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Export Instability and Policy Implications for  
Developing Countries as Residual Suppliers

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Abstract

A study by the author published in 1988 proposed the hypothesis that export instability depends upon the level of industrialization of the exporting country and the position of exports in the product cycle (growth or mature products). This paper provides further empirical evidence in support of the hypothesis. The paper discusses the significance of the empirical findings, explains why diversification has increased export instability in many developing countries, and discusses the policy implications of the findings. The paper also analyzes the effects of data aggregation on empirical results and suggests topics for future research.

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### Summary

The hypothesis that export instability is related to the degree of industrial development of the exporting country and to the position that individual exports occupy in the product cycle (growth or mature products) was addressed in an earlier study by the author of this paper and has found empirical support. This paper extends the empirical work in the earlier study to a different group of products and finds further support for the hypothesis. It also discusses the significance of the empirical findings, their relevance in explaining why diversification policies have increased export instability in many developing countries, and their policy implications. Finally, the paper analyzes the effects of data aggregation on the empirical results of studies of export instability and suggests topics for future research.

There appears to be an inverse relationship between export instability and the level of industrialization for growth products. The instability of growth products is much higher for the developing than for the industrial countries. Developing countries are likely to be residual suppliers of growth products, and therefore to absorb a large share of demand fluctuations during the business cycle. As a result, if developing countries diversify by exporting more growth products, they are likely to add to their export baskets products for which instability is high and related to the business cycle. Total export instability may increase as a result of this diversification because the fluctuations of the additional exports would be high and would not tend to cancel each other out. In contrast, the instability of exports of mature products is not similarly related to economic development, and exports of mature products are less subject to cyclical fluctuations than exports of growth products in developing countries. Consequently, diversification into mature products is more likely to reduce total export instability for developing countries. Diversification in industrial countries, however, is likely to reduce export instability regardless of whether the additional exports are growth or mature products.



## I. Introduction

A recently published study (Mullor-Sebastian 1988) proposed the hypothesis that export instability is related to the degree of industrial development of the exporting country in a manner consistent with the product cycle theory of comparative advantage, and found empirical support for this hypothesis. The study focused mainly on theoretical aspects of export instability and on related econometric work, and gave little attention, due to space limitations, to several significant empirical findings, to the relevance of the empirical findings in explaining why diversification policies increased export instability in many developing countries, and to the policy implications of the findings. The aim of this paper is to analyze the implications of the empirical findings of the 1988 study, to present the results of further work undertaken more recently, and to discuss their policy implications.

Two remarks should help focus the discussion contained in this paper. First, the theory proposed attempts to explain the instability of exports from developing countries in terms of the role of residual suppliers played by developing countries. Therefore, the theory can explain *fluctuations in the exports of products supplied by both* developing and industrialized countries but cannot explain the fluctuations in the exports of products supplied only by developing countries, such as coffee and cocoa. These products are for the most part agricultural products, and their exports are more likely to be affected by supply factors, such as the weather or agricultural producers' reactions to price changes (Massell 1970). Accordingly, the data used for the study were predominantly data on manufacturing.

Second, diversification of exports can be understood in two ways. One refers to the addition of new categories of products to a country's basket of exports. The other refers to changes in the proportions that individual exports represent with respect to total exports in each country. 1/ For the purposes of this paper, the first meaning is used because it is the most prevalent in the literature, although the policy implications would be similar if the second meaning were chosen.

Section II summarizes the theoretical aspects and the empirical findings of the 1988 study; Section III discusses the short-run implications of the empirical findings of the 1988 study on the

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1/ Thus, if in period I a country exports two products, A and B, with A representing 80% of total exports and B 20%, and in period II the proportions change to 70% for product A and 30% for product B, the country's exports are said to be more diversified in period II, even though the number of products exported is the same in both periods.

instability of growth and mature products exported by developing and industrialized countries and presents the results of more recent work; Section VI extends the discussion of the empirical findings to the behavior of export instability over time and also presents results of more recent work; Section V examines the methodological issue of the effects of data aggregation on the results of studies of export instability; and Section VI presents guidelines for successful export diversification policies.

## II. Developing Countries as Residual Suppliers of Growth Products

The 1988 study proposed the hypothesis that the export instability of growth products is inversely related to the level of industrialization of the exporting country, but that no such relationship exists for mature products. Growth products are in the early stages of their life cycles, and their characteristics include the following: the technology used in their manufacture is relatively complex and changes frequently, product differentiation is high and protected by patents, and their markets are oligopolistic. Opposite features characterize mature products.

The explanation suggested for the relationship between export instability and industrialization was that developing countries may be expected to play a role of residual suppliers of growth products on world markets due to their late entry into the world markets for growth products; their distance from consumers, which makes it difficult for them to follow the evolution of the tastes and needs of consumers; their limited spending on research and on product development; the differentiation inherent in growth products that makes the loyalty of consumers to products manufactured by early entrants into the markets a major obstacle for the new entrants; the difficulties that developing countries have in maintaining a production flow of even quantity and quality because of foreign exchange shortages to pay for imported inputs; the lack of standardization and the sophistication of the technology used in the manufacture of growth products; and the oligopolistic nature of the markets for growth products, among other factors. This takes into account both demand factors, such as consumers preferences and the business cycle, and supply factors, such as the scarcity of human skills in developing countries.

Because developing countries are likely to be residual suppliers of growth products, they probably absorb a relatively large share of demand fluctuations during the business cycle, being able to expand their exports of these products during the upswing phase of the business cycle, when industries are working close to capacity in industrialized countries, but experiencing a decline in sales (or in the growth rate of sales) during the downturn phase, when the established suppliers from

industrialized countries can satisfy a larger proportion of world demand themselves. <sup>1/</sup> Therefore, the export instability of growth products can be expected to be higher for developing than for industrialized countries. On the contrary, the export instability of mature products can be expected to be of a similar order of magnitude for all countries, again due to the characteristics of mature products and of their markets.

Therefore, if developing countries diversify by exporting more growth products, they are likely to add to their export basket products whose instability is high and strongly related to the business cycle; thus, total export instability may increase because the fluctuations of the additional exports would be high and would not tend to cancel each other out. These may be the reasons why diversification policies have often resulted in higher export instability in developing countries.

In contrast, the instability of mature products is not similarly related to economic development because developing countries compete with industrialized countries on more equal terms in the markets for these products. Because mature exports are less subject to cyclical factors than growth exports in developing countries, they are more stable than growth exports. Consequently, the likelihood that total export instability would diminish would be greater if developing countries diversified into mature products due to their lower instability and lesser importance of the cyclical component in the fluctuations of their exports.

Over time, the instability of growth products exported by developing countries can be expected to decline because the products mature and because the countries learn to produce and market the goods. Thus, if diversification into growth products has the advantage of introducing new technology and of broadening the industrial base of developing countries, the fact that export instability increases after diversification should not be a deterrent to exporting additional growth products.

There are two methods to test the proposed hypothesis. One is to test it directly by observing how growth and mature exports from developing and from industrialized countries fluctuate in relation to the business cycle. A major difficulty associated with this method would be to identify the relevant markets for each exporting country and the appropriate cyclical variable. The second method is to test the hypothesis indirectly. In this case, there would be support for the

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<sup>1/</sup> To a limited extent, industrialized countries could also have some difficulty breaking into the oligopolistic markets for growth products, and their new exports of these products may have somewhat higher instability.

hypothesis if (1) the instability of growth products were higher for developing than for industrialized countries, (2) the instability of mature products were not substantially different for developing and for industrialized countries, (3) the instability of growth products were higher than that of mature products for developing countries, (4) there existed an inverse relationship between instability and the level of industrialization for exports of growth products, but not for exports of mature products, (5) the instability of growth exports from developing countries had a strong cyclical component, and (6) the instability of exports of growth products from developing countries declined over time as products matured. This would indicate that growth exports from developing countries, but not from industrialized countries, have a strong cyclical component, and that mature exports from both developing and industrialized countries have either a weak or no cyclical component. This second method was chosen to conduct the empirical tests.

The hypothesis proposed in the 1988 study was tested using trade data for two groups of products exported by 11 developing and 7 industrialized countries during the 1965-1980 period. 1/ Mature products comprised raw cotton, wool and silk, and their manufactures (yarn and fabric); growth products comprised synthetic fibers and their manufactures. The empirical results provided strong support for the hypothesis; this support is reinforced by results presented here for various types of machinery exports from developing and industrialized countries.

The use of data with a low level of aggregation in the 1988 study made it possible to identify the existence of a highly significant relationship between export instability and economic development for growth products. Studies of export instability have often been based on highly aggregated data that blur instability patterns and trends. This

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1/ Several equations were run relating indices of export instability of growth products to proxies for economic development and gave good fits. One of them was:

$$I_s = 0.109 - 0.115 \cdot 01 \text{ MNF} \quad R^2 = 0.827 \\ (9.80) \quad (-6.91)$$

where  $I_s$  is the instability index, GDP is gross national product, and MNF is the percentage of manufactures in total exports. The corresponding equation for mature products was:

$$I_s = 0.285 - 0.108 \cdot 02 \text{ MNF} \quad R^2 = 0.063 \\ (6.10) \quad (-0.86)$$

The empirical research was done using two instability indices for two time periods: 1965-80, and 1970-80. All references here are to the 1965-80 period. The two indices gave very similar results.

may help explain why past studies have not made much progress in explaining export instability.

III. Short-run Implications of the Relationship Between Export Instability and the Level of Development of Exporting Countries

An empirical finding of the 1988 study was that the export instability of a particular product is not necessarily the same for every exporting country. 1/ Thus, for the period 1965-1980, the instability index of synthetic fiber exports was 1.14 for Argentina and 1.04 for Thailand, but only 0.10 for Italy and Japan. 2/ These results are at variance with the commonly held belief that exports of particular products are inherently stable or unstable, a belief that underlay empirical studies designed to ascertain whether exports of manufactures or of primary products are more stable. Thus, factors such as competition from other suppliers, the development of synthetics to replace raw materials, changes in tastes, and cyclical changes in industrialized countries' income have been held responsible for export fluctuations, and "...It has been argued that these factors are more severe for raw materials than for food products and least severe for manufactured products." 3/ Instead, it is argued here that the exports of certain manufactures can be expected to have high instability for developing countries but not for industrialized countries. 4/

The differences in the degree of export instability of products followed a clear and consistent pattern: the instability of growth products was much higher for the developing than for the industrialized

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1/ Although throughout the paper references to a "product" are made for brevity, it is to be understood that statements actually refer to "groups of products." Thus, synthetic fibers are treated as one product but comprise 11 Standard International Trade Classification (SITC) items disaggregated to the four-digit level; similarly, natural fibers comprise 21 SITC items.

2/ Two instability indices were computed. The two gave remarkably similar results.

3/ Love 1985, pp. 245-246.

4/ The degree of homogeneity of products in available trade data was a problem in testing the hypothesis. The data used had the lowest level of aggregation (either 4 or 5 digit in the SITC) available in internationally comparable trade data, but the products still were not totally homogeneous in each category. However, care was taken to select product categories that appeared to contain either a totality or a clear majority of growth or mature products.

countries. When exports of groups of countries were considered, the export instability of growth products was almost six times as high (0.59) for the developing as for the industrialized (0.10) countries. Moreover, data for individual countries showed that the export instability of growth products was higher for any developing country than for any industrialized country. In contrast, the instability of mature products was very similar for both categories of countries: 0.11 for developing and 0.16 for industrialized countries. Regressions using instability as the dependent variable and the percentage of manufactures in total exports, a proxy for industrial development, as an explanatory variable gave a very good fit for growth products but a very poor one for mature products.

The results of more recent work (Table 1) provide further support for the hypothesis that there is an inverse relationship between export instability and the level of industrialization of the exporting country for growth products. Instability indices were calculated for groups of countries and for products other than those included in the 1988 study, but for the same period of time. <sup>1/</sup> The calculations were made for 10 types of machinery exports from 14 developing and 8 industrialized countries: Argentina, Brazil, Canada, Colombia, Egypt, France, Germany, Greece, Hong Kong, India, Italy, Japan, Korea, the Netherlands, Pakistan, Singapore, Taiwan, Thailand, Turkey, United Kingdom, United States, and Venezuela. The following cross-section regressions were run:

$$I = a_1 + b_1 \text{ GDP} + e_1 \quad (1)$$

$$I = a_2 + b_2 \text{ MACH} + e_2 \quad (2)$$

where I represents the instability indices; GDP, per capita GDP; and MACH, the percentage of machinery in total exports; both GDP and MACH are proxies for industrialization.

The export data were United Nations SITC items disaggregated to the four- or five-digit level. Each regression was run for all 10 types of machinery exports. The observations for each regression consisted of all the countries in the sample for which data are available. Because not every country exports all types of machinery, the number of observations varies for each regression; in particular, each developing country exported only a few types. When using both explanatory variables jointly, the fit worsened, as expected from the collinearity that exists between

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<sup>1/</sup> The instability index is the standard error of the estimate of a regression linking exports to time,  $\ln X_t = a + bt + e_t$ , where  $X_t$  represents exports;  $t$ , time; and  $e$  is the disturbance term. The time period varies slightly for some products due to data availability; for most products it is 1966-1980.

Table 1. Regression Results for Machinery Exports

Product	Constant	GDP	R <sup>2</sup>	n
Electro-medical equipment (SITC 7261)	.105E+01 (12.130)	-.140E-03 (-6.686)	0.788	14
X-ray apparatus (SITC 7262)	.948E+00 (9.439)	-.134E-03 (-5.705)	0.747	13
Electric power machinery (SITC 7221)	.721E+00 (5.508)	-.879E-04 (-2.319)	0.221	21
Microphones, loudspeakers (SITC 72492)	.973E+00 (4.899)	-.132E-03 (-2.831)	0.365	16
Spinning, struding machinery (SITC 71711)	.116E+01 (7.643)	-.146E-03 (-4.074)	0.601	13
Weaving, knitting machinery (SITC 71712)	.922E+00 (7.258)	-.122E-03 (-4.079)	0.602	13
Cultivating machinery (SITC 7121)	.921E+00 (5.865)	-.115E-03 (-3.041)	0.381	17
Electrical refrigerators (SITC 72501)	.100E+01 (6.661)	-.136E-03 (-3.745)	0.539	14
Excavating machinery (SITC 71842)	.135E+01 (8.555)	-.210E-03 (-5.708)	0.632	17
Piston engines, non-air (SITC 7115)	.659E+00 (5.542)	-.877E-04 (-2.891)	0.330	19

Table 1. Regression results for Machinery Exports (concluded)

Product	Constant	MACH	R <sup>2</sup>	n
Electro-medical equipment (SITC 7261)	.105E+01 (9.443)	-.196E-01 (-5.081)	0.683	14
X-ray apparatus (SITC 7262)	.936E+00 (8.470)	-.189E-01 (-5.039)	0.698	13
Electric power machinery (SITC 7221)	.792E+00 (7.314)	-.172E-01 (-3.792)	0.431	21
Microphones, loudspeakers (SITC 72492)	.113E+01 (5.946)	-.254E-01 (-3.818)	0.510	16
Spinning, struding machinery (SITC 71711)	.122E+01 (9.511)	-.234E-01 (-5.352)	0.723	13
Weaving, knitting machinery (SITC 71712)	.102E+01 (9.351)	-.208E-01 (-5.672)	0.745	13
Cultivating machinery (SITC 7121)	.892E+00 (5.143)	-.158E-01 (-2.493)	0.293	17
Electrical refrigerators (SITC 72501)	.908E+00 (5.691)	-.163E-01 (-2.901)	0.413	14
Excavating machinery (SITC 71842)	.131E+01 (7.712)	-.284E-01 (-4.446)	0.569	17
Piston engines, non-air (SITC 7115)	.721E+00 (5.918)	-.155E-01 (-3.326)	0.394	19

Note: The figures in parentheses are t statistics and n is the number of observations.

these variables. The coefficients of equations (1) and (2) always had the expected sign and were highly significant. 1/ These results provide support for the hypothesis that developing countries are residual suppliers of growth products.

Acting as residual suppliers reinforces the negative effects of recessions on the exports of developing countries because those suppliers tend to absorb a relatively high share of the fluctuations in total world demand. Developing countries also absorb a large share of fluctuations in world demand through the practice of subcontracting, which many countries have chosen as a means to industrialization. 2/ For developing countries, subcontracting has important advantages: it allows them to manufacture legally products covered by patents and copyrights in which they have a comparative advantage, results in savings from advertising, and guarantees them outlets for their production, to name just a few. Whereas subcontracting has been very successful in countries such as Korea and Singapore, it also has a major drawback. Firms in industrialized countries use subcontracting as an instrument to stabilize their output during the downswing phase of the business cycle by curtailing the number of contracts awarded to firms in developing countries rather than resorting to layoffs at home. In some extreme cases, subcontracting firms in developing countries acquired capital equipment on the basis of contracts entered into during the upswing phase of the cycle and nearly went bankrupt when further contracts were not forthcoming in the downturn. 3/ Therefore, the participation of developing countries in the markets for growth products, both as exporters and as subcontractors, helps mitigate the effects of the business cycle on the output and exports of industrialized countries.

The proposed theory helps explain why export diversification policies have often not succeeded in reducing export instability in developing countries. Indeed, the world share of developing country exports of manufactures increased from 4.7 percentage in 1962 to 9.8 percentage in 1980; 4/ it was found that during this period many developing countries

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1/ Data problems resulted in a low number of observations for each type of machinery exports and in time periods that are slightly different for each.

2/ Subcontracting can be loosely defined as an arrangement whereby a firm, usually located in an industrialized country, contracts with another firm, usually located in a developing country, to manufacture goods that the firm in the industrialized country will sell for its own account.

3/ For a definition of subcontracting, bibliography on the subject, and a detailed study of subcontracting in Tunisia, see Gheza 1982.

4/ Calculations based on U. N. trade data made by the author.

had diversified their exports but their export instability had increased. 1/ The usual policy prescription is that developing countries ought to export additional goods, preferably manufactures, in order to dampen instability. 2/ This advice is based on two trends of thought. The first holds that because industrialized countries export mainly manufactured goods and their export proceeds are relatively stable, developing countries should also export manufactured goods in order to decrease export instability. However, the results of the 1988 study and the more recent work show that the exports of manufactures result in export proceeds that are stable for industrialized countries but unstable for developing countries, and would reject a diversification advice that was based on the assumption that what holds for industrialized countries regarding exports also holds for developing countries.

The second trend of thought that leads to the advocacy of diversification in order to reduce export instability is based on some assumed statistical properties of exports that, for the most part, remain implicit. This trend of thought runs along the following general lines. Assuming that export fluctuations are predominantly random, additional exports will tend to dampen the fluctuations of total export proceeds because increases in the exports of some products will be compensated by decreases in the exports of others at any point in time, given that the export covariances are negative. It is further assumed that the fluctuations of the additional products will be of the same magnitude as the fluctuations of existing exports, or even smaller, if the additional exports are manufactures.

The theory proposed in the 1988 study challenges both assumptions. If developing countries are residual suppliers of growth products, their exports of these products will not be predominantly random; instead, they will be strongly influenced by the business cycle and therefore their export covariances will be positive. In this case, some of the random fluctuations of exports will cancel out, but the cyclical fluctuations will remain. The second assumption has already been discussed and found

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1/ For a study of 24 developing countries documenting the results of diversification on export instability, see Love 1983. In general, increased shares of nontraditional exports were accompanied by greater increases in export instability.

2/ "...diversification...has tended to be equated with the expansion of manufactured exports on the grounds that earnings from manufactured goods can be expected to be less volatile than those from primary products and that the intercorrelation between earnings from a manufactured product and a primary commodity is likely to be less than between earnings from pairs of primary commodities." Love 1983, p. 787.

not to be warranted in all cases. Thus, diversification in developing countries could increase the instability of total export proceeds if the fluctuations of the additional exports were not primarily random but strongly related to the business cycle and if the additional exports were more unstable than the traditional ones.

Diversification in industrialized countries, however, is likely to reduce export instability. The 1988 study found that, in contrast with the large differences in the instability of growth and mature exports from developing countries, the export instability of growth and mature products from industrialized countries is very similar (and usually very low) for all the products included in its sample. The results of the more recent work show that the instability of machinery exports from industrialized countries is similar to that of the products included in the 1988 study. Moreover, industrial countries are the primary suppliers of growth products on world markets, and the existence of residual suppliers helps cushion the effects of the business cycle on their own exports. Therefore, export diversification in industrialized countries would probably decrease their total export instability because the instability of additional exports is likely to be of roughly the same low magnitude as that of the original basket of exports, and because the cyclical component of export instability appears to be less strong for industrialized than for developing countries.

Consequently, diversification may increase export instability for developing countries but reduce it for industrialized countries. Moreover, industrialized countries usually export a wide array of growth products that is likely to be composed of products that are affected differently by the business cycle. To the extent that demand for the output of all growth industries is not affected similarly in a recession, exporting a large number of growth products may afford some protection against cyclical fluctuations.

The above discussion has focused on the effect that demand factors have on the instability of growth exports from developing countries. Of course, those exports are also subject to supply fluctuations, and growth exports from industrialized countries are subject to fluctuations caused by demand factors. The only claim made thus far is that demand factors are more important causes of export instability for developing than for industrialized countries.

#### IV. Degree of Industrialization and the Behavior of Instability over Time

The 1988 study compared the export instability of each product for two time periods and found that the behavior of instability over time was related to the kind of products exported and to the degree of development of the exporting countries. 1/ The instability of both growth and mature products exported by the industrialized countries increased moderately over time. This can be explained by the economic upheavals that took place during the second half of the period 1966-80: crude oil prices tripled in late 1973, and a severe and widespread recession ensued that resulted in high unemployment and excess capacity. Trade in the 1970s was characterized by extreme contrasts. Early in the decade, the volume of world trade increased steadily until it reached a record in 1973. Excess demand and the increase in crude oil prices led to high inflation and, subsequently, to recession; in 1975, world output declined, the first contraction in output since the 1950s, and the volume of world exports declined by 5.3 percentage. The recovery, which started in 1976, was very rapid, and world trade in real terms rose by almost 12 percentage that year. 2/ The sharp recovery gave way to modest growth of world trade until the end of the decade. Given the fluctuations experienced by world trade during the 1970s, the increase found in the instability of all exports from industrialized countries is not surprising.

The pattern of changes in instability over time for the exports of developing countries was quite different. The instability of exports of mature products increased, just as it had for the industrialized countries. However, the instability of exports of growth products experienced a dramatic decline, not just when the exports of all developing countries as a group were considered, but also for each individual country. The sole exception was a country that had been torn by war and lost, during that period, territory that produced a major raw material used in the production of synthetic fibers. The consistency of the results for each country, and the large decline in instability for

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1/ Instability during the 1966-80 period was compared with instability during the 1970-80 period, instead of comparing instability during the 1966-70 and 1971-80 periods, because the regressions run for the 1966-70 period to calculate the instability indices would have had only six observations. To compare instability during the 1966-80 with the 1970-80 period, if instability was higher (lower) in 1970-80 than in 1966-80, then instability was lower (higher) in 1966-70 than in 1970-80.

2/ International Financial Statistics, Supplement on Trade Statistics, Supplement Series, No. 4, International Monetary Fund, Washington, D.C., 1982.

the individual countries, suggest that the statistical results can be considered to accurately reflect the true trend in export instability for the growth exports of developing countries.

This observed long-run decline in the instability of the growth exports from developing countries included in the study is consistent with the increase in instability of total exports that usually accompanied the process of diversification. The explanation lies in the changing composition of developing countries' export baskets as diversification proceeded. Over time, developing countries added growth products to their export baskets. The early growth exports experienced a decline in instability over time, as discussed; however, this decline was more than compensated by the high instability of the additional growth exports. As additional growth exports came to represent an increasing percentage of total exports, total export instability increased.

The decline in the instability of growth exports from developing countries during a decade of economic turmoil is remarkable and requires an explanation. The decline is consistent with the proposed hypothesis that export instability and industrialization are inversely related, and can be interpreted in two non mutually exclusive ways. The first is that the growth products included in the study evolved over the sixteen year period, tending to acquire some features associated with mature products. Thus, the technology used in their manufacture became more standardized and predominantly embodied in the capital equipment, making it possible for the developing countries to utilize less skilled labor; patents held by industrialized countries may have expired, decreasing the costs of production for the developing countries; and the degree of product differentiation had lessened, helping the developing countries overcome the barrier of product loyalty built by the early entrants in the market. These and other changes apparently made it easier for developing countries to compete over time with the industrialized countries in the world markets for growth products.

The second interpretation is that the developing countries became more industrialized. They acquired expertise in the manufacture of those growth products, consolidated their commercial ties, firmed up their reputation as reliable suppliers in terms of product quality and delivery schedules, and found or developed market niches not fully served by industrialized countries. Most likely, changes in both the products and the countries accounted for the decrease in the instability of growth products exported by developing countries.

In order to find out whether the behavior of export instability of growth products other than synthetic fibers followed similar trends for the developing and the industrialized countries over time, instability indices for two different time periods were also calculated for various

types of machinery exports (Table 2). The indices shown are simple arithmetic averages of the indices of individual countries.

These results provide further evidence that the instability of growth exports from developing countries declined over time. For the developing countries, the export instability of 9 out of the 10 products decreased over the 1966-80 period, although in some cases the decreases were very small. In contrast, for the industrialized countries, export instability increased for 5 products, remained unchanged for 3 and decreased for only 2.

One difference between the above results and those of the 1988 study is that the export instability of the synthetic fibers declined markedly, whereas the export instability of machinery declined only slightly. This difference may be explained by the characteristics of the products. Even though the raw materials for the production of synthetic fiber textiles are chemicals and those for natural fiber textiles are agricultural commodities and livestock products, the two types of textiles have important similarities: their end uses are the same, and, consequently, the markets for the fabrics made of synthetic fibers overlap to some extent with the markets for the fabrics made of natural fibers. Thus, because the developing countries were already established in the markets for natural fiber textiles when they started exporting synthetic textiles, they may have had less difficulty finding outlets for their production of synthetic textiles. Also, some of the experience acquired in the production and marketing of textiles from natural fibers could have been adapted to synthetic textiles, so that the learning process could have been shortened. By contrast, machinery is a totally different product from those traditionally exported by developing countries and is sold in different markets.

Another difference between the two sets of data is that, for developing countries, the instability of synthetic fiber exports was lower than that of machinery exports. This may be because developing countries entered the world markets for such sophisticated products as electro-medical equipment only recently and, consequently, they were in the early stages of market penetration and of the learning process during the period covered by the study. Finally, lack of data for machinery exports of some countries may have affected the results.

#### V. Effects of Data Aggregation on the Results of Studies of Export Instability

The use of trade data with a very low level of aggregation in the 1988 study and in the work presented above made it possible to observe differences in the size and in the behavior over time of the export

Table 2. Instability Indices

	Industrialized Countries		Developing Countries	
	1966-80	1970-80	1966-80	1970-80
Electro-medical equipment (SITC 7261)	0.22	0.22	0.93	0.92
X-ray apparatus (SITC 7262)	0.17	0.17	0.82	0.79
Electric power machinery (SITC 7221)	0.14	0.16	0.67	0.60
Microphones, loudspeakers (SITC 72492)	0.14	0.13	0.90	0.84
Spinning machinery (SITC 71711)	0.28	0.33	1.11	1.03
Weaving machinery (SITC 71712)	0.20	0.21	0.84	0.73
Cultivating machinery (SITC 7121)	0.13	0.19	0.87	0.81
Domestic elec. refrig. (SITC 72501)	0.25	0.25	0.83	0.86
Excavating machinery (SITC 71842)	0.15	0.14	1.12	0.93
Piston engines (SITC 7115)	0.10	0.11	0.62	0.58

instability of various products, and to identify a strong relationship between export instability and economic development. In contrast, previous studies of export instability have usually been based on highly aggregated data. Such level of aggregation blurred the differences in the instability of products, helping explain why the results of many studies have been inconclusive.

The manner in which aggregation of the trade data affected the numerical value of instability indices in the 1988 study will be discussed first. For this purpose, let us recall that the fluctuations of time series data are due to four components: trend, seasonal, random, and cyclical. The trend was eliminated in the study by the choice of the instability indices, and the seasonal component by the use of annual data. Of the last two components, the random one would be partially eliminated by aggregation of export data, but the cyclical component would remain.

Instability indices were calculated both for the exports of each country and also for the exports of developing and industrialized country groups in order to assess whether inferences drawn for a group of countries would be valid for all members of a group. Data aggregation resulted in a cancellation of fluctuations that varied according to the products and the degree of development of the countries. For growth products exported by 8 developing countries, the instability of 6 countries was above the instability for the group, and the instability of only 2 countries was below. 1/ One possible explanation might be that the instability of the largest exporters could have dominated the instability of the export series for the group; however, this was not the case, because the 2 countries with instability below the instability for the group were not the largest exporters. Another explanation might be that some cancellation of random fluctuations of individual countries took place when the instability of the total exports of the group was calculated. For the industrialized countries, the same type of calculations showed that, for a group of 7 countries, the instability of 4 was above the instability for the group, and the instability of 3 was below, a clustering around the instability for the group that suggests little effect from aggregation.

For mature products exported by 11 developing countries, the instability for each country was above the instability for the group, often by a large amount. 2/ Thus, the instability for 7 countries was more than twice the instability for the group. For the industrialized

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1/ Data are for the 1970-80 period rather than for the longer 1965-1989 period because there were no export data available for some developing countries in the sample prior to 1970.

2/ Data are for the period 1965-80.

countries, the instability for the individual countries was only slightly above the instability for the group, and the pattern held for the 1965-80 but not for the 1970-80 period. Thus, the cancellation of fluctuations of exports from developing countries was greater for mature than for growth products, a pattern consistent with the proposed hypothesis that the export instability of growth products from developing countries has a strong cyclical component, which remains in the aggregated data. In addition, the cancellation of fluctuations of both growth and mature exports was greater for developing than for industrialized countries, suggesting that exports from developing countries may also have a stronger random component than exports from industrialized countries.

The manner in which aggregation of data may have affected the conclusions of past studies of instability will be discussed next. The results of a large body of research on export instability carried out over the last thirty years have been rather meager. As late as 1985, it was acknowledged that "Attempts to determine the causes of the export instability experienced by developing countries have been largely unsuccessful. Numerous studies have failed to establish any significant association between alleged causes and export instability." 1/ This failure may be related to the highly aggregated data used in empirical studies. The need for more disaggregated data has seldom been felt perhaps because, with few exceptions, there has tended to be little theoretical reasoning behind the empirical work on instability.

The level of aggregation of the data used seems to have critically affected the results of studies that failed to identify relationships between instability and its alleged causes or that were inconclusive. In an early study, Coppock compared the instability of world exports of primary and manufactured goods and concluded that "Contrary to widely held views, exports proceeds were decidedly more stable for primary goods than for manufactured goods." 2/ Aggregation may have affected Coppock's results as follows. For manufactures, export data aggregated across countries reflected mainly the instability of manufactures from industrialized countries because these countries supplied more than 90 percentage of manufactures to world markets. Therefore, the instability indices of manufactures thus calculated were low and could not detect the high export instability of some manufactures from developing countries found with disaggregated data. For primary products, exports aggregated across countries are likely to show a substantial cancellation of random fluctuations because these products may be subject to predominantly random fluctuations, such as climatic factors and agricultural pests. Thus,

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1/ Love 1985, p. 244.

2/ Coppock 1962, p. 35.

Coppock basically compared, on the one hand, the instability of exports of manufactures from industrialized countries, which have low instability, and on the other hand, the instability of exports of primary products, which may be individually unstable, but have fluctuations that cancel each other in part, so that the instability of the aggregate is relatively low.

Coppock also calculated the instability of the "value of exports of goods and services" for 83 countries and compared "export instability indexes of countries, when the countries are classified according to the principal type of commodities in their exports." <sup>1/</sup> By using more disaggregated data, namely, country instead of world exports, and by distinguishing between four types of products to classify countries, he was able to observe that countries with food as the principal export had the most stable export proceeds, followed by manufactures and crude materials with similar instability, and by minerals with the highest instability. However, research continued to be carried out on the basis of highly aggregated data, ignoring a suggestion from his results that additional relevant information may be obtained from disaggregated data.

Massell measured the instability of total merchandise exports to test the hypothesis that instability is related to per capita income and found no relationship between the two variables, confirming Coppock's results (Massell 1970). However, the 1988 study discussed in this paper found a significant relationship between export instability and per capita income for growth products, but no relationship for mature products. Apparently, the degree of aggregation in Massell's data made it impossible to identify the relationship.

To observe the behavior of instability over time, Lawson also measured the instability of total merchandise exports and found a decline in the instability of developing countries during the period 1950-69, but for industrialized countries the results depended on the choice of index (Lawson 1974). Possibly because of data aggregation, the results could not identify differences in the pattern of instability over time for various products.

Increases in the instability of total exports were observed by studies covering the period 1960-80 for developing countries that implemented policies of export diversification (Love 1983). These increases in instability may have actually been the result of at least three different trends: increasing for two categories of products and decreasing for a third category. First, the instability of exports of mature products and commodities could have increased as a result of the

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<sup>1/</sup> Coppock 1962, p. 103.

economic events of the 1970s just described, causing an increase in the overall instability of export proceeds. Second, the (high) instability of growth products added to the basket of exports throughout the period studied could have caused an increase in overall export instability. In contrast, the instability of some of the growth products that were already exported before the start of the period studied could have declined as the developing countries learned by doing and became more established on world markets, causing a decrease in total export instability. It is not surprising that these opposite trends resulted in an overall increase in instability, given that the share of growth products in the total exports of developing countries was relatively small at the start of the period studied and that these were the only products for which instability appears to have declined.

In conclusion, export instability is a complex problem and may not lend itself to explanations that cover all exports, from cocoa to computers, originating in all countries. If the explanation of instability depends upon the products and countries, more disaggregated data than have been used so far will be necessary to identify relationships. The use of total export data in studies of the causes of instability presupposes that those causes are the same for all products, an assumption that does not appear to be supported by empirical research. The results of the work discussed in this paper suggest that, on the contrary, the causes of instability are different for different products.

Further theoretical work on the causes of export instability for various categories of products is needed. Observed differences in the instability of different types of products when aggregates are considered may be due to differences in the instability of individual exports. Alternatively, all exports could have about the same instability when considered individually, but the fluctuations of some of them could be predominantly random and cancel out in the aggregate, whereas this may not be the case for others. Therefore, the instability of the aggregate may give an erroneous idea of the instability of the components. But whether the observed difference is due to differences in the size of instability of individual products or to differences in the nature of the fluctuations, the implication is that the causes of instability for all types of products may not be the same.

Identification of the causes of export instability for various types of products may require a deep knowledge of the products and their markets, a laborious undertaking. Nevertheless, accurate identification of the causes of export instability, including an assessment of the relative importance of random and cyclical factors, is important because the policy responses should be tailored to the causes. The failure to recognize that the causes of instability may be different for each product has led to questionable policy advice. An example can be found

in Murray (1978). After measuring export covariances, Murray concluded that export instability was caused by supply factors in a number of developing countries and advocated supply side policies to reduce instability in those countries. This policy advice, however, may not be warranted for each product even if his work had correctly identified the causes of instability for the export aggregate.

Another potential area for research could focus on the way in which different products are affected by the business cycle. The demand for products that are income-inelastic will experience relatively modest fluctuations during the cycle; this may be an important consideration for developing countries, especially in respect of growth products, on account of the share of fluctuations in demand that these countries tend to absorb.

## VI. Policy Implications

The results of the 1988 study and of the work presented above have four main policy implications. This section discusses them but offers only a guide to policy formulation and stops short of dispensing policy advice because the choice of alternative strategies for diversification also depends upon other desirable economic objectives besides the reduction in export instability.

The first implication is that export diversification does not necessarily reduce overall export instability because the instability of the additional exports may be high and strongly related to the business cycle, so that fluctuations in the exports of different products would not tend to cancel each other out. However, this should not be taken to mean that diversification is not a desirable policy option for its own sake. Insofar as diversification does not lead to a reduction in the number and quantity of traditional exports, it increases total export revenues, and increasing total revenues may be more important than reducing instability. Moreover, producing for export often allows a country to achieve greater economies of scale than it would if it produced exclusively for its domestic market. This is especially important for small developing countries that have very narrow domestic markets. Finally, some research has found evidence that diversification encourages competition and the introduction of new technology (Kuznets 1988).

Second, the results of the 1988 study and of further work presented above suggest that diversification may proceed along two basic patterns, and that, for developing countries, different effects on overall instability could be associated with each pattern. The first pattern would consist of exporting additional growth products. Because of the characteristics associated with the growth products, the instability of

the additional exports would be high and strongly correlated with the business cycle, so that the increase in the number of products exported may result in greater instability despite the partial cancellation of random fluctuations. In this case, the most likely outcome of diversification would be an increase in overall instability.

The second pattern would consist of exporting additional mature products. <sup>1/</sup> Because of the characteristics associated with mature products, the instability of these additional exports would be lower and not as strongly associated with the business cycle as in the case of the growth products. In this case, diversification could result in lower overall export instability. However, although the additional exports of mature products can be expected to be relatively stable, the difficulties of breaking into a new market should not be overlooked. Instability during the early years of diversification may still be relatively high for the additional mature products, until the exporting country consolidates its position on world markets. Therefore, diversification could lead to a decline in overall export instability, to no change, or to a small increase.

Expectations of lower instability of total exports after diversification should not be the sole consideration guiding the developing countries' choice of additional exports. For instance, developing countries are very competitive in textiles made of natural fibers, and their exports of these products are relatively stable, but this should not lead to the conclusion that it would be advisable for them to try to increase this category of exports in order to reduce export instability because the expansion of their markets for textiles is restricted by the provisions of the Multifiber Arrangement. Restrictions have also been placed by industrialized countries on their imports of footwear and steel, for example, and by newly industrialized countries on their imports of some mature products, an indication that when developing countries become competitive enough to constitute a threat to the mature industries of industrialized countries, protectionist moves often tend to limit market size for their products. Thus, if developing countries wish to increase total exports, the second pattern of export diversification may not be the preferred one, although it is the most likely to result in reduced export instability.

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<sup>1/</sup> Other patterns would involve shifting resources from the production of traditional exports to the production of new exports of either growth or mature products, or shifting resources between the production of traditional exports to achieve diversification without the addition of products to the basket of exports. These patterns will not be discussed here because the essence of the discussion of the two basic patterns can also be applied to them.

The third policy implication is related to the behavior of instability over time. The instability of exports of growth products is likely to be high at first and to decline over time, so the initial high instability of certain exports should not be a deterrent insofar as it may be expected to be transitory. However, the decline in instability would be faster for those products that tend to mature more quickly and also in cases where countries have related marketing or manufacturing experience that can be applied to the additional exports. For instance, the instability of all the products comprised in the aggregate called "synthetic fibers", such as yarn and fabrics made of synthetic raw materials, declined dramatically during the period under study, but the instability of the various types of machinery declined only slightly. This may be explained by the fact that the products included in "synthetic fibers" have similarities with most of the products included in "natural fibers", both being products with the same end uses, so that the experience acquired in the production and marketing of natural fibers could be used to advantage for the synthetic fibers. In contrast, sophisticated machinery is unlike any of the products traditionally exported by the developing countries, so its instability was higher and experienced a smaller decline.

Moreover, if developing countries wish to diversify their exports into manufactures they can expect the instability of the new exports to be higher the more sophisticated the products are. The newly industrialized countries, which have a relatively developed manufacturing sector and have acquired expertise in the use of marketing techniques, are likely to have more stable exports of sophisticated products than the countries with a rudimentary industrial sector and little experience selling manufactures abroad.

Finally, the fact that the business cycle affects demand for certain products more than for others may be a consideration in the choice of additional exports. If developing countries know that their exports of growth products are especially vulnerable to cyclical fluctuations, they may wish, other things being equal, to export those products that are less affected by the cycle.

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