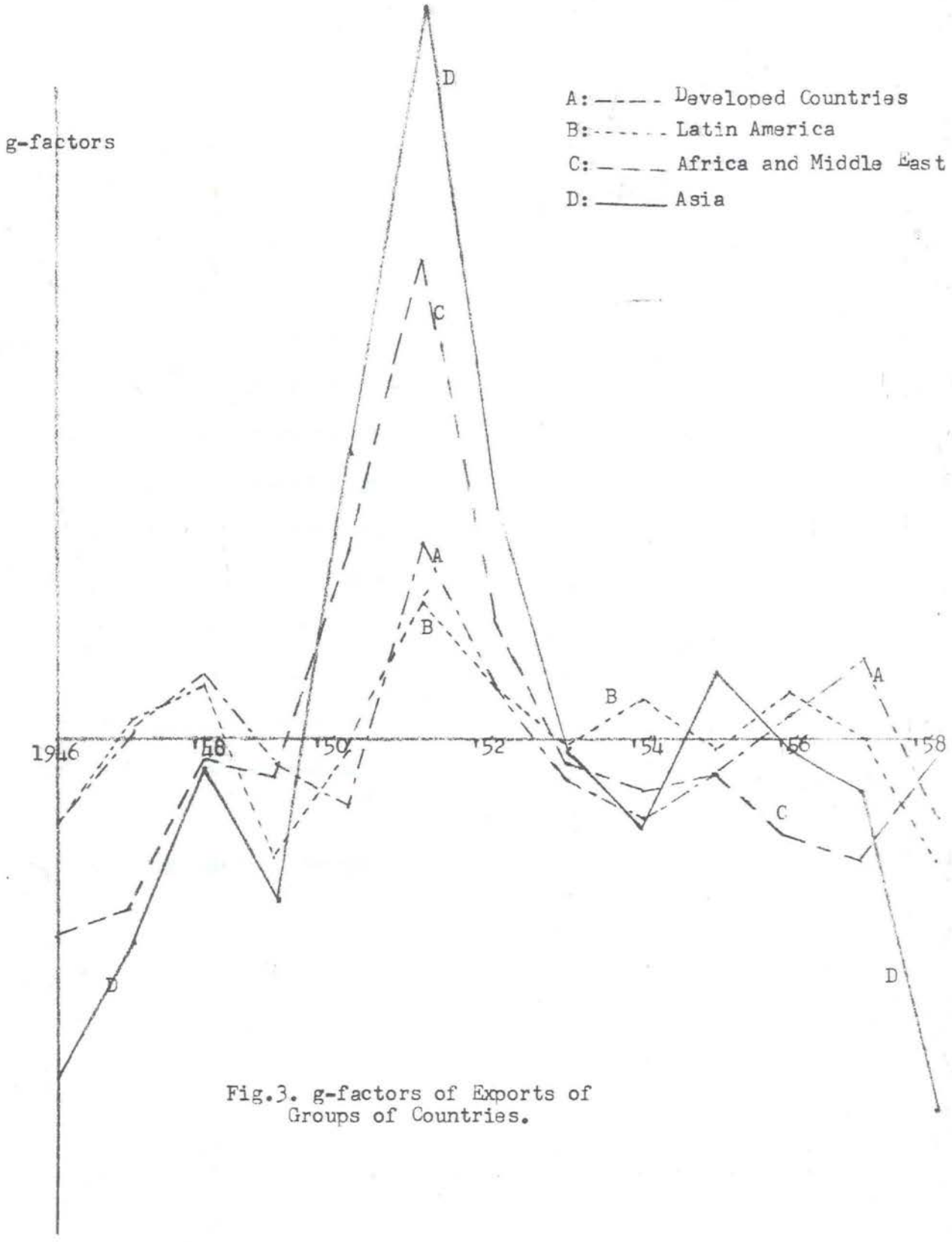

Fig.3. g-factors of Exports of Groups of Countries.

Table 7.2 shows the average values of the various measures of instability and their correlation with growth rates.

Table 7.2 Growth and Instability of Export Values by Groups of Countries (1946-58)

		Country Group: A	B	C	D	B+C+D
1.	Number of countries	31	21	18	13	52
2.	Annual growth as percentage of average	9.95	5.55	9.35	4.85	6.69
	Average Value of Instability Measure					
3.	s	11.59	11.78	18.52	20.38	16.26
4.	p	10.44	10.67	16.54	16.09	14.06
5.	C	19.43	17.68	25.88	28.66	23.26
	Correlation of Growth Rate with Measure					
6.	s	.1116	-.7549	-.5867	.3467	-.2475
7.	p	.0361	-.6247	-.4064	-.3487	
8.	C	.3176	-.5853	-.5256	.3963	-.2326
9.	G^2	.1642	.1753	.1977	.4353	.2809

The g-factors, as calculated here, indicate the sort of deviations from linear trends that are common to groups of countries. They may therefore be taken as rough measures of the fluctuations affecting these countries from outside. The pattern of the g-factors described in Table 7.1 indicate such disturbances of world trade as those due to the Korean War and economic conditions in the developed countries, especially in the United States. The G-ratios given in Table 7.2 show that the incidence of these external influences on instability has been particularly serious in the less-developed countries.

In addition to these, the measure W has been calculated by Fleming and Lovasy [4, p.117] and by McBean [6, p.407] for a number of developed and less developed countries. Table 7.3 summarizes these results together with the corresponding values of C and A measures for these countries for roughly the same period.

Table 7.3 Comparison of Three Measures of Instability (1946-58)

Measure	Average Value of Measure in: 23 Developed Countries	40 Less-Developed Countries
W	8.53	9.34
C	18.97	23.95
A	10.30	13.04
F as percentage of:		
C	45	39
A	83	72

Table 7.3 illustrates the property of the W measure, referred to in Section 4 above, to underestimate the extent of instability because the moving average, from which the W measure calculates deviations, absorbs a part of the fluctuations themselves. Further, this table shows that the W measure underestimates instability to a greater extent in the case of the less-developed countries than in the case of the developed countries.

Tables 7.2 and 7.3 clearly demonstrate the greater instability, on the average, of the exports of the less-developed countries, compared with the developed countries. Yet, in his study of export instability, McBean concludes that "the tendency for underdeveloped countries to have less stable export earnings ... is a fairly weak tendency, that the differences are not large, and that there is a considerable overlap in experience of instability between rich and poor countries." [6, p.36] This is stressed also by Professor Edward S. Mason in his Foreword to McBean's book, where he says, "In the course of this investigation, it became clear that the less-developed countries are little if any more subject to fluctuations of export earnings than the developed countries." [6, p.9] It is strange that these economists reach such conclusions in spite of overwhelming evidence to the contrary. The extent of the difference between developed and less-developed countries is shown in Table 7.4.

Table 7.4 Comparison of Export Instability of Developed and Less-Developed Countries (1946-58)

Measure	Average Measure of Instability of Less-Developed Countries as percentage of that of Developed Countries.
	I. Sample of 83 Countries
s	140
p	135
C	120
	II. Sample of 63 Countries
C	126
A	127
F	110

This table shows that, except for the W measure which, as we have seen, underestimates instability of less developed countries to a greater extent than for developed countries, the other measures show at least 20% and as much as 40% more instability in the less developed countries.

The extent of the difference between developed and less developed countries may also be considered in a statistical way, which is extensively used by McBean. It is difficult to devise an appropriate statistical test of the difference, because the assumptions underlying the annual statistical tests, such as independence and randomness of sampling, are obviously not true. Even assuming that these conditions are satisfied, and sample sizes are sufficiently large for normality of the sampling distributions, the results of a simple statistical test are shown in Table 7.5. The standard error, E, of the difference of two sample means, is assumed to be given by:

$$E^2 = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$$

using suffix 1 for developed countries and suffix 2 for less-developed countries. Then, the difference of sample means is expressed as a normal deviate thus:

$$ND = \frac{\bar{X}_2 - \bar{X}_1}{E}$$

A one-tailed test being appropriate to test the hypothesis that the two means have arisen from random samples from populations with the same mean, against the alternative hypothesis that the sample of less-developed countries is drawn from a population with a larger mean, a probability measure P has been taken from the normal probability distribution, indicating the probability that differences larger than the normal deviate in a positive direction could have been obtained by chance alone.

Table 7.5 Statistical Comparison of Sample Means of Instability Measures of Developed and Less-Developed Countries.

Measure	Difference expressed as normal deviate	P-probability of larger positive deviations
I. Sample of 83 Countries		
s	3.11	.0009
p	2.15	.0026
C	1.62	.0526
II. Sample of 63 Countries (Cited by McBean)		
C	2.16	.0154

This clearly shows that the probability of obtaining the observed differences of the s and p measures by chance alone is absurdly small, and even if the C measure is very low, in spite of the fact that, as we have seen, the C measure is an unsatisfactory measurement of instability.

McBean also stresses the fact that some developed countries have also had a great deal of instability. This seems irrelevant because the argument is not that all developed ccuntries have lower export instability than all less-developed countries. It is, however, interesting that of his examples of developed countries with a great deal of export instability, primary commodity exports are important for two of them, namely Australia and Finland. His third example is only supported by two measures of instability, which are not entirely satisfactory, as shown in Table 7.6.

Table 7.6 Export Instability of France

Measure	France	Average of 31 Developed Countries
s	9.98	11.59
p	9.64	10.44
A	8.8	10.08
C	20.9	19.43
W	9.4	8.53

As yet another argument in support of his view that there is only a low degree of association between level of development and export instability, MacBean cites the correlation coefficient calculated by Coppock, of - 0.23 between the C measure of instability and per capita GNP (in 1957). The per capita GNP figure, will all the doubts about statistical reliability of such figures, and the difficulties of international comparison, is a notoriously poor index of stage of development. Even if it is taken as a rough indicator, no one has seriously argued that export instability is associated with such an index of development; rather, the real case is that the exports of primary goods are particularly vulnerable to instability, under present conditions of world trade, and that this affects the less-developed countries, and for that matter, some developed countries also, to the extent that primary goods form a large part of their exports. Finally, the MacBean statistical test of this correlation coefficient is misleading, when he says that observed value of the correlation coefficient "is barely significant at the .05 level of significance" [p.34-36]. If the evidence is to be used to test the hypothesis of zero association against the alternative of a negative association, then a one-tailed test is appropriate and by this test, the observed correlation coefficient is significant at the .025 level of significance, for the probability of obtaining a <u>smaller</u> correlation coefficient by chance alone is less than .025.

It is interesting to consider the relationship between rates of growth and degrees of instability in the export earnings of individual countries. One of the correlation coefficients calculated by Coppock is between the C measure and the annual amount of growth of exports in dollars. This amount of growth varies so much with the size and income level of the countries that it is not surprising he got a correlation coefficient of only 0.07. He also found a correlation coefficient of 0.23 between the C measure and the logarithms of the annual proportional rate of growth. If instead, we consider the annual proportional rate of growth obtained by least squares regression of the logarithms of export values on time, we find a correlation coefficient with the C measure of 0.24, the correlation within the developed countries being 0.58 and within the less-developed countries being 0.23. This result is, therefore, contrary to the result shown in Table 7.2, where the correlation between the C measure and the annual amount of growth expressed as a percentage of the average exports was found to be -0.23 for the less-developed countries. However, this difference is not to be taken seriously, in view of the innate weakness of the C measure as an index of instability.

The s-measure is found to be negatively correlated with the growth rates of groups of primary commodities (Table 6.2) in groups of less-developed countries and in all less-developed countries (Table 7.2) with one exception -- the Asian countries. This case is most likely due to the particular pattern of the g-factors in those countries, for when the g-factors are removed as in the p measure, we find negative correlations between growth and instability in all groups of primary commodities and all groups of less-developed countries.

In some recent discussions there is an attempt to separate policies concerned with the slow growth of exports from those concerned with their high instability. If the negative correlations observed here indicate a close connection between these two aspects, then such a separation of policies may have to be reconsidered.

We have so far considered the instability of international trade from the point of view of the exporting countries only. The instability can also be studied from the point of view of the importing countries. Coppock has calculated the C-measure of instability of imports of 83 countries. From this, we find that the average value of the C-measure was 19.48 for 31 developed countries and 24.73 for 52 less-developed countries. He also formed a correlation coefficient of 0.43 between export proceeds and import values for all these countries; in fact, the correlation coefficient between the C-measures of export instability and import instability is 0.5119 for 31 developed countries and .3658 for 52 less-developed countries.

A further analysis can be made of the way the import instability of some countries affect the export instability of others, using GATT data on the net-work of international trade for the period 1953-65 [2]. From this data, the s-measure of instability was calculated for groups of countries and is shown in Table 7.7 below.

Table 7.7 Instability of Exports of Group of Countries by Destination. (1953-65)

To:	s-Measure of Instability of Exports from Industrial Countries	Non-Industrial Countries
Industrial	7.51	5.15
Non-Industrial	4.32	4.62
World	6.21	4.95

Table 7.7 shows that the exports of all non-industrial countries as a group was less unstable, but this is partly to be explained by the compensating effect of the trade of different countries. The table also shows that exports to industrial countries are generally more unstable.

8. The Role of Price and Quantity Fluctuations

A number of authors have also studied the relative contributions of price and quantity fluctuations to the instability of export proceeds. Coppock finds, for total world exports in the period 1947-58, that "price fluctuations were a more important source of instability in export proceeds than quantity fluctuations" [1, p. 287]. However, quantity fluctuations appear to be larger when the exports of individual countries are considered. This is shown by the C measure itself. Table 8.1 shows the average values of the C measure for all countries for which it was calculated by Coppock, and for these countries (excluding the centrally-planned countries and a few others) classified by MacBean into Underdeveloped and Rich countries.

Table 8.1. Fluctuations in Export Volume and Unit Value (1946-58)

Countries:	Average Value of C Measure of Instability for: Export Proceeds	Unit Values	Volume
All countries	21.8	15.4	17.1
Rich Countries	17.6	10.7	14.0
Underdeveloped Countries	23.1	17.6	19.4

However, it is found that, in the less-developed countries, price fluctuations measured by the C index, were greater than volume fluctuations in 20 cases, less in 20 cases and equal in 3, while in the developed countries, price fluctuations were greater in 18 countries, and less in 7. A different calculation by Michaely, using the M measure, shows that fluctuations in unit values were greater than in export volumes. His results [8, p.71 and 99] are summarized in Table 8.2 below. It will be noted that the M measure does not take account of variations due to trends, and therefore tends to overestimate instability to a greater extent in the case of volumes than in unit values.

Table 8.2. Fluctuations in Export Volume and Unit Value 1948-58

Countries:	Average Value of M-Measure of Instability in Export Volumes	Unit Values
21 Developed Countries	7.83	8.40
15 Developing Countries	10.82	13.09
Total: 36 Countries	9.08	10.35

The role of price and quantity fluctuations in world exports of particular primary products has also been studied in the U.N. Study [11, p.407] using the U_2 measure of instability and is cited in MacBean [6, p. 427]. The results are summarised in Table 8.3 below.

Table 8.3. Fluctuations in Export Volumes and Unit Values of 27 Primary C commodities (1948-57)

Fluctuation in:	Average Value of U_2 measure of Instability
Unit Values	11.6
Volume	9.6
Export Proceeds	14.0

The relative contributions of price and quantity fluctuations may vary from time to time, but the general indication of these calculations for the post-war period is that price fluctuations were greater for world trade as a whole, but that for individual countries, quantity fluctuations were greater, presumably showing the effect of volume fluctuations in world trade as a whole, and changes in shares of individual countries, at least in the case of primary commodities.

The s-measure of instability was calculated for price and volume variations, using the IFS data on exports and export price indices, with export volumes derived by divided value of exports by export price indices, so as to make the measurement of price and volume variations consistent. The results are given in Appendix Table 4, and summarised in Table 8.4.

Table 8.4. Price and Volume Fluctuations in Exports 1950-64

Countries:	Average Values of s-measure of Instability in Export Proceeds	Unit Values	Export Volume
22 Developed Countries	8.96	6.20	7.38
32 Developing Countries	13.33	10.60	10.90
54 Countries	11.55	8.80	9.47

The role of price and quantity fluctuations in contributing to instability of export proceeds may also be studied by the correlation between measures of instability of export proceeds and those of price and quantity variations. Some results, based on inter-country correlations, are shown in Table 8.5 below.

Table 8.5. Inter-Country Correlations Between Fluctuations in Export Proceeds and Price and Quantity Fluctuations

Countries:	Inter-Country Correlation Coefficients Between Instability Measures of:		
	Export Proceeds and Unit Values	Export Proceeds and Quantum	Unit Values and Quantum
	(a) C-Measure of Instability (1946-58)		
18 Developed Countries	0.7329	0.5858	0.1271
45 Developing Countries	-0.0193	0.5955	-0.1010
Total: 67-70 Countries	0.13	0.58	
	(b) s-Measure of Instability (1950-64)		
22 Developed Countries	0.3919	0.8249	0.0398
32 Developing Countries	0.2892	0.7277	0.2326
Total: 54 Countries	0.4588	0.7820	0.2684

Table 8.5 shows that export instability was more highly correlated with instability of export volumes than with export prices, except in the case of developed countries, using the C-measure. However, MacBean has calculated the correlation coefficients between U measures of export proceeds, unit values and export volumes of 27 primary commodities during the period 1948-57. He finds that instability of export proceeds of these primary commodities was more highly correlated (0.8382) with the instability in their prices than with the instability in their volumes (0.5005). [p.42] He also finds a positive correlation of 0.2132 between the instability of unit values and export volumes. This further supports the hypothesis that price fluctuations contributed more to instability of export proceeds, than quantity fluctuations, in the total world trade in primary commodities, but that quantity fluctuations were a more important factor for the trade of individual countries.

The correlation coefficients in terms of the s-measure in Table 8.5 show the same sort of relationships between export proceeds and price and quantity fluctuations in developed and developing countries, but there is a difference in the correlation between price and quantity fluctuations, the positive correlation being much greater in the case of the developing countries. This suggests that the relationship between price and quantity fluctuations was de-stabilizing in its effect on instability of export fluctuations. The s-measure of instability summarises the extent of fluctuation in any variable over a whole period, and does not indicate the effects year-by-year. This is shown by the correlation coefficients between annual values of pairs of variables for each country. Table 8.6 shows the average values of such intra-country correlation coefficients, based on the IFS data on export values and price indices.

Table 8.6. Intra-Country Correlation Coefficients Among Export Proceeds, Unit Values and Export Volumes (1950-64)

Countries:	Average Values of Intra-Country Correlation Coefficients between annual values of:		
	Export Proceeds and Unit Values	Export Proceeds and Volumes	Unit Values and Volumes
22 Developed Countries	0.1359	0.9464	0.0273
32 Developing Countries	0.1616	0.7238	-0.2581
Total: 54 Countries:	0.1511	0.8144	-0.1419

When the data on export proceeds V, unit values P, and quantum of exports Q, are consistent in the sense that V = PQ, then a measure of instability can be used which takes account of the relationship between annual changes in prices and quantities. This is the logarithmic standard error of estimate (eliminating a linear trend in logarithmic values). From the relationship,

$$\log V = \log P + \log Q,$$

we derive the result

$$J_v^2 = J_p^2 + J_q^2 + 2 \text{ Cov } (\log P, \log Q).$$

This relationship was calculated for groups of countries from IFS data and is shown in Table 8.7 below:

Table 8.7. Logarithmic Standard Errors of Estimate of Export Proceeds, Unit Values and Quantities (1950-64)

Countries:	J_v^2	J_p^2	J_q^2	Average Correlation Coefficient of log P and log Q
22 Developed Countries	$(0.03973)^2$	$(0.02917)^2$	$(0.03003)^2$	-0.0994
32 Developing Countries	$(0.06019)^2$	$(0.04646)^2$	$(0.04848)^2$	-0.1967
Total: 54 Countries	$(0.05282)^2$	$(0.04032)^2$	$(0.04196)^2$	-0.3522

The results of Tables 8.6 and 8.7 suggest that an important cause of the greater instability of export proceeds in the less-developed countries is due to the greater negative correlation between annual variations in price and quantities.

9. The Role of Concentration in Primary Commodities

The export proceeds of a country depend on a multitude of factors, so that it is idle to search for any 'sole determinant'. It is therefore not very enlightening to be told that "commodity concentration is . . . . far from being the sole determinant" [8, p.73]. Given the difficulties of measurement and the number of factors that can cause instability, it is interesting to have identified any single factor which can explain even about 10% of the variation in instability between countries. From the available evidence, it is clear that one such factor is the proportion of primary goods in a country's exports.

Massell gives the data for 36 countries (equally divided between developed and less-developed countries) of the primary product ratio, Q_1, for 1959, i.e. the percentage, by value, of a country's exports in the S.I.T.C. groups 0 to 4, and calculates the s-measure of instability for the period 1948-59. From this, we find a correlation coefficient of 0.3095 between s and the primary product ratio. This measure of the relationship is affected by a lot of 'noise', i.e. the effect of a lot of other influences. A way of 'filtering' the noise, i.e. of suppressing the effect of these other influences to some extent, is to divide the sample of 36 countries into nine groups of four countries each, stratified on the basis of their export instability. The results are shown in Table 9.1 below. The table also shows Massell's calculation of the Gini-Hirschman index of commodity concentration C_3, based on a 3-digit S.I.T.C. classification of commodities.

Table 9.1 Instability, Primary Product Ratio and Commodity Concentration of Exports of 36 Countries in 9 Groups.

Groups of Countries	s	Average Values of: Q_1	C_3
I	19.8	79.9	56.9
II	14.4	90.3	53.2
III	14.0	79.4	45.2
IV	12.0	96.1	67.1
V	11.0	58.5	31.4
VI	10.3	65.4	46.9
VII	9.6	53.9	31.0
VIII	8.5	63.5	40.1
IX	6.0	53.0	35.1

The correlation coefficient between s and Q_1, calculated for these groups of countries, nnow becomes 0.6063, showing the persistent nature of this relationship when the disturbing effect of other minor factors has been suppressed by such grouping.

A similar effect can also be seen from a sample of 38 countries, for which MacBean has compiled data on the primary product ratio Q_2, for 1954, defined as percentage, by value, of a country's exports in the S.I.T.C. groups 0-3. [6, p.40]. If we omit Malaya and Singapore, because of the special character of the trade of Singapore, and correct the figure for Rhodesia and Nyasaland, which is obviously wrong, the sample consists of 21 developed and 15 less-developed countries. The correlation coefficient

between Q_2 and the s-measure of instability is 0.3394 when the countries are taken individually, but becomes 0.6317 when the sample is 'stratified' into nine equal groups on the basis of the s-measures.

The primary-product ratio is, therefore, clearly a major factor in explaining the export instability of countries. Several authors have tried to measure the relationship between instability and commodity concentration of exports. They find that both the direct correlation coefficients between instability and commodity concentration, and the partial correlations eliminating the influence of the primary-product ratio, to be weak. In using their correlation coefficients to test the null hypothesis that there is no relationship between export instability and commodity concentration, they have not indicated the alternative hypothesis clearly enough to judge whether the test they are applying is sufficient to detect the probable magnitude of the relationship.

A form of the alternative hypothesis has been specified by Massell as follows. Let a_i represent the fraction of a country's export resources used for producing the i-th export good, with $\sum a_i = 1$; and let the export proceeds x_i which a country can earn by using all its export resources to produce the i-th commodity be a random variable with mean A_i and variance S_i^2. Massell then shows that, if

(i) the country is equally efficient in producing all commodities, so that $A_i = A$, constant for all i;

(ii) the export earnings from all commodities are equal unstable, i.e. $\frac{S_i^2}{A_i} = \frac{S_i}{A} = V$, constant for all i; and

(iii) all exports are independent, i.e. the random variables X_i are all independently distributed;

then,

(1) total export earnings X is a random variable with mean A and variance $AV \sum a_i^2$;

(2) the commodity concentration of exports measured by the Gini-Hirschmann index C is $\sum a_i^2$; and

(3) the instability of total export earnings, measured by its coefficient of variation, V_T, is related to commodity concentration, by

$$V_T = V.C. \quad \ldots\ldots\ldots\ldots (9.1)$$

Under these conditions, a reduction of commodity concentration will reduce the instability of total export earnings proportionately.

The conditions assumed in this derivation are notoriously unrealistic. They must be relaxed to a great extent to get even a rough approximation to the actual conditions of world trade. As a first step, let us classify all goods into two classes, primary goods and manufactures. Let b_i represent a country's exports of the i-th primary good, as a proportion of its total exports, with $\sum b_i = Q$, the primary product ratio, and let c_k represent a country's exports of the k-th manufactured good as a proportion of its total exports, with $\sum c_k = (1-Q)$. Then, the degrees of concentration in primary goods and in manufactures may be defined as follows:

$$C_p^2 = \frac{\sum b_i^2}{Q^2} \quad ; \quad C_m^2 = \frac{\sum c_k^2}{(1-Q)^2}$$

It then follows that the degree of concentration of total exports is given by:

$$C^2 = Q^2 C_p^2 + (1-Q)^2 C_m^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (9.2)$$

The primary-product ratio, Q, is thus seen to be an element of the degree of concentration. Further, the statistical evidence shows that it is a principal element of C. For instance, from the grouped data of Table 9.1, it is found that the correlation coefficient between C and Q is 0.9218; this implies that the variations in C are mainly due to variations in P, and that there is little variation in C_p and C_m.

A more general relationship between V_T, the instability of total exports, and the degree of concentration can be derived from the following assumptions:

(a) The correlation coefficient between any pair of primary goods is r_1; that between any pair of manufactures is r_2, and that between any primary good and any manufactured good is r_3.

(b) that the export instability of all manufactured goods, measured by the standard deviation, is the same, equal to S_1, and of all primary goods is also the same, equal to kS_2.

Then, it follows that

$$V_T^2 = \frac{S_1^2}{A}\left(k^2Q^2C_p^2(1-r_1) + (1-Q)^2C_m^2(1-r_2) = k^2q^2r_1 + (1-Q)^2r_2 + 2kQ(1-Q)r_3\right) . \quad (9.3)$$

Substituting (9.1) in (9.3), we have two alternative forms:

$$V_T^2 = \frac{S_1^2}{A}\left(k^2C^2(1-r_1) + C_m^2(1-Q)^2(1-r_2-k^2+k^2r_1) + k^2Q^2r_1 + (1-Q)^2r_2 + 2kQ(1-Q)r_3\right) \ldots (9.4)$$

or

$$V_T^2 = \frac{S_1^2}{A}\left(C^2(1-r_2) + C_p^2Q^2(k^2-r_1-1+r_2) + k^2Q^2r_1 + (1-Q)^2r_2 + 2kQ(1-Q)r_3\right) . \ldots (9.5)$$

These results show that, when the additional factors are taken into account, the relationship between V_T and C becomes less direct, and depends on the change of C with P, but that if P is constant, the relationship is much smaller. When such a smaller relationship is disturbed by other factors, it is more difficult to detect the relationship statistically. The effect on the instability of total exports becomes significant only when concentration is reduced by changes in the primary product ratio.

10. The Effect of Export Instability on Investment

Economic development in the less-developed countries is based on investment in a number of key sectors in which their capital endowment is hopelessly inadequate to utilize modern science and technology in their productive process; such investment depends, to a great extent, on imported capital goods, as the less-developed countries are generally at such a low level of technology that they cannot produce these capital goods domestically; these countries depend principally on their foreign exchange earnings from their exports to pay for such capital goods imports, but these earnings have also to pay for considerable imports of consumer goods, which are quick to expand at times of increase in export earnings, but are slow to decline at times of decreases in export earnings. The result of this chain of relationships is that fluctuations in foreign exchange earnings from exports are transmitted substantially to cause fluctuations in the resources needed for capital formation.

This reasoning has been confirmed by a number of empirical studies. For example, the U.N. World Economic Survey, 1959 [12, p.60] says: "In most primary producing countries, domestic investment is closely linked to the availability of imported capital equipment; and when the fluctuations in the purchasing power of exports have necessitated corresponding changes in imports of capital equipment, they have accordingly been transmitted to domestic investment activity. The data ..... demonstrate that this mechanism has frequently operated in the primary producing countries. Not only have the countries with greater fluctuations in external purchasing power generally experienced greater fluctuations in total real imports, but they have also experienced greater instability in domestic fixed investment." However, the

Survey goes on to say that "this relationship between fluctuations in external purchasing power and in domestic fixed investment, which is clearly discernible when the primary producing countries are considered as a whole, has not held with equal force among the individual countries, or even for the same countries over time. For, among other things, the strength of the mechanism has often been modified by the aims and operation of government policies regarding investment and imports."

Similar conclusions were reached in the report of a U.N. Committee of Experts (the Crawford Report), which says [10, p.10-11]: "It need hardly be said that the relationship between variations in export proceeds and domestic investment is not inflexible, but may sometimes appear to be rather tenuous. From time to time, in the experience of individual countries, the link has been weakened, or apparently severed, by the operation of other factors. For example, in countries which are net importers of food, an important determinant of the supply of foreign exchange available for imports of capital goods has been the level of domestic food production; in years of bumper harvests in domestic agriculture, it has been possible to reduce imports of foods and thus increase the supply of imported capital goods, though total imports may have remained unchanged. Again, where the composition of domestic investment has shifted towards classes of investment, such as construction, which utilize mainly domestic materials, total investment has sometimes been maintained or increased despite a decline in imports of capital goods - though such a change in composition sometimes implies greater concentration on less productive investments. By and large, however, total domestic investment has been quite closely related to available supplies of imported capital equipment; and partly through this relationship, the year to year changes in

total investment have tended to reflect the instability in export proceeds or in importing power of exports."

These conclusions have been challenged by MacBean, who concludes from his study, that "the data show at best a very weak relationship which must itself be regarded as 'not proven' " [6, p.71]. He bases this conclusion on the correlation coefficient of 0.3433 which he finds between fluctuations in the importing power of merchandising exports and fluctuations in gross domestic fixed capital ofrmation in 20 countries for the period 1950-59. The fluctuations were measured by the average annual percentage change in each variable corrected for linear trend estimated by least squares. This group of countries includes Greece and Portugal, which are not typical of the less-developed countries. If these countries are omitted, the correlation coefficient becomes 0.4369. Further, MacBean uses a two-tailed test of significance based on the t-distribution in asserting that the observed correlation is not significant at even the 10% level of significance. In fact, given the nature of the alternative hypothesis against which the null hypothesis is being tested, it is more appropriate to use a one-tailed test and by this test, the observed correlation for the whole sample is significant at the 10% level of significance, and the correlation coefficient for the sample, omitting Greece and Portugal, is significant at the 5% level of significance. In view of the nature of the data, and the influence of many other factors which have influenced the variables, the existence of a significant relationship between export instability and fluctuations in investment activity in the typical less-developed countries, must be considered to be well established by the available evidence.

Coppock, MacBean and some other writers have examined the short-term consequences of export instability on investment by considering the correlation between a measure of export instability and another measure of instability summarizing the fluctuations in investment of a country for a whole period. This is not quite satisfactory and a better indication is given by time-series analysis. In time-series analysis, we fit a regression equation, one for each country, relating the annual values of investment (preferably after eliminating the time-trend) to the annual values of exports (again eliminating a time-trend). Let the regression equation for the i-th country be written as:

$$Y_i = b_i X_i = r_i \frac{j_i}{h_i} X_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10.1)$$

where X_i and Y_i are deviations of exports and investment from their linear trends, fitted by least squares; h_i and j_i are their respective standard errors of estimate; and r_i is the correlation coefficient between X and Y in the i-th country. Then,,the 'amount' of the fluctuation of investment around its trend that is explained by the fluctuation of exports, also around its trend, is given by:

$$Y_{it}^2 = b_i^2 \sum X_{it}^2 = r_i^2 \, j_i^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10.2)$$

where X_{it} is the deviation of the exports of the i-th country around its trend at time t, and Y_{it} is the deviation of investment from its trend at time t, as computed from the regression equation (10.1). Hence, r_i^2 is the proportion of the fluctuation of Y_{it} that is 'explained' by the fluctuation in X_{it}. The influence of fluctuations in exports on fluctuations in investment for a group of countries can then be indicated by the average values of r_i^2 or r_i for that group of countries.

If b_i and r_i are constant for all countries, there will be a perfect correlation between h_i and j_i. The correlation between h_i and j_i is, therefore, mainly concerned with the uniformity among the countries of the group.

MacBean has considered a time-series analysis of the relationship between annual values of exports and annual values of capital goods imports on the one hand, (in his Table 3.6) and between annual values of capital goods imports and annual values of gross fixed capital formation (in his Table 3.7) for a number of Latin American countries. In these tables, he considered the number of times the two variables of each pair moved in the same direction. He found, on this basis, that the relationship between capital goods imports and gross fixed capital formation was significant at the 5% level, and the relationship between exports and capital goods imports, lagged by one year, was significant at the 0.1% level. In a bivariate normal distribution, the observed sign-correlation between exports and capital goods imports corresponds to a variate correlation of 0.81, and that between capital goods imports and investment corresponds to a variate correlation of 0.41. MacBean also found that the intra-country correlation between the time-series of exports and capital-goods imports was significant at the 5% level in 9 out of 10 Latin American countries, and between exports and fixed capital formation significant at this level in 3 out of 8 countries. Two of the countries for which the rank correlation between capital goods imports and investment were not significant were Brazil and Venezuela, in which private foreign capital was an important source of foreign exchange. MacBean was not able to collect much statistical data, and what data he has collected gives many indications of a strong link between exports and investment, through capital-goods imports.

Yet he concludes that "this is scarcely sufficient evidence to support the view that investment in underdeveloped countries is seriously disrupted by export instability." [6, p.75]. This conclusion is clearly unjustified; all that can be said is that the evidence collected and analyzed by MacBean is not sufficient to counter the strong prima facie case in favor of the hypothesis.

MacBean has also considered the effect of export instability on economic development and concludes that "for underdeveloped countries in general, however, the evidence indicates that export fluctuation has not been an important obstacle to their economic development," and that "our search for evidence demonstrating the adverse influence of short-term instability of export earnings on the prospects of growth in underdeveloped countries gives us no grounds for believing that export instability is in fact so harmful." [6, p.127] This conclusion is so contrary to common sense that it is interesting to examine the statistical analysis on which it is based.

The main basis of the conclusion seems to be the positive correlation which MacBean has found between the rate of growth of investment and the W measure of instability in the importing power of exports in a group of less-developed countries during the fifties. This positive correlation gives rise to a positive partial regression coefficient of investment growth-rate and export instability in a number of multiple regression equations computed by him. The data on which this statistical analysis is based is given in Table 10.1 below, mostly taken from MacBean's Table 4.1.

Table 10.1 Variables for Statistical Analysis of the Relationship of Export Fluctuation to Economic Growth

Country	$\dot{I}$	X_1	X_2	Z	w
Argentina	2	- 2.9	11.8	0	-12.1
Bolivia	6	- 2.5	11.2		
Brazil	2	2.3	8.1	-1	- 2.9
Burma	15	6.5	9.6	10	- 3.4
Ceylon	5	1.5	7.9	5	1.8
Chile	3	2.6	8.8	2	0
Colombia	9	7.2	8.8	- 1	3.9
Congo	9	-0.1	6.9	9	7.3
Cuba	11	1.1	7.3		
Ecuador	9	5.7	9.7	2	1.1
Ghana	10	2.3	10.3		
Guatemala	8	7.5	6.9		
India	13	2.4	5.0	3	-11.4
Iraq	29	10.6	9.0		
Israel	3	4.7	7.5		
Mexico	6	3.6	7.7		
Morocco	-9	3.8	3.2	-9	19.3
Peru	7	9.6	6.6		
Philippines	9	2.4	7.6	1	-16.2
Portugal	6	4.3	6.5	2	3.2
Rhodesia-Nyasaland	9	2.5	8.7	7	6.7
South Africa	4	3.1	5.4	-3	-4.5
Thailand	7	2.6	5.9		
Turkey	16	3.2	8.4	-1	3.4
Venezuela	10	14.4	3.6		

In Table 10.1, the variable $\dot{I}$ is taken as the annual rate of growth of fixed-capital formation during the period 1950 to 1958. The data was taken from the U.N. World Economic Survey, which explains that "the rates of growth of investment and output have been calculated as the constant annual rate of growth given by a logarithmic straight line joining the terminal years. However, in the under-developed countries, as changes in the level of investment and output in a single year are commonly subject to erratic influences, such as an export boom or a crop failure, it has been considered preferable to use the average of a pair of years as the terminal period. In the present chapter, the averages of 1950 and 1951 and 1957 and 1958 are generally used." [12, p.64].

The variable X_1 is taken as "the rate of growth of import capacity (merchandise exports, net services, private and official donation, private capital, and long-term official capital divided by import price index) 1950/1 to 1957/8." This variable is also derived from the U.N. World Economic Survey of 1959 and refers to the annual compound rate of growth between terminal years, in this case only the single terminal years.

The variable X_2 is the W-measure of instability based on deviations from the moving average.

From Table 10.1, we find the correlation coefficient between $\dot{I}$ and X_1 to be 0.37, between $\dot{I}$ and X_2 to be 0.25, and between X_1 and X_2 to be -0.40. From the positive correlation between $\dot{I}$ and X_2, BacBean rejects the argument that export instability affects development adversely and even goes on to speculate on possible reasons why fluctuations in export might actually lead to faster growth of investment. This is a very misleading interpreation of the evidence. The variable only represents the rate of growth of investment

expenditures; as such, it cannot show the adverse consequences on development of export instability. The real damage to development prospects arising from export fluctuations is due to the unintended fluctuations it causes in investment activity, because the same amount of money spent on investment in an unstable fashion over a period of time leads to more waste and is less productive in the long run than when spent at a more steady and planned rate. We have already seen the link between fluctuations in export earnings and investment expenditures operating through fluctuations in imports of capital goods.

The rate of growth of investment expenditures does not depend in any causal fashion on the degree of fluctuations in export receipts. A more complete explanation of the growth of investment can be given in terms of the growth of export earnings and other foreign exchange receipts. MacBean's data itself, shows the positive correlation between growth rates of investment and foreign exchange receipts. The variable X_1 includes foreign exchange receipts from sources other than export earnings, but these other receipts, such as development assistance and private capital flows, are generally more directly linked with investment activity. Data on these other sources of foreign exchange, of the same type as that used by MacBean, is shown in Table 10.1 under the heading Z, being the change in the level of foreign saving, i.e. the difference in foreign saving as a percentage of the gross domestic product, as given in the U.N. World Economic Survey, 1960 [13,p.74]. For the 15 countries of MacBean's sample for which this data is available, we find a correlation coefficient between I and Z of 0.64, and the multiple correlation coefficient of I with X_1 and Z of 0.70. If we include also the variable w, indicating the annual rate of growth of reserves over the period as one of the explanatory variables, the multiple correlation coefficient becomes as high as 0.79.

It is, therefore, clear that the variables X_1, Z and w give as complete an explanation of $\dot{I}$ as can possibly be expected from the nature of the data. It is at the same time interesting to seek an explanation of the positive correlation which MacBean has found between $\dot{I}$ and export instability. However, the nature of the data he has used is particularly unsuitable for such an analysis. The annual rate of growth of import capacity and investment has been measured only from the terminal periods and is, therefore, not truly indicative of the growth trends over the whole period. Also, we have seen that the W measure of instability is not a satisfactory measure of fluctuations. Some other measures of these variables is given in Table 10.2 below, for as many of the countries in MacBean's sample as possible.

Table 10.2 Investment and Export of Less-Developed Countries

Country	Rate of Growth of Investment	Rate of Growth of Exports	s measure of Export Instability
1. Argentina	4.78	- 2.85	16.37
2. Brazil	5.20	0.94	12.49
3. Burma	7.57	0.58	12.39
4. Ceylon	6.35	1.81	8.61
5. Chile	4.01	4.26	13.35
6. Colombia	1.63	4.96	17.03
7. Ecuador	6.99	9.47	10.51
8. Guatemala	7.65	6.13	9.34
9. India	8.38	-0.55	9.90
10. Israel	5.32	17.60	14.40
11. Mexico	7.34	5.25	9.95
12. Morocco	-8.25	6.69	5.90
13. Peru	1.68	1.06	7.25
14. Phillipines	8.41	4.59	8.63
15. Thailand	8.24	2.43	10.84
16. Turkey	7.01	2.21	17.08
17. Venezuela	3.60	8.98	5.69

The rate of growth of investment in Table 10.2 is the rate of growth along a linear trend fitted by least squares to investment data, converted to U.S. dollars, for the period 1951-60, and expressed as a per cent of the average for the period for each country. The rate of growth of export earnings was derived in the same way from the data for the period 1948-58, given in the IMF paper [4] and from which the w measure of instability used by MacBean was calculated. The s measure of export instability given in the table was derived from the same data.

From Table 10.2, we find the correlation coefficient between growth of investment and growth of exports to be -0.15, between growth of exports and export instability to be -0.13, and that between growth of investment and export instability to be 0.25. This data shows the same sort of correlation between growth of investment and export instability as MacBean's data, but now it is easy to see that this is the result of a negative correlation between export growth and export instability combined with the fact that the growth of exports happened to be also negatively correlated with the growth of investment for this group of countries during this period.

The relationship among the three variables in the 17 countries can be seen more clearly in the following Table 10.3.

Table 10.3 Classification of 17 Countries According to Investment Growth, Export Growth, and Export Instability

	Less Than Average Growth of Exports	More Than Average Growth of Exports
Less Than Average Export Instability	A. Less Than Average Investment Growth: 13. Peru B. More Than Average Investment Growth: 4. Ceylon 9. India 15. Thailand	A. Less Than Average Investment Growth 12. Morocco 17. Venezuela B. More Than Average Investment Growth 7. Ecuador 8. Guatemala 11. Mexico 14. Philippines
More Than Average Export Instability	A. Less Than Average Investment Growth 1. Argentina 5. Chile B. More Than Average Investment Growth 2. Brazil 3. Burma 16. Turkey	A. Less Than Average Investment Growth 6. Colombia B. More Than Average Investment Growth 10. Israel

Table 10.4 Classification of 17 Countries According to Investment Growth and Export Instability

	Less Than Average Investment Growth	More Than Average Investment Growth
Less than Average Export Instability	12. Morocco 13. Peru 17. Venezuela Mean I_g = -0.99 Mean s = 6.28	4. Ceylon 7. Ecuador 8. Guatemala 9. India 11. Mexico 14. Philippines 15. Thailand Mean I_g = 7.62 Mean s = 9.68
More than Average Export Instability	1. Argentina 5. Chile 6. Colombia Mean I_g = 3.47 Mean s = 15.58	2. Brazil 3. Burma 10. Israel 16. Turkey Mean I_g = 6.28 Mean s = 14.03

Table 10.3 shows the concentration of countries in the top-right and bottom-left cells, corresponding to the negative correlation between export growth and export instability for this group of countries in this period. If the growth of investment depended mainly on the growth of exports, one would have found most of the countries with slow growth of investment in the left side of the table, corresponding to the less than average growth of exports. But we find in fact that there are many countries with rapid investment growth on the left side and a few countries with slow investment growth on the right side, and we have already seen how a fairly complete explanation of this can be given in terms of the other sources of foreign exchange receipts and use of reserves. As a result of such other factors, entirely unconnected with exports or export instability, we have a classification of countries according to investment growth and export instability as shown in Table 10.4, which happens to yield a positive correlation between export instability and investment growth.

Appendix Table 1.

Growth and Instability of World Exports of Primary Commodities
1950 - 58.

Commodity	Annual Rate of Growth (%)	Measure of Instability s	p
I Minerals, etc.			
1. Petroleum	6.17	8.57	13.28
2. Copper	8.07	17.31	12.65
3. Coal	2.93	6.77	5.09
4. Iron Ore	17.32	11.75	8.61
5. Tin	- 3.70	12.10	7.87
6. Lead	1.13	10.18	4.04
7. Zinc	- 1.77	23.47	16.06
Average I	4.31	12.88	9.66
II Agricultural Raw Materials			
8. Pulp and Paper	1.19	21.67	10.20
9. Cotton	- 2.27	12.33	7.65
10. Wool	- 1.46	13.13	7.55
11. Timber	11.35	10.10	11.56
12. Rubber	- 4.11	25.79	14.45
13. Jute	- 6.98	23.83	12.22
14. Hides and Skins	0.89	5.87	12.52
Average II	- 0.20	16.10	10.88
III Foodstuffs			
15. Coffee	3.11	12.95	6.90
16. Wheat	- 0.51	15.58	12.59
17. Sugar	3.84	9.27	8.76
18. Tobacco	2.17	7.09	6.75
19. Rice	- 0.06	13.25	9.88
20. Tea	4.43	11.81	10.36
21. Cocoa	- 0.20	20.04	17.92
22. Fish	5.99	5.05	8.01
23. Butter	- 2.63	7.85	7.57
24. Bananas	0.30	10.45	6.68
25. Coconuts	- 4.36	14.25	14.13
26. Wine	4.76	8.82	13.98
27. Corn	2.04	13.26	11.62
28. Citrus fruits	4.73	8.31	7.92
29. Barley	- 3.00	27.31	21.76
Average III	1.37	12.35	10.99

Appendix Table 2.

Growth and Instability of Exports of Individual Countries - 1946-58.

Country	Annual Rate of Growth (%)	Measure of Instability s	p
(A) 31 Developed Countries			
1. Australia	7.86	18.03	14.21
2. Austria	15.87	8.22	6.32
3. Belgium-Luxemburg	9.43	9.90	5.20
4. Bulgaria	18.50	18.00	16.52
5. Canada	5.33	5.34	3.81
6. Czechoslovakia	8.98	8.90	9.24
7. Denmark	10.94	5.82	4.63
8. Finland	11.71	18.86	15.54
9. France	10.88	9.98	9.64
10. Germany, East	8.34	17.70	15.90
11. Germany, West	19.21	7.00	4.71
12. Greece	13.07	14.16	14.93
13. Hungary	8.97	13.66	16.38
14. Iceland	5.37	15.91	17.27
15. Ireland	6.92	6.27	8.09
16. Iraly	12.74	9.11	7.74
17. Japan	17.51	13.23	10.51
18. Netherlands	12.95	7.19	8.06
19. New Zealand	6.18	11.04	9.30
20. Norway	10.87	10.59	6.24
21. Poland	9.53	12.29	11.28
22. Portugal	8.96	8.41	8.20
23. Rumania	7.49	5.70	8.50
24. Spain	3.90	10.37	8.98
25. Sweden	10.06	10.27	6.43
26. Switzerland	7.12	3.63	3.58
27. S. Africa	9.53	7.21	6.08
28. United Kingdom	4.48	13.11	10.94
29. United States	3.76	11.98	10.53
30. U.S.S.R.	12.26	24.41	22.12
31. Yugoslavia	9.86	22.88	21.75
Average A.	9.95	11.59	10.44

Appendix Table 2.- Cont.

Country	Annual Rate of Growth (%)	Measure of Instability s	p
(B)21 Latin American Countries			
32. Argentina	- 2.23	20.00	18.25
33. Bolivia	- 1.79	18.50	15.41
34. Brazil	2.05	11.00	7.38
35. Chile	3.99	14.40	11.41
36. Col mbia	8.01	13.20	11.15
37. Costa Rica	8.57	11.40	11.29
38. Cuba	2.29	15.43	14.07
39. Dominican Republic	6.57	10.63	8.70
40. Ecuador	10.19	11.18	11.23
41. El Salvador	10.12	7.15	4.69
42. Guatemala	6.65	6.07	4.97
43. Haiti	4.56	17.10	14.36
44. Honduras	3.76	12.04	11.38
45. Mexico	7.74	7.36	6.46
46. Nicaragua	11.57	9.11	8.62
47. Panama	7.15	7.88	11.37
48. Paraguay	3.66	9.88	8.78
49. Peru	6.90	7.39	4.92
50. Puerto Rico	6.64	9.21	12.18
51. Uruguay	- 1.09	18.35	15.79
52. Venezuela	11.18	10.06	10.70
Average B.	5.55	11.78	10.67

Appendix Table 2. - Cont.

Country	Annual Rate of Growth (%)	Measure of Instability s	p
(C) 18 Countries in Africa and Middle East (including Turkey)			
53. Belgian Congo	7.44	9.57	9.99
54. U.A.R.	4.21	20.31	10.95
55. Ethiopia	9.05	14.80	21.21
56. Ghana	8.98	19.67	14.17
57. Iran	- 0.73	51.61	46.76
58. Iraq	14.93	21.56	27.41
59. Israel	18.60	9.67	13.72
60. Jordan	15.20	9.49	10.43
61. Lebanon	7.76	14.20	12.08
62. Liberia	9.91	26.01	18.06
63. Libya	6.53	14.08	9.14
64. Morocco	12.79	10.92	6.30
65. Nigeria	8.71	16.95	13.11
66. Rhodesia-Nyasaland	9.57	13.88	15.12
67. Sudan	8.34	29.82	21.05
68. Syria	8.77	15.50	15.97
69. Tunisia	11.95	21.07	16.21
70. Turkey	6.23	14.32	16.02
Average C.	9.35	18.52	16.54
(D) 13 Asian Countries			
71. Burma	2.25	12.40	13.48
72. Cambodia	3.36	19.40	22.21
73. Ceylon	5.85	10.94	11.50
74. China (Mainland)	4.15	17.22	21.27
75. China (Taiwan)	7.41	9.81	11.43
76. India	3.69	13.50	8.61
77. Indonesia	8.63	38.91	20.68
78. Korea	0.26	26.70	23.21
79. Malaya	7.56	34.08	16.45
80. Pakistan	4.44	28.69	15.01
81. Philippines	2.14	10.26	18.93
82. Thailand	8.26	21.29	11.92
83. Vietman	5.07	21.75	13.47
Average D	4.85	20.38	16.09

Appendix Table 3.

g-factors for Exports of Groups of Countries

	(A) Developed Countries 1947-58	1948-58	1950-58	(B) Latin American Countries 1947-58
1947	- 0.80			- 1.28
1948	4.32	3.04		1.75
1949	- 3.04	- 3.24		- 9.66
1950	- 6.20	- 5.63	- 4.85	- 1.97
1951	10.39	9.84	8.70	9.23
1952	2.09	1.98	2.03	3.14
1953	- 4.57	- 3.86	- 2.21	- 0.40
1954	- 5.97	- 5.19	- 5.13	2.84
1955	- 2.89	- 2.34	- 3.54	- 0.62
1956	2.62	2.03	0.60	3.54
1957	7.42	6.08	6.08	1.26
1958	- 3.37	- 2.71	- 1.68	- 7.83

	(C) Africa & Middle East Countries 1947-58	1948-58	1949-58	1950-58	(D) Asian Countries 1947-58	1948-58	1949-58	1950-58
1947	-14.96				-17.53			
1948	- 5.07	- 9.56			- 4.80	-13.43		
1949	- 5.61	- 9.79	-10.98		-13.55	-18.97	-23.70	
1950	8.26	3.49	0.40	- 4.25	12.71	5.31	0.06	-11.99
1951	27.93	22.57	17.30	10.94	39.35	40.35	32.82	18.05
1952	6.53	4.59	2.17	- 1.82	6.26	6.21	4.60	5.42
1953	- 1.95	- 2.80	- 4.26	- 5.89	- 5.07	- 5.91	- 4.54	- 5.37
1954	- 2.44	- 2.45	- 2.95	- 2.48	- 9.67	-10.47	- 6.52	- 9.07
1955	- 0.32	0.52	- 0.37	1.09	2.10	3.05	0.84	- 0.53
1956	- 3.88	- 1.45	- 0.99	1.52	2.54	- 0.29	- 2.36	- 3.17
1957	- 6.75	- 4.58	- 2.06	1.38	0.70	5.70	6.57	8.15
1958	- 1.74	- 0.54	1.74	- 0.49	-13.04	-11.55	- 7.77	- 1.49

Appendix Table 4.

Instability of Export Proceeds, Unit Values and Volume

Country	s-measures of Instability in: Export Proceeds	Unit Value	Export Volume
I. 22 Developed Countries			
1. Australia	12.88	10.97	5.47
2. Austria	4.53	7.98	4.38
3. Belgium	10.62	7.56	8.82
4. Canada	7.01	4.83	6.96
5. Denmark	6.81	3.53	5.92
6. Finland	12.32	15.24	6.44
7. France	8.50	5.30	9.25
8. Germany	5.30	4.66	3.89
9. Greece	8.95	6.64	5.43
10. Ireland	9.15	3.38	7.85
11. Italy	15.40	5.13	15.65
12. Japan	14.51	8.36	13.63
13. Netherlands	6.83	4.25	4.89
14. Norway	8.59	6.64	8.48
15. New Zealand	7.89	7.01	4.65
16. Portugal	8.06	5.80	6.62
17. S. Africa	6.01	5.25	5.27
18. Spain	14.36	4.47	15.44
19. Sweden	9.81	9.81	8.04
20. Switzerland	7.01	3.53	3.75
21. United Kingdom	3.38	3.41	3.03
22. United States	8.26	2.53	7.45
Average I.	8.96	6.20	7.38

Appendix Table 4. Cont.

Country	s-measures of Instability in: Export Proceeds	Unit Value	Export Volume
II. 32 Less-Developed Countries			
23. Argentina	13.61	10.80	10.02
24. Bolivia	22.03	13.40	9.70
25. Brazil	8.23	10.54	8.10
26. Ceylon	6.53	6.55	2.93
27. Chile	10.19	11.27	4.73
28. China (Taiwan)	29.07	9.32	21.40
29. Colombia	14.05	14.52	7.17
30. Costa Rica	9.28	12.56	11.75
31. Cyprus	10.39	10.15	4.43
32. Cominican Republic	8.94	11.96	12.02
33. Ecuador	8.54	6.90	5.20
34. El Salvador	10.28	12.06	9.16
35. Ethiopia	12.20	10.41	11.26
36. Ghana	8.22	17.56	14.07
37. Guatemala	9.37	14.92	13.60
38. Haiti	16.45	12.10	14.44
39. Honduras	10.53	9.27	11.18
40. India	10.75	9.99	7.02
41. Iraq	14.41	7.39	15.53
42. Israel	17.63	5.92	19.45
43. Malaya	10.80	11.24	6.26
44. Morocco	6.85	7.42	4.80
45. Nicaragua	17.94	13.34	15.71
46. Nigeria	8.69	8.12	5.44
47. Pakistan	23.62	18.63	10.60
48. Panama	23.36	7.93	20.67
49. Peru	15.39	9.97	12.65
50. Philippines	10.49	6.99	7.88
51. Sudan	20.69	12.61	17.34
52. Thailand	12.30	3.92	11.84
53. Uruguay	19.76	17.32	18.56
54. Venezuela	5.99	3.98	3.99
Average II	13.33	10.60	10.90
Average I & II	11.55	8.80	9.47

References

1. Coppock, Joseph D., "International Economic Instability", (New York, McGraw-Hill, 1962).

2. GATT (United Nations General Agreement on Tariffs and Trade), "International Trade", annual reports 1959 to 1965.

3. International Bank for Reconstruction and Development, "Supplementary Financial Measures" (Washington D.C.; I.B.R.D., 1965).

4. International Monetary Fund, article on "Fund Policies and Procedures in Relation to the Compensatory Financing of Commodity Fluctuations", I.M.F. Staff Papers Vol.VIII, No.1, p.1 (November 1960).

5. Keynes, J.M., "The General Theory of Employment, Interest and Money", (London:Macmillan, 1936).

6. MacBean, A.I. "Export Instability and Economic Development", (Cambridge: Harvard University Press, 1966).

7. Massell, B.F. "Export Concentration and Fluctuations in Export Earnings: A Cross-section Analysis", (The Rand Corporation,1963)

8. Michaely, M., "Concentration and International Trade", (Amsterdam: North-Holland, 1962).

9. United Nations, "Instability in Export Markets of Under-Developed Countries", (United Nations, 1952).

10. United Nations, "International Compensation for Fluctuations in Commodity Trade" (United Nations, 1961) (The Crawford Report).

11. United Nations, "World Economic Survey, 1958" (United Nations,1959).

12. United Nations, "World Economic Survey, 1959" (United Nations,1960).

13. United Nations, "World Economic Survey, 1960" (United Nations,1961).

14. Zimmerman, L. J., "Poor Lands, Rich Lands", (New York, Random House,1965).

Shortfalls in the I.M.F. Compensatory Financing Facility

The I.M.F. Compensatory Financing Facility, established in 1963, was "designed to compensate for temporary shortfalls in export receipts." [1, p.1] The idea of 'temporary shortfalls' was interpreted as "deviations of actual exports from some normal level." [2, p.1] The present note examines some problems raised by this concept of shortfalls and the statistical and other methods used to estimate the normal level of exports.

1. What is the Norm from which Shortfalls Should be Measured?

In the Fund approach, "the norm itself from which the deviations are measured must move with, though more gradually than, the movement in actual exports, and the shorter the period within which an approximate balance between positive and negative deviations is to be attained, the more responsive the norm must be to the movement in actual exports," [2, p.1] and "a five-year moving average of exports centered on the middle year is taken as the statistical definition of normal exports." [2, p.2] This average is called the "ideal norm."

If this normal level can be accurately predicted and if countries are compensated when actual exports fall below this level, and use export earnings in excess of this normal level to repay such compensatory financing or to meet future shortfalls, then the time-series of export availabilities (i.e. actual exports plus compensatory financing in shortfall years or minus excess of exports above the normal level in other years) will be smoother than the time-series of actual exports, and to that extent, compensatory financing will overcome the problems of export fluctuations. A compensatory

financing scheme based on these assumptions will therefore perform a 'smoothing' function. However, these assumptions are totally unrealistic; in particular, it assumes that a shortfall occurring in any year should have been foreseen two years ahead, at which time, in fact, there must be a forecast for five years ahead, so that countries can adjust their plans for foreign exchange expenditures to a 'smoother' time series of export availabilities. The problem for compensatory financing arises precisely because shortfalls cannot be foreseen so far ahead so that countries find themselves in balance of payments problems, because of their difficulty in adjusting planned foreign exchange expenditures to unexpected shortfalls of export earnings.

It appears that an important consideration for measuring shortfalls from such a norm is to ensure that shortfalls so defined should be temporary. Presumably the argument is that only temporary shortfalls will be compensated by the Fund, because the Fund can only provide short-term assistance, in order to maintain the revolving character of its resources. However, it does not follow that the use of short-term assistance requires temporariness of compensable shortfalls, for member countries may make other adjustments, such as curtailment of imports, longer-term borrowing from other sources, etc., to repay the Fund's compensatory assistance. Therefore, this interpretation implies that shortfalls have to be defined in such a way that assistance to meet these shortfalls have to be repaid only out of exports in excess of such a norm, and from no other adjustment. There does not seem to be any justification for this assumption.

The I.M.F. staff discussion of this subject distinguishes between different concepts of trend, to be used to define the normal level of exports.

One document says "the Fund's compensatory financing facility is designed to compensate for shortfalls from the presumed current trend level of exports rather than from a previous trend level." [1,p.8] The distinction is not clear. Presumably, the distinction is that 'a previous trend level' refers to an estimate for the current year based only on past data, while the 'presumed current trend level' refers to an estimate based on past data and some assumptions about the future as well. In practice, countries have to plan their foreign exchange expenditures on the basis of their 'previous trend levels' and therefore the Fund approach does not help countries to meet shortfalls from expectations but on the other hand, requires countries to adjust their planned foreign exchange expenditures, not only to the shortfall which has actually occurred but also to shortfalls which might occur in the next two years. Further, the Fund approach requires countries to make a part of this adjustment in the very year in which the shortfall occurs.

As the whole object, not only of the Fund's compensatory facility, but also of all other activities of the Fund, is to help countries which have difficulty in making immediate adjustments to changing circumstances, this approach to compensatory financing is contrary to that object.

2. How to Estimate the Ideal Norm?

The Fund uses an average of the exports of the current year and of the previous two years to estimate the 'ideal norm', defined as the moving average of exports over a five-year period, centered in the current year. If we represent the exports in year t as x_t, and the five-year moving average of exports as m_t, then

$$m_t = \frac{(x_{t-2} + x_{t-1} + x_t + x_{t+1} + x_{t+2})}{5} \quad .. \quad .. \quad ..(1)$$

The Fund staff have determined that, on the basis of past experience and using the usual regression analysis, the 'best' formula for estimating m_t (after rounding off the coefficients) is given by

$$\bar{m}_t = \tfrac{1}{4}x_{t-2} + \tfrac{1}{4}x_{t-1} + \tfrac{1}{2}x_t \quad .. \quad .. \quad .. \quad .. \quad (2)$$

It has been argued in the Fund papers that this estimating formula is particularly appropriate because the percentage standard deviation of such a 'practical' norm from the 'ideal' norm is very low. The low value of such a deviation is not surprising, for an estimate of the average of any five variables based on the actual values of three of them is naturally better than other estimates. In fact, this approach should be judged on what it implies about future exports and the extent to which shortfall compensation by this method meets the actual problems raised by export fluctuations.

3. When is there a Shortfall?

According to the Fund concept of normal exports and the Fund formula for estimating the normal exports, a country experiences a shortfall when

$$x_t < \bar{m}_t$$

i.e. when $x_t < \tfrac{1}{4}x_{t-2} + \tfrac{1}{4}x_{t-1} + \tfrac{1}{2}x_t$

i.e. when $x_t < \tfrac{1}{2}(x_{t-2} + x_{t-1})$ .. .. .. (3)

i.e. when exports in any year are less than the average of the past two years.

4. How much is the Shortfall?

The amount of the shortfall, according to the Fund formula, is

$$\bar{m}_t - x_t$$

$$= (\tfrac{1}{4} x_{t-2} + \tfrac{1}{4} x_{t-1} + \tfrac{1}{2} x_t) - x_t$$

$$= \tfrac{1}{2} \left(\frac{x_{t-2} + x_{t-1}}{2} - x_t \right) \quad .. \quad .. \quad .. \quad (4)$$

If we assume that the expected exports in any year is the average of the past two years, this result shows that the shortfall from the Fund's practical norm is only half the shortfall from the expectation.

5. What is Implied for Next Two Years?

If the 'practical' norm used by the Fund to estimate the 'ideal' norm is, in fact, equal to the 'ideal' norm, then

$$\frac{x_{t-2} + x_{t-1} + 2 x_t}{4} = \frac{x_{t-2} + x_{t-1} + x_t + x_{t+1} + x_{t+2}}{5}$$

$$\text{i.e. } x_{t+1} + x_{t+2} = 1.50 x_t + 0.25 x_{t-1} + 0.25 x_{t-2} \quad .. \quad .. \quad (5)$$

If we write s_t for the shortfall in any year, in which a shortfall occurs, then

$$s_t = \bar{m}_t - x_t = \tfrac{1}{4} x_{t-2} + \tfrac{1}{4} x_{t-1} - \tfrac{1}{2} x_t \quad .. \quad .. \quad .. \quad .. \quad (6)$$

and

$$(x_{t+1} + x_{t+2}) = (x_{t-2} + x_{t-1}) - 3 s_t \quad .. \quad .. \quad .. \quad (7)$$

This result shows the extent to which the implied forecast for the two years following a shortfall year is pessimistic. A country experiencing an export shortfall in any year would, therefore, have greater difficulties in recouping its losses from future earnings, and if the object of the scheme is to make export availabilities 'smoother' than actual exports, then the shortfalls should have been foreseen two years ahead and part of the export earnings of the previous two years used to meet the shortfall, as stated in section (1) above.

6. What is Implied for Future Years?

If the 'practical' norm defined by the Fund continues to equal the 'ideal' norm which it purports to estimate, over a period of years in the future, then equation (5) should hold for that period. This equation can be re-written as follows:

$$4 x_{t+2} + 4 x_{t+1} - 6 x_t - x_{t-1} - x_{t-2} = 0 \quad .. \quad .. \quad .. \quad (8)$$

This is a fourth-order homogeneous linear difference equation, from which the future course of exports may be derived, given four initial conditions, e.g. the exports of the first four years. An illustration is given in Table 1 below, assuming exports in the first four years equal to 200, 204, 195 and 201, respectively.

Table 1. Implied Forecast of Future Exports

Year	Exports	Norm	Difference	Cumulative
1	200.00			
2	204.00			
3	195.00	198.50	- 3.50	- 3.50
4	201.00	200.25	+ 0.75	- 2.75
5	192.50	195.25	- 2.75	- 5.50
6	208.75	202.75	+ 6.00	+ 0.50
7	179.00	189.81	-10.81	-10.31
8	232.50	213.19	+19.31	+ 9.00
9	136.31	171.03	-34.72	-25.72
10	309.38	246.89	+62.49	+36.77

The above table shows that the use of the practical norm to estimate the ideal norm implies fluctuations in future exports of increasing amplitude. This is not just a consequence of the particular figures chosen for the initial years, but a feature of the formula used. This can be seen straightaway by the fact that the largest root of the difference equation (8) is negative and greater than one, being in fact equal to - 1.8 approximately.

7. Why not Drop the Current Year?

A resolution of UNCTAD in 1964 (A.IV. 17) requested the I.M.F. to drop or reduce the weight given to the current year in estimating the norm from which shortfalls are measured. This has been rejected in a recent Fund paper, reviewing the Compensatory Financing Facility, in which it is argued that "if the trend values are determined solely as an average of past years - the trend line might lie persistently above, or below, the actual series to a substantial extent, which would be contrary to the normal meanings of the term 'trend'." [1,p.5]

This argument is incorrect. Among the various formulae considered by the Fund staff for estimating the ideal norm is one, described as B-1, [2,p.6] in which only the exports of the previous two years are used, and the weights for the two years obtained by the same regression analysis as that used to derive the practical norm. If we round off these coefficients we get a weight of two-thirds for the exports of the previous year and one-third for the exports of the second year before the shortfall. If this formula is used to estimate the ideal norm, and is, in fact, equal to the ideal norm over a period of years, then the implied forecast of future exports is as shown in Table 2, for the same initial conditions as in Table 1.

Table 2. Forecast of Future Exports Implied by Norm B-1

Year	Exports	Norm B-1	Difference	Cumulative
1	200.00			
2	204.00			
3	195.00	202.67	- 7.67	- 7.67
4	201.00	198.00	+ 3.00	- 4.67
5	213.33	199.00	+14.33	+ 9.66
6	176.67	209.22	-32.55	-22.89
7	209.00	188.89	+20.11	- 2.78
8	246.10	198.22	+47.88	+45.10
9	99.37	233.73	-134.36	-89.26
10	259.97	148.29	+111.68	+22.42

Table 2 shows that even with a formula, such as B-1 based only on exports of previous years, the implied forecast of future exports is such that both positive and negative deviations occur just as frequently as in the case of the 'practical' norm adopted by the Fund.

In another paper, it is argued that "the norm should ideally reflect not only the actual exports of the more or less recent past but also those of the more or less imminent future. Otherwise, if the movement in actual exports has a persistent tendency in one direction, the movement in the norm will lag continuously behind that in actual exports so that, if the persistent trend is upwards, positive deviations of actual exports from the norm will predominate, while if the trend is downwards, negative deviations will be the rule." [2,p.1] This argument is also not always valid, and depends on the way in which past exports are reflected in the norm. For instance, if exports follow a linear trend, upward or downward, at any rate whatsoever, the formula $(2\, x_{t-1} - x_{t-2})$ will predict the current year exports exactly. Similarly, if exports follow a parabolic trend of any form whatsoever, the formula $(x_{t-3} - 3\, x_{t-2} + 3\, x_{t-1})$ will predict the current year exports exactly. Such estimating formula can be derived for any trend of a polynomial character, or one that can be reduced to a polynomial type. It will be noticed that the sum of the weights in the estimating formula is one. Such estimating formula necessarily involve negative weights, for if the weights are positive, the estimate must always lie within the values observed in the past, and cannot therefore predict upward or downward trends. In order to apply such estimating formulae, some judgment must be made about the nature of the underlying trend.

8. How to Use Qualitative Information

The 1963 Decision of the Fund laid down that "Fund will seek to establish reasonable estimates regarding the medium-term trend of the member's exports on the basis of appropriate statistical data in conjunction with qualitative information about its export prospects." [3, p.25] A later Fund paper reports that "the qualitative estimates, involving a direct forecast of exports two years ahead, have been found in practice to yield better results than the formula."

The way in which the Fund has used qualitative information is explained as follows: "In the three cases in which the Decision has been applied thus far, the estimation of normal exports has represented a compromise between (a) a figure or figures arrived at through the application of automatic formulae to past statistical data, and (b) an estimate based on a combination of these data with a forecast for actual exports two years ahead, these forecasts in turn being arrived at by a process of market appraisal using all available information." [1, p.6] This is, indeed, a strange procedure. If ' a process of market appreisal using all available information' is permissible, one would have thought it could have been used to estimate the prospects for the current year, by itself or in combination with trends derived from past statistical data. Instead, the Fund applies this process to two future years in order to derive the norm for the current year.

9. Conclusion

(1) The 'ideal norm' defined by the Fund and the 'practical norm' used to estimate it are unrealistic as they imply an excessively pessimistic forecast for the two years following a shortfall and a forecast of increasingly violent fluctuations in exports of later years.

(2) The Compensatory Financing Facility, based on the Fund concept of the 'norm', is unhelpful to the developing countries because it throws a heavy burden of adjustment of planned expenditures on the countries themselves, inthe very year in which a shortfall occurs.

(3) The concept of temporary shortfalls is unnecessary to protect the revolving character of the Fund's resources, if it is assumed that Fund assistance to meet such shortfalls can be repaid from other adjustments, than of exports only.

(4) In order to help developing countries to meet the problem of export fluctuations in a realistic manner, while protecting the revolving character of the Fund's resources (i) the concept of the 'norm' should be related more closely to reasonable expectations, based on prior information (ii) the amount of assistance provided should be a substantial part of the shortfall from such expectations, and (iii) the country should be encouraged to repay the short-term assistance from the Fund by all available methods of adjustment and other sources of finance.

References

(1) I.M.F. "Compensatory Financing of Export Fluctuations: Developments in the Fund's Facility".

(2) I.M.F. "A Comparison of Formulae for Determining Export Norm". (DM/62/20)

(3) I.M.F. "Compensatory Financing of Export Fluctuations", 1963.