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An Econometric Study of Exports of Manufactures From Developing Countries

Prepared by Marian E. Bond

Authorized for Distribution by Anthony Lanyi

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Abstract

This paper studies the flow of manufactured exports from developing countries grouped into five geographical regions. Some of the determinants of the demand for and supply of these exports are explored and a model of of manufactured exports is built. Empirical evidence of the world income elasticity of demand for developing country manufactures, the price elasticities of demand and supply, and other domestic variables are presented. These results are compared with those obtained from other studies, and where applicable policy recommendations are drawn.

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Summary

This paper studies the flow of manufactured exports from developing countries grouped into geographical regions. The aim is to estimate the link between the impressive growth of exports of manufactures from developing countries in recent years and world economic activity. In order to assess how domestic supply variables affect manufactured exports from developing countries, supply-side determinants of these exports are also explored. A model is then used to derive empirical evidence on the response of manufactured exports to changes in underlying demand and supply.

The empirical results, as well as estimates in other studies, point to income elasticities of demand for manufactures that are generally larger than those for food, beverages and tobacco, and agricultural raw materials, though not larger than those for minerals and energy. The sizes of these income elasticities are also comparable with those for the industrial countries. However, interregional differences exist in the income elasticities of demand for exported manufactures. In general, demand tends to be more income elastic for manufactures from Asia, Europe, and the Western Hemisphere than for Africa and the Middle East. The evidence also shows that the price elasticities of demand for manufactured exports from developing countries are considerably lower than their counterparts for industrial countries. Indeed, the price elasticities of demand for exports from the developing world hardly ever exceed one for any of the export groups.

The results from this study also indicate that the price elasticities of supply for manufactures are considerably larger than the price elasticities of supply for other commodities. However, the supporting evidence from other studies on supply elasticities is meager, so the policy implications that can be drawn from this evidence are correspondingly limited.

I. Introduction

In examining the recent impressive growth of exports of manufactures from developing countries, an important question that arises is how this growth is linked to world economic activity. In particular, it would be interesting to know the extent to which price and income elasticities of demand differ between manufactured exports and commodity exports from developing countries; the differences among price and income elasticities of demand across developing country regions; and whether exports of manufactures from developing countries are constrained by domestic supply or by world demand. Answers to the questions might assist developing countries in assessing the effect of the structure of their export incentives on export earnings. Information on the size of elasticity estimates would be particularly useful in this respect.

These issues can be addressed by developing a model of demand and supply for manufactured exports from developing countries, by calculating the way in which these exports respond to crucial variables, and by investigating the changes that have taken place in the world market for manufactures. Differences between elasticity estimates for commodity exports and manufactures, and among elasticities for manufactures from different regions of developing countries 1/ have not been widely examined in the literature. There have been quite a few studies recently that provide information on the magnitude of price and income elasticities for all commodities from all developing countries. Bergsten and Cline estimate income elasticities of 3 for non-oil imports of OECD countries, while estimates by Goldstein and Khan produce an elasticity of 1.3. Other studies estimate elasticities for manufactures from developing countries. Cline estimates an income elasticity of 1.67 for the major industrial countries' imports of manufactures from developing countries; his estimates for individual countries vary from 3.5 for the United States to 0.6 for Japan. Similarly estimates by Hamilton and Kreinin differ among individual countries from 0.85 to 1.62. Deppler and Ripley (1978), Goldstein and Khan (1985), and Clark (1977) provide estimates of income elasticities ranging from 1.26 to 2.60 for total imports of manufactures by industrial countries.

The question of whether exports of manufactures from developing countries are constrained by domestic supply or by world demand has been addressed by Donges and Riedel (1976), who find that lack of demand is not the ultimate obstacle to expansion of manufactured exports in developing countries. Although the value of exports of manufactures from developing countries has grown from 11 percent of world exports of manufactures in 1965 to 14 percent in 1980, this increase was insufficient to offset the decline of these countries in the share of world primary commodity exports; consequently, developing countries' share in total

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1/ Manufactured exports differ across regions in both the types of manufactured goods and in the location of markets. They also differ because of local resources and domestic policies.

world exports fell from 17.2 percent in 1965 to 13.9 percent in 1980. Furthermore, most of the increase in manufactured exports has come from the Asian countries, whose share in world exports of manufactures rose from 3 percent in 1965 to over 5 percent in 1980.

The present paper examines the determinants of exports of manufacturers from five different developing country regions 1/ from both a demand and a supply perspective; estimates income and price demand and supply elasticities for manufactured exports to the world; 2/ and measures the response of exports of manufactures to domestic variables. Section II analyzes patterns of developing country exports of manufactures and discusses some of the regional differences from a demand and supply perspective. Section III develops the econometric testing by estimating a demand and supply equation and comparing the results with those of other studies. Section IV discusses some of the questions presented in the introduction to this paper and summarizes the conclusions.

II. Patterns of Exports of Manufactures Among Developing Country Regions

The purpose of this section is first to look at the types of manufactures exported by developing countries, and second to explain some of the determinants of the demand for and supply of these exports. In particular, this section will emphasize regional differences, highlighting the disparity between the outcomes for Asian and Western Hemisphere countries.

1. Types of manufactures exported by developing countries

The range of manufactured goods exported by developing countries vary enormously, as indeed does the range of definitions of manufactured goods. For the purposes of this paper a manufactured good is defined as a product that involves, at the very least, some processing of a raw material or assembling of pre-manufactured goods. Thus, for example, dried, salted or tinned meat would be a manufactured good but raw or frozen meat would not be; sugar and cocoa products would be a manufactured good but raw sugar or cocoa would not be. In general, as a country becomes more developed, its pattern of comparative advantage in manufactured goods changes, moving from production of goods that are relatively more labor-intensive to production of those that are more capital-intensive. As might be expected, the industrial countries have a comparative advantage over the developing countries in the manufacture of capital-intensive

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1/ The five developing country regions are Africa, Asia, Europe, the Middle East, and Western Hemisphere. The countries included in these regions follow groupings used in the World Economic Outlook; details are given in Appendix I to this paper. These groupings include oil producing countries, except for the major oil producers in the Middle East.

2/ The countries used to represent the world are listed on the inside of the back cover of International Financial Statistics.

commodities, and the newly industrializing developing countries 1/ have a comparative advantage over other developing countries in producing labor-intensive commodities. 2/

2. Demand and supply determinants of exported
    manufactures from developing countries

The share of developing countries in world exports of manufactures grew from 11 percent in 1965 to almost 14 percent in 1980 (Table 1). Much of the impressive growth performance of developing country exports over the past took place in the Asian countries, whose share in world markets rose from 3 percent in 1965 to over 5 percent in 1980. Among the Asian countries, South Korea, Hong Kong, and Singapore showed the most dramatic growth in shares in world markets for manufactured imports.

a. Demand

Manufactured exports from developing countries grew at an average rate of 19 percent per year during the years 1965 to 1980. Imports of such exports from these countries grew the most in OPEC countries: 28 percent per annum, compared to 18 percent growth for other developing and industrial countries combined. The industrial countries are still the largest consumers of these exports; in 1980, they accounted for 69 percent of these exports, compared with 6 percent for OPEC countries and 15 percent for other developing countries.

The demand for the manufactured exports from different developing countries varies depending on (i) the markets developing countries export to and (ii) the products they export. First, growth of demand for these exports varies considerably among national markets. These markets grow at different rates because of variations in (i) growth in GNP and (ii) the income elasticity of demand for developing country manufactures. For example, among the seven major industrial countries, the United States market for imports of manufactures grew the fastest (Table 2); in 1978 it accounted for 45 percent of manufactured exports from developing countries, up from 35 percent in 1969. The high export growth to the United States was accounted for by a high income elasticity of demand rather than by the growth of GNP. The second fastest growth of imports of manufactures from developing countries took place in Japan, where a high growth in GNP was the more important factor (Table 2). In the United Kingdom, Italy, and France, where the slowest such growth took place, both growth of GNP and income elasticity of demand were important. 3/

1/ Newly industrializing developing countries are defined in the Appendix to this paper.

2/ Balassa (1980).

3/ Cline (1984). These are apparent income elasticities and therefore include influences affecting the supply curve of developing countries as well as shifts in the demand curve.

Table 1. Exports of Manufactures from Developing Country Regions
Industrial Countries and OPEC to the World, 1965 and 1980

(In billions of U.S. dollars)

| Region | 1965 | | 1980 | | 1980/1965 |
	Amount (1)	Percent of Total (2)	Amount (3)	Percent of Total (4)	Ratio (4)÷(2) (5)
Africa	2.4	2.2	25.3	2.2	1.0
Asia	3.3	3.1	62.1	5.3	1.7
Europe	2.7	2.5	37.3	3.2	1.3
Middle East	0.7	0.6	8.7	0.7	1.2
Western Hemisphere	2.9	2.6	28.9	2.5	0.9
Total Developing Countries	12.0	11.0	162.3	13.9	1.3
Industrial Countries	96.2	88.1	995.6	85.3	0.9
OPEC 1/	1.0	0.9	9.2	0.8	0.9
World	109.2	100.0	1,167.1	100.0	1.0

Source: World Bank Trade Data.

1/ Algeria, Indonesia, Nigeria, and Venezuela are included in the oil exporting countries group; total developing countries exclude these four variables for the purpose of this table.

Table 2. Factors Accounting for Growth in Manufactures from
Developing Countries to Industrial Countries

| Importing Country | Income Elasticities of Demand for Manufactured Exports of Developing Countries | | | GNP Growth Average Period Growth 1965-82 | Growth in Manufactured Exports from Developing Countries 1969-78 |
	Cline 1/	Hamilton & Kreinin 1962-76	1970-76		
Canada	1.8	1.11	1.00	3.9	7.6
France	1.2	1.32	1.62	3.7	4.4
Italy	0.9	1.19	1.23	3.6	3.8
Japan	1.4	1.59	1.60	6.5	8.4
United Kingdom	0.6	0.85	1.01	1.9	1.5
United States	3.5	1.25	1.61	2.7	10.8
West Germany	2.3	1.30	1.08	2.9	7.0

1/ Cline estimates apparent income elasticities. These are not pure income elastities, but the outcome of shifts in both supply and demand for exported manufactures from developing to industrial countries.

Second, the demand for developing country manufactured exports also varies across products, as can be shown by the import demand elasticities by product in industrial counties. These elasticities are higher for products such as engineering equipment, sophisticated machinery and luxury type products, than they are for products such as clothing, processed food and other consumer goods (Table 3). Thus, elasticities and consequently real growth in exports have been high for relatively capital-intensive products, and low for relatively labor-intensive products. 1/ Consequently, a developing country that has ties to a market with high domestic growth and that produces products with a high-income demand elasticity would appear to be in an especially advantageous position. As a developing economy becomes more capital-intensive, the income elasticities of demand for its products rises. The reason is that the income elasticity of demand for primary products and semi-manufactured products are generally smaller than the income elasticity of demand for manufactures, which are more capital-intensive. Indeed Hamilton and Kreinin (1980) found evidence for this. They discovered that over a period when developing countries became more capital-intensive, the income elasticity of demand for imports of manufactures from developing countries rose—from 1.26 in 1962-70 to 1.38 in 1970-76.

The huge rates of growth in demand for manufactured exports from Asian countries came about because of the increasing capital-intensiveness of Asian industry, and the increasing diversification of the goods produced. Thus Asian countries experienced a rise in the income elasticity of demand for its products. They also continued to serve relatively high growth markets. By contrast, African and Western Hemisphere countries achieved much slower rates of growth because many of their exports remain labor-intensive and the markets for these products are expanding more slowly.

Over the past two decades developing countries have become increasingly aware of the role of protectionism in limiting the growth of manufactures from developing countries to industrial countries. 2/ While the constraining influence of trade barriers often depends upon the type of product exported, barriers themselves also create new opportunities for developing countries. For example, Korea, when faced with limitation

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1/ Balassa (1980) supports the view that the largest growth in demand for exported manufactures takes place in capital-intensive products. He calculates that the largest increases are observed in specialized machinery and road motor vehicles, where the ratio of 1978 to 1973 exports of non-oil developing countries is well over 4. A similar ratio for machinery, transport and household appliances reached well over 3. The smallest increases are observed in the textile and clothing industries (1.8); these industries have long been subject to restrictions in industrial countries, and also are increasingly subject to limitations imposed by the Multifiber Agreement.

2/ See Cline (1984) for an in-depth discussion of protection in the industrial countries and the prominent sectors associated with protectionist pressures, and Corden (1987) for a review of the analytical issues related to protectionism.

Table 3. Import Demand Elasticities in the United States
and West Germany for Selected Commodities

United States (Kreinin)			West Germany (non-EEC imports) (Glismann)		
Commodity	Price Elasticity	Income Elasticity	Commodity	Price Elasticity	Income Elasticity
Cotton products	-1.17	1.37	Clothing	-0.75*	3.50
Man-made fibre textile products	-0.99	6.86	Textiles	-0.44*	1.49
Leather	-0.74	1.69*	Leather goods	-1.55	1.04
Footwear	-0.79*	3.98	Shoes	-1.71	3.31
Plywood	-0.51*	2.39	Plastic goods	-1.19	5.01
Electronics machinery and equipment	-0.92	3.39	Music, sporting goods and toys	1.04*	5.36
House electronic equipment	-0.71*	7.74	Electronics	-0.85	3.48
Photographic equipment	-1.08	2.86			

Source: Donges, J.B. and J. Riedel.

* Indicates the elasticity is not significantly different from zero at the 10 percent level of significance.

in export volume growth under the Multifiber Agreement, switched from low-priced textiles and clothing to higher-valued items for which barriers were not imposed. There is evidence to suggest that trade barriers imposed by industrial countries tend to be of similar magnitudes for the same products, and that the degree of protection tends to be smaller in those cases where a high level of exports of a product is offset by a high level of imports of the same product—i.e., for products in which industrial countries have a comparative advantage. Protection tends to affect more adversely products for which the industrial countries have little current comparative advantage—products that use unskilled labor intensively. These are often industries that have experienced displacement of jobs in industrial countries caused by the expansion of manufactured exports from developing countries (Blackhurst et al. (1978), Cable (1977), Hamilton (1980), Krueger (1980)). Thus, countries that produce more diversified manufactured exports and use more capital-intensive technologies are less subject to the constraining influence of trade barriers.

b. Supply

In all five developing country regions examined, the share of manufactured goods in total export supply has increased considerably over the past couple of decades (Table 4). The increase has been the greatest in Asian countries, where the share of manufactures in total exports almost doubled from 1965 to 1980 without any reduction in the volume of primary commodity exports. With large surpluses from the agricultural sector available for investment, Asian countries were able to expand their manufacturing sectors quickly. The share of manufacturing in exports also increased sharply for African countries, although this was almost totally offset by a reduction in primary commodity exports. In Africa, 1/ Asia, Europe, and the Middle East manufactures accounted for well over half of total exports in 1980; only for the Western Hemisphere countries did manufactures account for less than half of total exports.

The supply of manufactured exports of a developing country is affected by many variables, including relative prices and exchange rates, transportation costs, macroeconomic policies and developments, marketing strategies, availability of raw materials or spare parts, quality of products, and export incentive schemes. Except for natural resource endowments, most of the variables presented above are affected by domestic policies and three of the available policy choices are discussed below.

First, exchange rate policies have to create an environment favorable to the production of goods for export. In many developing countries the maintenance of an overvalued exchange rate has led to a real appreciation of the domestic currency, because the relatively high rates of domestic

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1/ In many African countries much of the increase in manufactured exports reflects the replacement of raw material exports by processed raw material exports.

Table 4. Exports of Commodity Group from Developing Country Regions,
Industrial Countries, and OPEC to the World, 1965 and 1980

(In percent of exports of all commodities)

	Food		Beverages and Tobacco		Agricultural Raw Materials		Minerals		Energy		All Commodities		All Commodities		Manufactures	
	1965	1980	1965	1980	1965	1980	1965	1980	1965	1980	1965	1980	1965	1980	1965	1980
Africa	30.2	22.2	19.5	11.8	23.4	10.7	26.4	24.5	0.5	30.8	100.0	100.0	62.4	42.0	37.6	58.0
Asia	34.3	32.4	12.4	5.4	37.5	25.9	14.4	13.8	1.4	22.5	100.0	100.0	62.6	35.3	37.4	64.7
Europe	45.2	52.6	18.4	8.2	24.6	24.3	11.6	14.9	0.2	0.0	100.0	100.0	32.4	20.3	67.6	79.7
Middle East (non-oil)	36.5	17.0	0.4	0.0	55.8	17.0	3.4	7.9	3.9	58.1	100.0	100.0	53.7	31.7	46.3	68.3
Western Hemisphere	39.1	40.4	23.7	23.9	15.0	8.3	19.9	20.5	2.3	6.9	100.0	100.0	77.1	62.0	22.9	38.0
Total developing countries	36.2	34.0	18.1	13.0	25.7	16.5	18.4	17.9	1.6	18.6	100.0	100.0	62.3	40.3	37.7	59.7
Industrial countries	50.2	46.5	2.1	1.5	24.1	15.6	18.4	17.6	5.2	18.8	100.0	100.0	22.4	18.5	77.6	81.5
OPEC 1/	6.3	0.5	2.0	0.5	2.1	1.6	2.8	0.8	86.8	96.6	100.0	100.0	78.7	91.2	21.3	8.8
Average world	38.5	26.8	7.3	3.2	21.0	10.5	15.8	11.4	17.4	48.1	100.0	100.0	33.2	30.8	66.8	69.2

Source: World Bank Trade Data.

1/ Algeria, Indonesia, Nigeria, and Venezuela are included in the oil exporting group.

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inflation have not been fully offset by a fall in nominal exchange rates.
Into this category fall many of the African countries, where production
of primary commodities for export fell sharply and manufactured exports
were uncompetitive on world markets. More successful countries carried
out substantial devaluations, eliminated multiple exchange rates, and
thereby ensured competitiveness for their manufactured exports.

Second, government policy must create effective relative prices
favorable to exports. Asian countries, in particular South Korea,
provided an extensive system of policy incentives in favor of exporters
of manufactures. However, the need to promote manufactured exports was
much stronger in the Asian than in other countries, because they suffered
from strong population pressure, which, together with limited land supply,
offered much smaller potential for expanding primary exports. Western
Hemisphere countries, particularly Chile and Argentina, also provided
incentives to exporters, but these were much weaker and generally their
incentive systems remained heavily biased against exports. 1/ Most
African countries provided little incentives to exporters, as overvalued
exchange rates and import substitution policies tended to put exporters
at a severe disadvantage.

Third, there is a need for monetary and fiscal policies that create
a stable financial environment, which, in turn, improves the environment
for exports. In many Asian countries, in particular Korea and Hong Kong,
monetary and fiscal policy stabilized prices and created a low inflationary
environment; the stable financial environment that followed reduced uncer-
tainty, stimulated investment and encouraged technological improvements
in these countries. The increased growth in export earnings that resulted
allowed these countries to purchase the raw materials and spare parts
necessary to continue with further capital build-up and technological
improvement in the export sector. By contrast many Western Hemisphere
countries pursued inflationary fiscal and monetary policies, which
created an unstable financial environment where the gains derived from
technological improvements and cost control were overshadowed by large
changes in both absolute and relative prices. 2/

1/ See Lin (1986, 1987) for an in-depth discussion of policies adopted
in Asian and Western Hemisphere countries.
2/ Lin (1986, 1987).

III. Econometric Testing of Price and Volume Equations for Manufactured Exports of Developing Countries

In the empirical equations developed in this section, the five developing country regions distinguished are Africa, Asia, Europe, Middle East, and Western Hemisphere. These regions are defined in Appendix I. They were selected because of the availability of the data and because of similarities that exist among the countries within each regional group, such as closeness to industrial country markets and transportation costs.

1. Empirical modeling of the demand equations

The demand function for exports of manufactures is based on the equations used by Goldstein and Khan (1978). Exports from developing countries and domestic goods in importing countries are assumed to be imperfect substitutes. Thus the resulting export demand function represents the quantity demanded as a function of the level of real income in the importing region and of relative prices. Furthermore, adjustment in export demand to changing market conditions is assumed to occur within a period of one year. [1]

$$(1) \quad \ln XM_R^D = a_0 + a_1 \ln (PXM_R/PMM) + a_2 \ln YM + a_3 t$$

where

$\ln XM_R^D$ = exports of manufactures from the Rth developing country region demanded by importing countries, in real terms and in U.S. dollars,

YM = real income in importing countries, in U.S. dollars

PXM_R = export price of manufactures from region R, in U.S. dollars, 1980 = 100,

PMM = price of manufactures in importing countries in U.S. dollars, 1980 = 100,

t = trend term, reflecting long-run changes in demand for manufactures.

Equation (1) is specified in logarithms. a_1 is the elasticity of demand, in the rest of the world, for region R's exports of manufactures with respect to region R's price of manufactures (relative to the price

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[1] Goldstein and Khan (1984) have noted that estimates of export equations using Koyck-type formulations show that while adjustment is not instantaneous, the lags are fairly short, with most of the effect occurring within four quarters.

of manufactures in the rest of the world) and a_2 is the real income elasticity of such demand. It is expected that a_1 will be negative and a_2 will be positive.

2. Empirical modeling of the supply equations

The supply function for exports of manufactures from region R to the world is specified as a log-linear function of current export prices of manufactures to domestic price levels in producing countries in region R, an index of productive capacity in region R, and supply shocks:

$$(2) \quad \ln XM_R^S = \beta_0 + \beta_1 \ln (PXM_R/P_R E_R) + \beta_2 \ln \overline{Y}_R + \beta_3 \ln SS_R$$

where

$\ln XM_R^S$ = exports of manufactures supplied from region R to importing countries,

$P_R E_R$ = domestic price level in producing countries R, converted into U.S. dollars,

$\overline{Y}_R$ = index of productive capacity in region R,

SS_R = supply shocks in region R.

Equation (2) embodies the idea that exporters increase their supply of exports of manufactures as the price of exports rises relative to domestic prices. 1/ β_1 is a price substitution parameter indicating the price elasticity of exporting versus selling to the domestic market, as well as the parameter indicating the elasticity of domestic factor costs. Exports of manufactures are also expected to increase as productive capacity in manufactured goods in region R increases. However, if productive capacity rises along with an exogenous rise in domestic consumer demand for exportables and nontradable goods, a negative relationship between productive capacity and exports of manufactures could exist. It is therefore expected that the sign of β_1 will be positive; β_2 will be positive or negative, depending upon the degree of export bias associated with industrial expansion in a given region. Normalizing the equation for price of manufactured exports in region R yields the following equation:

1/ As Goldstein and Khan (1984) note, the regional domestic price index, P_R, serves a dual role in the supply equation. First, it serves as a proxy for domestic costs, lowering the profitability of producing exports when factor costs in export industries rise. Second, it serves as a proxy for prices--when domestic prices increase, the relative profitability of selling exports falls.

$$(3) \quad \ln PXM_R = b_0 + b_1 \ln XM_R^S + b_2 \ln P_R E_R + b_3 \ln \overline{Y}_R + b_4 \ln SS_R$$

The normalized coefficients are related to the structural parameters in the following way:

$$b_0 = -\beta_0/\beta_1$$

$$b_1 = 1/\beta_1$$

$$b_2 = -\beta_1/\beta_1$$

$$b_3 = -\beta_2/\beta_1$$

$$b_4 = -\beta_3/\beta_1.$$

Since β_1 is positive it is expected that $b_1 > 0$ and $b_2 < 0$. Equations (1) and (3) can be estimated simultaneously in order to obtain the estimates of the structural parameters.

3. Estimation of the demand and supply equations

Equations (1) and (3) were estimated using annual data for the five developing country regions for exports of manufactures. Nonlinear least squares estimation procedures were used to obtain the estimates using the MINDIS routine. The classification of countries into five regions has been discussed earlier, and is presented in Appendix I. Data from Fund member countries were used for world imports. 1/ Definitions of the data used in the estimation and the sources of these data are given in Appendix II. The estimates of the export flows of manufactures from the five exporting regions to the world, using equations (1) and (3), are presented in Table 5. 2/

a. Demand equations

Although the results reported in Table 5 are on the whole consistent with the relationship hypothesized in equation (1), several reasons why the estimated equations are subject to methodological qualifications can be suggested. First, the quality of the data could be improved. Second, the data—particularly the price data—are not necessarily comparable across countries and across regions. Third, because of the difficulty in modelling the trade policies of developed and developing countries, trade barriers are not included in these equations. Fourth, the long-run changes that have taken place in the demand for imported manufactures can only be imperfectly captured by a trend term.

1/ IMF data excludes nonmember centrally planned economies.
2/ The estimated coefficients and their respective t statistics (in parentheses), together with the coefficient of determination, R^2, and the standard error of the estimate, SEE, are also presented in Table 5.

Table 5. Exports of Manufactures from Five Developing
Country Regions to the World, 1965 to 1982

Africa	1.	$\ln XM = -6.95 + 0.26 \ln (PXM/PMW) + 0.99 \ln YW + 0.09t_1 - 0.06t_2$ (7.50) (3.62) (2.98) (6.10) (18.03) $R2 = .978;$ SEE = 0.08
	2.	$\ln PXM = 0.45 - 0.17 \ln XM + 0.88 \ln P_R E_R + 0.28DOIL2$ (3.14) (3.90) (28.30) (4.45) $R2 = .983;$ SEE = 0.08
Asia	1.	$\ln XM = -2.62 + 0.04 \ln (PXM/PMW) + 0.14 \ln YW + 0.10t_1 + 0.10t_2$ (14.48) (1.93) (5.82) (21.28) (21.01) $R2 = .988;$ SEE = 0.08
	2.	$\ln PXM = 82.48 \quad 9.08 \ln XM + 0.41 \ln P_R E_R - 17.21 \ln\overline{Y}$ (2.79) (2.89) (2.48) (2.64) $R2 = .996;$ SEE = 0.04
Europe	1.	$\ln XM = -9.23 - 0.25 \ln (PXM/PMW) + 2.32 \ln YW + 0.02t$ (5.25) (1.87) (3.95) (1.70) $R2 = .918;$ SEE = 0.14
	2.	$\ln PXM = -10.58 \quad -1.20 \ln XM + 0.24 \ln P_R E_R + 2.94 \ln\overline{Y}$ (2.46) (1.78) (1.54) (3.72) $R2 = .974;$ SEE = 0.09
Middle East	1.	$\ln XM = -13.54 - 0.13 \ln (PXM/PMW) + 3.33 \ln YW - 0.04t$ (3.04) (1.09) (2.95) (0.84) $R2 = .875;$ SEE = 0.16
	2.	$\ln PXM = 1.66 + 0.53 \ln XM + 1.62 \ln P_R E_R - 0.98 \ln\overline{Y}$ (0.61) (1.25) (5.19) (1.19) $R2 = .982;$ SEE = 0.10
Western Hemisphere	1.	$\ln XM = -15.33 - 0.61 \ln (PXM/PMW) + 4.54 \ln YW - 0.07t - 0.53 DOIL1$ (4.94) (1.85) (3.46) (2.66) (4.32) $R2 = .957;$ SEE = 0.12
	2.	$\ln PXM = 1.55 + 0.34 \ln XM + 0.66 \ln P_R E_R - 0.12 \ln\overline{Y}$ (4.34) (4.00) (8.41) (1.98) $R2 = .975;$ SEE = 0.09

In this paper the demand for exports are treated as a positive function of the level of real income in the importing countries. However, because of the poor quality of income data for some individual countries, a broader aggregate of world income (YW) prepared for the World Economic Outlook was used as a proxy for real income in the importing countries (YM). Although the estimated income elasticities shown in Table 5 have the expected positive signs and are significantly different from zero at the 5 percent level of significance, the size of the parameter estimates are surprisingly low for Africa (0.99) and the Middle East (0.33). These results are surprising when compared with income elasticities of demand for manufactures obtained from other studies and shown in Tables 2, 3 and 6. 1/ The results for Asia (0.14) and Europe (2.32) are comparable with the results reported in these tables for the major industrial countries. However, the estimated income elasticity for the Western Hemisphere countries (4.54) seems to be rather high, reflecting the fact that Brazil and Mexico, the largest countries in the group, have experienced major increases in their share of nontraditional exports. To some extent, an exporting country can influence the elasticity of demand facing its exports by pursuing policies that tend to gear production to relatively high-elasticity products and markets. To some extent, the influence of such policies may explain the relatively high elasticities facing exports from Asia and Europe. The low elasticity for Africa and the Middle East could also be explained by the large share of traditional goods in their exports; the estimates may also be picking up the effects of the Multi-Fiber Agreement, which tightened up on imports of textiles and apparel, and of the introduction of trade barriers in the footwear industry after 1977; or the elasticity estimates may be low because the real world income variable does not accurately reflect growth in the markets of these two regions. Furthermore, the European Community's generalized system of preferences, which gives certain African countries a competitive advantage in traditional manufactures, could produce an estimated income elasticity for imports of manufactures from Africa that is much smaller than if the preferences did not exist.

Trade barriers, one of the major deterrents to developing country trade in manufactures, are not modelled here. However, there is no doubt that the effect of tariff barriers could be reflected in the income elasticity of demand for all regions. The estimation period used in this study—1965 to 1982—includes a sub-period over which protectionism increased. Indeed, Hughes and Newberry (1986) point out that the second phase of the Multi-Fiber Agreement (MFA), which came into effect in 1977, drastically reduced the allowable rate of imports into industrial countries to between 4 and 6 percent per annum in volume terms. Subsequent renewals have tightened the restrictions yet further, so that the scope for new exports, especially with respect to low quality textiles or clothing, is

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1/ Table 2 presents estimates of the income elasticity of imports of manufactures by industrial countries from developing countries, and Table 6 presents estimates of the income elasticity of total industrial country imports of manufactures.

extremely limited. This helps to explain the low income elasticity estimates for Africa and the Middle East, whose exports are less sophisticated and therefore more likely to be subject to protectionism. Indeed, Hughes and Newberry state that to some degree the sophisticated exporters have been able to sidestep the quotas by increasing their value-added per quota unit. 1/

In the estimation, the price of manufactures in importing countries (PMM) was proxied by the world price of manufactures (PMW). Although the world price of manufactures does include the manufacturing price of the region that makes up the dependent variable, the weight of developing country regions in the manufacturing price index is quite small. The estimated price elasticities in the export demand equation (1) carry the expected negative sign for only three of the five regions--Europe, Middle East and Western Hemisphere--and only two of these are significantly different from zero at the 10 percent level of significance, Europe (-0.25) and Western Hemisphere (-0.61). The results here are also somewhat lower than those from other industrial country studies (Table 6). The positive demand price elasticity for Asia, though small, is somewhat surprising, suggesting an upward sloping demand durve for exported manufactures from Asian countries. Asian countries are fairly sophisticated in their marketing strategies, often initially producing new export products at subsidized prices. As excess demand for these products increases, the price often increases simultaneously, because the good cannot continue to be produced at the subsidized price. In a comparative static model of demand and supply that does not include subsidies to exports, an apparent upward sloping demand curve could well be measured. Furthermore, the composition of exported manufactures is changing very rapidly in Asian countries; for example, Korea has recently moved into exporting cars. The estimated coefficient on the price index may be picking up this increased quality of exports, because of the measurement problem in the price index.

The time trend was included in all the equations and for Africa and Asia was split into two periods (1965 to 1971, and 1972 to 1982)--t_1 and t_2, respectively--to represent the important structural changes in demand that took place over the estimation period. The coefficients are positive for Asia and Europe; negative for the Middle East and Western Hemisphere; and positive and negative for Africa for t_1 and t_2, respectively. A negative coefficient could in part reflect the effects of the growth of trade restrictions, which were increasing over the last decade of the period of observation; some of the Asian countries have managed to avoid the effects of these restrictions through flexibility in choice of products and markets.

1/ This has taken place in many Asian countries where quotas are treated as "tradable" among domestic manufactures, thus leading to a secondary market in quotas.

Table 6. Long-Run Price and Income Elasticities for Exports of
Manufactures from the World to Industrial Countries

Importing Country	Deppler- Ripley 1/ (1978)	Taplin (1973) 2/	Basevi (1973) 3/	Clark (1977)	Houthakker & Magee (1968)	Barker (1976)
Income elasticities						
United States	1.27	2.50	1.67	2.60	1.11	
United Kingdom	1.32	2.61	1.78			1.99
Industrial countries	1.54	1.44	1.46			
Price Elasticities						
United States	-1.92	-3.02	-0.62	-4.72	-1.8 to -4.0	
United Kingdom	-0.43	-0.66	—			-1.37
Industrial Countries	-0.97	-1.23	-0.71			

Source: Goldstein, M. and M.S. Khan

1/ Unweighted average, 14 industrial countries.
2/ Unweighted average, 25 industrial countries.
3/ Unweighted average, 10 industrial countries.

The dummy variable DOIL1 was included in the equation to measure the demand effects of the changes in oil prices that took place in the 1970s. The estimated equation indicates that this factor led to a fall in demand for manufactures from Western Hemisphere countries, probably because countries such as the United States, faced with higher production costs, cut back on demand. DOIL1 was insiginificant in the other equations.

b. Supply equations

Estimate of price elasticities of supply (β_1) can be derived from

the estimated version of equation (3) by calculating $(b_1)^{-1}$; these computed

elasticities are presented in Table 7. In terms of the estimates of β_1 for geographical regions, the equations for Asia and Western Hemisphere perform the best; these results reflect policies in these countries that allow relative prices to reflect export prices, so as to encourage exports. The coefficient for the Asian countries is very small, however; it would probably be considerably higher if incentives paid to exporters of manufactures could have been included in the price variable. The size of the estimates for the Middle East and Western Hemisphere are consistent with supply-price elasticities for exports measured for the industrial countries. For example, Dunlevy (1979) measured a supply-price elasticity for exports of manufactures to the United States of 2.1. The policy of subsidizing the industrial sector in many African countries in the late 1960s and 1970s may provide some explanation for the implausibly large and significantly negative supply price coefficient estimated for these countries. Although the price received for African manufactures relative to domestic prices fell over the estimation period, the inclusion of a subsidy may have allowed the price of manufactures in domestic terms to rise relative to domestic prices, thus encouraging an increase in production of manufactures for export despite the relative movement of world and domestic prices.

Table 7. Estimated Export Price Elasticities of Supply, β_1, for Manufactures by Region

	Africa	Asia	Europe	Middle East	Western Hemisphere
Manufactured exports	−5.88**	0.11**	−0.83*	1.87*	2.94*

* Significant at the 90 percent level of significance.
** Significant at the 95 percent level of significance.

The capacity variable (Y_R) was included in the equations to estimate the effects of domestic capacity on exports of manufactures. This variable was selected in order to assess whether exports of manufactures from developing country regions are constrained by domestic supply. There are various difficulties in interpreting the productive capacity variable, because it violates the assumption of independence between explanatory variables and its inclusion makes it more difficult to interpret the values or significance of the regression coefficients accurately. This problem was particularly severe for the equation for Africa, and the capacity variable was therefore dropped from this equation. In three of the remaining four equations (Asia, Middle East, and Western Hemisphere) the estimate of b_3 is negative, which means that as domestic capacity increases, the supply of exports of manufactures falls. The capacity variable is calculated using domestic production and could be picking up the preferences of entrepreneurs for domestic, as opposed to foreign markets. However, many Asian countries are export-oriented economies where entrepreneurs target foreign markets. In this case, the assumption of independence in the equations may have been violated, and the parameter estimate may consequently be biased.

The dummy variable DOIL2, included to measure supply shocks from changes in oil prices, was insignificant in four of the equations and therefore dropped from the equation. However, the results indicate a positive impact of oil prices on the supply of exports of manufactures from the African countries, perhaps reflecting policies that subsidized the manufacturing sector and therefore placed a wedge between effective costs and real costs of production.

IV. Summary of Results

As indicated earlier, when examining export earnings of developing countries, three recurring questions are (i) the extent to which price and income elasticities of demand differ between manufactured exports and commodity exports, (ii) the extent to which supply price elasticities for manufactured exports differ across regions, and (iii) the question of whether exports of manufactures from developing countries are constrained by domestic supply or by world demand. Answers to these questions would help policymakers in formulating their trade policies. This section considers how the quantitative findings of both this and other studies bear upon these issues.

1. Estimates of price and income elasticities of demand

In comparing the price and income elasticities of demand that have emerged from this and other studies, four broad conclusions stand out. First, for all the regions added together, the income elasticities of demand for exports of manufactures are larger than the income elasticities for exports of food, beverages and tobacco, and agricultural raw materials, though not larger than those for minerals and energy (Table 8). The size of the income elasticities are also comparable with those for the industrial countries presented in Table 6.

Table 8. Estimated Elasticities of Demand, by Commodity and Region

	Food	Beverages & Tobacco	Agricultural Raw Materials	Minerals	Energy	Manu-factures
Income elasticities						
Africa	1.01**	1.34**	0.54	3.85**	5.10**	0.99**
Asia	1.14**	—	0.46**	1.19**	3.56**	1.35**
Europe	1.12**	—	1.15**	2.91**	—	2.32**
Middle East	1.54**	0.51**	—	0.26	2.52**	0.33**
Western Hemisphere	1.32**	0.68	—	1.74**	0.81**	4.54**
Total	1.20	0.68	0.56	2.16	3.53	2.03
Price elasticities						
Africa	-0.32**	-0.31**	-3.28**	-0.85	-0.06	—
Asia	-0.33**	—	-0.34**	-0.40**	-0.36**	—
Europe	-0.14*	-0.26**	-0.21*	-0.48*	—	-0.25*
Middle East	-0.46**	—	-0.09**	—	-0.28	-0.13
Western Hemisphere	-0.11*	-0.33**	-0.14**	-0.38*	—	-0.61*
Total	-0.22	-0.33	-0.62	-0.51	-0.21	-0.37

Second, the income elasticities of demand for exports of manufactures are not consistently larger than the income elasticities for primary products for each individual region. In particular, this is true for Africa and the Middle East. Countries in these regions often move into exporting manufactures, such as processed foodstuffs; these products may not have an income elasticity of demand higher than their unprocessed counterparts. Therefore, from the point of view of increasing export earnings as foreign markets grow, exporting certain kinds of manufactured products may be no better than exporting raw agricultural products. Indeed, since the imported content of some of these manufactures is higher than the imported content of the raw export, it may be preferable to continue to export a raw material and diversify into manufactures other than that raw material in processed form. The evidence presented here suggests that Asia, Europe, and Western Hemisphere all face higher income elasticities of demand for their manufactured exports than for their agricultural raw material exports. The main difference in the income elasticities across regions is that the latter three regions just mentioned export manufactures more sophisticated in nature than those exported by Africa and the Middle East.

Third, the price elasticities of demand for manufactures do not seem to differ significantly from those for other commodities. Indeed, the price elasticities of demand for exports hardly ever exceed unity for any of the export groups (Table 8). The price elasticities for manufactures for developing countries also seem to be much lower than those for the industrial countries presented in Table 6 and for the selected manufactures presented in Table 3. There are at least two reasons why the estimates in this study may differ from other estimates. First, estimates for groups of manufactures will always be lower than those for individual items, because the substitution possibilities are lower. Second, the estimates in this study may not reflect the full adjustment of quantity to prices. Goldstein and Khan (1984) suggest that 50 percent of the final relative price adjustment takes place within a one-year period, which is the length of adjustment in the estimates presented in this study. Nevertheless, when a two-year lag on the relative price variable was included in the equations estimated in this study, the estimated coefficient was not significantly different from zero and the variable was therefore dropped from the equations.

Fourth, although the type of manufacture exported plays a big role in the size of the income and price elasticities, differences in composition of manufactured exports may not be the only reason for observed differences between regions and between industrial and developing countries. One explanation highlighted in a study by Goldsbrough (1981) is that price elasticities of demand are much smaller for intra-firm trade (trade among affiliates of the same firm) than for conventional trade (Goldstein and Khan (1984)). The share on intra-firm trade in developing country exports may be greater than that of individual countries as well as differing between regions.

2. Estimates of price elasticities of supply

As mentioned in Goldstein and Khan (1978) there is very little evidence in the form of estimates of price elasticity of supply of exports; in fact, the only comprehensive study of exports of manufactures is that of Dunlevy (1979), who finds a supply-price elasticity of 2.1 for exports of manufactures for the United States; as mentioned earlier, the present estimates for the Middle East and Western Hemisphere are consistent with Dunlevy's study.

One interesting conclusion to arise from the results in this study is that the price elasticities of supply for manufactures are considerably larger than price elasticities of supply for other commodities (Table 9). The exception to this is Asia; as mentioned earlier, the elasticity is low for Asia, perhaps because export incentives given to domestic exporters are not included in the price variable and because non-price variables may also be important in explaining the growth of manufactured exports from this region. Because any supporting evidence on supply elasticities is so meager, the policy implications that can be drawn from this evidence are correspondingly limited. The observation that export supply elasticities for manufactures are higher than for other commodities does, however, suggest that subsidies to manufactures for exports will yield greater response than subsidies to other export commodities. Furthermore, the evidence that export elasticities differ significantly across countries also suggests that export subsidies or other incentives to exporting will not yield the same export supply response across countries.

Table 9. Estimated Export Price Elasticities of Supply (β_1)
by Commodity and Region

	Food	Beverages & Tobacco	Agricultural Raw Materials	Minerals	Manu-factures
Africa	--		0.70**		
Asia	1.21**	0.23**	0.17*	0.24*	0.11**
Europe	0.19**	1.23**			
Middle East			0.27**		1.87*
Western Hemisphere		0.54**			2.94**
Total	0.70	0.66	0.43	0.24	1.08*

3. <u>World demand or domestic supply as a constraint</u>

It is difficult to provide strong quantifiable evidence based on econometric techniques as to how protectionist pressures in industrial countries constrain exports of developing countries. However, there is evidence to suggest that manufactures face trade barriers in industrial countries on a higher percentage of export value than do raw material exports. 1/ Nonetheless, it is hard to believe that the existing tariff levels are insurmountable obstacles to developing countries expanding their exports of manufactures. Developing countries need to develop an export strategy, particularly if they have a comparative advantage in producing goods in sectors associated with protectionist pressures and patterns of high market penetration by developing countries. Another consideration in formulating such a strategy is whether processed raw materials face a lower price elasticity of demand than the corresponding unprocessed products.

There is evidence presented in this paper suggesting that domestic factors may cause growth in manufactured exports to fall in some regions. As domestic demand for exportables outpaces domestic production, the growth in supply of exports may well fall as entrepreneurs move to sell their products in domestic markets.

1/ Donges, J.B. and J. Riedel (1976), p. 81 state that food and manufactures encounter barriers on 68 percent of their exports to developed countries compared to 27 percent for raw materials.

Classification of Countries

The classification of countries adopted in this paper is the same as the one adopted by the Fund in <u>International Financial Statistics</u>:

African countries

Algeria	Gambia, The	Rwanda
Angola	Ghana	St. Helena
Benin	Guinea	São Tomé & Principe
Botswana	Guinea-Bissau	Senegal
Burkina Faso	Kenya	Seychelles
Burundi	Lesotho	Sierra Leone
Cameroon	Liberia	Somalia
Cape Verde	Madagascar	Sudan
Central African Republic	Malawi	Swaziland
Chad	Mali	Tanzania
Comoros	Mauritania	Togo
Congo	Mauritius	Tunisia
Côte d'Ivoire	Morocco	Uganda
Djibouti	Mozambique	Zaire
Equatorial Guinea	Niger	Zambia
Ethiopia	Nigeria	Zimbabwe
Gabon	Reunion	

Asian countries

Afghanistan	India	New Caledonia
American Samoa	Indonesia	Pakistan
Bangladesh	Kampuchea, Dem.	Papua New Guinea
Bhutan	Kiribati	Philippines
Brunei	Korea	Singapore
Burma	Lao, P.D. Republic	Sri Lanka
China, People's Republic	Macao	Thailand
Fiji	Malaysia	Tongo
French Polynesia	Maldives	Vanuatu
Guam	Nauru	Viet Nam
Hong Kong	Nepal	Western Samoa

European countries

Cyprus	Hungary	Romania
Faeroe Islands	Malta	Turkey
Gibraltar	Portugal	Yugoslavia
Greece		

Middle Eastern countries

Bahrain	Jordan	Yemen Arab Republic
Egypt	Lebanon	Yemen, P.D. Republic
Israel	Syrian Arab Republic	

Western Hemisphere countries

Antigua & Barbuda	El Salvador	Nicaragua
Argentina	Falkland Islands	Panama
Bahamas	Greenland	Paraguay
Barbados	Grenada	Peru
Belize	Guadeloupe	St. Kitts & Nevis
Bermuda	Guatemala	St. Lucia
Bolivia	Guiana, French	St. Pierre & Miquelon
Brazil	Guyana	St Vincent
Cayman Islands	Haiti	Suriname
Chile	Honduras	Trinidad & Tobago
Colombia	Jamaica	Uruguay
Costa Rica	Martinique	U.S. Virgin Islands
Dominica	Mexico	Venezuela
Dominican Republic	Monserrat	
Ecuador	Netherlands Antilles	

The newly industrialized countries, as defined by IFO Institute for Economic Research, are Argentina, Algeria, Brazil, Colombia, Egypt, Greece, Hong Kong, Israel, the Republic of Korea, Malaysia, Mexico, Nigeria, the Philippines, Portugal, Singapore, Spain, Taiwan-R.O.C., Thailand, Turkey, Venezuela, and Yugoslavia,

1. __Definitions of the Variables in the Model__

   All data are annual.

   $P_R E_R$[1]/ = index of the consumer price index in producing countries in region R, in U.S. dollars, 1980 = 100;

   PXM_R = index of the export price manufactures, from region R, in U.S. dollars, 1980 = 100;

   PMW = index of world price of manufactures, in U.S. dollars, 1980 = 100;

   XM_E = index of the volume of exports of manufactures from region R, in billions of U.S. dollars and in 1980 prices;

   $\overline{Y}_R$ = trend of real output in region in index form;

   YW = index of real world income, in U.S. dollars, 1980 = 100.

2. __Data Sources__

   a. World Bank Trade System

   b. __International Financial Statistics__

   c. Commodities Division and Current Studies Division of the International Monetary Fund.

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[1]/ This series was calculated in the following way:

$$P_R E_R = \sum_j \alpha_j \, P_j \, E_j$$

$$\sum \alpha_j = 1$$

where α_j is the weight of country j's GDP in region R in U.S. dollars.

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