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A New Approach to the Relationship Between Export
Instability and Economic Development

Prepared by Alicia Mullor-Sebastian *

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Abstract

This paper proposes a hypothesis to explain export instability in terms of the life cycle of products and the degree of industrialization of the exporting country. The hypothesis, which challenges commonly held assumptions, is tested using two groups of products. The results of the study have important policy implications. They suggest that the usual recommendation to developing countries to diversify their exports may be based on invalid assumptions; provide an explanation for the unexpected finding that export diversification has often increased export instability in developing countries; and suggest how export diversification in developing countries should proceed to achieve stability.

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<u>Contents</u>	<u>Page</u>
I. Introduction	1
II. A New Approach to Export Instability	2
III. Methodology of the Study	5
1. The products: synthetic and natural fibers	5
2. The countries	6
3. The data	7
4. The instability indices	7
5. The development indicators for the regression analysis	8
6. Unit value and quantity components of instability	9
IV. Empirical Results and Policy Implications	9
1. Export instability and degree of industrialization	9
2. Relative instability of growth and mature exports and degree of industrial development	12
3. Evolution of instability over time and degree of industrial development	14
4. Policy implications	15
V. Summary and Conclusions	15
<u>Text Tables</u>	
1. Regression Results for Synthetic Fiber Exports	11
2. Regression Results for Natural Fiber Exports	13
Appendix Tables	18
References	27

I. Introduction

This paper proposes the hypothesis that export instability is related to the degree of industrial development of the exporting country in a manner determined by the product cycle theory of comparative advantage. ^{1/} The hypothesis is tested using textile fibers as a case study. The results obtained have policy implications, suggest that the usual recommendation to less developed countries (LDCs) to diversify their exports in order to reduce their export instability may be based on invalid assumptions, and provide a potential explanation of why export diversification has often increased export instability in LDCs instead of decreasing it as expected.

Three decades of research on export instability have resulted in a consensus on only one of the main areas of study, namely, that export instability is higher for LDCs than for developed countries (DCs). ^{2/} Consensus has not been achieved on the other areas. Studies on export instability have usually added together exports of very different characteristics and/or originating from both LDCs and DCs and have computed the instability of the resulting aggregate. The results of studies based on such aggregated data have been inconclusive. However, the assumptions that constitute the theoretical underpinnings of the studies have continued, even without empirical support, to provide the basis for policy recommendations to LDCs.

This paper argues that the use of highly aggregated data is not appropriate and that it stems from the assumptions underlying the conventional theoretical reasoning used to explain export instability. The paper also suggests that the export instability of a given product is influenced by both the characteristics of the individual product and the degree of development of the exporting country. This implies that the export instability of a given product may be different depending upon whether the exporting country is an LDC or a DC and is at variance with commonly accepted assumptions.

The structure of the paper is as follows: Section I is an introduction; Section II presents a hypothesis to explain the determinants of export instability; Section III lays out the methodology for the

^{1/} The product cycle theory states that developed countries have a comparative advantage in growth products and LDCs in 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; research is important in their development; their income elasticity of demand is high; and their markets are oligopolistic. Opposite features characterize mature products. For empirical tests of the product cycle theory, see L. T. Wells (1972) and A. Mullor-Sebastian (1983).

^{2/} For a review of the literature on export instability, see J. Manger (1979).

empirical work; Section IV details the empirical results; Section V provides an interpretation of the results and discusses the policy implications; and Section VI is the summary and conclusions. 1/

II. A New Approach to Export Instability

This paper proposes the hypothesis that export instability is related to the life cycle of products and to the degree of industrialization of the exporting country. It is suggested that the export instability of growth products is higher for LDCs than for DCs and that, when a country is industrialized, the instability of its export revenues from growth products will tend to be relatively low. This challenges two conventional assumptions: that the instability of LDC exports of manufactures is the same as that of DCs, 2/ and that all exports of LDCs have roughly the same degree of instability. 3/ The reasons for the higher LDC export instability of growth products may be found in the characteristics of the growth products and their markets in conjunction with some relevant features usually associated with the economies of LDCs.

Initially, the manufacture of a growth product tends to be located in the country that developed it, and, because DCs tend to spend more on both research and product development than LDCs, the manufacture of growth products tends to be located in DCs. 4/ Consequently, the DCs are initially the only exporters of growth products and therefore hold a "natural monopoly" in world trade for these products. Thus, by the time the manufacture of growth products moves to LDCs, the DCs are firmly entrenched in world markets, making entry of newcomers difficult. Therefore, new entrants are likely to play a role of residual suppliers 5/ unless they are able to displace the original exporters and capture a larger share of the market.

DCs usually originate the technology required to manufacture the growth products that they develop. This technology is often not embodied in the capital equipment in the early stages and therefore production

1/ Additional information concerning the empirical work and statistical issues is available from the author upon request.

2/ Love also challenged this assumption, but on the grounds that LDCs experience periodic input shortages and that they operate in unfamiliar markets. See J. Love (1983). It would be possible to find counter-arguments for both.

3/ This assumption is implicit in the current practice of lumping together all exports of LDCs to compute instability and underlies the recommendation to LDCs to diversify exports in order to reduce instability. If all exports are equally unstable, diversifying should cause export fluctuations to cancel each other out to a certain extent.

4/ R. Vernon (1963 and 1966).

5/ Maizels has suggested that the concept of "market power" has to be incorporated in any theory that purports to explain trade of LDCs, but this analysis was restricted to commodity trade. See A. Maizels (1984).

requires highly skilled labor, an input usually in short supply in LDCs. As a result, some LDCs tend to have quality control problems and their products may have less acceptance. DCs conduct extensive marketing research thereby tailoring products to suit customers' needs, whereas in "every developing country . . . marketing is the most underdeveloped part of the economy, let alone marketing research. The result is that (LDCs) are unable to make effective use of the little they have." ^{1/} DCs are usually able to offer favorable credit terms and good service following sales, thereby making their products more attractive to purchasers, whereas LDCs generally cannot offer credit terms and service to match those of their industrialized competitors. Credit terms depend upon available export credits, which are scarce in LDCs, whereas service is facilitated by geographic proximity to consumers, another factor favoring DCs.

A further element that enhances the competitiveness of DCs is the degree of differentiation in growth products. ^{2/} Because differentiation is usually high in growth products, it is not always as easy for buyers to change suppliers as in the case of mature, and therefore more standardized, products. Thus, because of consumer loyalty to a particular version of a product, its developer enjoys a market advantage. Furthermore, the manufacture of growth products in LDCs may remain dependent for some time upon the supply of technology from DCs and of imported intermediate inputs; ^{3/} if foreign exchange restrictions exist, the inflow of technology and intermediate inputs may suffer, and this may make LDC suppliers less reliable as exporters than their DC counterparts.

Many growth products are developed in order to fulfill certain needs hitherto not satisfied by existing products; in this case, it is important for producers to be in close contact with the ultimate consumers and aware of their changing preferences. But it is often difficult for LDCs, which usually lack adequate marketing know-how and financial resources, to be aware of market trends. Consequently, proximity to large markets and managerial sophistication are advantages that DCs have over LDCs.

The structure of the market for growth and for mature products is usually very dissimilar, to the advantage of DCs. The markets for growth products tend to be oligopolistic, dominated by a few very large

^{1/} J. Z. Kracmar (1971). See also S. P. Padolecchia (1979).

^{2/} Product differentiation has traditionally been neglected as a building block in international trade theory. However, ". . . recent developments in the theory of international trade (Krugman, 1980; Lancaster, 1980), have introduced the role of imperfect competition and product differentiation into their analyses" J. de Melo and S. Urata (1984). See also E. Helpman and P. R. Krugman (1985).

^{3/} Diversification of production and exports is often accompanied by a surge in import needs in LDCs.

corporations; this is so because large corporations are able to spend heavily on product research and are therefore those which develop new, highly differentiated products, which they protect by means of patents and trademarks. Entry of latecomers into oligopolistic markets is relatively difficult. In contrast, the markets for mature products tend to be more competitive, in part because of the low degree of differentiation generally found in mature products.

LDCs are likely to play a role as residual suppliers of growth products due to the factors just discussed: their late entry into world markets; their lack of proximity to consumers; the difficulties they often experience in keeping an even flow of production in terms of both quality and quantity; the limited market research they carry out; their relative disadvantage vis-a-vis DCs attributable to the characteristics of growth products, including product differentiation and technological complexity in their manufacture; and the structure of markets for growth products. In their role as residual suppliers, their exports are subject to instability from the demand side. They are likely to absorb a high percentage of demand fluctuations because they can place only a relatively small share of their production on world markets in recession years, when most demand is satisfied by the established producers in DCs, but they can increase their exports substantially in expansion years if the increased demand is not satisfied by the established producers. Moreover, they may also play a role as residual buyers of imports for the manufacture of growth products for reasons similar to those that make them residual suppliers and this would further increase the instability of their exports of growth products.

The above analysis implies that the export instability of a particular product may be high for one country but low for another and that export instability may not always be an inherent characteristic of products but depends, for each product, upon the degree of industrialization of the exporting country. Following this analysis, it is not correct to aggregate exports of manufactures of both LDCs and DCs and then compute the instability of the resulting series in order to estimate "the export instability of manufactures." The statistical results of calculations of "the export instability of manufactures" based on such aggregated data reflect mainly the export instability of manufactures from DCs because their larger share dominates the export series.

Empirical observation that industrialized countries are exporters of manufactures and have low export instability has been the basis for advice to LDCs to diversify into exports of manufactures. But if the export instability of manufactures for LDCs is higher than for DCs, export diversification will not lead to less instability when LDCs diversify. Furthermore, if export instability of manufactures is higher than that of primary commodities for LDCs, diversification will lead to increased export instability for those countries. This, in fact, is what has happened in many instances to LDCs after they diversified

their exports. In a study of 24 developing countries, Love found evidence that export diversification had taken place in each country and that "increased shares of nontraditional exports have been accompanied by relatively greater increases in their instability." ^{1/} Love, however, offered no explanation for the increased export instability resulting from the diversification of exports.

III. Methodology of the Study

The study measured the export instability of synthetic and natural fibers of individual countries and also of countries grouped according to their level of economic development. Two export instability indices, computed for two time periods, 1965-80 and 1970-80, were used in order to determine whether the results of this study depend upon the index and/or the time period selected and also in order to analyze the behavior of instability for the different products and countries over time. These indices were then used as the dependent variable in regressions linking instability of synthetic fibers (growth products) and of natural fibers (mature products) to several indicators of economic development. It was expected that, for the growth products, there would be a close relationship between instability and economic development, indicating that DCs, which have a comparative advantage in growth products, would have low export instability, and that LDCs would have high export instability. No such close relationship was expected for the mature products, in which LDCs can compete on less unequal terms in international markets. Export values were decomposed into their quantity and unit value components in order to trace the origin of instability and to determine whether this origin differs according to the degree of development of the exporting country.

1. The products: synthetic and natural fibers

For the purposes of the study, the textile fibers were chosen for three reasons. First, textile fibers comprise two groups of products clearly identified in terms of their situation in the product cycle: natural and synthetic fibers. Natural fibers, mainly cotton and wool, are agricultural commodities that have been used in many economies for centuries and their manufactures are classified as mature products. By contrast, synthetic fibers, which are a product of the chemical industry, have appeared relatively recently in world markets, and are classified as growth products.

The structure of the markets for natural and synthetic fibers is very different: natural fiber markets are basically competitive and synthetic fiber markets are oligopolistic. ^{2/} Market strategies are also

^{1/} See Love, n. 4 above, and also (1979).

^{2/} See C. A. Tisdell and P. W. McDonald (1977).

dissimilar. Natural fiber producing countries try to influence production and prices through guarantees and subsidies on inputs and the lack of adequate funds is a major handicap to research and promotion. By contrast, the strategies of synthetic fiber producers 1/ include engaging in intensive research to identify potential markets; tailoring the fiber for the end-use; and developing marketing plans that usually include technical assistance to manufacturers, quality control to protect the trademark, and effective advertising and public relations. Moreover, the small degree of product differentiation in natural fibers makes it possible for some producers to benefit from the promotional efforts of others and reduces the incentive to engage in promotional activities, whereas the opposite is true in the case of synthetic fibers.

The second reason for choosing textile fibers is that the natural fibers, which are mature products, and the synthetic fibers, which are growth products, both have the same end-uses. Therefore, the demand for both kinds of fibers is presumably subject to broadly the same influences, being a derived demand from the same end-uses. The comparison of their export instability is consequently more appropriate than that of two products subject to different influences. The third reason is that the production of natural fibers and of textiles based on them is an important economic activity in LDCs: cotton is grown in about 70 LDCs 2/ and accounts for some foreign exchange earnings in more than 60. Moreover, the share of LDCs in world production increased from 37 percent in the mid-1950s to 41 percent in the mid-1970s.

2. The countries

The countries in the sample were classified into five groups. LDCs were considered to be more developed if they produced and exported synthetic fiber products because the production of synthetic fibers rests on the availability of technical know-how and large capital investments. Thus, the groups of countries are as follows:

Group I - Consists of LDCs that are the least industrialized of the countries in the sample. They are natural fiber producers that do not undertake the production and export of synthetic fibers: Guatemala, Pakistan, Paraguay, and Sudan.

Group II - Consists of LDCs with an intermediate level of industrialization. They are natural fiber producers that

1/ U.S. Advisory Commission on Food and Fibers, reported in Tisdell for an account of the competitive strategies of the natural and synthetic fiber producers.

2/ F.A.O. (1984).

undertake the production and export of synthetic fibers: Argentina, Brazil, Egypt, ^{1/} Mexico, Peru, Thailand, and Turkey.

- Group III - Consists of the most industrialized countries among LDCs. They are those LDCs that are approaching the level of industrialization of DCs: the Republic of Korea and Taiwan, Province of China.
- Group IV - Consists of industrialized countries that are exporters of synthetic fibers: Australia, the Federal Republic of Germany, Italy, Japan, the Netherlands, the United Kingdom, and the United States.
- Group V - Consists of industrialized countries that are exporters of natural fibers: Australia and the United States (this is a subgroup of Group IV).

In order to see if this classification of LDCs (according to whether or not they are exporters of synthetic fibers) corresponds to any measure of development, data on the proportion of GDP that the manufacturing sector represents in each LDC were compiled. LDCs that are exporters of synthetic fibers have higher manufacturing/GDP ratios than LDCs that are not, although in some cases the differences are small.

3. The data

The export data were United Nations Standard International Trade Classification (SITC) items disaggregated to the four-digit level. Synthetic fibers included eleven items and natural fibers, 21 items representing exports of fibers and of yarn and fabric. It was not possible to include clothing because trade data do not classify clothing according to the fiber. The only period for which data for all countries included in the sample were available was 1970-80.

4. The instability indices

Because in previous studies different instability indices often yielded considerably different results, two indices were used. The first 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. Because it is important to obtain a good fit for the trend equation so that the erratic fluctuations

^{1/} Although the Arab Republic of Egypt is included in Group II because it manufactures and exports synthetic fibers, it was excluded from regressions having the export instability of synthetics as the dependent variable because of the 1967 armed conflict. Egypt lost its oil fields and this probably disrupted the production and exports of synthetic fibers.

can be separated from the trend, several specifications were tried: linear, logarithmic, and second degree polynomial. The logarithmic equation gave the best fit. The second index was based on the absolute value of the deviation of exports from trend, normalized by the projected exports according to trend and divided by the number of years in the time series. The formula is:

$$I^* = \frac{\sum_{t=1}^n \frac{|X_t - \bar{X}_t|}{\bar{X}_t}}{n}$$

where X_t represents exports and \bar{X}_t , projected exports calculated on the basis of regressions of actual exports over time for the entire sample period. Although the numerical values of this second index were different from the first, the ranking of the countries by the values of their export instability indices remained the same. In all cases, the Cochrane-Orcutt correction was applied before computing the index whenever there was evidence of autocorrelation.

5. The development indicators for the regression analysis

In order to assess how export instability varies with the level of development, regressions were run with instability as the dependent variable and three indicators of development as the explanatory variables: per capita GDP, the percentage of machinery and equipment in total merchandise exports and the percentage of manufactures in total merchandise exports. ^{1/} The first was chosen because it reflects the consequences of many characteristics usually associated with different levels of economic development and in order to compare the results of this paper with those of previous studies, and the other two because of their suitability as proxies for industrial development. The regressions were:

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

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

$$I = a_3 + b_3 \text{ MNF} + e_3 \quad (3)$$

$$I = a_5 + b_5 \text{ GDP} + c_5 \text{ MACH} + e_5 \quad (4)$$

$$I = a_6 + b_6 \text{ GDP} + c_6 \text{ MNF} + e_6 \quad (5)$$

^{1/} The share of industry in GDP, which may seem a good indicator, can be high in countries with protectionist policies that encourage the existence of inefficient industries, and also in countries with a large cottage industry sector; thus, qualitative aspects are absent from the measurement of industry and the indicator does not accurately measure technological sophistication.

where GDP represents per capita GDP; MACH, the percentage of machinery and equipment exports in total merchandise exports; and MNF, the percentage of manufactures in total exports. ^{1/} The regressions were run for synthetic and natural fiber exports, for both indices and for two time periods.

6. Unit value and quantity components of instability

Having related export instability to the level of industrial development, instability was next divided into its unit value and quantity components in order to assess which of the two had a stronger impact on the instability of export proceeds, and whether either was related to the level of development. The measure of instability of unit values and quantities is the s.e.e. index.

IV. Empirical Results and Policy Implications

The study produced a number of interesting results. First, the export instability of the growth products, the synthetic fibers, bore an inverse relationship to the degree of industrialization of the exporting countries, whereas the export instability of the mature products, the natural fibers, was practically the same for all countries, regardless of their degree of industrialization. Second, the instability of synthetic fiber exports was considerably higher than the instability of natural fiber exports for all the LDCs but the pattern did not hold for DCs. Moreover, the instability of both quantities exported and unit values of synthetic fibers was higher for LDCs than for DCs. Third, the instability of exports over time followed different patterns for natural and synthetic fibers depending upon the degree of industrialization of the exporting countries. The instability of natural fiber exports increased for both LDCs and DCs, whereas the instability of synthetic fiber exports declined for the LDCs, but increased for the DCs.

The empirical work provided support for the hypothesis that the export instability of growth products is higher for LDCs than for DCs, which have a comparative advantage in these products. A detailed account of the results follows.

1. Export instability and degree of industrialization

The export instability of growth products was significantly related to the level of industrialization, but no such relationship existed for mature products. The export instability of the growth products, the synthetic fibers, bore an inverse relationship to the degree of

^{1/} The numerical values of GDP and MACH were taken from the UN's Yearbook of National Accounts Statistics, 1980. Those of MNF were computed from World Tables, IBRD, 1980. GDP was per capita GDP in 1975; MACH and MNF, 1970-77 average values of the indicators.

industrialization of the exporting country, with the more technologically advanced countries exhibiting a much lower instability in both the 1965-80 and the 1970-80 period. When computing the export instability of country groups, instability 1/ was highest for Group II (producers of natural fibers that also export synthetics, 0.59), lower for Group III (the most industrialized of the LDCs, 0.17), and lowest for Group IV (the DCs, 0.10), during the 1965-80 period 2/ (Appendix Tables 1 and 2). During the 1970-80 period, the pattern was the same. When computing the simple average of instability indices for the individual countries, the pattern was the same for both periods.

Because results in previous studies often depended upon the instability index chosen, a second index was used, one that does not square residuals but uses absolute deviations from trend and consequently does not give large deviations from trend undue weight. Although the numerical values of this index were different, instability was again highest for the least developed of all LDCs and declined for groups of countries with a higher degree of industrialization. The ranking of individual country indices was very similar to that obtained using the first index (Appendix Tables 3 and 4).

Regressions linking export instability of growth products to proxies for the degree of development of the exporting countries showed a close relationship between instability and degree of industrialization. The regressions utilized data for the countries in the sample, both LDCs and DCs, that export synthetic fibers, that is, Groups II, III, and IV; the dependent variable was the s.e.e. instability index 3/ (Table 1). The figures in parentheses are t-values. 4/ The coefficients of the explanatory variables always had the expected sign and were significant when only one of the variables was used; this was the case for both indices and for both time periods. When GDP and MACH were used as independent variables simultaneously, the coefficient of GDP became insignificant and took the wrong sign; when GDP and MNF were used simultaneously, the coefficient of GDP became insignificant, although it kept the expected sign. This is not surprising, because all these variables are proxies for the degree of development and thus measure the same characteristic; consequently, there may be a problem of collinearity. However, the coefficients of both MACH and MNF were always significant and had the expected sign. Therefore, the statistical tests supported the hypothesis that there is an inverse relationship between export instability and the degree of industrialization for growth products.

1/ As measured by the standard error of the estimate, unless otherwise indicated.

2/ Group I does not export synthetics.

3/ Regressions using the instability index based on the absolute value of deviations were also run, and the results were very similar.

4/ The value for the 5 percent significance level is 1.812 and for the 10 percent significance level, 1.372.

Table 1. Regression Results for Synthetic Fiber Exports

1. For the period 1965-80:

$$I_S = 0.7041 - 0.9658-04 \text{ GDP} \quad \begin{array}{l} \text{D.W.} = 1.483 \\ R^2 = 0.393 \end{array}$$

(4.662) (-2.546)

$$I_S = 0.8131 - 0.1740-01 \text{ MACH} \quad \begin{array}{l} \text{D.W.} = 1.977 \\ R^2 = 0.615 \end{array}$$

(6.407) (-3.994)

$$I_S = 0.1086 - 0.1146-01 \text{ MNF} \quad \begin{array}{l} \text{D.W.} = 1.946 \\ R^2 = 0.827 \end{array}$$

(9.796) (-6.912)

$$I_S = 0.8128 + 0.7473-06 \text{ GDP} - 0.0175 \text{ MACH} \quad \begin{array}{l} \text{D.W.} = 1.980 \\ R^2 = 0.615 \end{array}$$

(5.994) (0.014) (-2.274)

$$I_S = 0.1110 - 0.3484-04 \text{ GDP} - 0.1003-01 \text{ MNF} \quad \begin{array}{l} \text{D.W.} = 2.216 \\ R^2 = 0.865 \end{array}$$

(10.646) (-1.596) (-5.610)

2. For the period 1970-80:

$$I_S = 0.3025 - 0.2344-04 \text{ GDP} \quad \begin{array}{l} \text{Cochrane-Orcutt} \\ \text{correction applied} \\ R^2 = 0.165 \end{array}$$

(3.708) (-1.332)

$$I_S = 0.4599 - 0.8086-02 \text{ MACH} \quad \begin{array}{l} \text{Cochrane-Orcutt} \\ \text{correction applied} \\ R^2 = 0.600 \end{array}$$

(6.902) (-3.681)

$$I_S = 0.8333 - 0.8331-02 \text{ MNF} \quad \begin{array}{l} \text{D.W.} = 1.445 \\ R^2 = 0.619 \end{array}$$

(6.033) (-4.032)

$$I_S = 0.6220 + 0.1115-04 \text{ GDP} - 0.1359-01 \text{ MACH} \quad \begin{array}{l} \text{D.W.} = 1.378 \\ R^2 = 0.438 \end{array}$$

(4.523) (0.206) (-1.741)

$$I_S = 0.8457 - 0.1765-04 \text{ GDP} - 0.7603-02 \text{ MNF} \quad \begin{array}{l} \text{D.W.} = 1.415 \\ R^2 = 0.633 \end{array}$$

(5.853) (-0.584) (-3.071)

In contrast with the growth products, the export instability of the mature products, the natural fibers, was very similar for all exporters, regardless of their degree of industrialization. Thus, instability was similar for Group I countries (LDC exporters of natural fibers that do not export synthetics, 0.11), for Group II countries (LDC exporters of natural fibers that also export synthetics, 0.11), and for Group V countries (DCs that are exporters of natural fibers, 0.16) for the 1965-80 period (Appendix Tables 5 and 6). The simple average of individual country indices was 0.29 for Group I countries, 0.25 for Group II countries, and 0.20 for Group V countries. For the 1970-80 period, the results were similar, as they were when using the index based on the absolute value of deviations from trend (Appendix Tables 7 and 8). The regressions linking the export instability of natural fibers to the proxies for economic development (Table 2) also suggest that there is not a significant relationship between export instability and industrialization for mature products. The coefficients of all the independent variables were insignificant.

2. Relative instability of growth and mature exports
and degree of industrial development

The export instability of growth products was higher than the instability of mature products for all LDCs that exported the two types of products. Thus, Group II, which exports both synthetic and natural fibers, had an instability index of 0.59 for synthetic fibers and of 0.11 for natural fibers; and the instability of synthetic fibers was higher than that of natural fibers for each individual country. These indices refer to the 1965-80 period, and the same pattern appears on the basis of 1970-80 data. For the two developed countries that are exporters of both synthetic and natural fibers, however, the export instability of the two types of products was practically the same.

It is interesting to note that the instability indices of DC exports of synthetic fibers (0.10) and of LDC exports of natural fibers (0.11) is practically the same. If it were generally true that the instability of DC exports of growth products is similar to that of LDC exports of mature products, this could help explain a seeming paradox. Empirical research has failed to show that there is a significant difference between the export instability of manufactures and primary products. This seems to be at variance with the observation that DC exports, which consist mainly of manufactures, are more stable than LDC exports, which consist mainly of primary products. The explanation may lie in the fact that the export instability of manufactures has measured basically only that of DC exports, as noted before.

When the quantity and unit price components of instability were analyzed separately, the instability of both the quantities exported

Table 2. Regression Results for Natural Fiber Exports

1. For the period 1965-80:		
$I_N = 0.2699 - 0.9360-05 \text{ GDP}$	$D.W. = 2.784$	
(7.192) (-0.719)	$R^2 = 0.045$	
$I_N = 0.2689 - 0.1856-02 \text{ MACH}$	$D.W. = 2.813$	
(7.707) (-0.836)	$R^2 = 0.060$	
$I_N = 0.285 - 0.1081-02 \text{ MNF}$	$D.W. = 2.737$	
(6.100) (-0.862)	$R^2 = 0.063$	
2. For the period 1970-80:		
$I_N = 0.2756 - 0.9083-05 \text{ GDP}$	$D.W. = 2.526$	
(6.386) (-0.607)	$R^2 = 0.032$	
$I_N = 0.2743 - 0.1754-02 \text{ MACH}$	$D.W. = 2.547$	
(6.810) (-0.685)	$R^2 = 0.041$	
$I_N = 0.2797 - 0.6945-03 \text{ MNF}$	$D.W. = 2.473$	
(5.129) (-0.474)	$R^2 = 0.020$	

and unit values of growth products ^{1/} was higher for LDCs than for DCs (Appendix Table 9). Data are available to compute only individual country indices, and only for three SITC items. The simple average of export instability indices for quantities of synthetic fiber yarn was 1.22 for Group II countries, declining to 0.42 for Group III, and to 0.16 for Group IV. The instability of unit values followed the same pattern of decline according to the degree of industrialization of the exporting country. The simple average of instability indices for individual countries also followed the same pattern. The other two SITC items for which data on quantities exported and unit values exist, regenerated fiber yarn and woven synthetic fabrics, follow exactly the same pattern. The instability of both components of export value declines when the degree of development increases, and the instability of unit values is higher than the instability of world prices of rayon and polyester for LDCs but lower for DCs. All this could suggest that the residual suppliers not only are unable to maintain their physical volume of sales when there is a decline in demand but also have to accept less advantageous terms than DCs. In contrast, the developed countries are able to command relatively stable prices even in periods of slack demand because of their trading partners' interest in maintaining their commercial

^{1/} In this case, only the s.e.e. was used as an index of instability.

relations. For both the LDCs and the DCs, however, the export instability of unit values is higher than the instability of world prices of rayon and polyester for LDCs but lower for DCs.

Regarding mature products, there are not enough data on exports by DCs to make even a tentative generalization. Data on exports of two mature products by LDCs do not reveal any specific pattern. The instability of both quantities and unit values was lower for Group II countries than for Group I countries for raw cotton, but this was not the case for grey cotton yarn.

3. Evolution of instability over time and degree of industrial development

Changes in export instability over time followed different patterns for growth and mature products depending upon the degree of industrialization of the exporting countries. When country groups were considered, the instability of synthetic fiber exports increased for the most industrialized of the LDCs and for the DCs, but declined for less industrialized LDCs, whereas the instability of natural fiber exports increased for both LDCs and DCs. This decline in instability for Group II countries during a period that included two energy crises and a major recession may be attributed to the fact that the less technologically advanced of synthetic fiber exporters were learning "to play the market." In contrast, the export instability of the more industrialized countries increased, perhaps as a consequence of the recession.

The instability of natural fiber exports increased ^{1/} for all groups of countries, developing as well as industrialized. This increase in instability of natural fiber exports is probably related to the economic recession of 1975-76, the abandonment of the U.S. policy of large stock holdings, and the effect that the increasing world use of synthetic fibers had on the demand for natural fibers.

4. Policy implications

The empirical results of this paper suggest that when LDCs engage in export diversification, their export instability may increase if diversification is achieved through increased exports of growth products. Therefore, export diversification cannot always be relied upon to reduce export instability, although other benefits may be derived from such a policy.

^{1/} The 1965-80 period was compared with the 1970-80 period instead of comparing 1965-70 with 1970-80 because the regressions for the 1965-70 period would have had only six observations. In comparing the 1965-80 with the 1970-80 period, it was assumed that if instability was higher (lower) in the 1970-80 than in the 1965-80 period, instability was lower (higher) in the 1965-70 than in the 1970-80 period. This may not hold under certain conditions regarding the deviations of observations from trend in the first and second periods.

This paper's conclusion that diversification may sometimes increase export instability reflects the experience of many LDCs, which have diversified their exports and subsequently experienced an increase in instability. Thus, export diversification may expand a country's economic base, but, in order to increase export stability, LDCs should diversify into mature products, in which they have a comparative advantage. The decline in export instability of growth products for LDCs over time, however, suggests that although diversification into growth products may increase instability in the short run, the long-run effects may be those desired. Instability in LDCs, particularly in the case of the more industrialized LDCs, could decline over time as the countries acquire the technological and managerial knowledge necessary to increase their international competitiveness or as the products mature.

V. Summary and Conclusions

This paper proposed and tested the hypothesis that export instability is related to industrialization in a manner determined by the product cycle theory of comparative advantage; analyzed the evolution of export instability over time; and offered an explanation of why diversification has often failed to reduce export instability in LDCs. The relationship between export instability and industrialization was explained in terms of the life cycle of products and the LDCs' role of residual suppliers of growth products. Thus, it was suggested that the export instability of growth products is higher for LDCs than for DCs, whereas the export instability of mature products is not significantly affected by industrialization.

The study tested the proposed hypothesis using synthetic fibers as the growth products and natural fibers as the mature products. Regressions were run using two instability indices of synthetic and natural fiber exports as the dependent variable and two time periods in order to ensure that the results of the test did not depend upon the choice of indices or time periods, and using three indicators of industrialization as the independent variables. The results of the study supported the hypothesis. The export instability of growth products was inversely related to the countries' level of industrialization, and all the independent variables had significant coefficients regardless of the index and the time period used. In contrast, the instability of natural fibers exports was not significantly related to industrialization. When instability was decomposed into its quantity and unit value components, quantity was the dominant factor determining the instability of synthetic fiber exports of LDCs. This suggests that LDCs played the role of residual suppliers.

Over time, the evolution of instability was different for growth and mature exports, depending upon the degree of industrialization of the exporting country. The instability of growth exports of the DCs

and the more industrialized of the LDCs increased, probably reflecting the effects of the energy crisis and the world economic recession. In contrast, the instability of synthetic fiber exports of the less industrialized LDCs decreased, suggesting that these countries were learning to "play the market," cementing their trade relationships and becoming more established in world markets. However, the instability of natural fiber exports of both DCs and LDCs increased over time; the economic crisis affected both groups of countries in the same manner.

This study challenged two commonly held assumptions: first, that the export instability of manufactures, or any other product, is the same for both LDCs and DCs, and, second, that all exports of LDCs have roughly the same degree of instability. This provided an explanation for the unexpected finding in recent empirical studies that diversification has often increased export instability in LDCs. Thus, this paper suggests that export instability of a given product may be different for different countries, depending upon their degree of industrialization. If LDCs diversify into manufactures, their export instability may increase if those manufactures are not mature products, that is, are not products in which LDCs have a comparative advantage and, consequently, low export instability.

The results of the study, therefore, also have policy implications. If an LDC wants to reduce its export instability in the short run, it should, ceteris paribus, diversify into mature products, in which it has a comparative advantage. ^{1/} In the long run, the instability of LDC exports of growth products, in which the countries are not competitive, may decline as the countries go through a learning process and become established in international markets. But this may be a long process, especially for the less industrialized LDCs, even though it could be the preferred route in some cases. The point made here is that the low export instability of DCs should not automatically translate into a policy recommendation to LDCs to export precisely those products that DCs are exporting. The obvious exception is when LDCs are chosen as offshore production centers and their output has an assured market.

^{1/} A caveat is in order here. The theory proposed deals with demand-side instability only. If export instability originates in the supply side, and if the random elements in production of mature and growth products are inversely correlated, diversification may still reduce instability. Such correlation, however, seems extremely unlikely.

Table 1. Instability Indices 1/ of Synthetic Fiber Exports From
Less Developed Countries

	Years	Instability Indices <u>2/</u>	R ²
Group II	1965-80 <u>3/</u>	0.5861	0.9299
	1970-80 <u>3/</u>	0.4247	0.8906
	1970-80	0.4354	0.8853
Argentina	1965-80	1.1422	0.3570
	1970-80	1.2060	0.0400
Brazil	1965-80	0.7566	0.9290
	1970-80	0.5445	0.8170
Mexico	1965-80	0.5848	0.8211
	1970-80	0.3617	0.7340
Peru	1965-80
	1970-80	1.7314	0.6870
Thailand	1965-80	1.0439	0.8928
	1970-80	0.6185	0.9082
Turkey	1965-80
	1970-80	0.4091	0.8632
Group III	1965-80	0.1748	0.9890
	1970-80	0.1963	0.9667
Korea	1965-80	0.2680	0.9770
	1970-80	0.2115	0.9750
Taiwan	1965-80	0.2200	0.9800
	1970-80	0.2339	0.9360

1/ Computed from $\ln X_t = a + bt + e_t$.

2/ Computed after correcting for autocorrelation when appropriate.

3/ Excludes Peru and Turkey, for which data prior to 1970 are not available.

Table 2. Instability Indices 1/ of Synthetic Fiber Exports From Developed Countries

	Years	Instability Indices <u>2/</u>	R ²
Group IV	1965-80 <u>3/</u>	0.1037	0.9763
	1970-80 <u>3/</u>	0.1223	0.9239
	1970-80	0.1250	0.9235
Australia	1965-80
	1970-80	0.2652	0.0005
Germany, Federal Republic of	1965-80	0.1418	0.9645
	1970-80	0.1599	0.8725
Italy	1965-80	0.1033	0.9754
	1970-80	0.1096	0.9496
Japan	1965-80	0.1001	0.9757
	1970-80	0.0981	0.9341
Netherlands	1965-80	0.1248	0.9511
	1970-80	0.1283	0.8441
United Kingdom	1965-80	0.1037	0.9746
	1970-80	0.1179	0.9303
United States	1965-80	0.1751	0.9454
	1970-80	0.2030	0.9087

1/ Computed from $\ln X_t = a + bt + e_t$.

2/ Computed after correcting for autocorrelation when appropriate.

3/ Excludes Australia, for which data for the entire 1965-70 period were not available.

Table 3. Instability Indices 1/ of Synthetic Fiber Exports From
Less Developed Countries

	Years	Instability Indices <u>2/</u>
Group II	1965-80 <u>3/</u>	0.4196
	1970-80 <u>3/</u>	0.2025
	1970-80	0.2147
Argentina	1965-80	0.8495
	1970-80	0.7021
Brazil	1965-80	0.5384
	1970-80	0.2595
Egypt	1965-80	0.4744
	1970-80	0.5908
Mexico	1965-80	0.4520
	1970-80	0.1806
Peru	1965-80	...
	1970-80	1.7353
Thailand	1965-80	0.8995
	1970-80	0.3739
Turkey	1965-80	...
	1970-80	0.3267
Group III	1965-80	0.1212
	1970-80	0.1244
Korea	1965-80	0.1670
	1970-80	0.1280
Taiwan	1965-80	0.1643
	1970-80	0.1618

1/ The indices are based on deviations of actual exports from trend values.

2/ Computed after correcting for autocorrelation when appropriate.

3/ Excludes Peru and Turkey, for which data for the entire 1965-70 period are not available.

Table 4. Instability Indices 1/ of Synthetic Fiber Exports From Developed Countries

	Years	Instability Indices <u>2/</u>
Group IV	1965-80 <u>3/</u>	0.0670
	1970-80 <u>3/</u>	0.0804
	1970-80	0.0806
Australia	1965-80	...
	1970-80	0.2066
Germany, Federal Republic of	1965-80	0.0910
	1970-80	0.1035
Italy	1965-80	0.0771
	1970-80	0.0770
Japan	1965-80	0.0657
	1970-80	0.0614
Netherlands	1965-80	0.0891
	1970-80	0.0790
United Kingdom	1965-80	0.0739
	1970-80	0.0904
United States	1965-80	0.1361
	1970-80	0.1622

1/ The indices are based on deviations of actual exports from trend values.

2/ Computed after correcting for autocorrelation when appropriate.

3/ Excludes Australia, for which data for the entire 1965-70 period are not available.

Table 5. Instability Indices 1/ of Natural Fiber Exports From
Less Developed Countries

	Years	Instability Indices <u>2/</u>	R ²
Group I	1965-80	0.1113	0.9583
	1970-80	0.1385	0.8767
Guatemala	1965-80	0.2244	0.8941
	1970-80	0.1456	0.9599
Pakistan	1965-80	0.2376	0.8435
	1970-80	0.2987	0.5638
Paraguay	1965-80	0.5409	0.9005
	1970-80	0.5869	0.8775
Sudan	1965-80	0.1678	0.8132
	1970-80	0.1576	0.4499
Group II	1965-80	0.1145	0.9187
	1970-80	0.1374	0.8261
Argentina	1965-80	0.2960	0.7520
	1970-80	0.2829	0.8193
Brazil	1965-80	0.2059	0.7717
	1970-80	0.2118	0.4874
Egypt	1965-80	0.1453	0.3760
	1970-80	0.1775	0.2364
Mexico	1965-80	0.2877	0.6764
	1970-80	0.2904	0.6583
Peru	1965-80	0.2305	0.7314
	1970-80	0.2050	0.8473
Thailand	1965-80	0.3703	0.9367
	1970-80	0.3914	0.8985
Turkey	1965-80	0.1932	0.9011
	1970-80	0.2083	0.7512

1/ Computed from $\ln X_t = a + bt + e_t$.

2/ Computed after correcting for autocorrelation when appropriate.

Table 6. Instability Indices 1/ of Natural Fiber Exports From Developed Countries

	Years	Instability Indices <u>2/</u>	R ²
Group V	1965-80	0.1601	0.9069
	1970-80	0.2004	0.8466
Australia	1965-80	0.2201	0.6739
	1970-80	0.2493	0.6467
Wool exports	1965-80	0.2374	0.5993
	1970-80	0.2556	0.6119
Cotton exports	1965-80	0.2287	0.8615
	1970-80	0.2388	0.8626
United States	1965-80	0.1756	0.9363
	1970-80	0.1704	0.9134

1/ Computed from $\ln X_t = a + bt + e_t$.

2/ Index computed after correcting for autocorrelation when appropriate.

Table 7. Instability Indices 1/ of Natural Fiber Exports From
Less Developed Countries

	Years	Instability Indices <u>2/</u>
Group I	1965-80	0.0842
	1970-80	0.0929
Guatemala	1965-80	0.1734
	1970-80	0.1010
Pakistan	1965-80	0.1886
	1970-80	0.1946
Paraguay	1965-80	0.3154
	1970-80	0.4204
Sudan	1965-80	0.1408
	1970-80	0.1113
Group II	1965-80	0.0863
	1970-80	0.0923
Argentina	1965-80	0.2319
	1970-80	0.2404
Brazil	1965-80	0.1423
	1970-80	0.1337
Egypt	1965-80	0.1031
	1970-80	0.1122
Mexico	1965-80	0.2259
	1970-80	0.2297
Peru	1965-80	0.1955
	1970-80	0.1651
Thailand	1965-80	0.2905
	1970-80	0.3216
Turkey	1965-80	0.1378
	1970-80	0.1678

1/ The indices are based on deviations of actual exports from trend values.

2/ Computed after correcting for autocorrelation when appropriate.

Table 8. Instability Indices ^{1/} of Natural Fiber Exports From Developed Countries

	Years	Instability Indices ^{2/}
Group V	1965-80	0.1092
	1970-80	0.1214
Australia		
Total exports	1965-80	0.1451
	1970-80	0.1647
Wool exports	1965-80	0.1572
	1970-80	0.1727
Cotton exports	1965-80	0.1647
	1970-80	0.2015
United States	1965-80	0.1330
	1970-80	0.1168

^{1/} The indices are based on deviations of actual exports from trend values.

^{2/} Computed after correcting for autocorrelation when appropriate.

Table 9. Instability of Quantities Exported (I_q) and of Unit Values (I_{uv}) for Selected SITC Synthetic Fiber Items 1/

	Years	Yarn of Synthetic Fibers		Regenerated Fiber Yarn		Woven Synthetic Fabrics	
		I_q	I_{uv}	I_q	I_{uv}	I_q	I_{uv}
Group II							
Argentina <u>2/</u>	1965-80	1.6444	0.3422	2.0737	0.1860	1.1932	0.3919
Brazil <u>3/</u>	1969-80	1.4406	0.2754	1.3412	0.1488	0.6438	0.1801
Mexico	1965-79	--	--	0.5362	0.2397	--	--
Peru <u>4/</u>	1973-80	0.6580	0.2916	0.9905	0.5615	1.8875	0.5782
Thailand	1970-79	0.9333	0.2925	0.6230	0.3524	--	--
Turkey <u>5/</u>	1970-80	1.4225	0.2771	--	--	0.9282	0.3239
Simple Average	--	1.2198	0.2958	1.1129	0.2977	1.1632	0.3685
Group III							
Korea	1965-80	0.6124	0.1566	0.8625	0.2390	0.4211	0.1540
Taiwan	1965-80	0.2254	0.1664	0.2669	0.1145	0.2652	0.1344
Simple Average	--	0.4189	0.1615	0.5647	0.1768	0.3432	0.1442
Group IV							
Germany	1965-80	0.1440	0.0845	0.0979	0.0708	0.1154	0.0592
Italy	1965-80	0.1520	0.0961	0.6168	0.0793	0.2091	0.0685
Japan	1965-80	0.1950	0.1157	0.1176	0.1036	0.1329	0.1003
Netherlands	1965-80	0.1330	0.0773	0.1007	0.0509	0.1690	0.0666
United Kingdom	1965-80	0.1294	0.0855	0.1558	0.0811	0.6612	0.6547
United States	1965-80	0.1969	0.0508	0.3744	0.0902	--	--
Simple Average	--	0.1584	0.0850	0.2439	0.0793	0.2575	0.1899

1/ Computed from $\ln Q = a_1 + b_1 t + e_1$, and $\ln UV = a_2 + b_2 t + e_2$.

2/ For regenerated fiber yarn, the dates are 1966-80.

3/ For yarn of synthetic fibers the dates are 1968-80.

4/ For woven synthetic fibers the dates are 1968-80.

5/ For woven synthetic fibers the dates are 1967-80.

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