TRADE PATTERNS OF LESS DEVELOPED COUNTRIES, 1978 TO 1986

by

Kimberly Holloman Alexander

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APPROVED:

Robert J. Mackay, Chairman

David I. Meiselman

Alan N. Freiden

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Committee Chairman: Robert J. Mackay
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(ABSTRACT)

The present study examines the trade patterns of Less Developed Countries from 1978 to 1986. Trade data for twenty-five developing countries is examined to test the hypothesis that there are universal factors effecting the development of every country. The hypothesis predicts that as economic development progresses, the proportion of total trade in primary goods will decrease while the proportion of total trade in manufactured goods will increase.

In order to test what is a long run phenomena for countries with relatively short time periods of data available, a pooled cross-sectional model is utilized.

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I. Introduction

The development process in Less Developed Countries (LDCs) is a much studied phenomena. Unfortunately, these studies are constrained by many factors, most notably, the lack of reliable data and the relatively short time period available for analysis. This makes individual country analysis very difficult. An alternative to individual country analysis was proposed first by Simon Kuznets and later by Hollis Chenery. They hypothesized that certain universal factors influence the economic development of all countries, therefore, a cross-section of countries at differing levels of economic development should reveal the same patterns as an individual country over a very long time period.

If the hypothesis is correct, the study of developing countries would be greatly enhanced. This study tests for the existence of patterns of development in the external trading behavior of LDCs, this approach differs from the majority of the literature that concentrates on internal patterns of development. Here, the share of exports and imports of Gross Domestic Product (GDP) as functions of per capita GDP and population are examined. Although the traditionally accepted determinants of trade such as factor endowments and technology are the most powerful in explaining trade patterns, it is often difficult to acquire the necessary data for LDCs. However, it is also useful to consider the effects of income level (per capita GDP) and market size (population) in the determination of trade patterns.

This paper begins with a review of the patterns of development hypothesis, what it is and how it evolved, next a synopsis of the major responses to this hypothesis is presented, then an explication of the work of Taylor et. al., examining trade shares and development patterns followed by a discussion of the model used here, next a review of the empirical results is presented followed by conclusions. Appendices are included which provide a listing of the countries utilized by this study, a detail of the trade data aggregation, and an elaboration of some of the graphical representations of results.

II. The Patterns of Development Hypothesis

The patterns of development hypothesis states that as an economy develops, less resources are devoted to the production of primary goods and at the same time more of the economy's resources are expended on the production of manufactured products. This relationship can be illustrated by examining the time-series of an individual country if a long enough time period is chosen for analysis. For example, consider Figure 1 which shows the hypothetical relationship over time of a measure of economic development (per capita GDP is utilized to measure economic growth) for Country A over a period of 50 years. Country A's per capita GDP grew from around 260$ per capita in year 10 to around $3,660 in year 50.

The share of Country A's economy expended on manufactured goods can also be depicted as in Figure 2. The patterns of development hypothesis would predict the share of manufactured goods to be a positive function over time (this is the "time-series" component of the hypothesis), as the figure shows, the share of manufactured goods increased from around 10% in year 10 to around 50% in year 50. Now, if we superimpose Figure 2 on Figure 1, one can see that the share of manufactured goods for each year is also associated with a certain level of per capita GDP, as shown in Figure 3 where the x-axis is time as well as per capita GDP.

This type of analysis, while interesting, is of limited use considering that few countries have 50 years of consistent data, or how ever long enough time period is necessary for the long-run trends to be evident. A possible solution to this problem was proposed first by Simon Kuznets and later by Hollis Chenery. They proposed that one can take a cross-section of say 50 countries (a cross-section is like a "snapshot" of each country at a certain point in time), each having a level of per capita GDP which corresponds with the level of per capita GDP for each year in Figure 1, and represent them as in Figure 4, after ranking the countries in ascending order of level of per capita GDP (for simplicity, every 10th country is shown).

Similarly, one can plot the share of manufactured goods for each individual country with the x-axis being per capita GDP. The share of manufactured goods for country 1 (C-1) is mapped with the per capita GDP of C-1, the share of manufacture goods for C-10 is mapped with the per capita GDP of C-10, etc.. The patterns of development hypothesis would predict that the same positive relationship as shown in Figures 2 and 3 will be evident, Figure 5 illustrates this. The share of manufactured goods for country 1 with per capita income of $260 is 10%, the share of manufactured goods for country 30 with per capita GDP of $1700 is 30% and the share of manufactured goods for country 50 with the highest per capita GDP of $3660 is 50%. If we had chosen the share of unfinished goods instead of manufactured goods, the same type of analysis would reveal a negative relationship with per capita GDP as predicted by the patterns of development hypothesis. Thus, a cross-section of countries at differing levels of per capita GDP can be used to represent the time-series of an individual country over a very long time period.

The patterns of development hypothesis states that cross-section data can be utilized to represent time-series behavior because of certain universal factors which are responsible for similar patterns or characteristics of economic structure and resource allocation in all countries at certain levels of economic development. Among these factors are:

a) similar changes in consumer demand (Engle functions),

b) the necessity to accumulate physical and human capital to increase per capita output,

c) access of all countries to similar technology, and,

d) access to international trade.

It is recognized, however, that such patterns do not represent a complete picture of any particular county's economic structure, rather, they serve as a general template for analyzing long-run economic structural change. Some factors leading to divergent development patterns are:

a) variation in social objectives and in the choice of policies,

b) variation in natural resource endowments,

c) variation in country size,

d) disparities in access to external capital, and

e) changes in the uniform factors over time.[1]

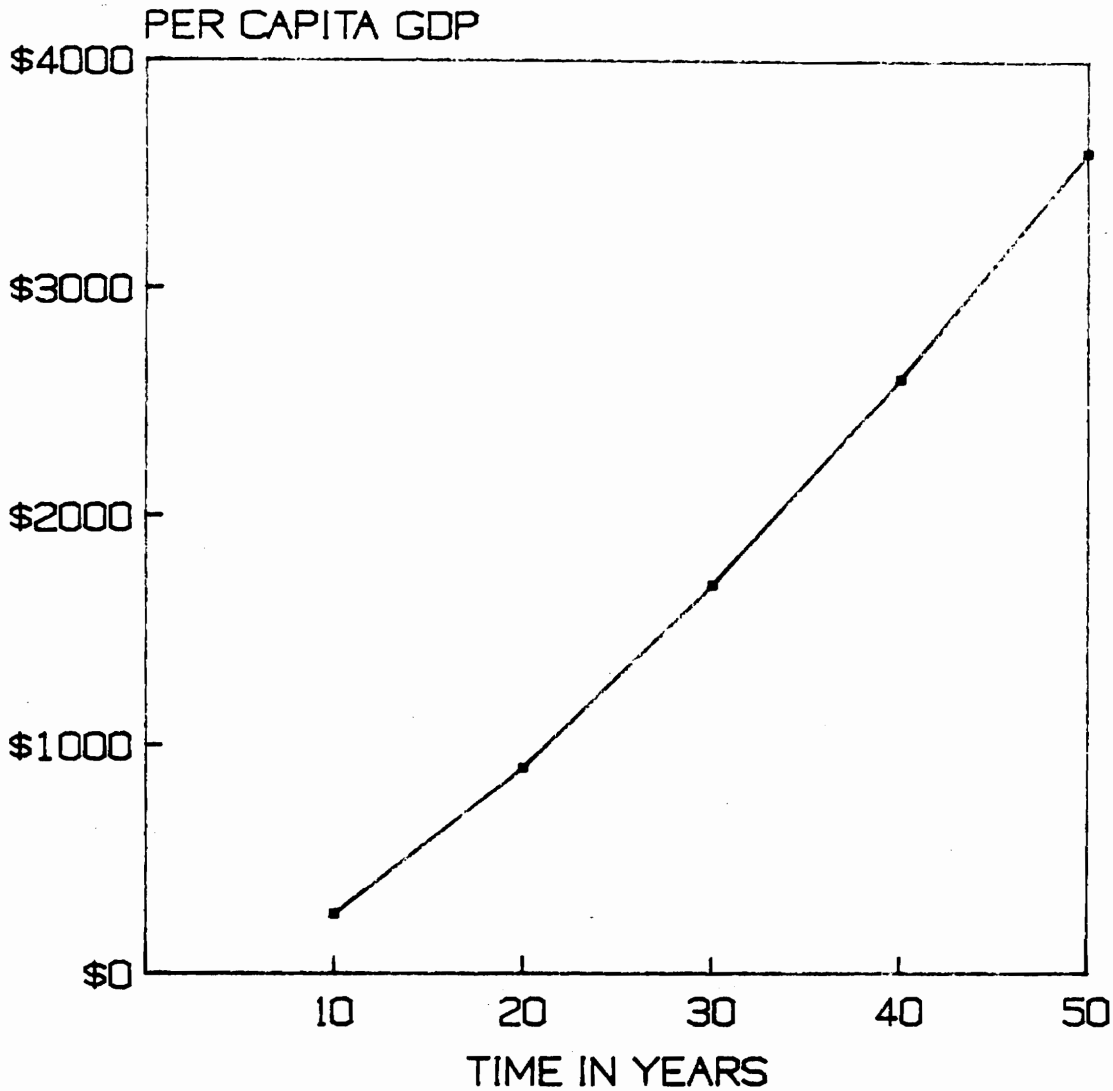

FIGURE 1
COUNTRY A

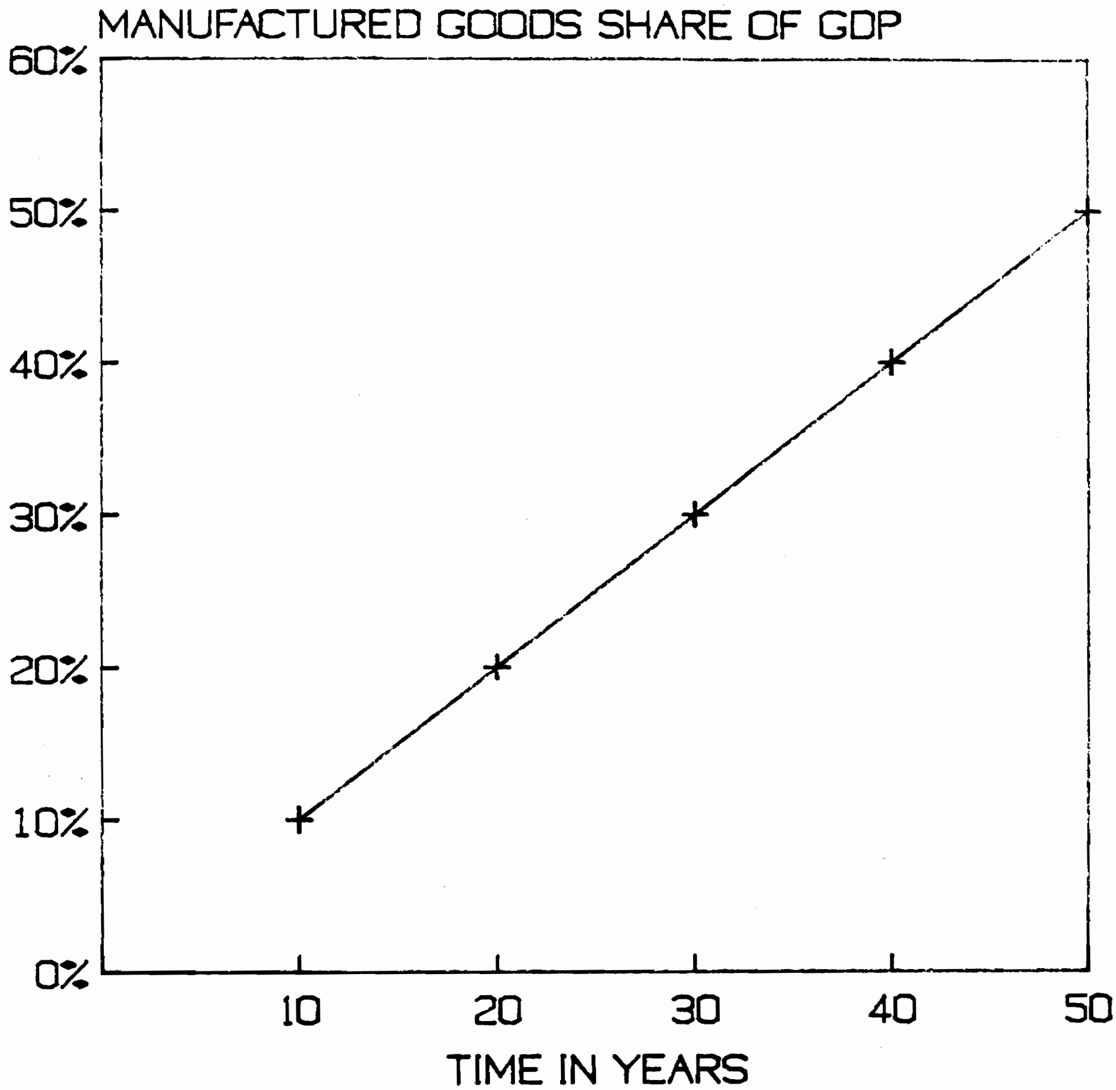

FIGURE 2
COUNTRY A

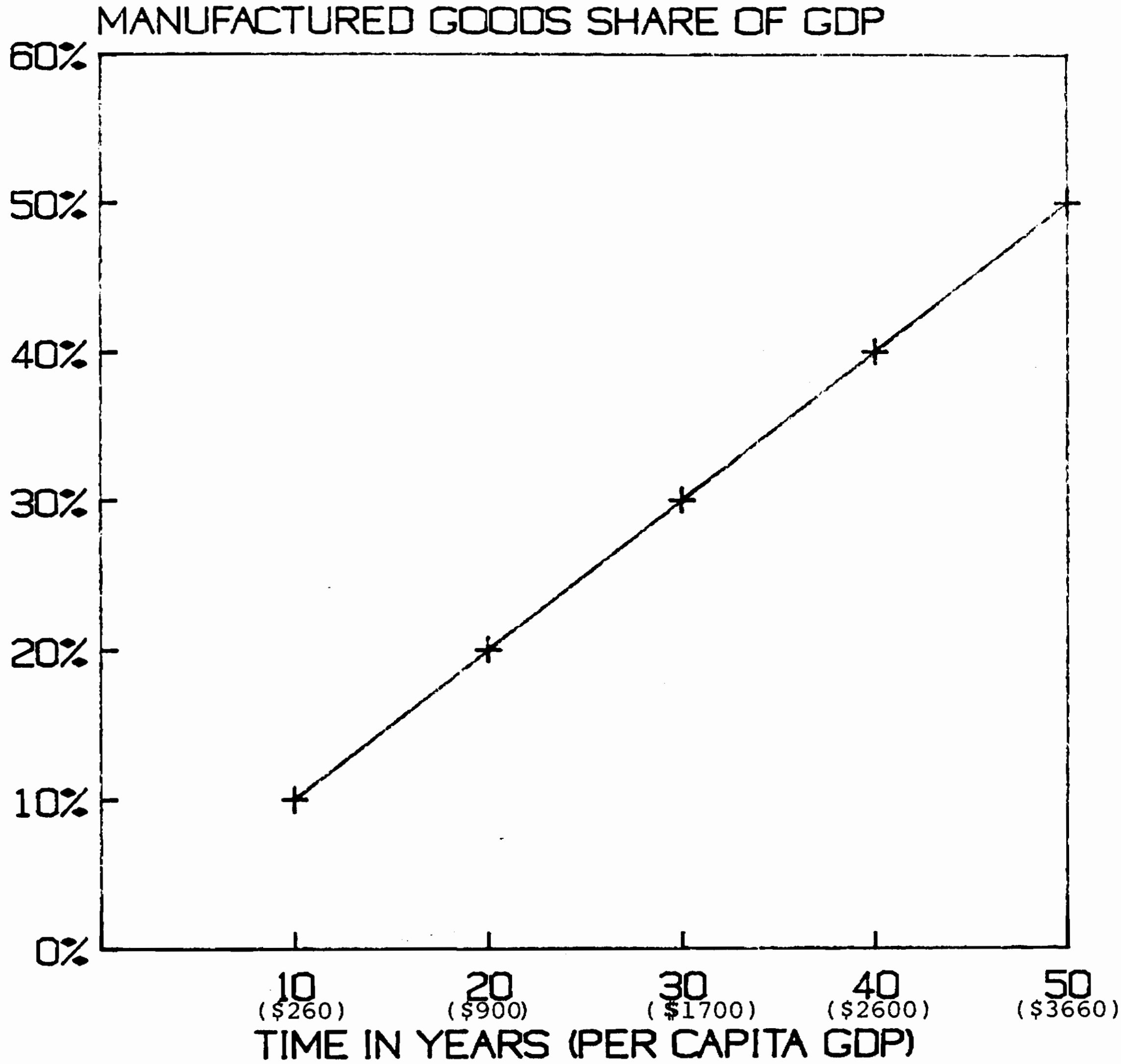

FIGURE 3
COUNTRY A

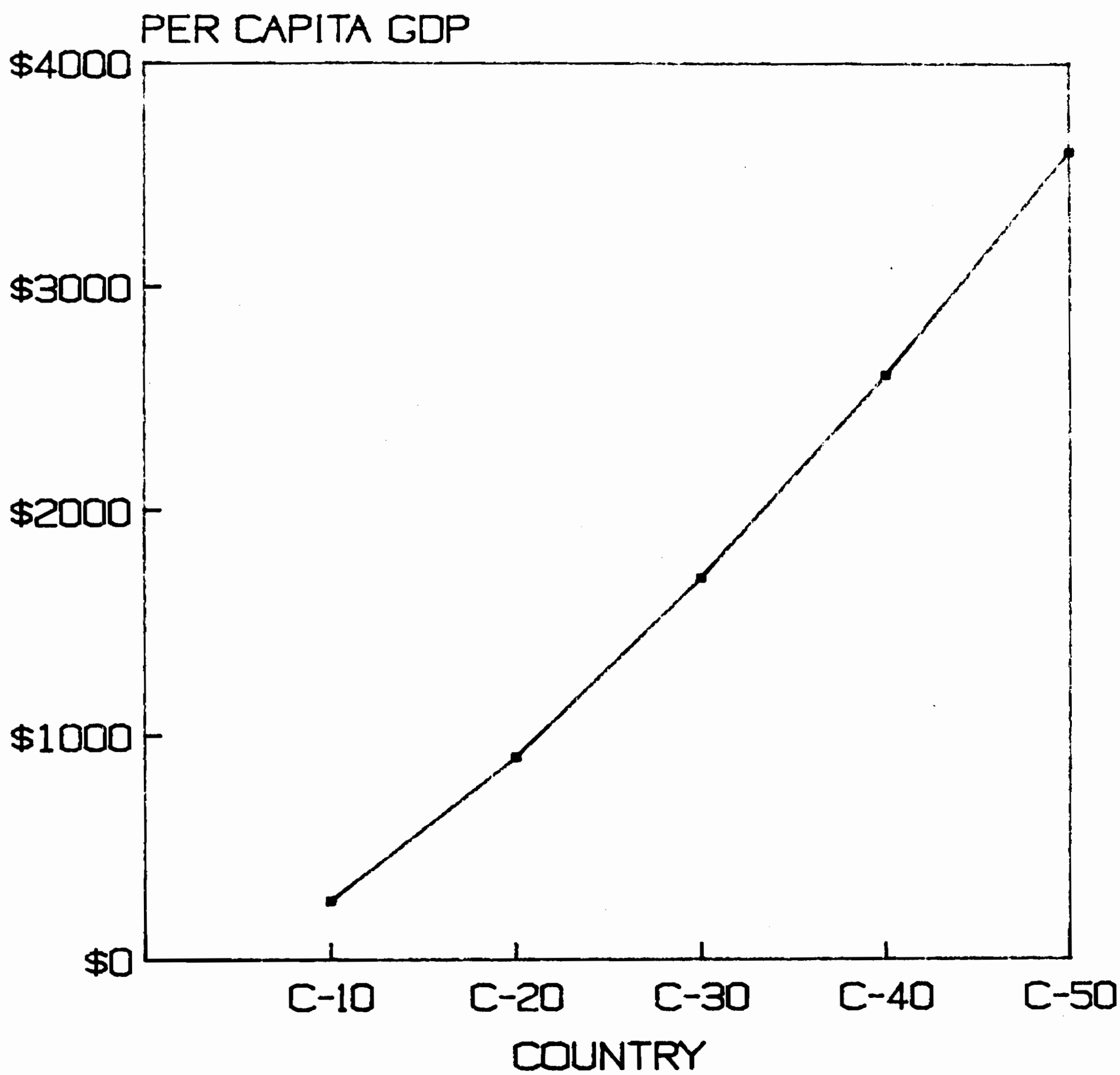

FIGURE 4
CROSS-SECTION

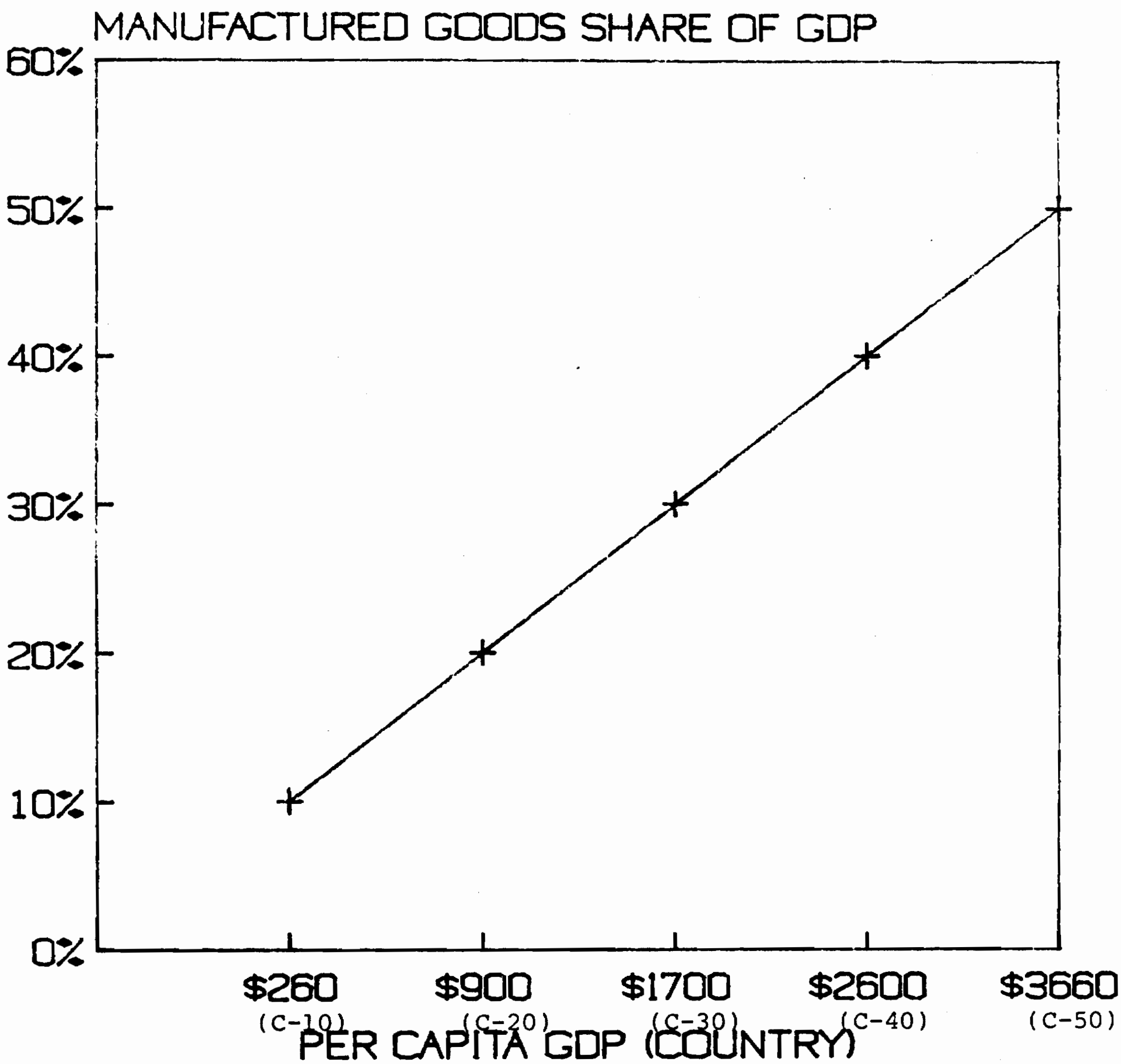

FIGURE 5
CROSS-SECTION

Evolution of the Patterns of Development Hypothesis

The use of cross-sections to represent time-series phenomena was first examined by Simon Kuznets in his seminal work "Quantitative aspects of the Economic Growth of Nations IX. Level and Structure of Foreign Trade: Comparisons for Recent Years." Simon Kuznets analyzes the determinants of total trade share as a proportion of gross national product for a cross-section of 62 countries utilizing 1958 data. Kuznets initially investigates the relationship of foreign trade proportions and per capita GNP and finds no statistically significant relationship. This finding puzzles Kuznets who states:

> One would expect that the higher income countries, at a more advanced state of economic development, with greater diversification within the country and better transportation and communications facilities, would tend to have higher proportions.[2]

Kuznets proposes that the true positive relationship between trade proportion and per capita GNP is hidden by the dominance of another factor - the size of the country. In order to correct for the effect of country size, gross national product is utilized as an explanatory variable. The possible explanations for the effects of country size on trade share (small countries tend to have high trade share proportions of GNP) are:

> the possible concentration of a few natural resources in a small country, with its small area;

> the limits to the division of labor within the country imposed by a limited market that might pervert the economic operation of large-scale industries; and the lower transportation costs for a country with smaller area to and from its boundaries than for larger countries.[3]

Kuznets indeed finds a positive and statistically significant relationship between per capita GNP and foreign trade share when country size is accounted for.

Hollis Chenery and Lance Taylor expand the work of Kuznets by testing whether there are uniform patterns of change in the structure of production as income levels rise (i.e., as income level rises, less of an economy's resources are allocated to the production of primary goods while more of an economy's resources are allocated to the production of manufactured goods). Chenery and Taylor propose that a cross-section of countries at differing levels of income will yield the same relationship as an individual country time-series over a long time period. The data set is a cross-section of 54 countries which includes developed and less developed countries and covers the period 1950-1963 (instead of using cross-sections for a single year, 14 years are utilized with the assumption that 14 "snapshots" purvey more information than one "snapshot"). Two regression equations are utilized:

$$\text{(1)} \quad \ln X_i = a + b_1 \ln Y + b_2 (\ln Y)^2 + b_3 \ln N$$

$$\text{(2)} \quad \ln X_i = \alpha + \beta_1 \ln Y + \beta_2 \ln N$$

where,

i = p,m and,

X_p = primary production share of GNP,

X_m = manufacturing share of GNP,

Y = per capita GNP,

N = population

For double log equations such as these, the coefficients can be interpreted as elasticities, b_1 (β_1) is the income elasticity of production share and b_3 (β_2) the elasticity of production share with respect to population. The results for equation one indicate that the share of manufactured goods increases as income level increases, however, the rate of increase declines as income level increases (b_2 is negative). The elasticity of the share of primary production with respect to the rate of increase of income level and population is negative, however it is not statistically significant with respect to the intercept or the level of income. The results for equation two indicate that the income elasticity of the share of manufactured goods is positive and the income elasticity of the share of primary goods is negative and both are significant. Table 1 summarizes Chenery and Taylor's results.

In order to test the applicability of cross-section data to express time-series phenomena, the authors tests for (1) how to optimize estimation efficiency by varying the grouping of countries (does it matter if the 50 countries in Figure 5 are large or small?), (2) homogeneity in production share of GNP estimated from cross-sectional and from time-series (is the slope in Figure 5 the same as the slope in Figure 2); and (3) shifts in these relations over time (does the line in Figure 5 shift up or down, is it stable?).

Chenery and Taylor try to determine if the effects of scale (country size) are important in the determination of production share. It is expected that size is a factor because economies of scale in large countries are expected to lead to industrialization before this occurs in small ones. Thus, dividing the group by population size, they find that for equation one the share of industry in GNP of large countries is a positive but concave function of GNP (b_2 is negative and significant). The share of primary production in GNP of large countries is a strictly decreasing function. For small countries, industry share is less income elastic than in large countries, and does not decline at higher levels of income (b_2 is not significantly different from zero). The second regression equation results in positive income elasticities for manufactured goods share for large and small countries and negative income elasticities for the share of primary goods for large and small countries, with all income coefficients significant. Chenery and Taylor conclude that country size is a significant factor in the development process. Table 1 summarizes Chenery and Taylor's results for large and small countries for regression equation one and two.

The authors then test the homogeneity of cross-sectional estimated coefficients and time-series estimated coefficients. Two tests are performed:

1) comparison of cross-section estimated income elasticities with time-series estimated elasticities, and
2) comparison of forecasted elasticities to actual elasticities utilizing cross-section estimates.

In order to test (1), Chenery and Taylor fit a linear logarithmic regression to the data for the entire period. They find that the median elasticities are very close to the cross-section patterns. The cross-section estimated elasticity of manufactured goods share (from regression equation two) is 0.37 for large countries while the median elasticity estimated from the time-series is 0.32, for the elasticity of primary product share the corresponding estimates are -.51 and -0.60 respectively. The cross-section estimated elasticity of manufactured goods for small countries (from regression equation two) is 0.37 while the median elasticity estimated from the time-series is between 0.32 and 0.34, for the elasticity of primary product share the corresponding estimates are -0.46 and between -0.40 and -0.55 respectively.

Chenery and Taylor next forecast shares based on the cross-section patterns estimated by regression equation one and compare the results to actual shares for two separate years. They find that cross-section patterns underestimate the decline in the share of primary products by about 5% while the cross-section patterns also underestimate the rise in the share of manufactured goods by about 5%.

Finally, Chenery and Taylor test for the stability of the cross-section estimated patterns. When cross-section regressions at four year intervals are performed utilizing equation one, they find a tendency for the cross-section regression to rotate for primary production, i.e., the slopes and intercepts for both large and small countries decrease in time. However, the cross-section regression for manufactured share is stable with no significant differences in intercepts or slopes.

Chenery and Taylor conclude by asserting that distinct development patterns are discernible from intercountry analysis, time-series estimated growth patterns support the hypothesis that there are universal factors affecting all countries, and lastly, that the combination of time series and cross-section data analysis is a useful tool for the evaluation of development patterns variation over time.[4] Thus, a "pattern of development" is hypothesized:

> as per capita GNP increases, the share of primary production decreases and the share of industry increases.

According to Chenery and Taylor, this is evident both in cross country comparisons and over long time periods for individual countries.

TABLE 1

SUMMARY OF RESULTS - CHENERY TAYLOR STUDY

		Intercept (t)	ln Y (t)	$(\ln Y)^2$ (t)	ln N (t)	R^2
All Countries						
Manufactured Products						
Equation	(1)	-7.03 (-21.31)	1.50 (13.66)	-0.097 (-9.7)	0.077 (7.68)	0.727
	(2)	-3.76 (-62.6)	0.37 (37.03)		0.044 (4.40)	0.688
Primary Products						
Equation	(1)	-0.098 (-0.28)	0.02 (0.17)	-0.043 (-4.33)	-0.029 (-2.87)	0.788
	(2)	1.56 (26.02)	-0.48 (-48.48)		-0.043 (-4.33)	0.782
Large Countries						
Manufactured Products						
Equation	(1)	-8.54 (-25.88)	2.03 (18.48)	-0.142 (-14.22)	0.084 (4.19)	0.874
	(2)	-3.63 (-32.97)	0.37 (36.83)		0.016 (0.79)	0.753
Primary Products						
Equation	(1)	0.27 (0.75)	-0.04 (-0.31)	-0.04 (-4.02)	-0.02 (-1.19)	0.905
	(2)	1.66 (18.44)	-0.51 (-50.64)		-0.04 (-2.15)	0.899
Small Countries						
Manufactured Products						
Equation	(1)	-4.17 (-7.07)	0.50 (2.50)	-0.01 (-0.50)	0.06 (3.00)	0.620
	(2)	-4.17 (-7.07)	0.37 (37.0)		0.05 (2.50)	0.620
Primary Products						
Equation	(1)	-0.10 (-0.16)	0.04 (0.18)	-0.04 (-2.00)	0.13 (1.50)	0.680
	(2)	1.34 (14.89)	-0.46 (-23.0)		0.02 (1.00)	0.670

III. Responses to the Patterns of Development Hypothesis

Debate over this relationship continues today. Early critiques applied more advanced statistical tests to the data with varying results. Kenneth Jameson takes one of Chenery's data sets and re-evaluates the results.[5] The data set consists of data for 89 countries over a varying number of years for each country. He finds that time-series estimates do not correspond to cross-section estimates. As such, he questions the existence of patterns of development. Jameson's methodology is an analysis of covariance. The test is an F-test of a restricted versus an unrestricted regression equation. The restricted model has a common slope and intercept, the unrestricted model allows for separate slopes and intercepts for each country. At the 0.01 level of significance, the homogeneity of slopes and intercepts is rejected. Jameson next performs 89 separate regressions, one for each country, he concludes that 45% of the sample have at least one coefficient which does not behave as the patterns of development hypothesis would predict.

While on the surface Jameson's results appear compelling, there are two major flaws in the analysis. First, the test of the restricted model (common slope and intercept for all countries) and the unrestricted model (different slopes and intercepts for each country) is testing the equality of coefficients obtained from varying number of years for each country. Twenty-one of the countries are estimated using less than 10 years of data while the longest time period analyzed is only 20 years, this clearly is not adequate enough time for long-run structural changes to be evident. Figure 6 illustrates this problem. The relationship depicted in Figure 5 is reproduced this time with the addition of the individual country slopes for every 10th country. Lets assume country 10 has five years of data labeled S-10 in Figure 6, country 20 has 10 years of data (S-20), country 30 has 20 years of data (S-30), country 40 has 5 years of data (S-40) and country 50 has 20 years of data (S-50). It is obvious first, that the individual slope lines (S-10 to S-50) vary according to the number of years available, and second, that the slope of line A (from the whole sample) is not comparable to the individual country slopes when the time periods are so short. If 50 years of data for each country were available, one would expect the slopes of each country and the slope obtained from the entire cross-section to correspond closely. The second major shortcoming is that although Jameson claims that 45% of the sample exhibit at least one coefficient with the wrong sign when separate time-series regressions are performed for each country, a closer examination of the results reveals that of the 178 coefficients (89*2) only 26 have opposite signs than predicted and of these only 8 are significant, thus only 4.5% of the sample exhibit signs opposite of what the patterns of development hypothesis predicts.

Paul Gregory and James Griffin provide further evidence on the patterns of development debate. They perform the following tests for the share of manufacturing of GNP:

1) tests on the homogeneity of cross-section and time series elasticities,
2) tests to discern whether the individual country time series elasticities differ significantly, and,
3) tests to determine the usefulness of single cross-section estimates to infer intertemporal effects.[6]

The authors begin with an analysis of covariance between time-series and cross-section variation. They transform the shares in such a way as to distinguish the variations "within" countries (or, the variance over time for each individual country) from the variation "between" countries (or, the "pure" cross-section variation). As such, Chenery's regression equation

$$\ln X_{it} = a + b_1 \ln Y_{it} \qquad \text{(country size is ignored)}$$

where,

$i=1,\ldots,$ 10 industrialized countries

$t=1,\ldots,$ 7 ten year periods

is transformed into an equation of first differences,

$$\Delta \ln X_{it} - \overline{\Delta \ln X_i} = b_{iw} (\Delta \ln Y_{it} - \overline{\Delta \ln Y_i})$$

which represents the "within" country variation. The barred terms refer to country means over all years and are interpreted as average rates of growth and b_{iw} is the time-series estimated income elasticity of country i. A second equation explains the "between" variation,

$$\overline{\Delta \ln X_i} = b_{ib} (\overline{\Delta \ln Y_i}).$$

The coefficient b_{iw} can be interpreted as the "pure" cross-sectional elasticity since average values across all years for each country are utilized as observations. For time series and cross-sections elasticities to be homogeneous, the coefficients b_{ib} and b_{iw} must be equal. An F-test is performed which indicates that the coefficients are not significantly different for manufacturing shares, therefore, the homogeneity of cross-sectional and time-series estimated coefficients is verified.

The second test of individual country time-series estimates of elasticities involves the use of Ordinary Least Squares using Dummy Variables (OLSDV), i.e., two separate regressions are run, one allows for separate country slopes and intercepts while the second allows for separate country intercepts but a common slope. The F-test of the restricted versus the unrestricted model indicates that there are significant differences in both intercepts and slopes between countries.

Lastly, Gregory and Griffin test for cross-section stability noting that both Kuznets and Chenery indicate that such stability may be an important signal of the compatibility of intercountry and intertemporal relations. The regression is run for seven separate 10 year intervals from 1910 to 1970. The results show a strong tendency for the elasticities to start out large and significant in the early time intervals and then to decline toward zero by the latter periods. This is perhaps an indication that intertemporal patterns are non-linear. In general, cross-section instability is evident, 1) if intercepts vary among countries, and 2) if the sample variance of the independent variable changes. The authors remark that cross-section stability may not be an optimal test of cross-section and time-series homogeneity. Gregory and Griffin's conclusions are:

1) both "pure" cross-section and time-series measure similar long-run responses when the observations are over a long time period and when intercept differences are removed,

2) there are significant differences in elasticities among countries,

3) reliance on single cross-sections to infer intertemporal effects is inappropriate, and,

4) despite elasticity differences among countries, combining cross-section and time-series (which allows for different intercepts) provide useful elasticity estimates.[7]

Thus, the evidence supports the existence of patterns of development, the share of manufactured goods does appear to increase as income levels increase and the share of primary goods does decline as income levels increase. Gregory and Griffin confirm that the use of cross-sectional data to estimate long run time trends is appropriate with certain qualifications. First, one should allow for separate intercepts for each country. The cross-sectional estimated intercept can be interpreted as the starting point of development (in Figure 1, time 0 and per capita GDP of \$0.0). If many of the 50 countries represented in Figure 5 actually had a per capita income of \$100, or \$1000 or \$3000 in time 0, then the interpretation of Figure 5 as representative of intertemporal behavior would be incorrect. Second, instead of using a single year cross-section or "snapshot", they recommend using as many "snapshots" or years of cross-section data as available.

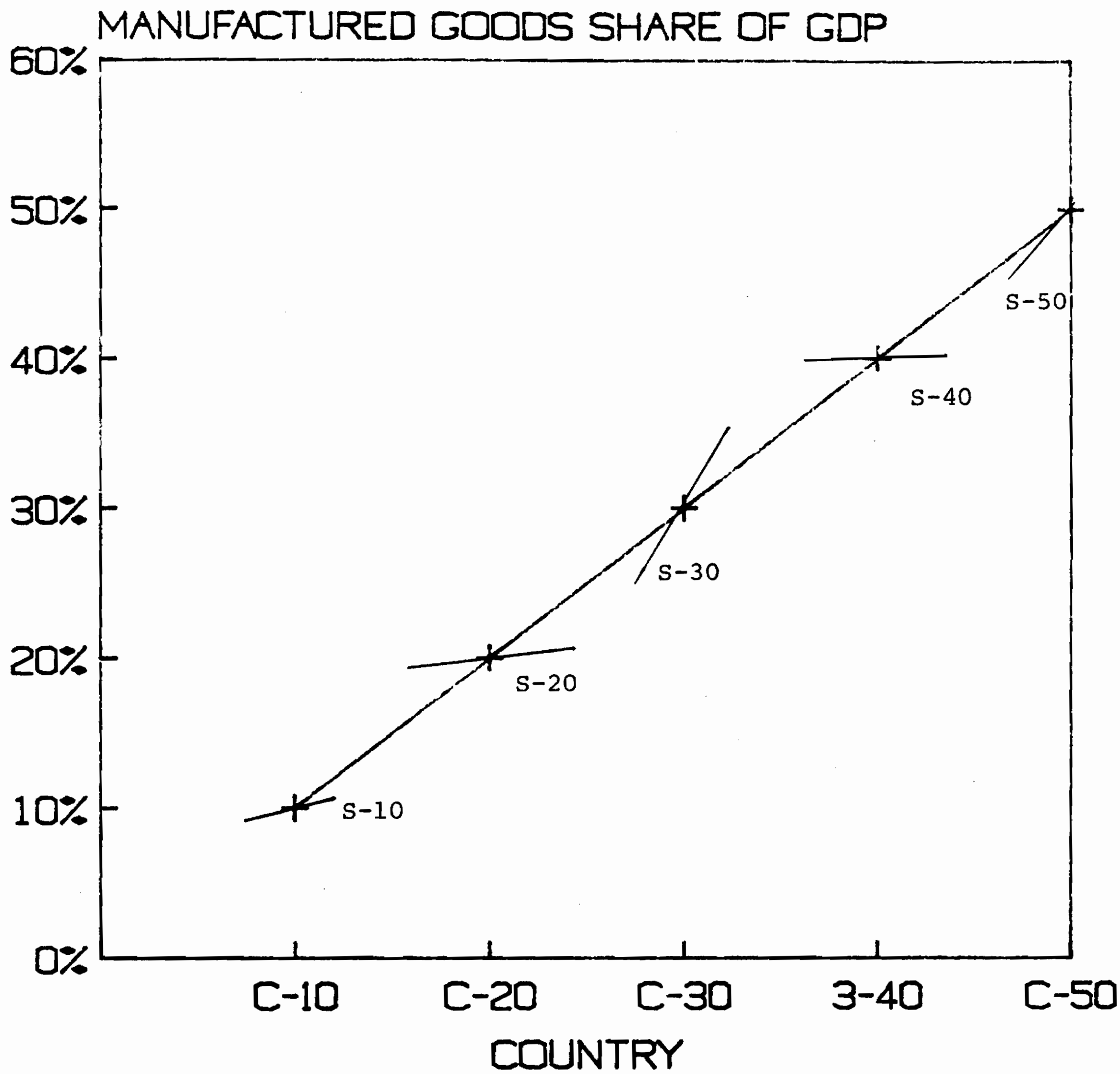

FIGURE 6
CROSS-SECTION

IV. Application of the Patterns of Development Hypothesis to Foreign Trade

In "Trade Patterns in Developing Countries, 1970-81," Lance Taylor, F. McCarthy and I. Alikhani apply Chenery's pattern of development equation to explicitly test for the existence of universal patterns in the structure of foreign trade.[8] The regression equation is:

Trade share = a + b ln (per capita GNP) + c ln (population).

They examine 50 developing countries over a twelve year period. Trade data is disaggregated into seven product categories:

1) Agricultural food products,
2) Agricultural non-food products,
3) Metals, minerals, and fertilizer,
4) Intermediate manufacturing,
5) Textiles, shoes, and clothing,
6) Other consumer goods, and
7) Capital goods.

The results for the entire sample indicate that per capita income and population are independent and significant in the determination of trade shares, however, they fall well short of explaining trade shares completely as the values of R^2 are relatively low. The authors find a negative relationship between total trade share (obtained by summing product category coefficients) and per capita GNP when population is utilized as a proxy for market size. This is counter to the findings of Chenery and Kuznets. However, when the equation is transformed so that total GNP is used as a measure of market size, the expected positive relationship is observed.

For a single log equation such as this the elasticity of the trade share with respect to the explanatory variables is obtained by calculating the ratio of the appropriate coefficient to the value of the trade share at the sample mean. The income elasticity of total import share is estimated at -0.07, and the partial elasticity with respect to population is -0.26.

The results for the individual product catagories indicate that import shares exhibit the coefficients predicted by the patterns of development hypothesis better than do export shares. This is expected considering that exports, more than imports, are determined by trading partner characteristics. Import shares decline as per capita GNP rises for all product catagories except non-food agriculture and metals, minerals, and fertilizers. The most significant finding is the strong import substitution evident for category 5 -- textiles, shoes, and clothing, there is a high R^2 of 0.51 and an income elasticity of -0.30.

The results for export shares show that catagories 1 through 3 exhibit negative income elasticities while the remaining product groups (4-7) have positive income elasticities. The elasticities of groups six and seven, other consumer goods and capital goods are especially strong.

The authors test for the stability of the coefficients over time by dividing the sample into three intervals, 1970 to 1973, 1974 to 1977, and 1978 to 1981. No significant differences in coefficients are observed.

The authors conclude first that shares of both imports and exports declined with rising per capita GNP during the 1970s, this decline is due primarily to the decline in the importance of agricultural food trade, and second, that there are no significant shifts in the observed trade patterns during the decade examined.

V. The Present Model

In order to test the patterns of growth hypothesis as applied to the foreign trade of Less Developed Countries, 25 countries over the period 1978 to 1986 are examined. Although this is a relatively short time period, it is consistent with previous examinations of the subject. Trade data for each country at the 5-digit Standard International Trade Classification (SITC) level are aggregated into seven inclusive catagories (except for fuels) which map loosely into the seven categories utilized by Taylor et. al. (see appendix B for commodity detail). Because of limited data availability, total trade figures are not utilized, instead trade between the twenty-five countries and members of the Organization of Economic Cooperation and Development (OECD) is used as a proxy of total trade. While this does impose certain limitations, the nature of inter-LDC trade is elusive and for the most part undocumented, as such, this compromise seems reasonable. The estimation technique used is a pooled cross-sectional model developed by Data Resources.

Let,

$i = 1,...,P$ $P=25$ countries

$t = 1,...,T$ $T=9$ years

$k = 1,...,K$ $K=2$ explanatory variables

$n = P*T \qquad n=225.$

The regression equation,

$X_{it} = \alpha + \beta_1 \ln Yi_t + \beta_2 \ln POP_{it} + u_{it}$

can be expressed in matrix notation as:

$$\mathbf{x}_i = \begin{bmatrix} X_{i1} \\ \cdot \\ \cdot \\ X_{iT} \end{bmatrix} \qquad \mathbf{D}_i = \begin{bmatrix} \ln Y_{i1} & \ln POP_{i1} \\ \cdots & \cdots \\ \ln Y_{iT} & \ln POP_{iT} \end{bmatrix} \qquad \mathbf{u}_i = \begin{bmatrix} u_{i1} \\ \cdot \\ \cdot \\ u_{iT} \end{bmatrix}$$

If the data is "stacked" in time to form

$$\mathbf{x} = \begin{bmatrix} \mathbf{x}_1 \\ \cdot \\ \cdot \\ \mathbf{x}_P \end{bmatrix} \qquad \mathbf{D} = \begin{bmatrix} \mathbf{D}_1 \\ \cdot \\ \cdot \\ \mathbf{D}_P \end{bmatrix} \qquad \mathbf{u} = \begin{bmatrix} \mathbf{u}_1 \\ \cdot \\ \cdot \\ \mathbf{u}_P \end{bmatrix}$$

then the model may be expressed as

$$\mathbf{x} = \begin{bmatrix} \mathbf{i} & \mathbf{D} \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \end{bmatrix} + \mathbf{u}$$

where **i** is a (nx1) vector of units, **D** is (nxk), **u** is (nx1), α is a scalar and $\beta=(\beta_1 \ldots \beta_K)'$.

The method utilized assumes a common intercept, α, and common slopes, β_k for all countries across all years. The disturbance term is assumed to be independent and normally distributed for all i,t. Then there is no serial correlation in the error term for any individual country and there is no dependence between the disturbance term for different countries, and the error term has a constant variance at all points. Application of OLS results in best linear unbiased estimators.

VI. Results of the Pooled-Cross Sectional Model

The results of the pooled-cross sectional model are presented in Table 2. Total import share moves counter to both changes in the natural log of per capita GDP and changes in the natural log of population (totals are obtained by summing coefficients of the separate shares) while total export share increases as the natural log of per capita GDP grows and declines with increases in population. Figures 7 and 8 illustrate graphically the relationship between import shares and per capita GDP for all product categories and Figures 9 and 10 illustrate the relationship between export shares and per capita GDP for all product categories (see Appendix C for an explanation of the graphing technique utilized). Although the values of R^2 are low as expected for cross-sectional data, several of the product groups show marked and significant relationships.

TABLE 2

LDC TRADE (1978 TO 1986)
POOLED-CROSS SECTION REGRESSION RESULTS

IMPORTS

SECTOR	CONSTANT (t)	LN PCGDP (t)	LN POP (t)	R SQR	F	MEAN (% GDP)	ELASTICITY N1
AGRICULTURAL FOOD PRODUCTS	0.119	-0.010	-0.009	0.226	32.323	1.39	-0.724
	(7.329)	(-5.690)	(-7.989)				
AGRICULTURAL NON-FOOD PRODUCTS	0.013	0.000	-0.001	0.078	9.348	0.584	-0.055
	(1.948)	(-0.4361)	(-3.018)				
METALS, MINERALS, AND FERTILIZER	0.052	-0.003	-0.005	0.193	26.385	1.222	-0.239
	(4.178)	(-2.156)	(-6.003)				
INTERMEDIATE MANUFACTURING	0.094	-0.004	-0.012	0.417	78.913	2.333	-0.150
	(4.624)	(-1.616)	(-9.015)				
TEXTILES, SHOES, AND CLOTHING	0.005	0.001	-0.002	0.309	49.519	0.546	0.220
	(0.6823)	(1.528)	(-4.921)				
OTHER CONSUMER GOODS	0.031	0.002	-0.008	0.352	60.213	1.535	0.107
	(1.601)	(0.7861)	(-6.194)				
CAPITAL GOODS	0.327	-0.056	-0.040	0.324	52.993	7.159	-0.218
	(4.295)	(-1.879)	(-7.798)				

EXPORTS

SECTOR	CONSTANT (t)	LN PCGDP (t)	LN POP (t)	R SQR	F	MEAN (% GDP)	ELASTICITY N1
AGRICULTURAL FOOD PRODUCTS	0.130	-0.011	-0.008	0.147	19.034	1.770	-0.622
	(6.492)	(-5.047)	(-6.159)				
AGRICULTURAL NON-FOOD PRODUCTS	0.087	-0.007	-0.006	0.073	8.728	1.079	-0.659
	(3.808)	(-2.870)	(-4.136)				
METALS, MINERALS, AND FERTILIZER	0.087	-0.007	-0.006	0.076	9.024	1.208	-0.583
	(3.990)	(-2.971)	(-4.215)				
INTERMEDIATE MANUFACTURING	-0.019	0.004	-0.002	0.189	25.686	0.648	0.686
	(-1.325)	(2.820)	(-1.892)				
TEXTILES, SHOES, AND CLOTHING	0.004	0.000	0.000	0.034	3.853	0.349	0.074
	(0.7067)	(0.4629)	(-1.340)				
OTHER CONSUMER GOODS	-0.124	0.024	-0.006	0.150	19.494	2.951	0.808
	(-1.664)	(2.949)	(-1.115)				
CAPITAL GOODS	-0.001	0.009	-0.013	0.2207	31.292	2.157	0.436
	(-0.0256)	(1.630)	(-3.539)				

N1 = ELASTICITY OF SHARE OF TRADE TO GDP WITH RESPECT TO PER CAPITA GDP.

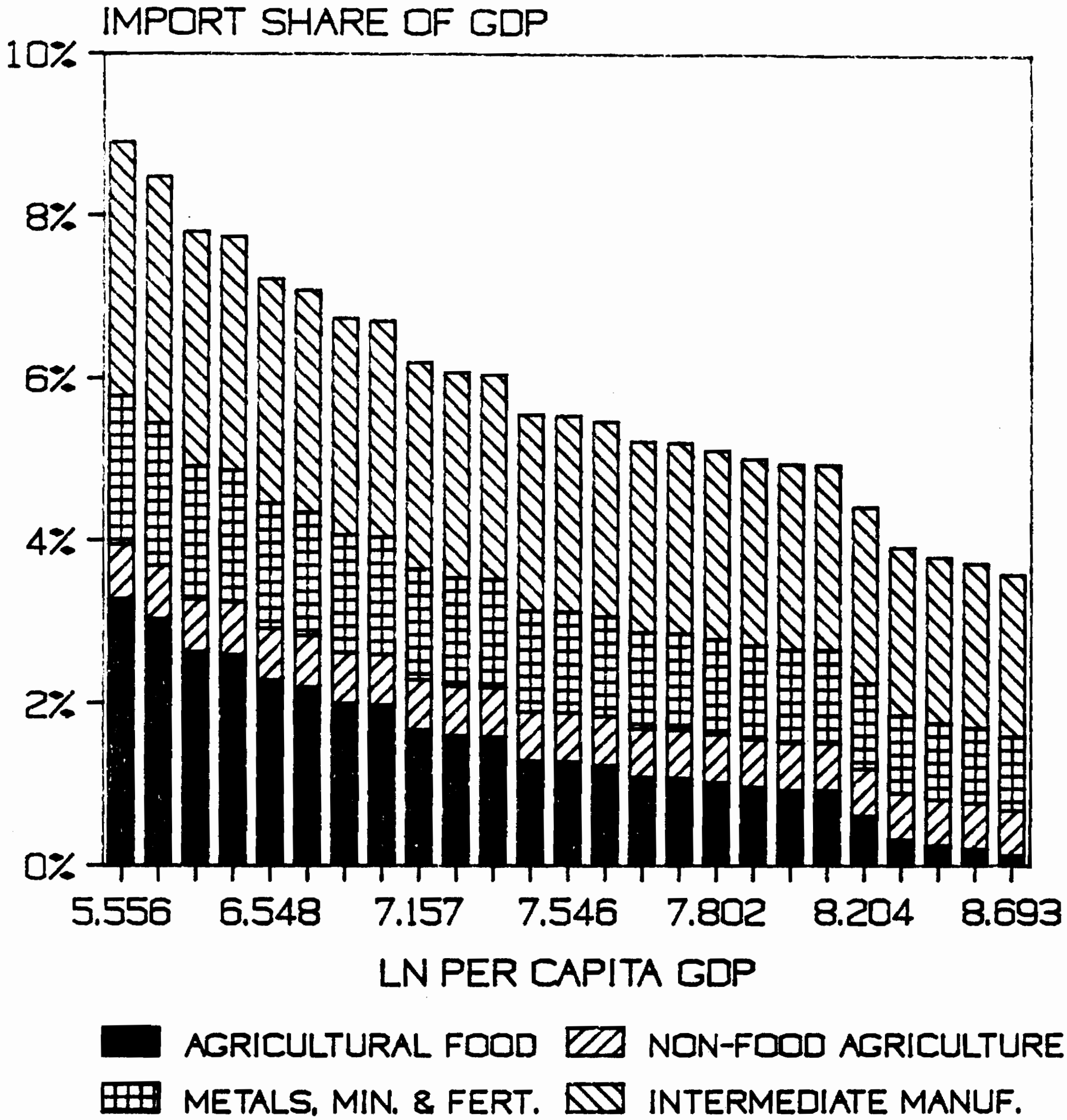

FIGURE 7
PRODUCT GROUPS 1 - 4

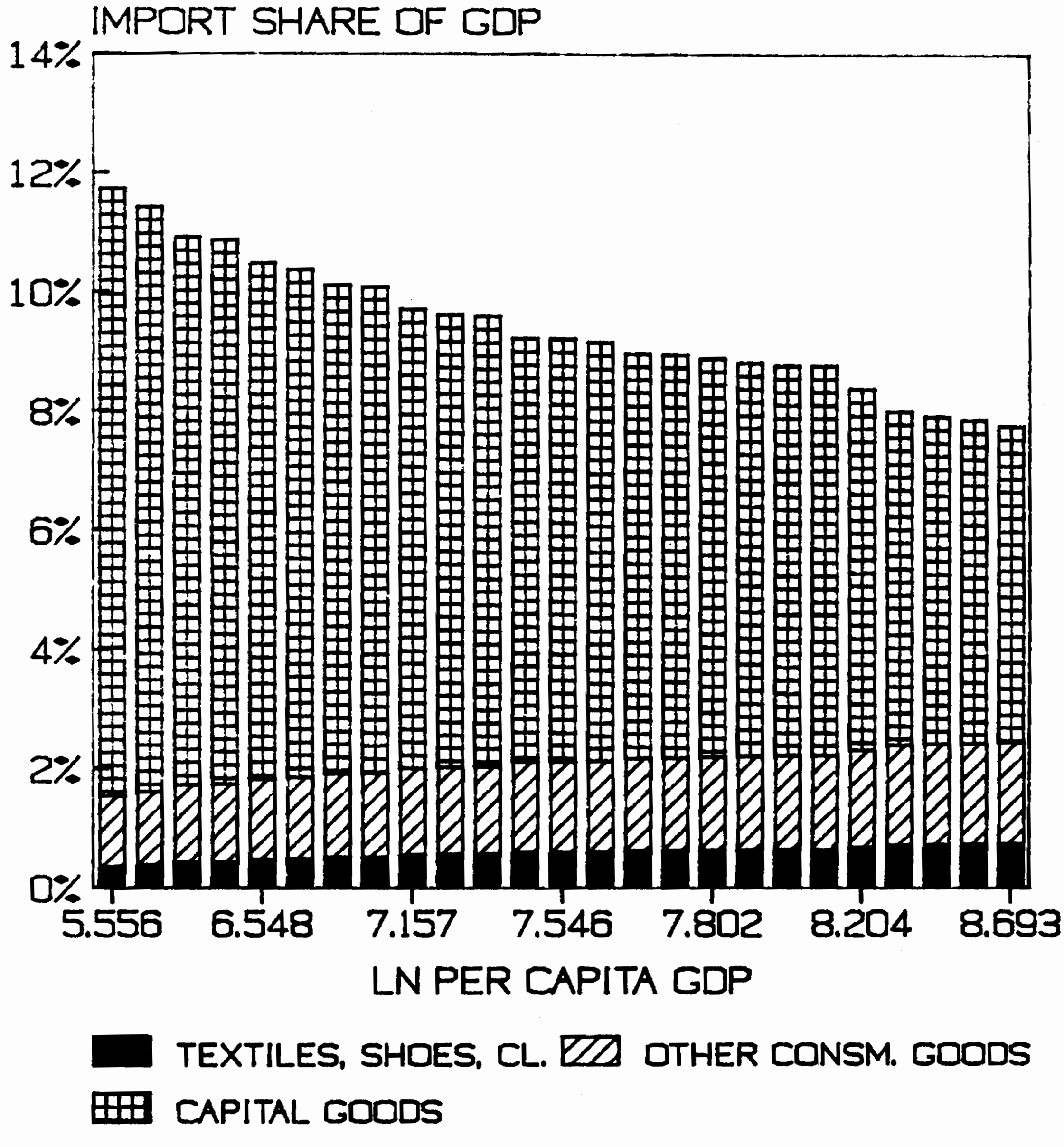

FIGURE 8
PRODUCT GROUPS 5 - 7

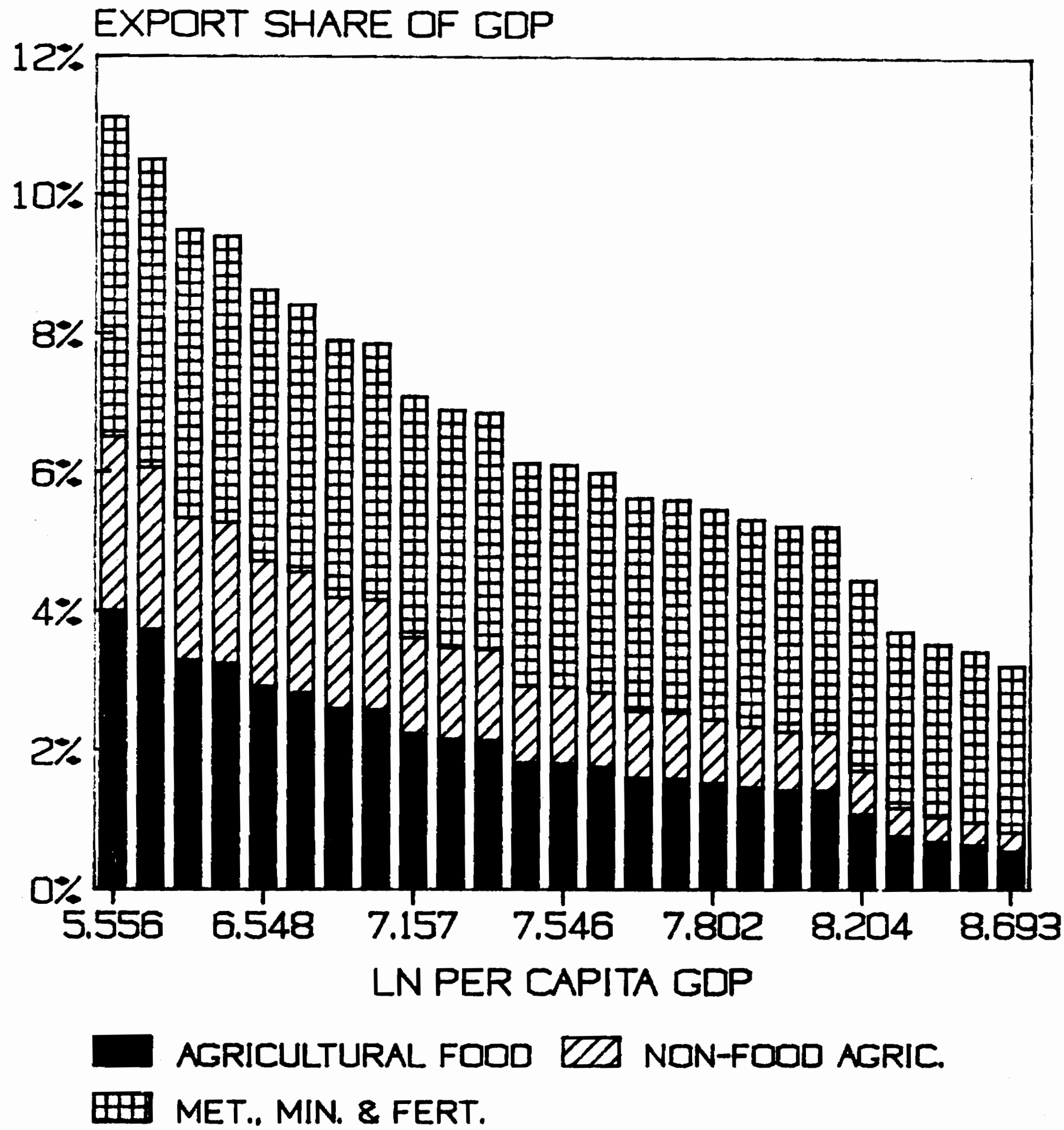

FIGURE 9
PRODUCT GROUPS 1 - 3

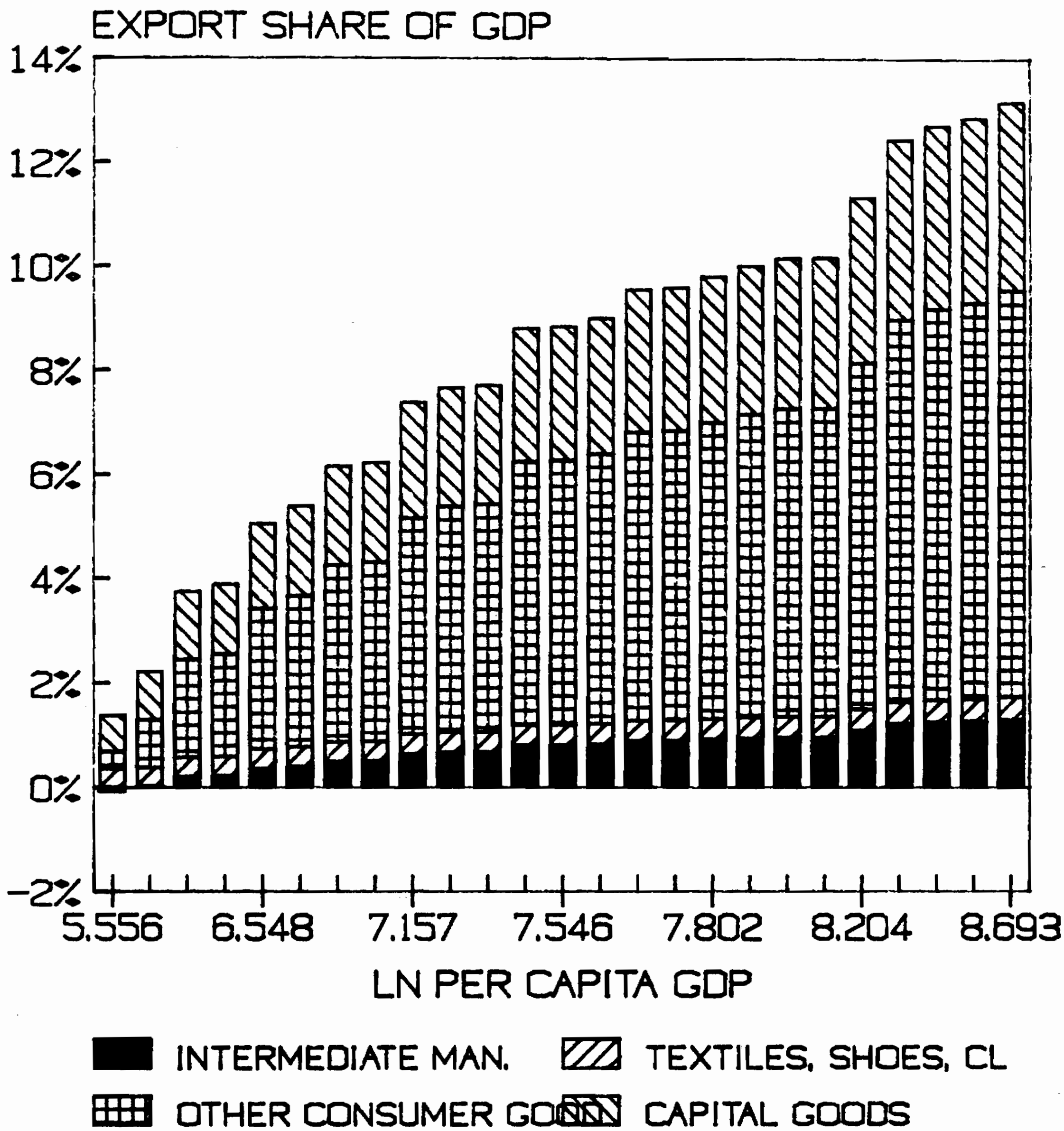

FIGURE 10
PRODUCT GROUPS 4 - 7

Imports

On the import side the shares of GDP comprised of agricultural food products (see Figure 11), metals, minerals, and fertilizers (Figure 13), and intermediate manufacturing (Figure 14) decline strongly as economic development progresses (significant at the one percent level). The share of capital goods (Figure 17) declines as per capita income increases as well and is significant at the five percent level. The shares of groups five and six, textiles, shoes, and clothing and other consumer goods (Figures 15 and 16) have positive income coefficients although group five is significant only at the 10% level and group six is not significant. With respect to population, shares of all product groups decline as population increases and all are significant. This is consistent with previous findings that trade plays a more significant part in the economy of smaller countries as measured by population.

The sample means of import trade shares range from 0.54% for textiles, shoes, and clothing to 7.16% for capital goods. Income elasticities are obtained by dividing the per capita GDP coefficients by the sample mean of the relative trade share. The "lower" product groups one through four exhibit fairly strong negative income elasticities, especially food agricultural products. The "middle" product groups (textiles, shoes, and clothing, and other consumer goods) have positive income elasticities, while the "highest" level product group, capital goods, is negative income elastic.

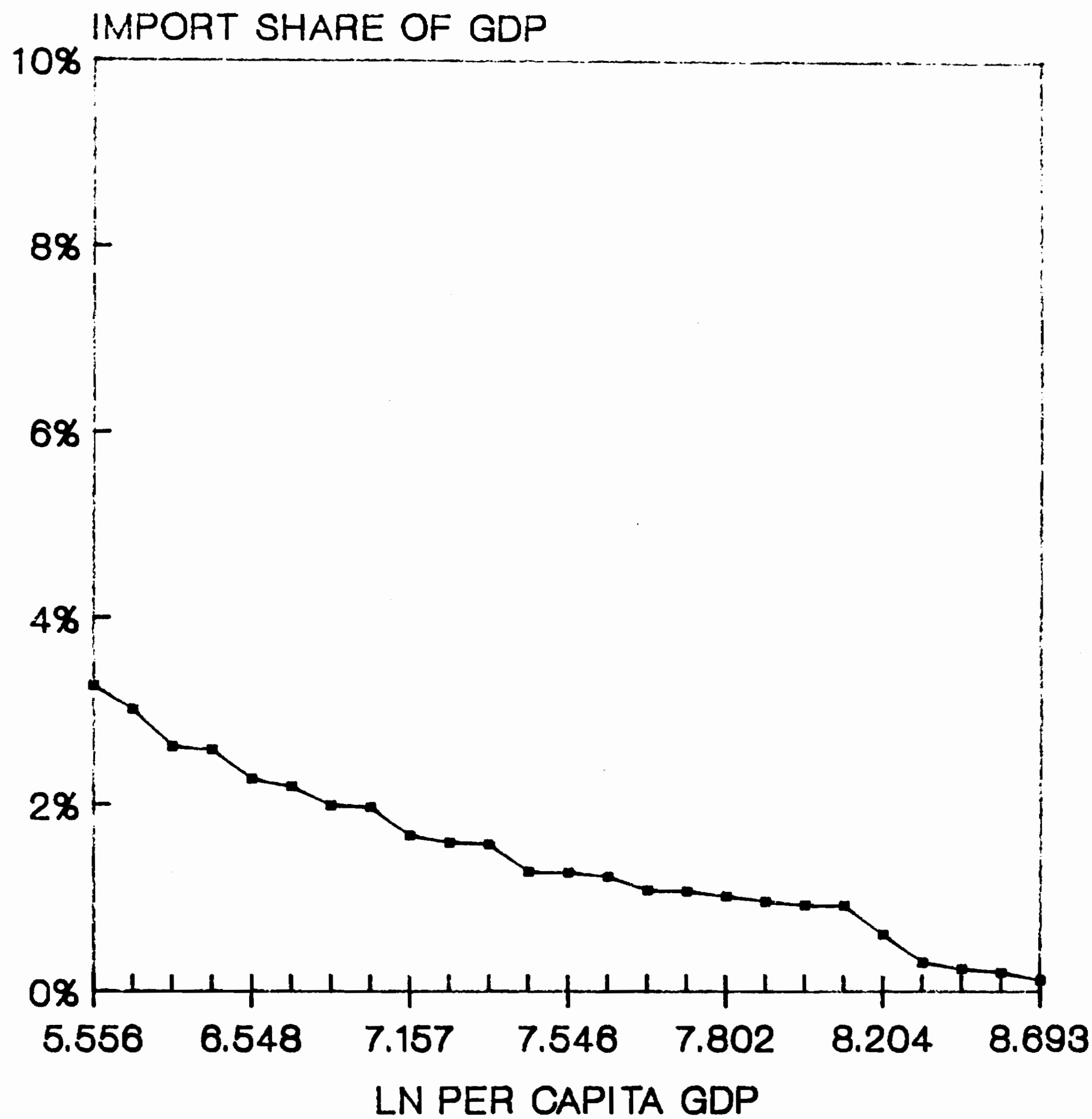

FIGURE 11
AGRICULTURAL FOOD PRODUCTS

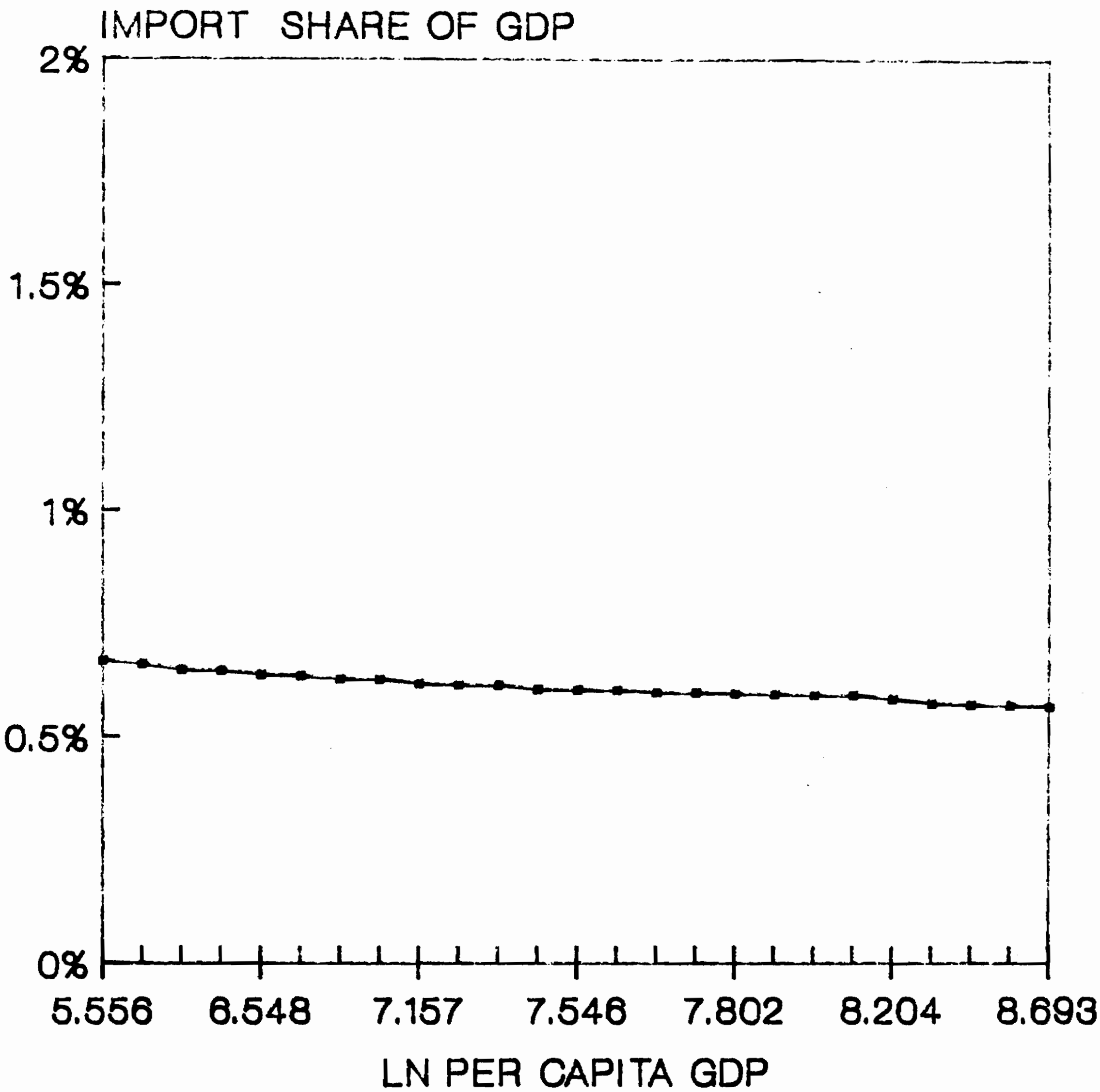

FIGURE 12
NON-FOOD AGRICULTURAL PRODUCTS

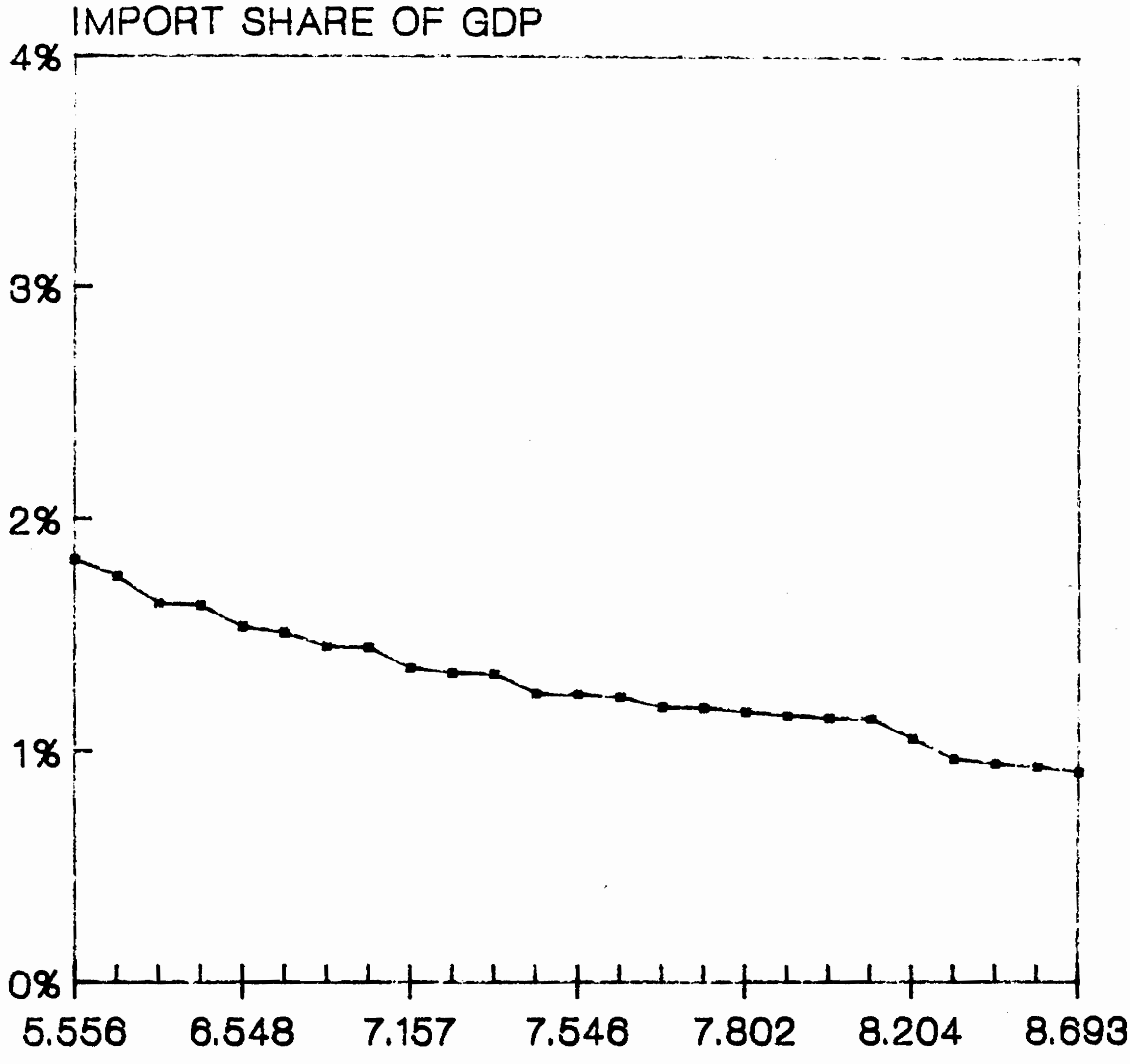

FIGURE 13
METALS, MINERALS, AND FERTILIZER

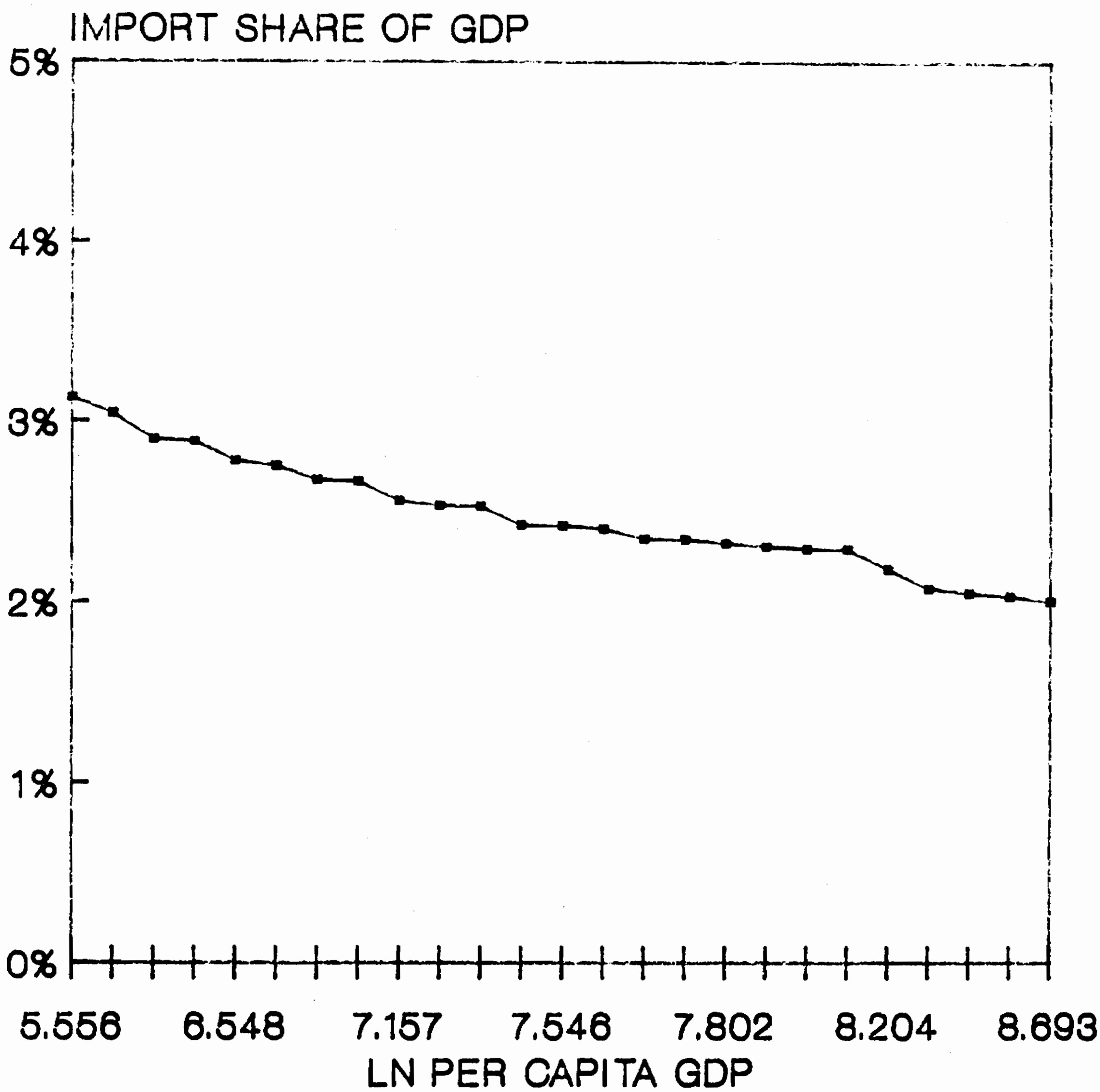

FIGURE 14
INTERMEDIATE MANUFACTURING

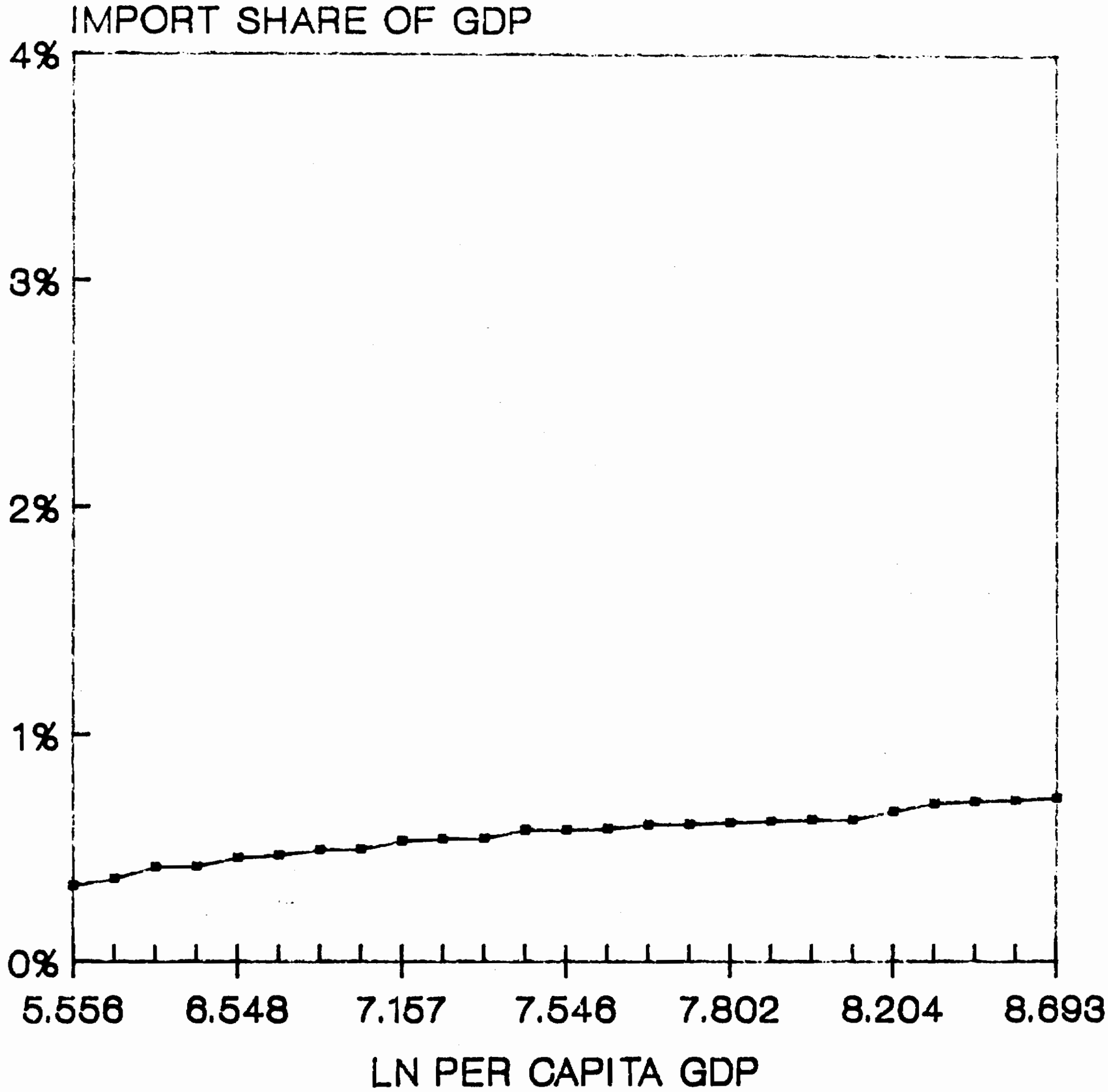

FIGURE 15
TEXTILES, SHOES, AND CLOTHING

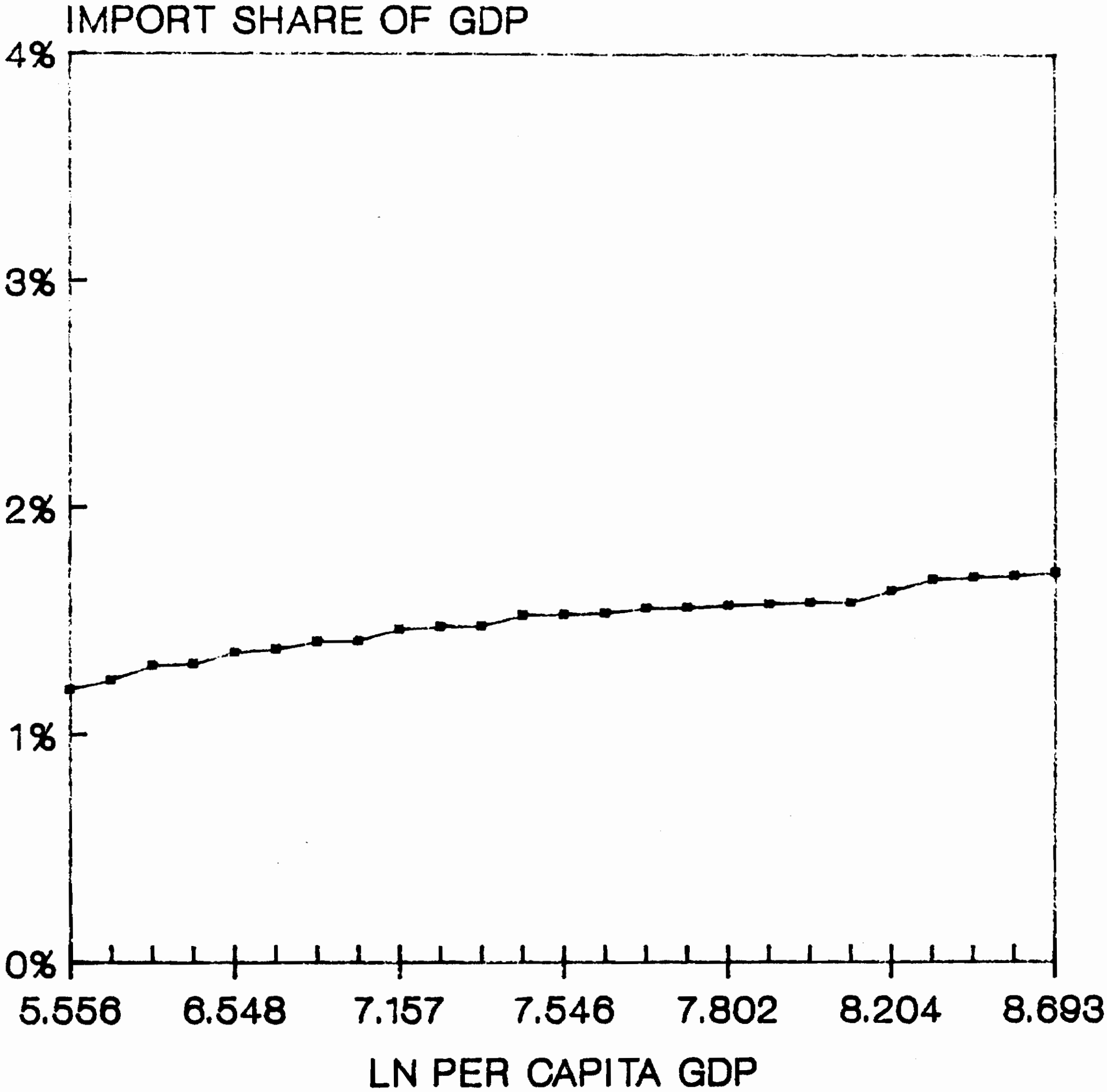

FIGURE 16
OTHER CONSUMER GOODS

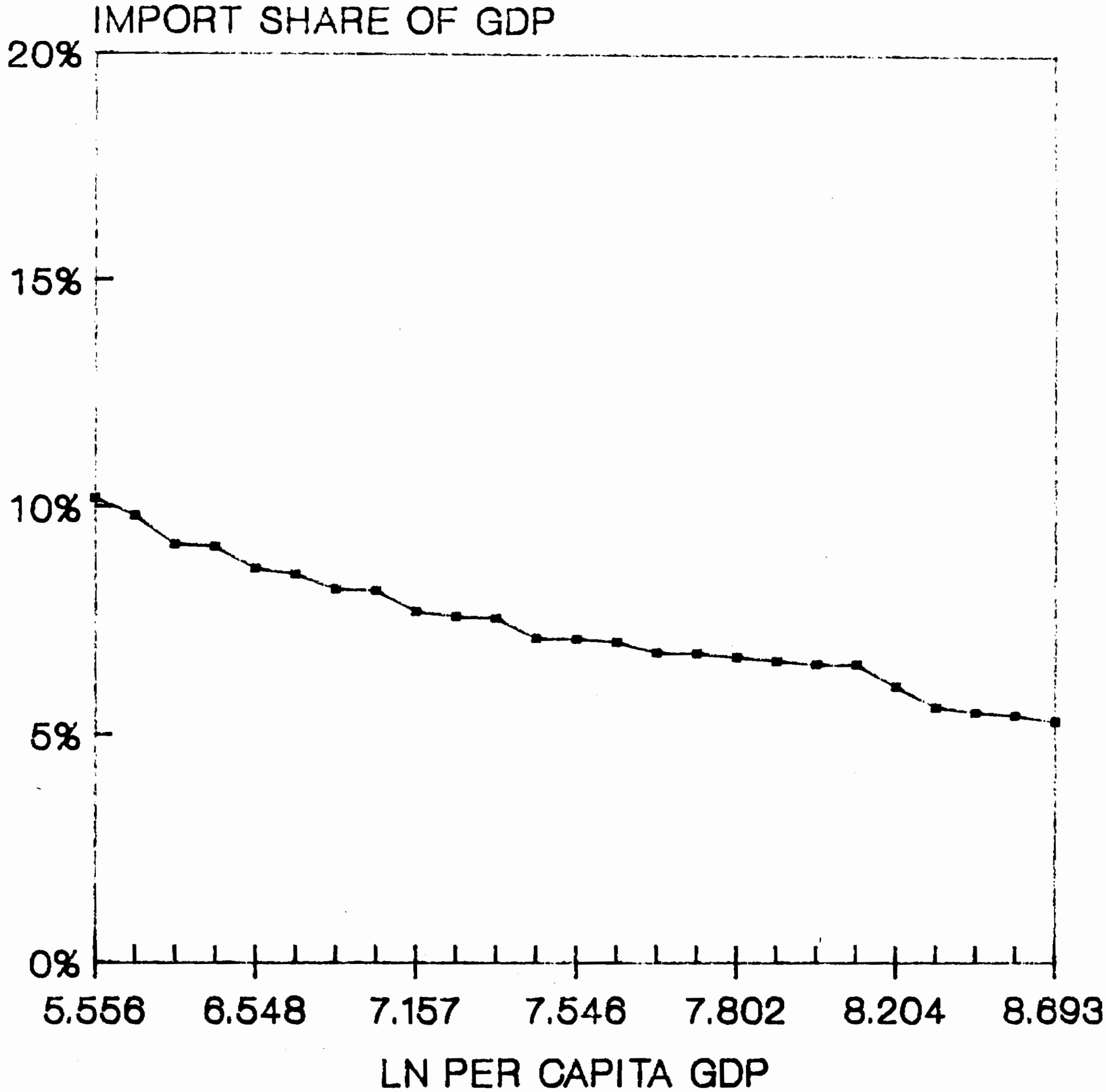

FIGURE 17
CAPITAL GOODS

Exports

On the export side, the first three product group regressions show highly significant coefficients, all shares decline as the natural log of per capita income increases (see Figures 18, 19, and 20). Product groups four, six, and seven (intermediate manufacturing, other consumer goods and capital goods) move together with changes in per capita income and have significant coefficients (Figures 21, 23, and 24), while group five (textiles, shoes and clothing) has a positive coefficient that is not significant (Figure 22). Export shares of all product groups are negatively related to population (most at the one percent level).

The sample mean export shares range from 0.35% for textiles, shoes, and clothing to 2.95% for other consumer goods. As expected, the income elasticities of the first three product groups are negative, -0.62 for agricultural food products, -0.66 for agricultural non-food products, and -0.58 for metals, minerals, and fertilizer. The income elasticities of groups four through seven are positive, 0.68 for intermediate manufacturing, a strong 0.81 for other consumer goods, 0.44 for capital goods, while textiles, shoes, and clothing has a weak income elasticity of 0.07.

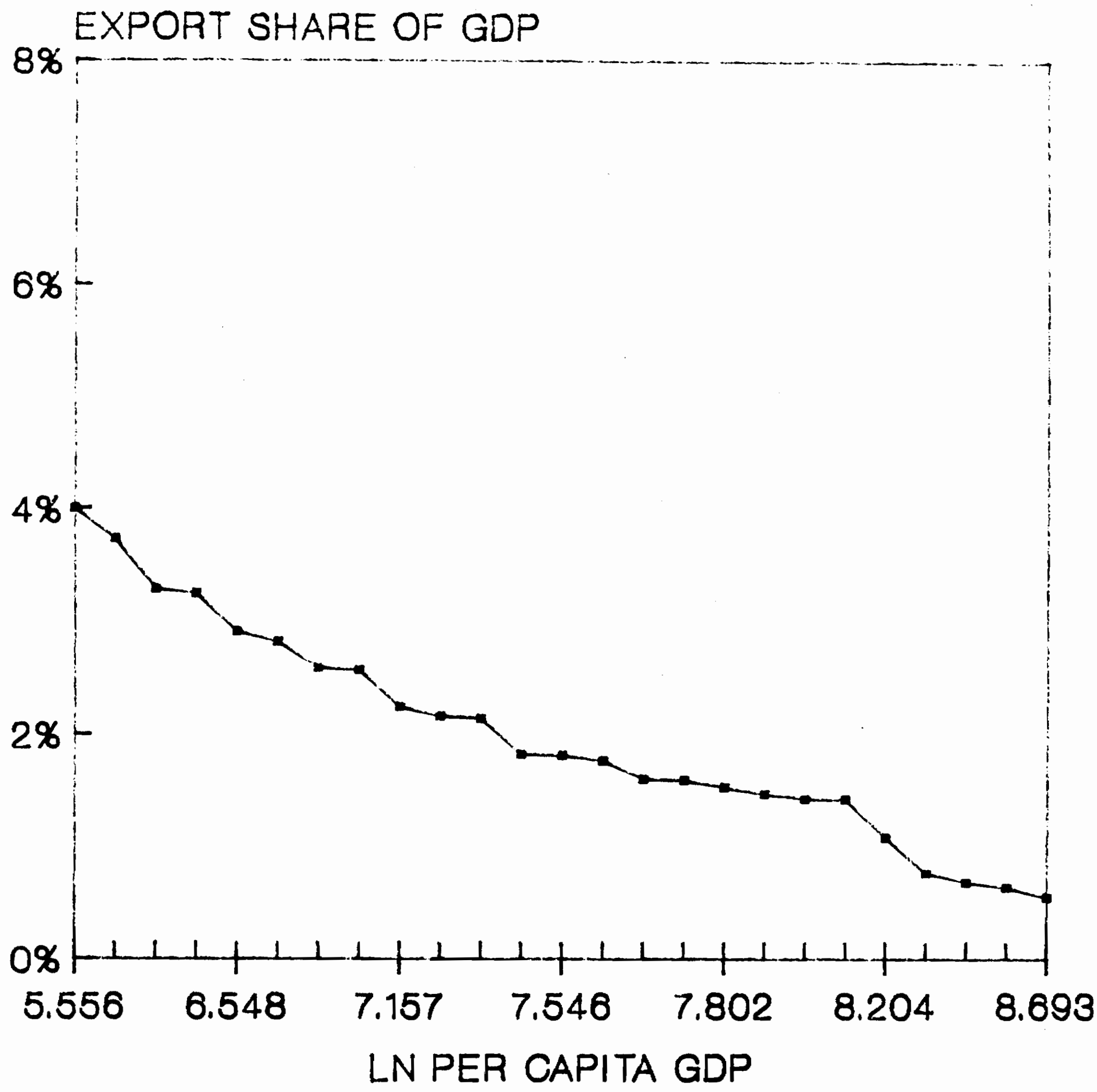

FIGURE 18
AGRICULTURAL FOOD PRODUCTS

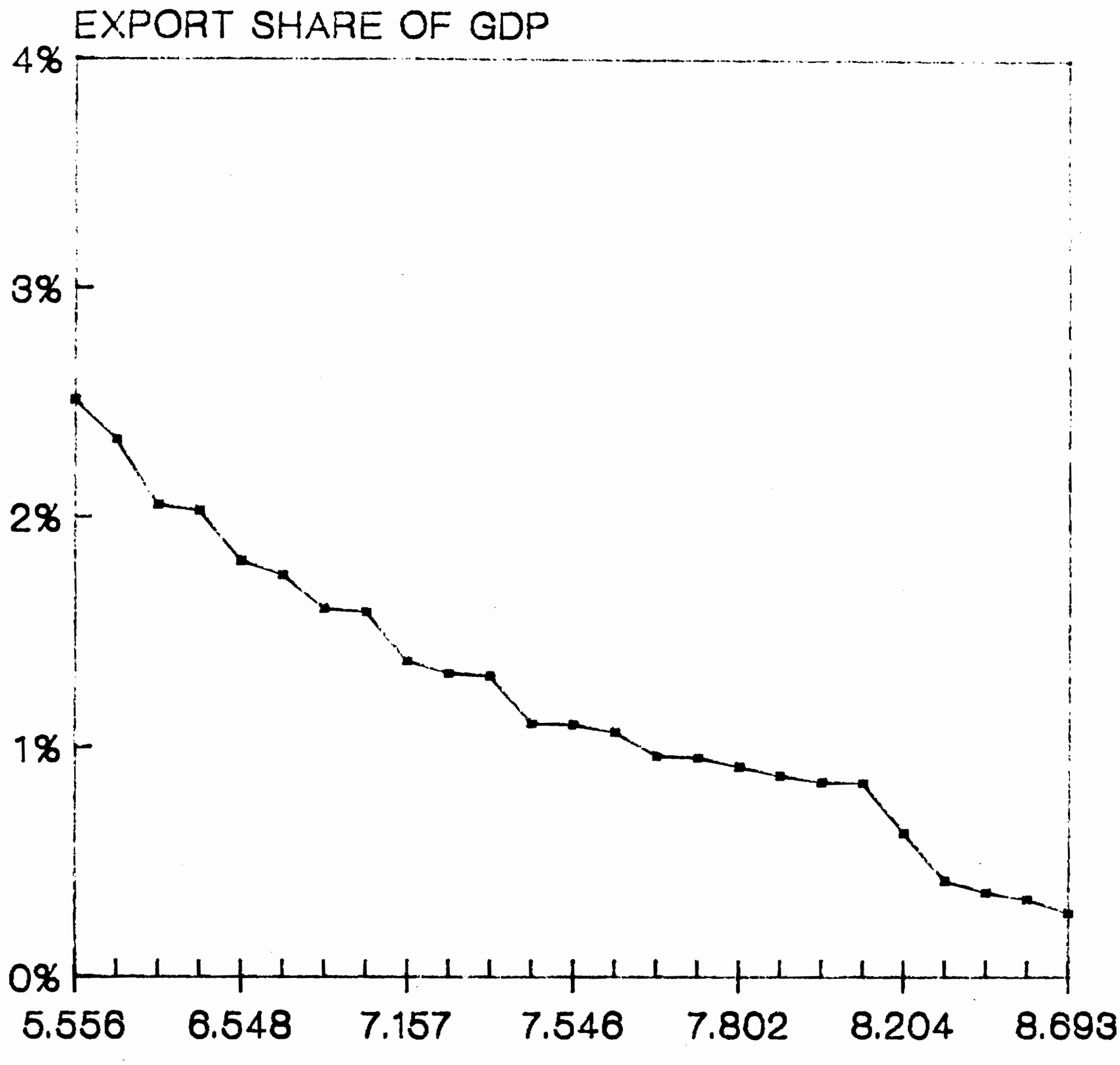

FIGURE 19
NON-FOOD AGRICULTURAL PRODUCTS

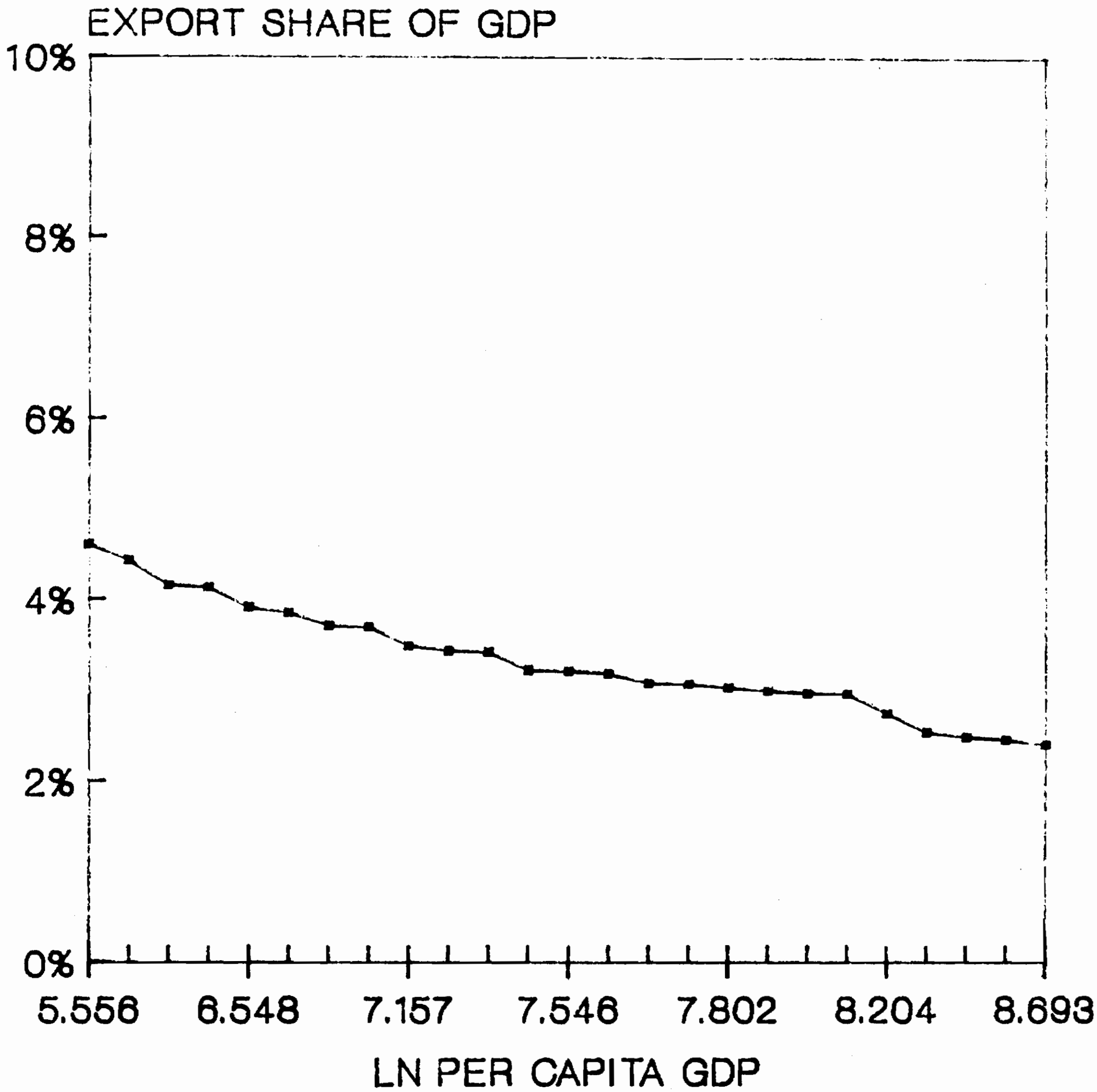

FIGURE 20
METALS, MINERALS, AND FERTILIZER

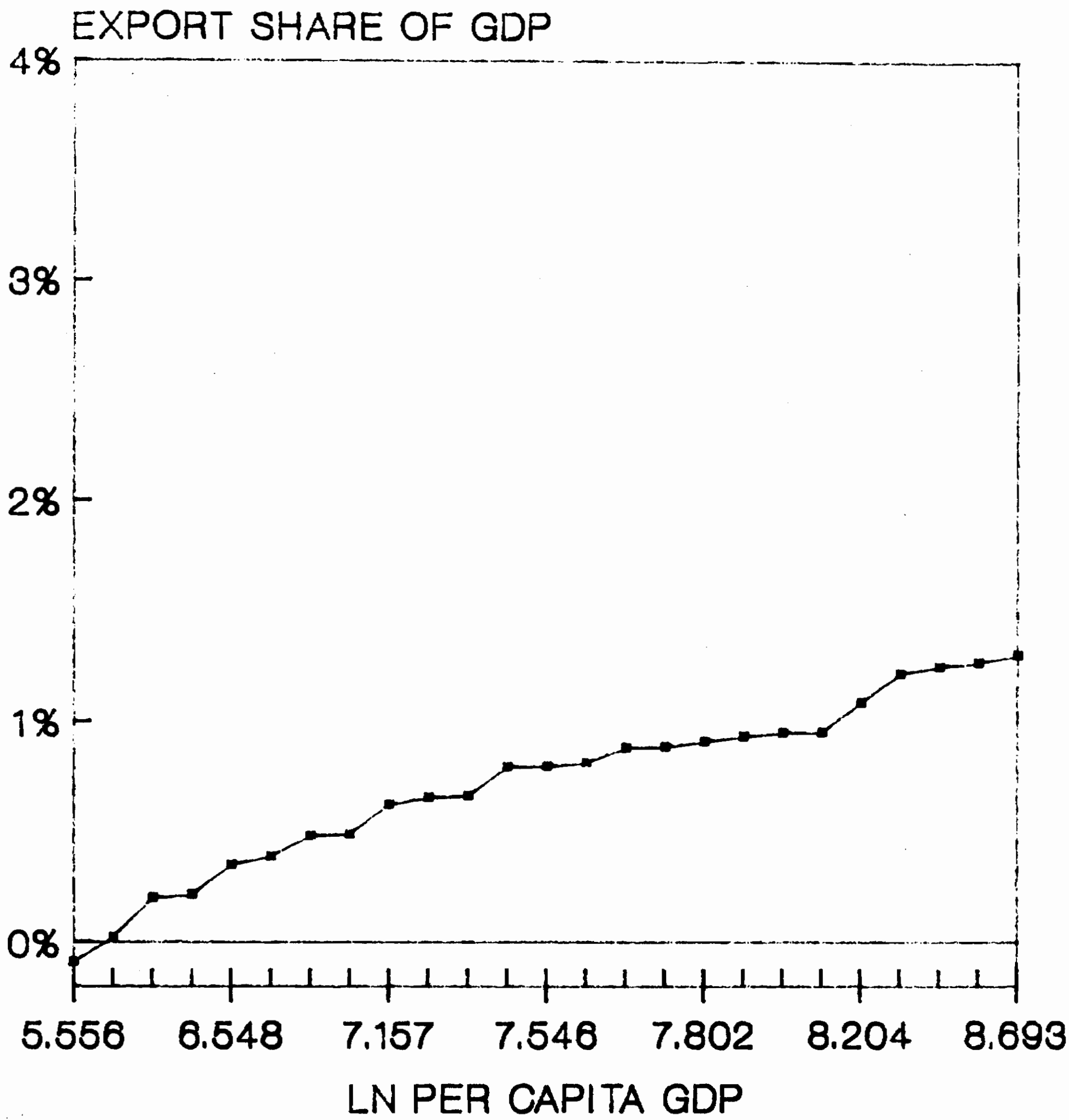

FIGURE 21
INTERMEDIATE MANUFACTURING

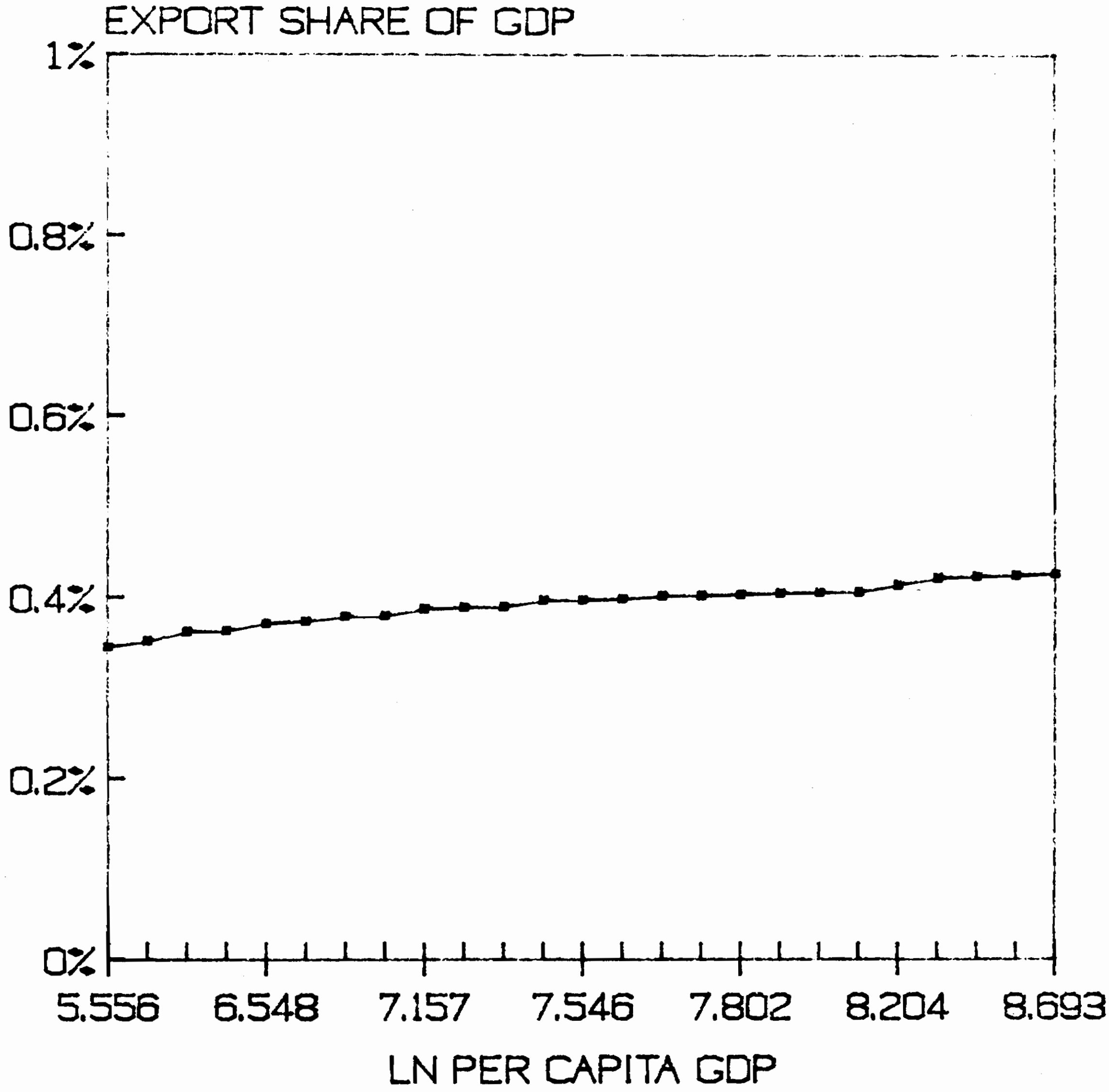

FIGURE 22
TEXTILES, SHOES, AND CLOTHING

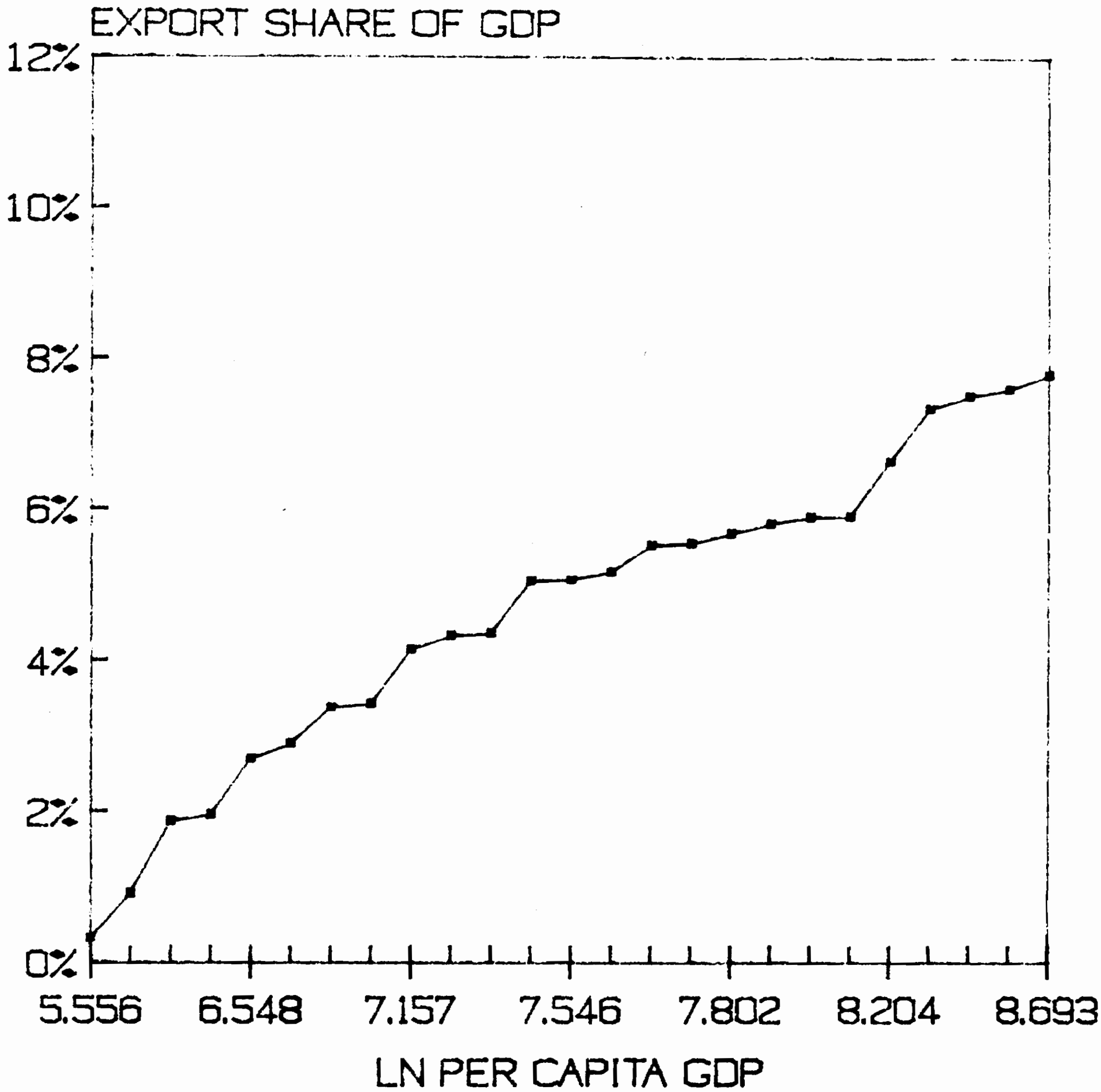

FIGURE 23
OTHER CONSUMER GOODS

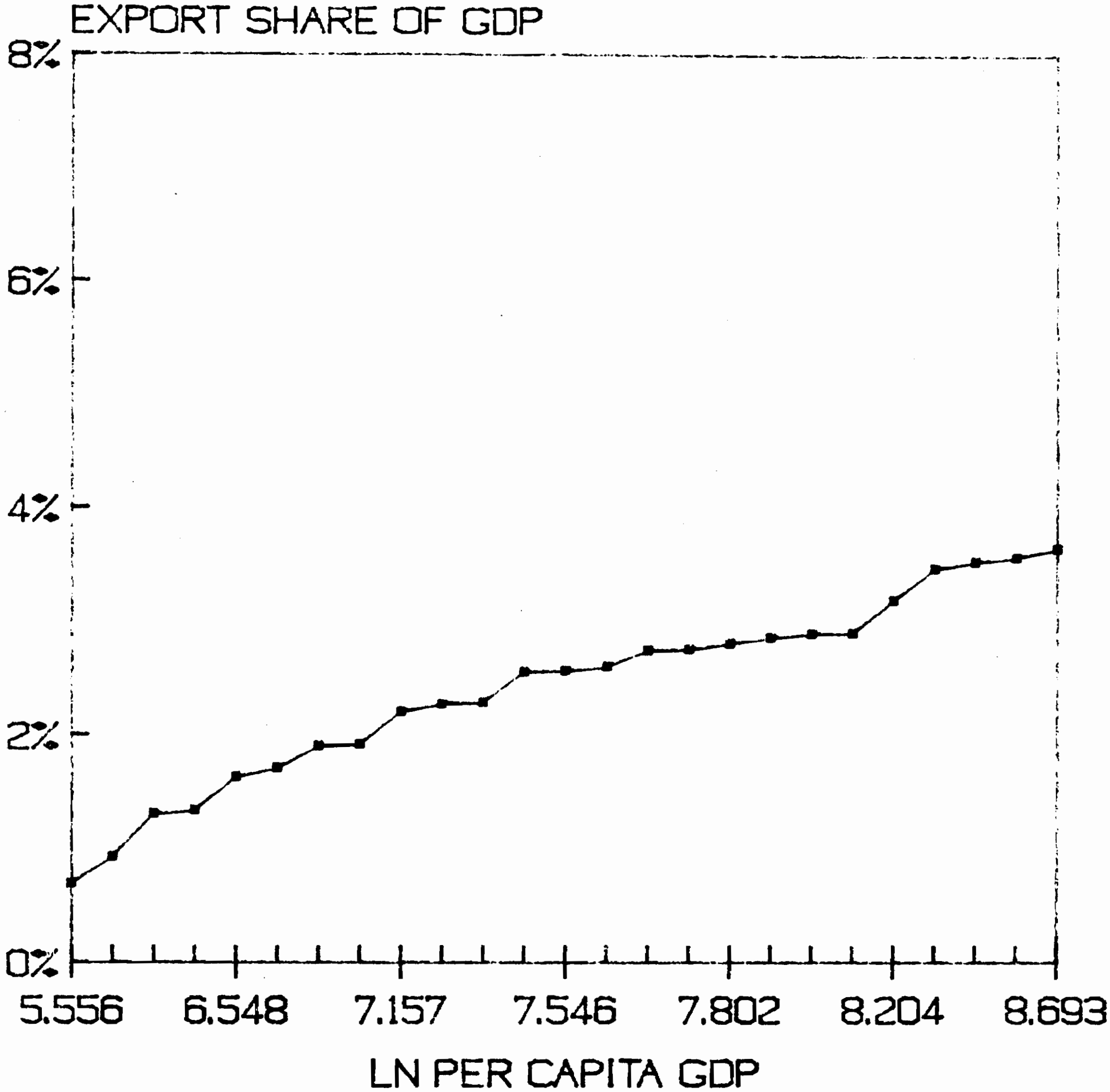

FIGURE 24
CAPITAL GOODS

Comparison of Results with Taylor Study

The signs of the estimated coefficients from the present work can be compared with those obtained by Taylor, et. al.. The results found in this study correspond exactly with the findings of Taylor for the import shares of agricultural food products, intermediate manufacturing, textiles, shoes, and clothing, and capital goods. The present export shares correspond exactly to Taylor's results for all product groups except groups four and five, (intermediate manufacturing and textiles, shoes, and clothing).

The three import product groups which do not correspond with Taylor, groups two, three and six, all have opposite signs on the income coefficients, while the export groups four and five have the same income coefficient signs as Taylor, they have different coefficients on the constant term and population variable. Table 3 provides a summary of the comparison of the two studies.

TABLE 3

SUMMARY OF COEFFICIENTS
Comparison of Taylor (T) - Alexander (A) Studies
Signs and Significance of Regression Coefficients

PRODUCT GROUP	CONSTANT		LN PER CAPITA GDP		LN POPULATION	
	(T)	(A)	(T)	(A)	(T)	(A)
IMPORTS						
GROUP 1	+	+	-	-	-	-
GROUP 2	-	+	-	-*	+	-
GROUP 3	-	+	+	-	+	-
GROUP 4	+	+	-	-	-	-
GROUP 5	+	+*	-	+*	-	-
GROUP 6	+	+	-	+*	-	-
GROUP 7	+	+	-*	-	-	-
EXPORTS						
GROUP 1	+	+	-	-	-	-
GROUP 2	+	+	-	-	-*	-
GROUP 3	+	+	-*	-	-	-
GROUP 4	+*	-*	+*	+	-	-
GROUP 5	-*	+*	+	+*	+*	-*
GROUP 6	-	-	+	+	-	-*
GROUP 7	-	-*	+	+	+	-

NOTE: +,- significant at the 0.05 level
* not significant

VII. Tests of the Pooled-Cross Sectional Model Results

As describe above, there are a number of methods available for testing the homogeneity of cross-sectional and intertemporal estimates. In order to test the validity of the estimates obtained from the pooled cross-sectional model, it is necessary to determine (1) if it is appropriate to assume a common intercept for all countries, (2) if the estimates are stable over time, and (3) if the estimates are consistent on an individual country bases.

Common Intercept

The pooled-cross sectional model assumes a common intercept for all cross section units. Considering the diversity of countries examined, it is expected that this assumption may not hold for all product groups. While Gregory and Griffin recommend allowing for separate intercepts when pooling cross-sectional data, the sample utilized by the present study is fairly homogeneous compared to other studies which pool developing and developed countries together. If the intercepts are found to be heterogenous, the coefficients estimated from the pooled cross-sectional will not be interpretable as intertemporal estimates.

To test the validity of this assumption, the following null hypothesis is examined for import and export shares for each product group:

H_o: $\alpha_i = \alpha_j$ for all i = j

where,

$$x_i = \alpha_i + \beta_1 \ln Y_i + \beta_2 \ln POP_i + u_i$$

is regressed as a time-series for all twenty-five countries separately. F-tests are performed at the five percent significance level for each cross-section with all cross-sections, i.e., 625 (25^2) tests are performed. The total number of non-equal pairs is summed and then divided by the total possible pairs (625) to give the percentage of non-homogeneous intercepts for each product group. The results are presented in Table 4. There is no consensus as to the critical percentage of non-homogeneous intercepts at which the assumption of a common intercept should be rejected. However, the results do indicate that while the null hypothesis cannot be accepted, on average 80% of the intercepts are homogeneous, i.e. they share a common starting point.

<u>Stability of the Coefficients over Time</u>

In order to test the stability of the pooled-cross section estimates across time, three separate regressions are performed for the periods 1978 to 1980, 1981 to 1983, and 1984 to 1986. A Chow test is performed at the 99%

confidence level. All product groups except export shares of capital goods exhibit stable coefficients across time. The results are summarized in Table 5. These results are consistent with the findings of Taylor, et. al. that coefficients are stable across time. Although Gregory and Griffin found instability of cross-section estimated coefficients when a long time period is examined, they attribute part of this to the non-homogeneity of intercepts, which as shown above is not evident in 80% of the current sample.

TABLE 4

TESTS FOR THE HOMOGENEITY OF INTERCEPTS

	PERCENTAGE OF NON-HOMOGENOUS INTERCEPTS
IMPORTS	
GROUP I	16.32
GROUP II	21.76
GROUP III	23.36
GROUP IV	12.48
GROUP V	24.00
GROUP VI	18.56
GROUP VII	26.24
EXPORTS	
GROUP I	12.16
GROUP II	13.44
GROUP III	15.36
GROUP IV	22.40
GROUP V	15.04
GROUP VI	29.12
GROUP VII	38.72

TABLE 5
TESTS FOR THE STABILITY OF COEFFICIENTS ACROSS TIME

Coefficients of ln Per Capita GDP
(t-statistic)

	1978-80	1980-83	1984-86	1978-86	F (3,216)
IMPORTS					
GROUP I	-0.009 (-3.432)	-0.012 (-3.616)	-0.010 (-2.912)	-0.010 (-5.69)	0.73
GROUP II	-0.001 (-0.523)	-0.001 (-0.688)	0.000 (0.334)	-0.000 (-0.436)	0.42
GROUP III	-0.004 (-1.725)	-0.004 (-1.307)	-0.001 (-0.281)	-0.003 (-2.156)	2.07
GROUP IV	-0.005 (-1.260)	-0.005 (-1.306)	-0.000 (-0.098)	-0.004 (-1.616)	0.75
GROUP V	0.000 (0.112)	0.001 (0.773)	0.002 (1.748)	0.001 (1.528)	0.55
GROUP VI	-0.001 (-0.309)	0.001 (0.283)	0.004 (1.166)	0.002 (0.786)	1.03
GROUP VII	-0.024 (-1.848)	-0.021 (-1.341)	-0.003 (-0.177)	-0.016 (-1.879)	1.13
EXPORTS					
GROUP I	-0.011 (-2.888)	-0.010 (-2.831)	-0.013 (-2.974)	-0.011 (-5.047)	0.63
GROUP II	-0.010 (-1.930)	-0.007 (-1.647)	-0.004 (-1.040)	-0.007 (-2.870)	0.98
GROUP III	-0.008 (-1.789)	-0.007 (-1.691)	-0.006 (-1.527)	-0.007 (-2.971)	0.05
GROUP IV	0.003 (1.306)	0.004 (1.503)	0.006 (1.859)	0.004 (2.820)	1.46
GROUP V	-0.000 (-0.451)	0.000 (0.172)	0.001 (1.012)	0.000 (0.463)	0.56
GROUP VI	0.011 (0.837)	0.022 (1.562)	0.038 (2.471)	0.024 (2.949)	0.86
GROUP VII	-0.002 (-0.217)	0.006 (0.679)	0.021 (1.664)	0.009 (1.630)	4.18

Test for the Consistency of Estimates for Individual Countries

To test the applicability of the estimates obtained by the pooled cross-section model to individual countries, the predicted and actual trade shares for each country are examined. Figures 25 through 31 show predicted and actual import shares for all countries and product groups, Figures 32 through 38 show the predicted and actual export shares for all countries and for each product group (for simplicity of presentation, the x-axis is labeled with every other country). The declining or increasing patterns evident in Figures 11 to 24 are not present in these presentations because while the countries are ranked in ascending order of per capita GDP, they are not ranked according to population.

On the import side, the actual versus fitted values of agricultural goods indicate that while most countries fit well, Egypt and Singapore import a greater proportion than predicted (see Figure 25). Figure 26 indicates that although import shares of non-food agricultural products are a rather small percentage of most countries GDP, Egypt, Korea, and Taiwan's import shares are much higher than predicted. The actual versus predicted import values of metals, minerals, and fertilizer shown in Figure 27 are fairly close with the exception of Singapore, where the model underestimates the actual share. Product group four (intermediate manufacturing) show close fits between the predicted and actual trade shares again with the exception of Singapore which is underestimated (Figure 28). The predicted import share of textiles, shoes and clothing underestimates the actual for Singapore and Hong Kong while most other countries are predicted fairly well (Figure 29). Figure 30 is interesting in that the high actual import shares of Singapore and Hong Kong pull the predicted values up, so that while these two countries are underestimated, the majority of the countries are slightly overestimated. The predicted import shares of capital goods are very close to the actual imports shares for most countries, with Singapore having a very high actual trade share which is underestimated (Figure 31).

On the export side, the regression equations for each product group have markedly lower R^2 values than the import share equations, this is definitely evident in the graphs of the predicted versus actual export shares. Figure 32 shows that while Thailand, Columbia and Ecuador have export shares of agricultural food products much higher than expected and the export shares of Egypt, Iraq and Venezuela are underestimated, many of the countries are predicted rather well, for instance, the Philippines, South Korea and Chile. Figure 33 is noted for Malaysia's extremely high non-food agricultural products export share of around 10% while the majority of the countries have trade shares less than 2% of GDP. The high actual trade shares of metals, minerals, and fertilizer of Peru, Chile and South Africa tend to pull up all predicted values so that many countries are underestimated (Figure 34). The predicted shares for the Philippines, South Korea, Algeria, Mexico and Venezuela, however, are extremely close to the actual trade shares for this product group. Figure 35 shows that while Israel has a much higher trade share of intermediate manufacturing than predicted, the trade shares for the Philippines, South Korea, Singapore and Hong Kong are well predicted. The export shares of textiles, shoes and clothing, while very low for most countries is predicted well for China, Turkey, Malaysia, Singapore and Israel although the estimated coefficients for the regression equation are not statistically significant. Figure 37 indicates that the very high actual export shares of other consumer goods of South Korea, Taiwan and Hong Kong result in the overestimation of most other country's trade shares although it predicts the export share of Thailand and Singapore quite well. The estimation of export shares of capital goods is dominated by the high actual trade shares of Taiwan and Singapore although the export share of Mexico and Hong Kong are well predicted.

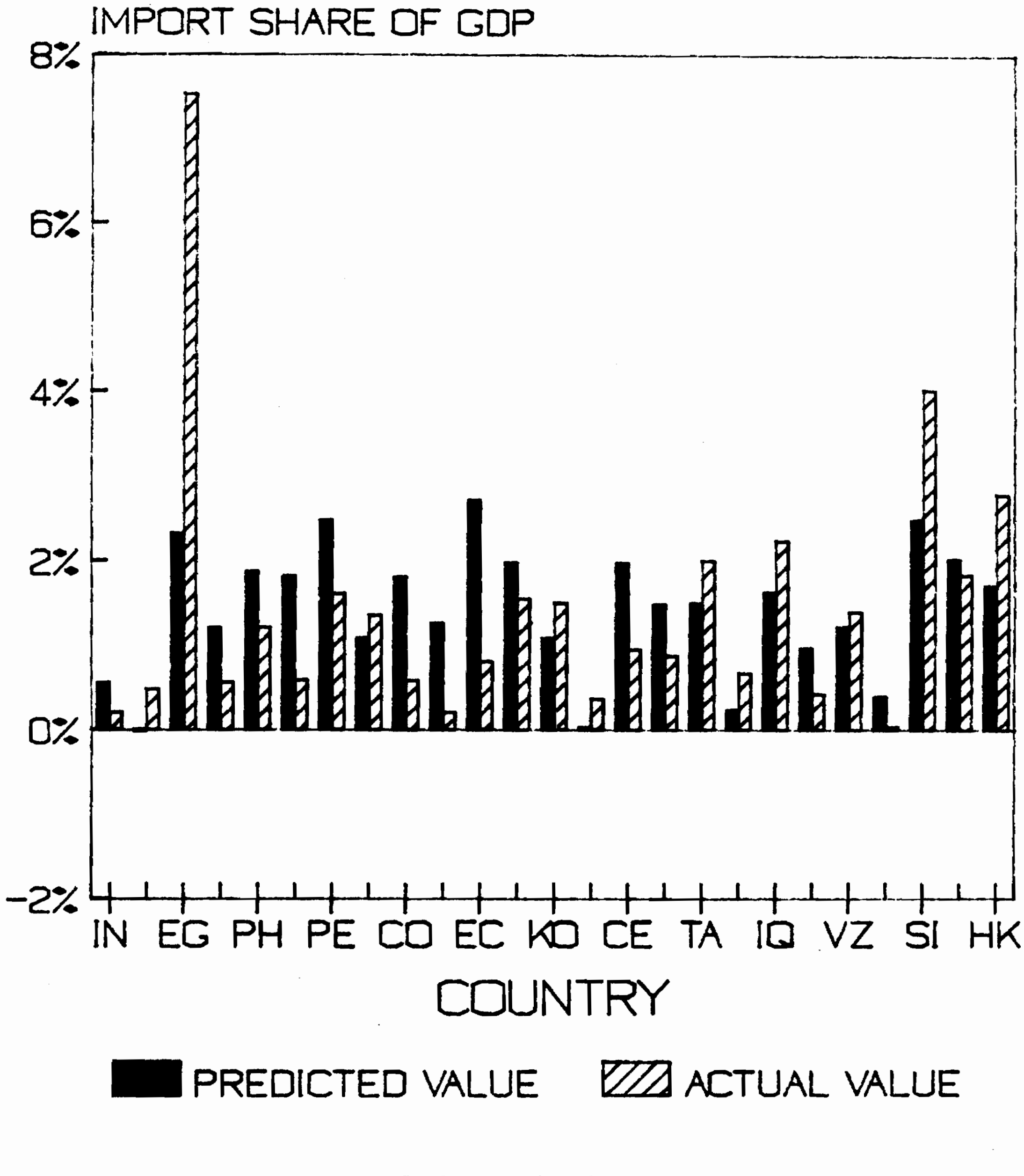

FIGURE 25
AGRICULTURAL FOOD PRODUCTS

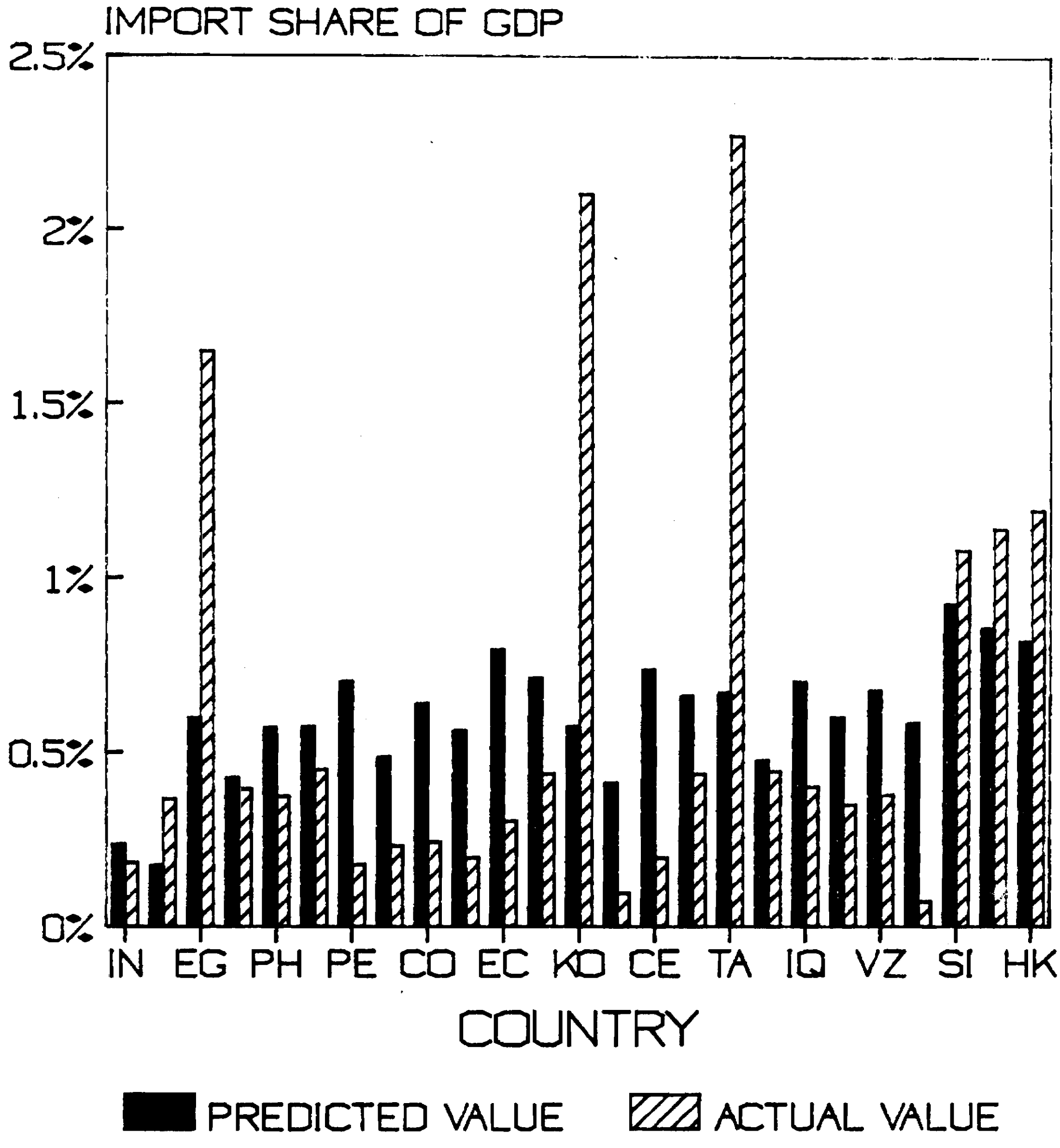

FIGURE 26
NON-FOOD AGRICULTURAL PRODUCTS

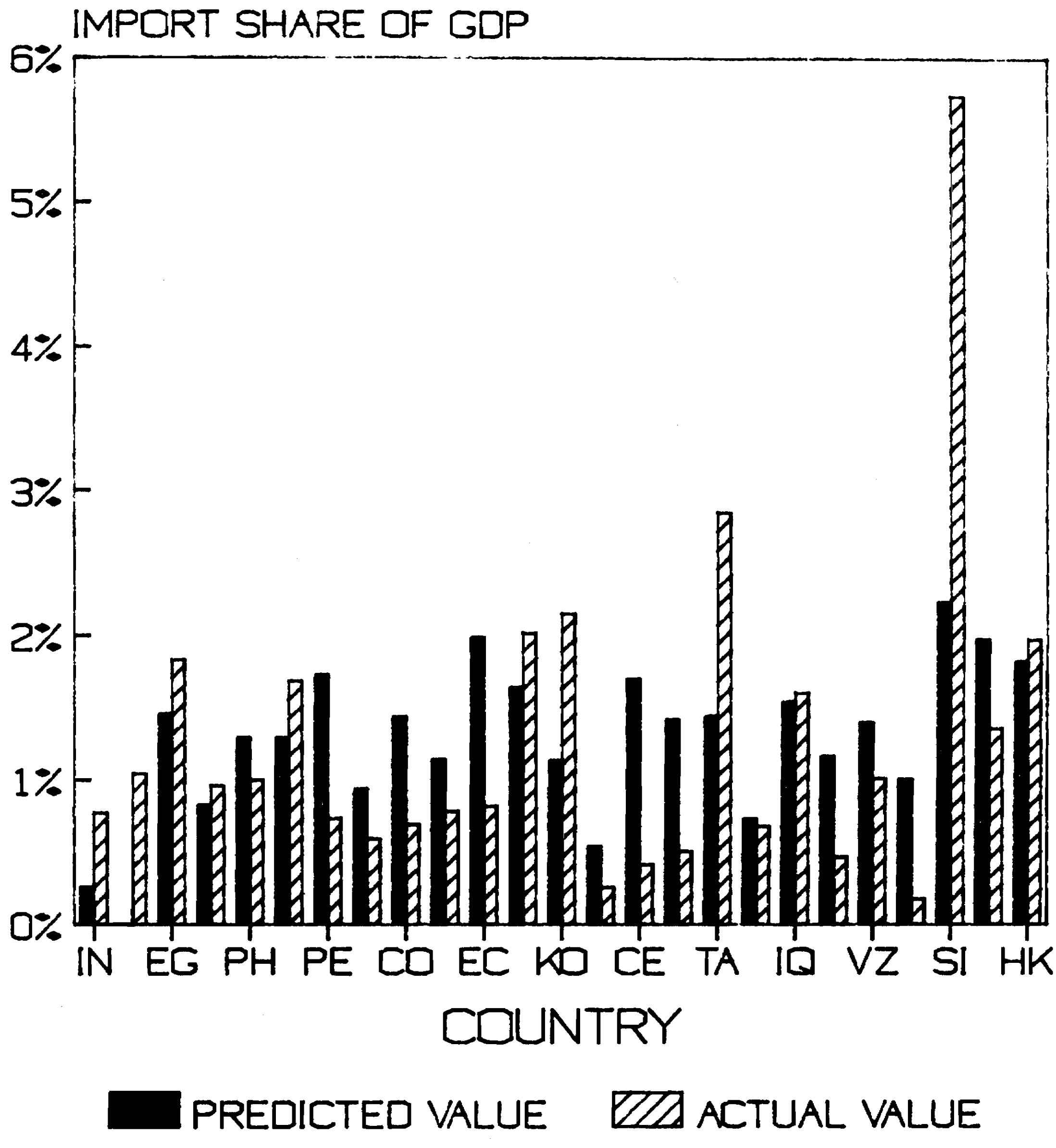

FIGURE 27
METALS, MINERALS, AND FERTILIZER

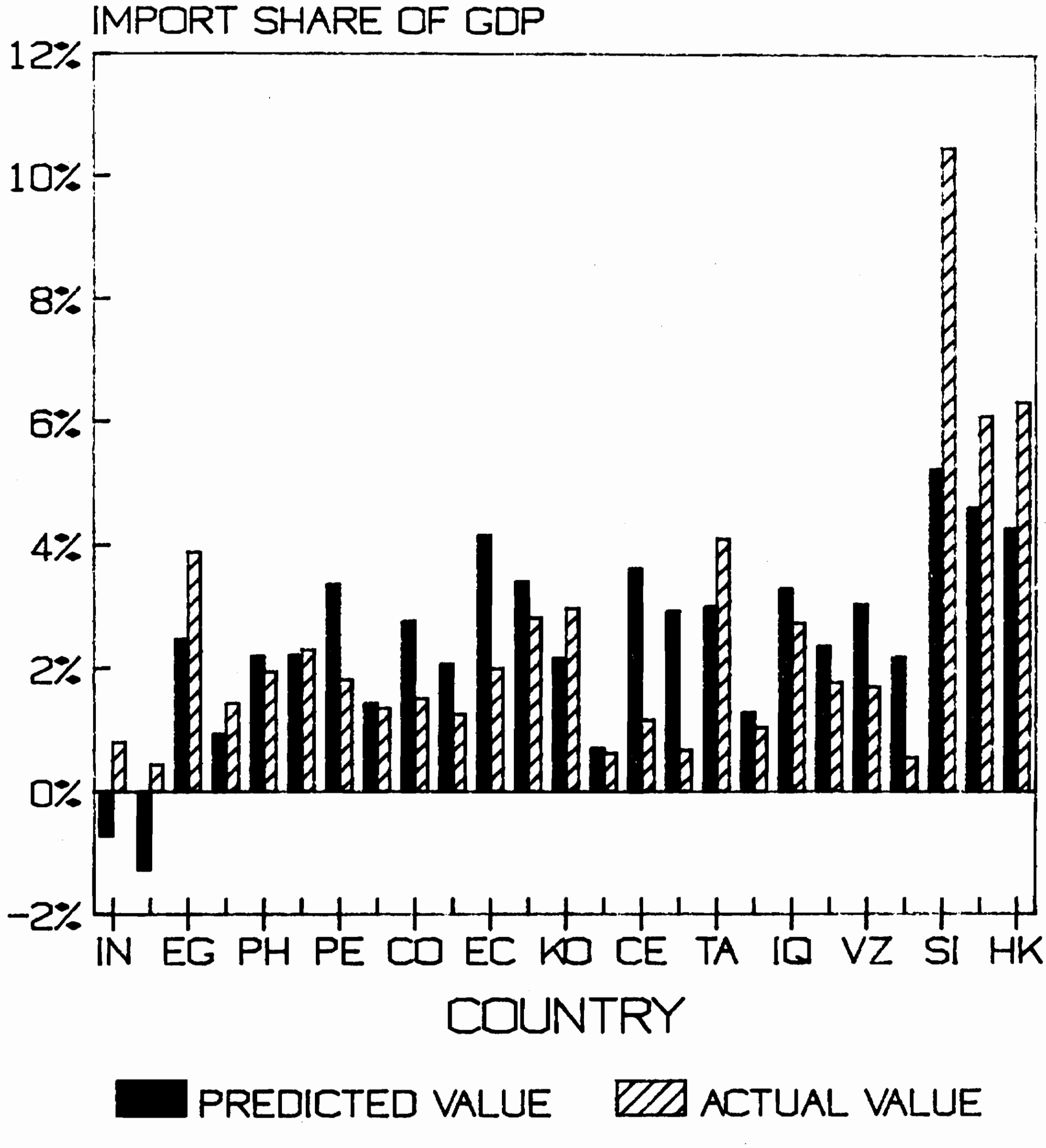

FIGURE 28
INTERMEDIATE MANUFACTURING

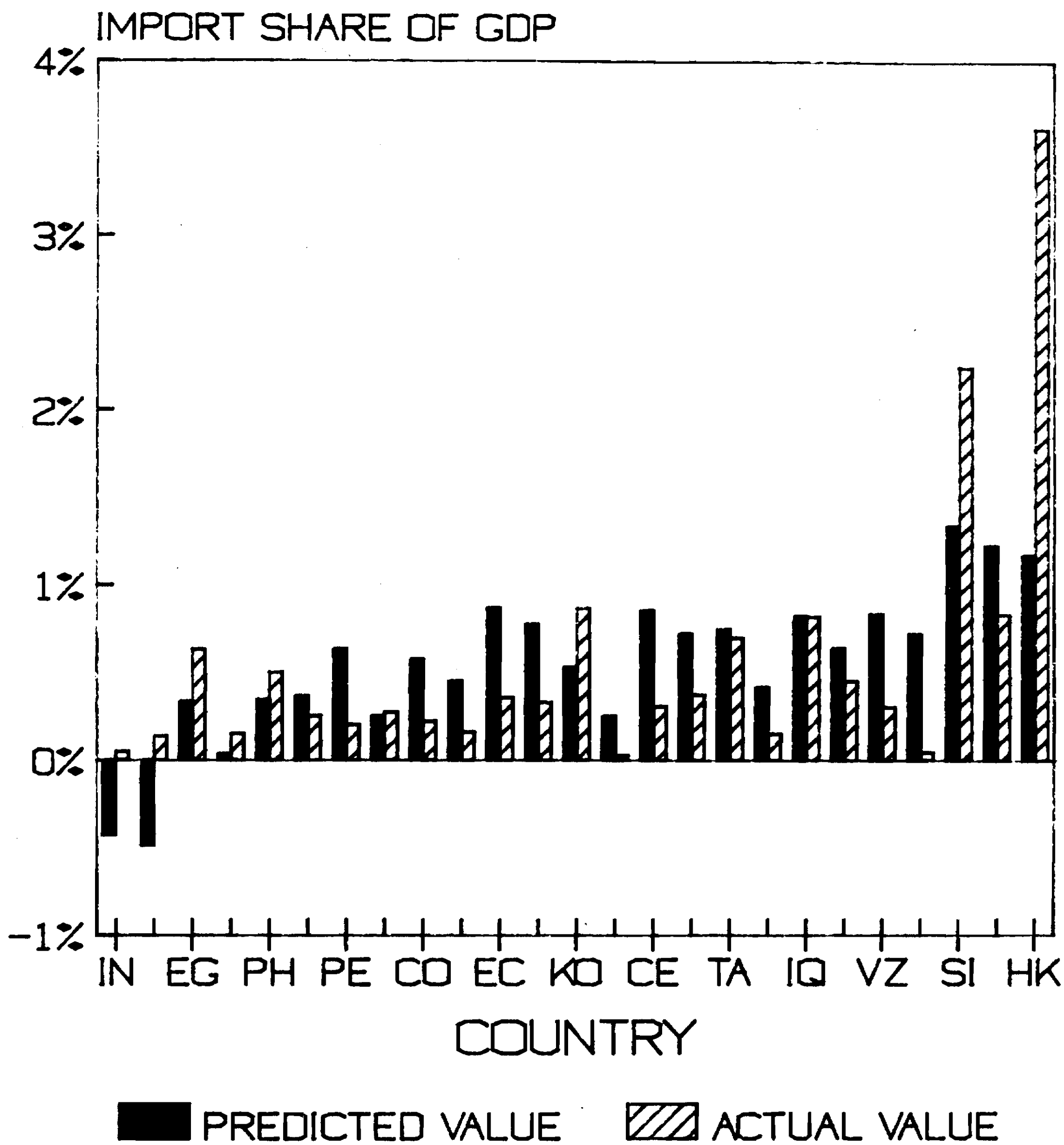

FIGURE 29
TEXTILES, SHOES, AND CLOTHING

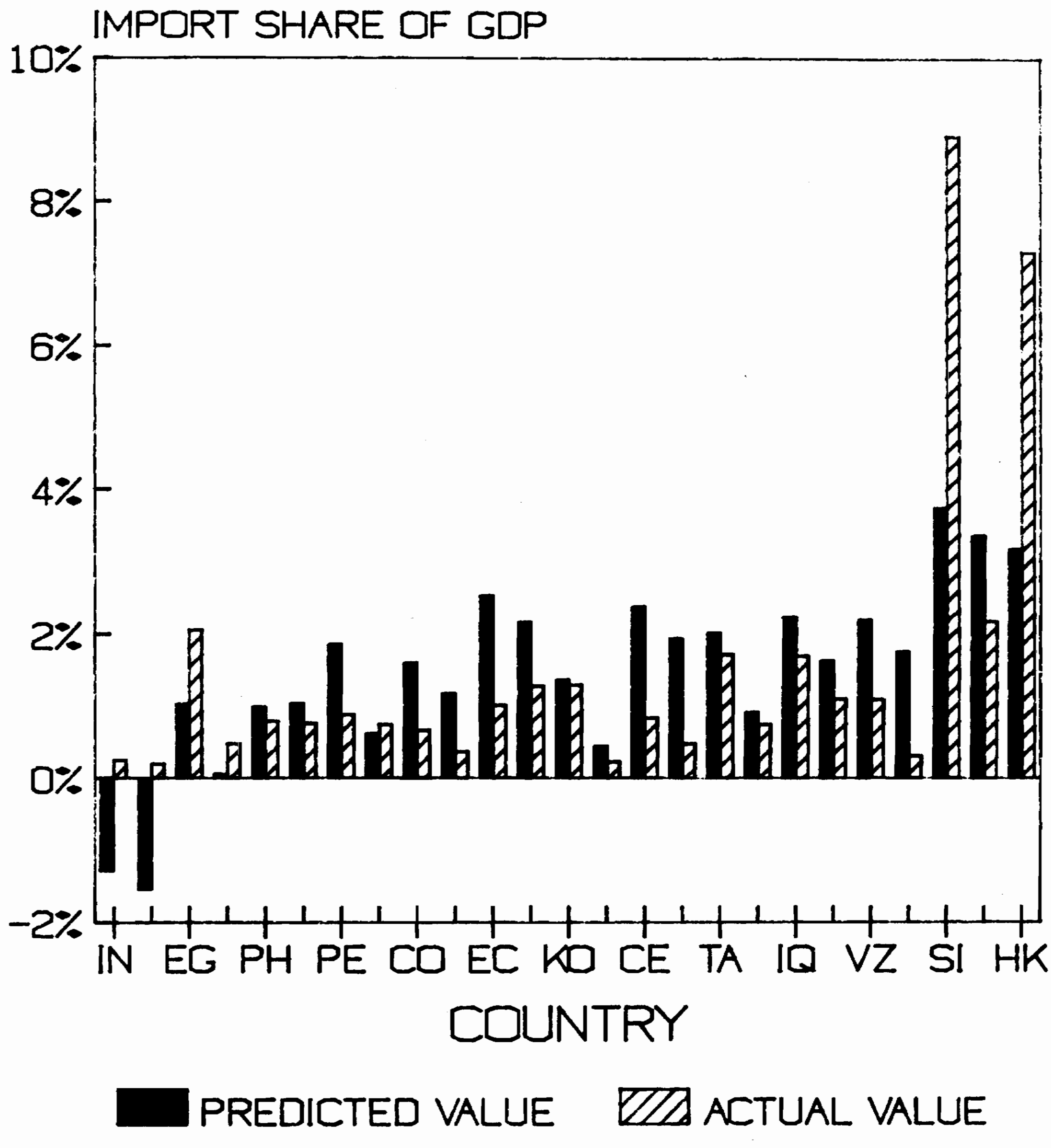

FIGURE 30
OTHER CONSUMER GOODS

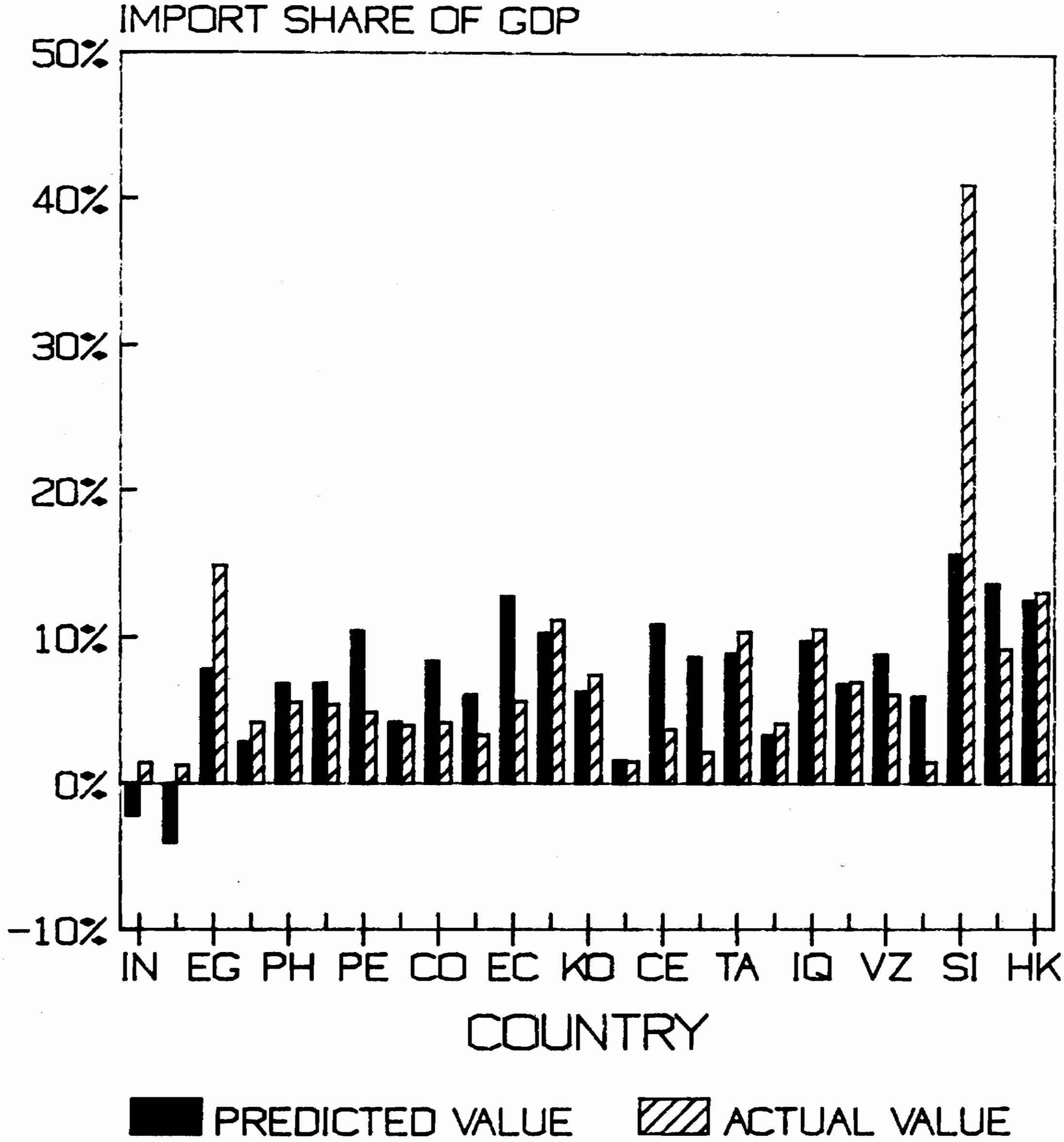

FIGURE 31
CAPITAL GOODS

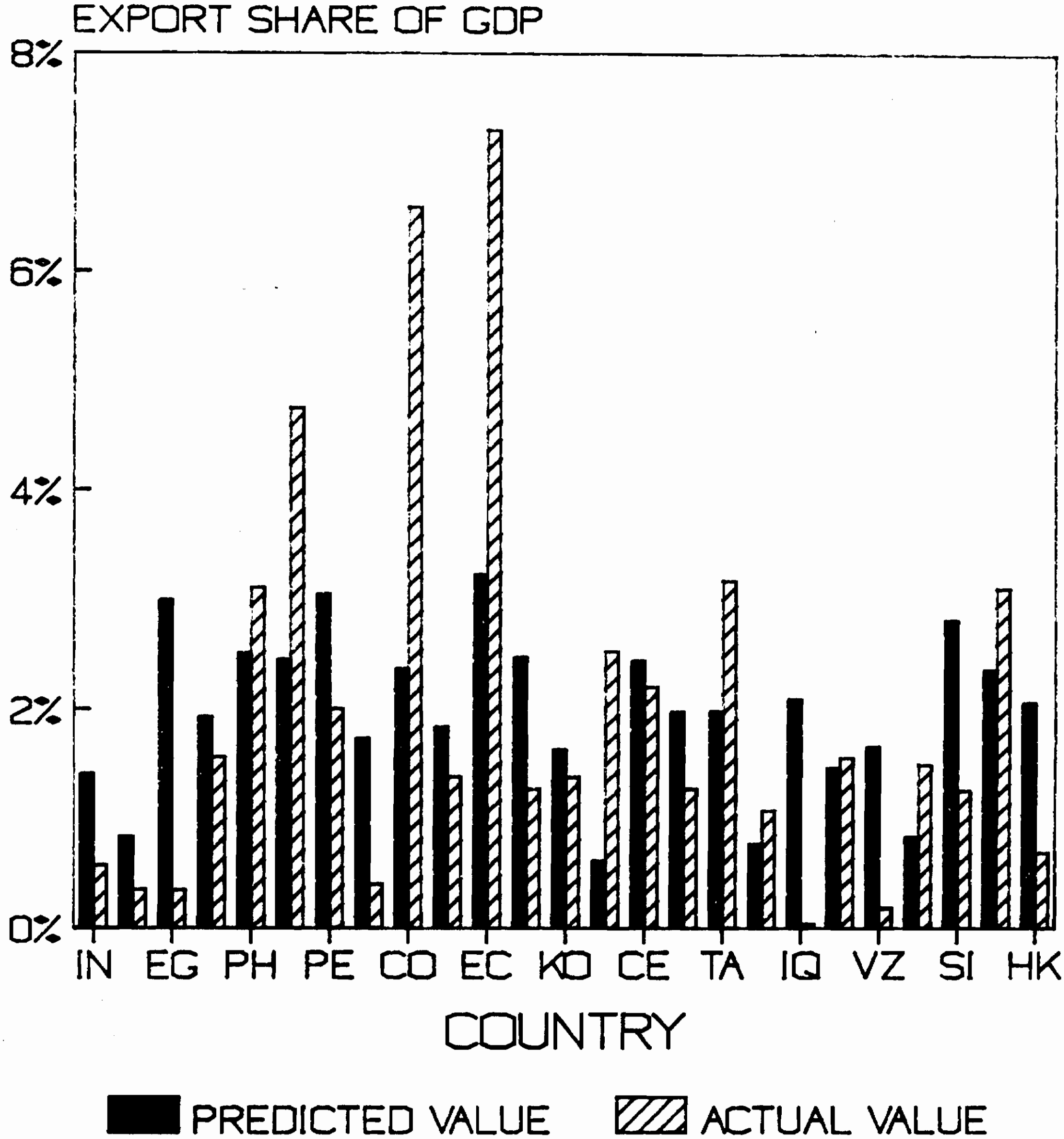

FIGURE 32
AGRICULTURAL FOOD PRODUCTS

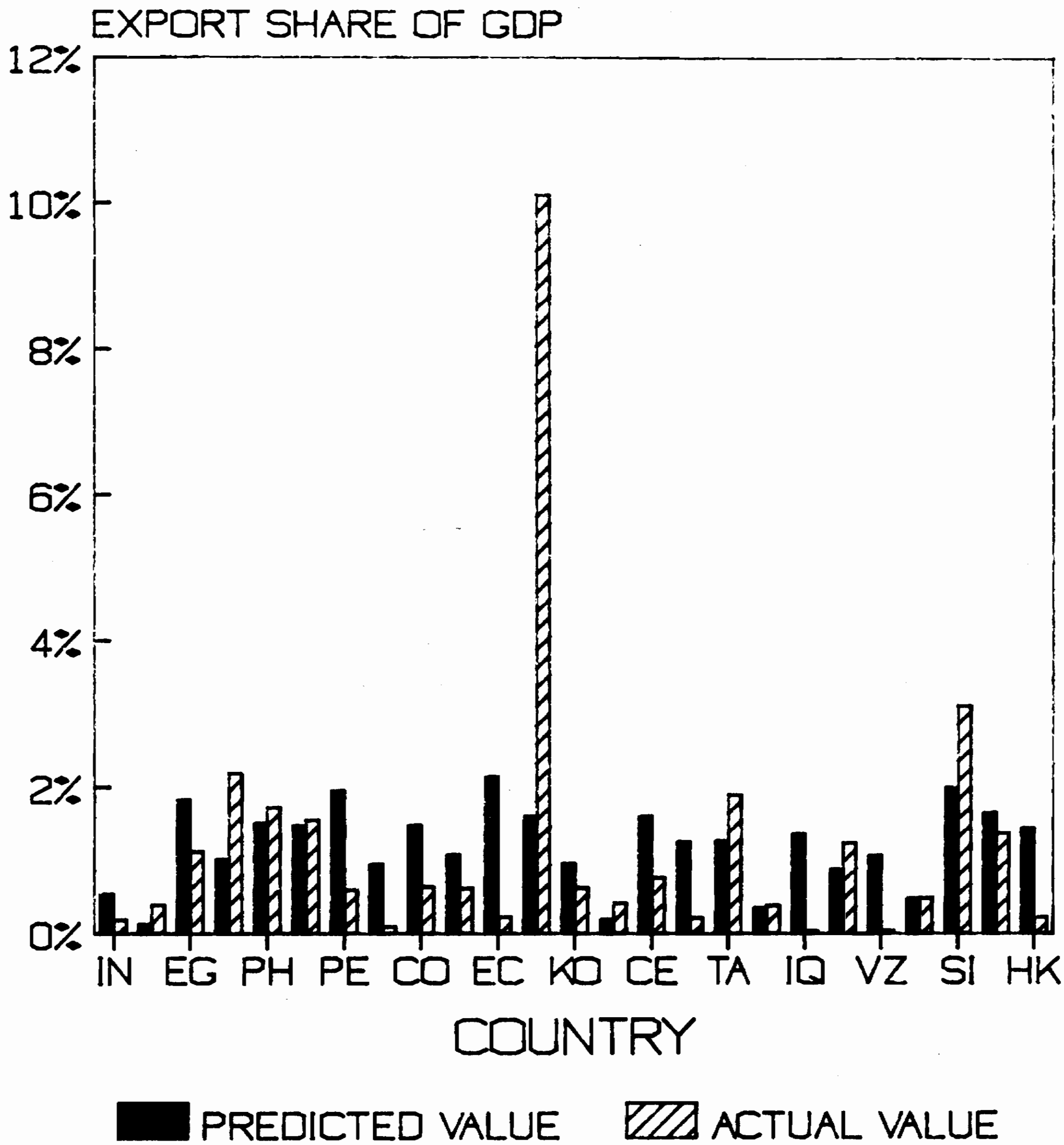

FIGURE 33
NON-FOOD AGRICULTURAL PRODUCTS

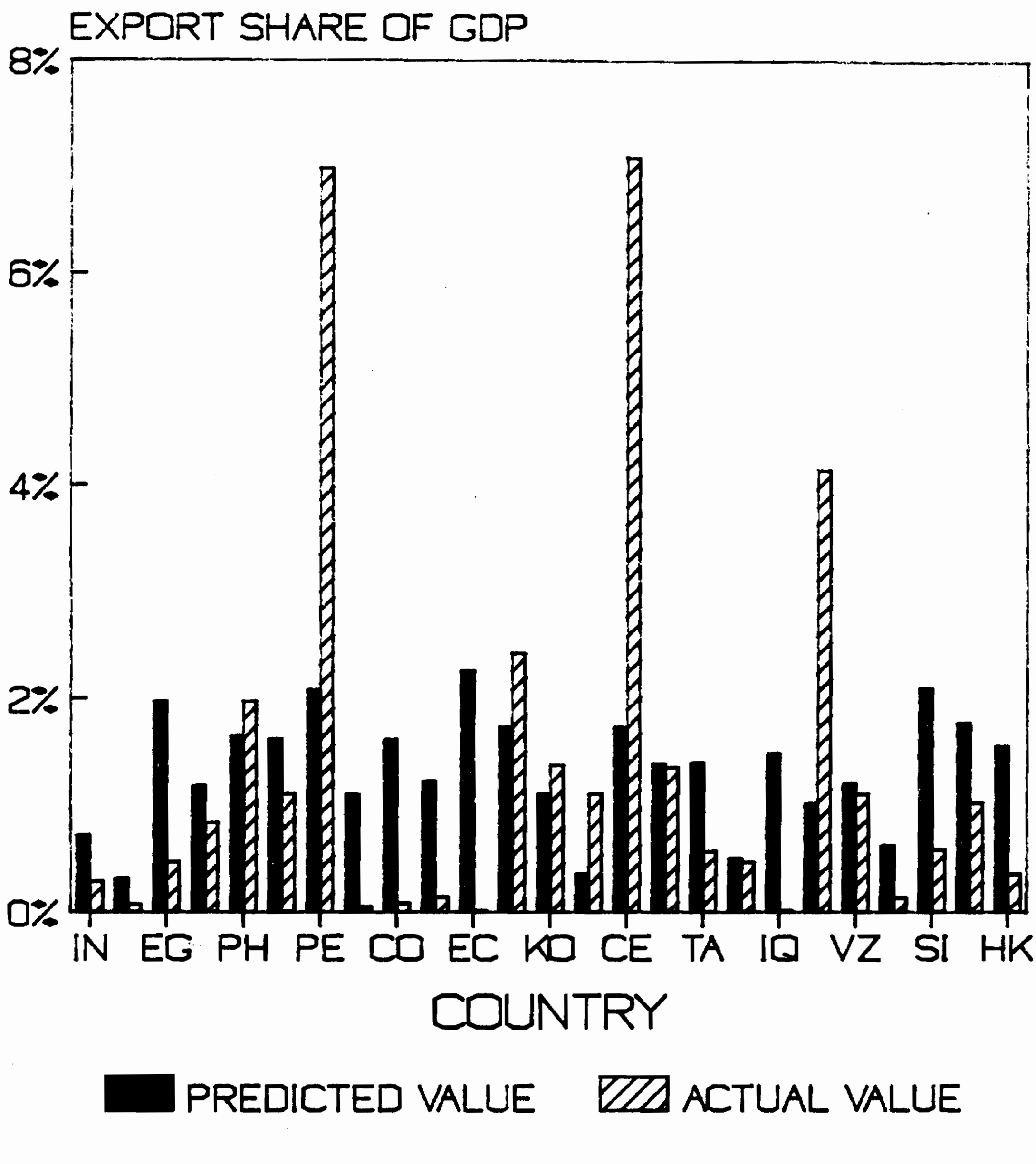

FIGURE 34
METALS, MINERALS, AND FERTILIZER

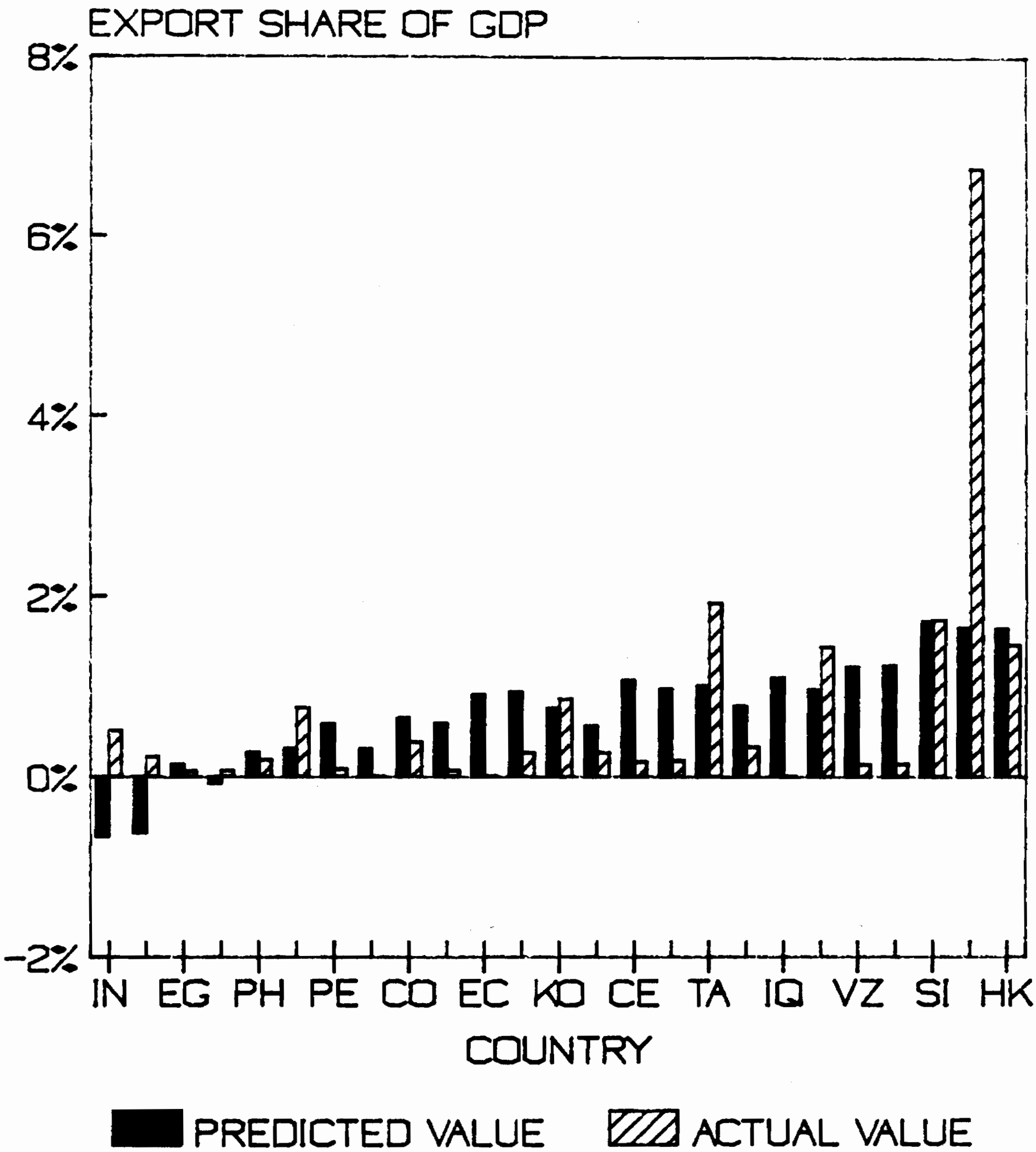

FIGURE 35
INTERMEDIATE MANUFACTURING

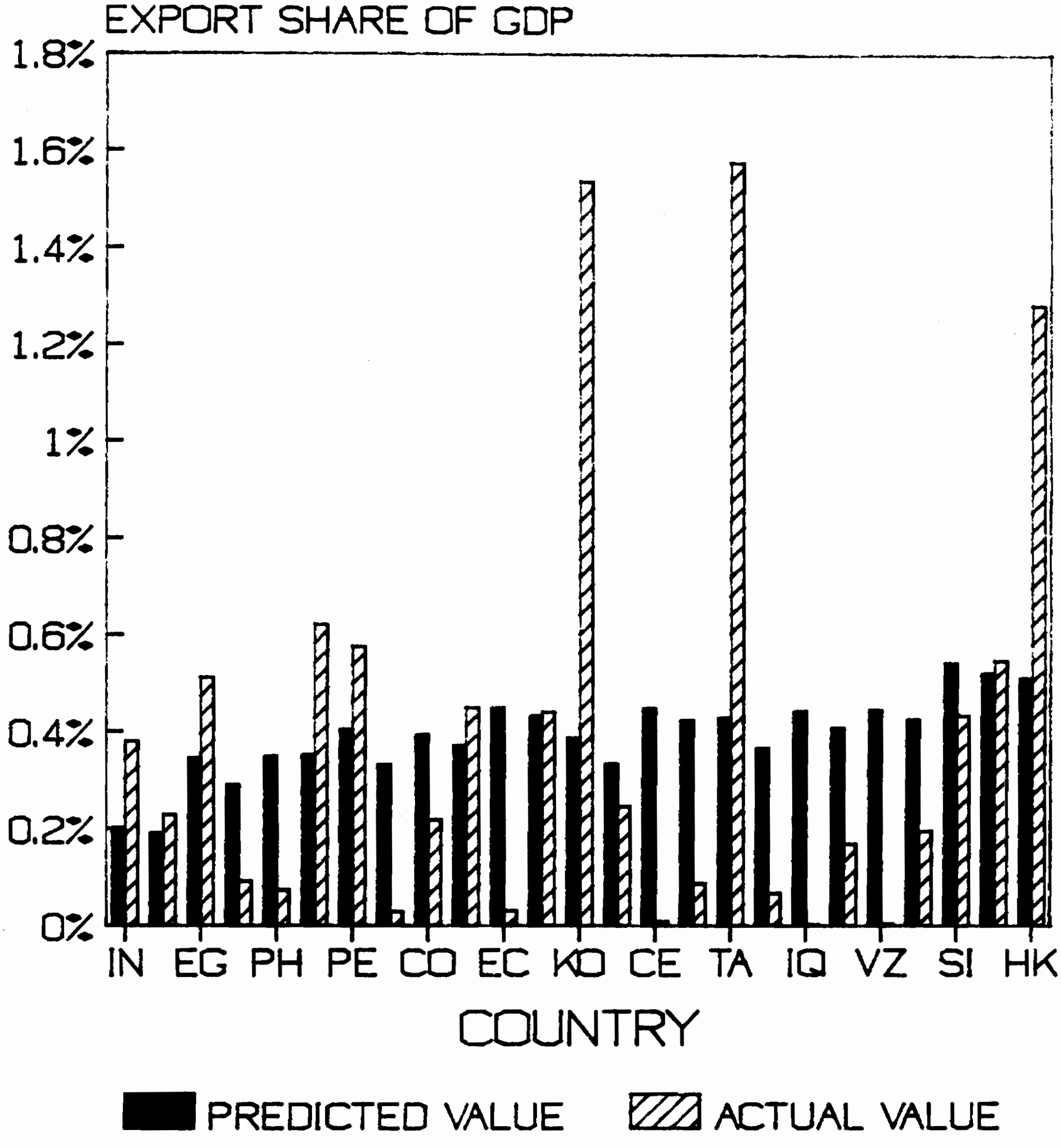

FIGURE 36
TEXTILES, SHOES, AND CLOTHING

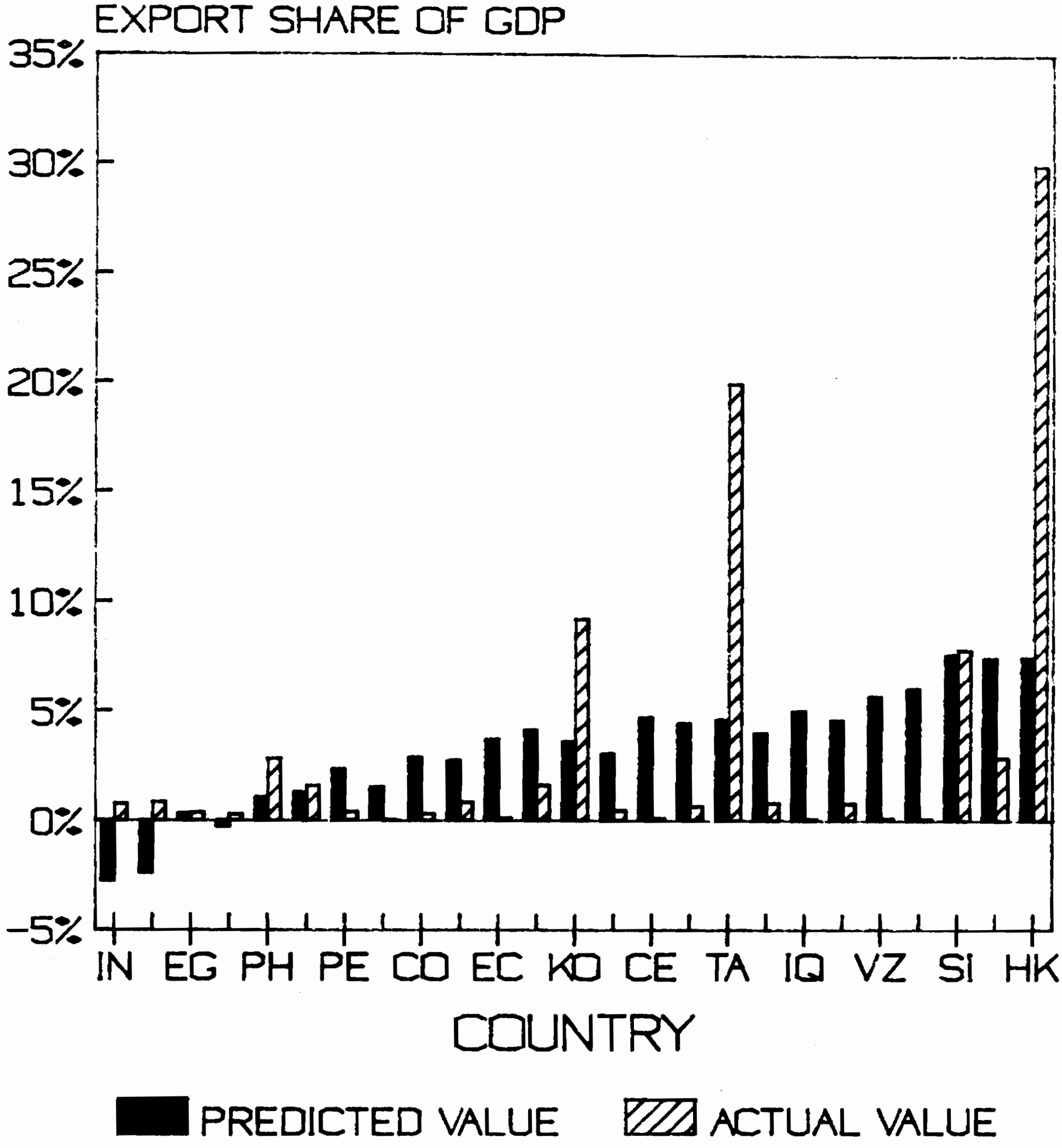

FIGURE 37
OTHER CONSUMER GOODS

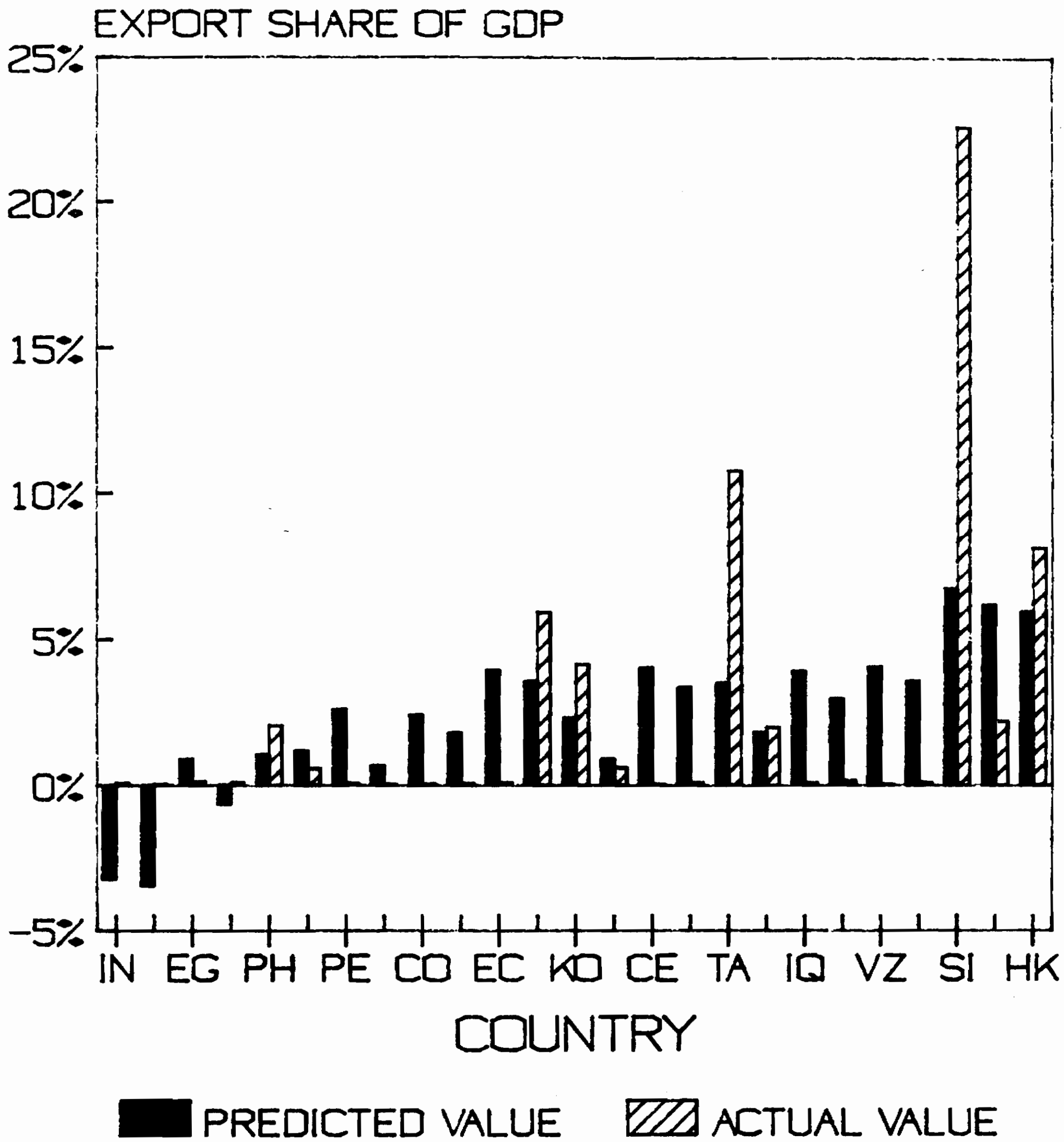

FIGURE 38
CAPITAL GOODS

VIII. Conclusions

The existence of patterns of development in the external trading characteristics of Less Developed Countries is confirmed by this study. The share of imports of product groups one, two, three and four decline as income level increases as do the export shares of product groups one, two and three. It is interesting that while the import shares of product groups five and six increase as income level increases, the import share of product group seven (capital goods) decreases, indicating that as economic development progresses, an economy is better able to substitute domestically produced capital goods for imported capital goods. The export shares of product groups four, five, six and seven increase as income levels increase with the export share of other consumer goods showing the most dramatic increases. These results are exactly what the patterns of development hypothesis would predict.

The question still remains, however, if these results can be interpreted as representing the long run development path for individual countries. Gregory and Griffin suggest that cross-sectional estimates and time-series estimates are homogeneous with certain qualifications. The present study goes far towards meeting those requirements, first, on average the countries have homogeneous intercepts, therefore, they share a common starting point in development, second, nine years of cross-section data is utilized, while not long enough to discern long run trends for each individual country, it does provide for more information than using a single year of cross-section data. The estimated coefficients also exhibit remarkable stability across time, supporting the assumption of common intercepts across countries. The comparison of predicted trade shares and actual trade shares reinforces the fact that while income level and population are powerful explanatory variables within the context of the patterns of development hypothesis, they fall short of predicting individual country behavior when a short time period is analyzed.

Until reliable and consistent data is available for Less Developed Countries over a long period of time so that tests of the homogeneity of cross-section estimates and time-series estimates are more accurate, the use of cross-section estimates to infer time-series behavior seems a useful tool in the analysis of LDC trading patterns.

Endnotes

1. Chenery, Hollis, Structural Change and Development Policy (New York: Oxford University Press, 1979), pp. 6-7.

2. Kuznets, Simon, "Quantitative Aspects of the Economic Growth of Nations IX. Level and Structure of Foreign Trade: Comparisons for Recent Years," Economic Development and Cultural Change, Vol. 8, Oct. 1964, part II, p.11.

3. Ibid., p.15.

4. Chenery, Hollis and Taylor, Lance, "Development Patterns: Among Countries and Over Time," The Review of Economics and Statistics, Vol. L, No. 4, November, 1968, pp. 391-416. See also, Taylor, Lance, "Development Patterns: A Simulation Study," Quarterly Journal of Economics, 1968; Chenery, H. and Syrquin, M., Patterns of Development, 1950-1960 (London: Oxford University Press, 1975).

5. Jameson, Kenneth, "A Critical Examination of the 'Patterns of Development'," Journal of Development Studies, Vol. 18, No. 4, July, 1982, pp. 431-46.

6. Gregory, Paul and Griffin, James, "Secular and Cross-Section Industrialization Patterns: Some Further Evidence on the Kuznets-Chenery Controversy," The Review of Economics and Statistics, August 1974, pp. 360-368.

7. Ibid., p. 367.

8. Taylor, Lance, McCarthy, Desmond, and Alikhani, Iradj, Trade Patterns in Developing Countries, 1970-81, World Bank Staff Working Papers, Number 642, Washington, D.C., 1984.

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APPENDIX A

LIST OF COUNTRIES

INDIA
CHINA
EGYPT
INDONESIA
PHILIPPINES
THAILAND
PERU
NIGERIA
COLUMBIA
TURKEY
ECUADOR
MALAYSIA
SOUTH KOREA
BRAZIL
CHILE
ALGERIA
TAIWAN
MEXICO
IRAQ
SOUTH AFRICA
VENEZUELA
ARGENTINA
SINGAPORE
ISRAEL
HONG KONG

APPENDIX B

PRODUCT GROUP AGGREGATION

PRODUCT GROUP	SITC CODE
GROUP 1	00, 02, 03, 041-048, 06, 07, 08, 09, 11, 12
GROUP 2	21, 26, 29, 22, 23, 24, 63, 25, 27 (except 2713), 661
GROUP 3	2713, 56, 281, 287, 28 (except 281, 28731-28732), 67, 68
GROUP 4	511-516, 52, 53, 54, 55, 57, 58, 59, 66 (except 661, 665, 666), 69 (except 696, 697, 6991, 6992, 6993)
GROUP 5	61, 62, 65
GROUP 6	658, 659, 665, 666, 696, 697, 6991, 6992, 6998, 8, 9
GROUP 7	711, 712, 714, 718, 721, 725, 728, 736, 737, 713, 716, 724, 726, 727, 741, 742, 743, 745, 749, 722, 723, 744, 75, 76, 77, 78, 79

APPENDIX C

Note on the Graphical Presentations

In order to represent in two dimensions what is essentially in three (trade share by per capita GDP by time) the time dimension is compressed out in the following manner. The solved regression equation is,

$$X_{it} = a + b\,(\ln Y_{it}) + c\,(\ln POP_{it})$$

where a, b, and c are estimates of α, β_1, and β_2 respectively, and X_{it} is the estimate of x_{it}. We can take the mean of X_{it} across t, so that

$$X_i = \underset{(Tx1)}{\begin{bmatrix} X_{i1} \\ X_{i2} \\ \cdot \\ \cdot \\ \cdot \\ X_{iT} \end{bmatrix}} \quad \text{and} \quad X_i = \underset{(1x1)}{X_i}$$

If a similar procedure is applied to the explanatory variable matrix, D_i, which can be divided into its component parts, and then stacked as described above, the following results,

$$\underset{(Px1)}{\overline{\mathbf{X}}} = \underset{(Px1)}{\mathbf{a}} + \underset{(Px1)}{\mathbf{b}}\ \underset{(Px1)}{\overline{\mathbf{Y}}} + \underset{(Px1)}{\mathbf{c}}\ \underset{(Px1)}{\overline{\mathbf{POP}}}$$

where each element of **a**, **b**, and **c** is the same for each country.

To present graphically the relationship between trade share and per capita GDP, one further step is necessary. If we take the mean of **POP** we have a scalar value which represents the sample mean population. This is then substituted into the above equation so that the influence of per capita GDP on trade share can be isolated, or

$$\overline{\mathbf{X}} = \mathbf{a} + \mathbf{b}\,\overline{\mathbf{Y}} + \mathbf{c}\,\overline{\overline{\mathbf{POP}}}.$$

VITA

Kimberly Holloman Alexander was born on March 30, 1962. Ms. Holloman Alexander graduated from Virginia Polytechnic Institute and State University in 1984 with a major in Political Science, a double major in Russian and Soviet Studies, and a minor in Economics. Ms. Holloman Alexander is currently employed by Data Resources as an Economic Research Assistant in the International Trade Group.