To the Graduate Council:

I am submitting herewith a dissertation written by Bert Gregory Wheeler entitled "International Trade as an Engine for Economic Development." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

William E. Cole, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Vice Provost
and Dean of the Graduate School

INTERNATIONAL TRADE AS AN ENGINE FOR ECONOMIC DEVELOPMENT

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Bert Gregory Wheeler

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ABSTRACT

The purpose of this investigation is to attempt to determine if international trade is an engine of economic development for less developed countries. The basic proposition is that international trade acts as a mechanical link between more developed countries and less developed countries transmitting the success of the "center" to the "periphery."

Methodology employed is to regress different infrastructure variables on exports to determine if a relationship exists. Time series data is utilized and all figures are transformed into logarithms. Dependent variables selected for the study are: (1) gross domestic product, (2) gross fixed capital formation, (3) energy requirement, (4) energy used in transportation, (5) communication, and (6) education. These proxies were chosen because they more adequately reflect a countries economic development than gross domestic product examined exclusively. Fifteen less developed countries were chosen because of their diversity and data availability.

Results indicate that in some less developed countries international trade may act as an engine of economic growth or development. However, because of lack of a statistically significant relationship in many countries examined, it is highly unlikely that international trade acts as a mechanical link between less and more developed countries. Interestingly, the relationship between gross domestic product or gross fixed capital formation and exports is found to be much stronger than the relationship between the other dependent

variables and exports. This implies that international trade may add to the economic growth of a country, while contributing little to economic development. Lower income less developed countries were found to have little relationship between economic growth and exports. Hence, exclusion of these nations from the study would lead to biased results, implying a stronger relationship than actually exists. Also, results indicate that level of economic development (as approximated by gross domestic product growth), is not an important determining factor explaining whether or not international trade aids the development process. In conclusion, the overall finding of the study is that international trade may act as an engine for economic growth in certain circumstances, but there is no solid evidence that trade among countries leads to economic development.

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CHAPTER I

INTRODUCTION

The primary purpose of this study is to perform an empirical test of the hypothesis that international trade is an engine of economic development. For many years the proposition that international trade acts as a stimulus to economic growth has been analysed, examined, and empirically tested. The results obtained from the various investigations are as diverse as the authors themselves. The phrase "engine of growth" was first alluded to by Sir Dennis Robertson (1938). Robertson concluded that the "specializations"[1] which result from international trade were not exclusively a device for increasing the productivity of labor, ". . . [T]hey were above all an engine of growth."[2] Depending on one's perspective, the engine of growth is either depicted as a finely tuned V-8, or a worn out four cylinder badly in need of an overhaul.

If one were to examine economists' thought on the possible relationships between international trade and economic development, it becomes apparent that thinking on the subject ". . . exhibits cyclical behavior."[3] Before the 1930s trade was believed to be the "best" policy

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[1] Dennis H. Robertson, "The Future of International Trade," The Economic Journal, March 1938, p. 5.

[2] Ibid. p. 3.

[3] Juergen B. Donges and James Riedel, "The Expansion of Manufactured Exports in Developing Countries: An Empirical Assessment of Supply and Demand Issues," Weltwirtschaftliches Archiv., Vol. 113, No. 1, p. 58.

because it led to the exploitation of each country's comparative advantage. As countries specialized in goods for which their relative costs were lower, world-wide output was thought to rise because countries were able to concentrate resources on goods which they were relatively well suited to produce. The increase in worldwide output was enjoyed by all through the medium of free trade. Welfare of individual countries was believed to be enhanced.

This is illustrated in Figure 1, which represents a less developed country which has a comparative advantage in consumer goods (C). Pretrade production obtains at point A, with OK units of capital goods (K) and OC units of consumer goods produced. Capital in the context of Figure 1 represents a finished product and not a productive input. The concave curve PP' represents the country's production possibilities and is so shaped due to the assumption of increasing costs. Autarky prices are given by the ratio OT to OT'. As the country moves from autarky to free trade, production of consumer goods increases and production of capital goods declines as the country begins to specialize in the good for which it has a comparative advantage. Free trade production obtains at point F, with OC' units of consumer goods produced and OK' units of capital goods produced. This trade induced change in production is represented by movement along the country's production possibilities curve from A to F. Prices with trade change from OT/OT' to OS/OS' (i.e., capital goods become relatively cheaper). The country trades C'C" units of consumer goods for K'K" units of capital goods so that final consumption obtains at point G. The country is consuming more of both goods relative to pretrade consumption. Therefore, a higher level

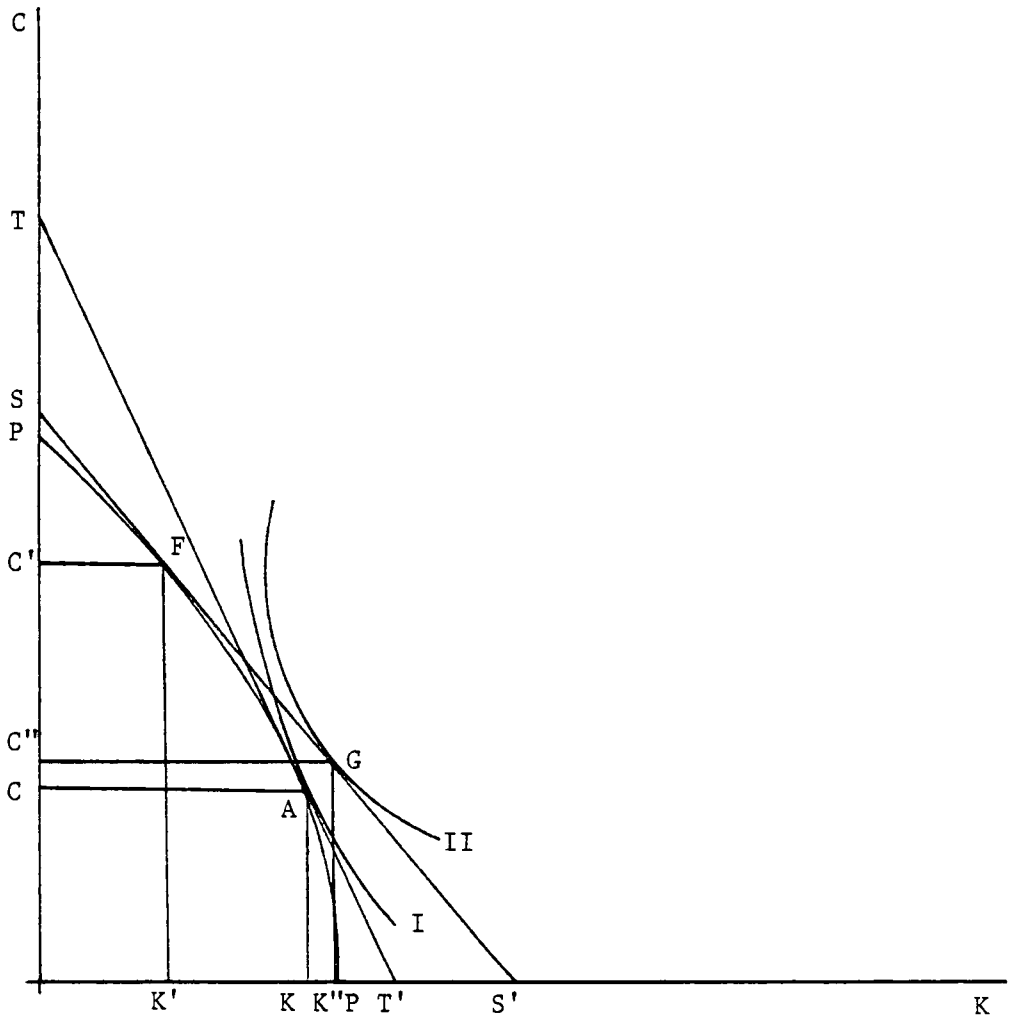


FIGURE 1

STATIC GAINS FROM TRADE

of welfare is attained, as illustrated by consumption on a higher indifference curve (i.e., I → II). The effect illustrated in Figure 1 may be adequately described as "traditional" or "static" gains from trade. This study will attempt to examine not "static" gains from international trade, but "dynamic" gains, which may be characterized as a trade induced shift of the production possibilities curve.

During the 1950's, disappointment of many economists at the apparent failure of the export of primary products to spur development caused some to propose different development strategies. Along with failure of primary export strategies came the realization that economic development was more than the optimal allocation of resources. In order for economic development to occur, a transformation of the entire economy was necessary. Some economists rejected the market mechanism in favor of a more controlled policy.

"Import substitution industrialization" was the new strategy for rapid economic development. According to this idea, substitution of imports by domestic production was to release countries that were in bondage to larger more powerful countries who purchased less developed country's goods at low prices. Further, the terms of trade had been turning against less developed countries during the period of free trade. Rejection of the market mechanism characterized this next stage in the "cyclical behavior" of economic thought attempting to unravel the relationship between international trade and economic development.

As appealing as import substitution industrialization appeared to many less developed countries, when evidence from implementation of this strategy began to be examined, the policy was a failure. In many

instances it only increased the problems it was designed to alleviate. Instead of being dependent on larger more developed countries for export of primary products, less developed countries became dependent on the more developed countries for imports at a more advanced stage of production. At the same time, a small group of countries were proving that trade could aid in the struggle for development. Development evidence led to yet another cyclical swing in the pattern of economists' thought. Expansion of labor intensive products for export became foremost in many economists' minds. This shift toward economic liberality was not, however, a complete turn to totally free trade. A role was seen for government intervention.

The last few years have witnessed what might be described as the latest wave in the "cyclical behavior" in economic thought on the relationship between international trade and economic development. Anti-trade sentiments are once again coming to the surface. The previous revival in autarky intellect was due to the belief that problems were being encountered on the supply side, that less developed countries were becoming "dependent" on more developed countries. However, the current wave of protectionism stems from perceived problems on the demand side. The fear is that less developed countries will not be able to sell their products in well saturated markets of more developed countries. The basic argument is that if all less developed countries produce labor intensive products, markets abroad will be flooded with these products. Excess supplies will tend to depress prices received by less developed countries. This is an example of the fallacy of composition. If one less developed country produces labor

intensive products for sale abroad they may do so profitably. However, if all less developed countries attempt to sell labor intensive products in industrialized countries, markets will become saturated. Prices will turn against less developed nations. Economists clearly are unable to reach a concensus about the relationship between international trade and economic development.

The hypothesis that international trade acts as an engine for economic growth has a long historical background. The nineteenth century provided a real world laboratory for the proposition. Britain was the economic giant of that century. While Britain was more industrialized than many parts of the world, she was lacking in the ability to produce enough food to feed her own population. In order to satisfy her need of a larger food supply, she sought to purchase foodstuffs from other nations. Well suited to supply Britain with needed foodstuffs were several countries which could easily be considered the less developed countries of the nineteenth century. Particularly, the United States, with her abundant provision of land was especially well suited to engage in profitable trade with Britain. Britain bought grain and other staples from the United States. The foreign exchange the United States received for her exports was used to contribute to economic growth. Intercontinental railways, financed by foreign exchange, were constructed. These railroads contributed immeasurably to the economic development of the still young United States. They opened the country to a relatively fast, efficient method for the transportaion of both raw and finished materials and products for the markets in the east.

Ragnar Nurkse, in his 1959 Wicksell Lectures, discusses the effect international trade had on the rate of growth of "new" countries during the nineteenth century. If a country had natural resources that were in demand by the "old" countries, the country might trade the resources for capital that was used to exploit the resources or to increase the supply of the resources. Industries which produced the natural resources then were able to expand, provided a market for their products remained viable.

> [T]his may lead not only to an enlargement of the export sector but also to the building of overhead facilities essential to the expansion of domestic activities as well. In fact, railways were the principal object of external investment in the areas of recent settlement.[4]

This type of activity might be considered a ". . . dynamic spread of economic growth through trade."[5] In this manner the success of the center was transmitted to the rest of the world. Nurkse believed that much of the worldwide economic growth of the nineteenth century might be attributed to international trade.

However, according to Nurkse, ". . . it is inevitable that economic thought should lag behind the facts of economic history."[6] Or, stated differently, Nurkse thought that the apparent relationship between

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[4] Ragnar Nurkse, Patterns of Trade and Development, Wicksell Lectures, 1959, p. 18.

[5] Ragnar Nurkse, "Contrasting Trends in Nineteenth and Twentieth Century Trade," Harvard Economic Studies, Vol. CXVIII, p. 284.

[6] Ragnar Nurkse, Patterns of Trade and Development, Wicksell Lectures, 1959, p. 18.

economic growth and international trade that has been accepted since the nineteenth century was a product of peculiar circumstances. It should not be accepted as a general theory applicable to all times. The unique demand conditions of the nineteenth century precipitated the relation between economic growth and international trade. According to Nurkse, once the voracious demand for raw materials subsided, the engine of growth would simply run out of fuel.

In the same year that Nurkse lectured on the possibilities for economic growth through international trade, Gottfried Haberler presented his Cairo Lectures on the same subject. His

> . . . overall conclusion was that international trade has made a tremendous contribution to the development of less developed countries in the nineteenth and twentieth centuries and can be expected to make an equally big contribution in the future if it is allowed to proceed freely.[7]

Haberler's reasoning was due to his belief that gains to an individual country from international trade were far greater than gains which classical economists attributed to trade. Classical theory has been criticized on grounds that it merely takes into account "static" gains from trade, that it presents only a timeless cross-section and hence ignores any "dynamic" benefits that might accrue to the country. "This type of criticism is, in fact, about as old as the theory itself."[8] It is also a criticism of which international economists have been aware.

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[7] Gottfried Haberler, "International Trade and Economic Development," National Bank of Egypt Fiftieth Commemoration Lectures, Cairo, 1939, p. 10.

[8] Ibid. p. 8.

Trade theory simply is not meant to adequately describe the dynamic nature of the economy. Theory is by its very nature an abstraction from reality. This is necessary to enable economists to examine exceedingly complex phenomena. Therefore, to adequately capture all gains which accrue to countries from international trade, we must also take into consideration "dynamic" benefits which trade supplies.

> If we were to estimate the contribution of international trade to economic development, especially of the underdeveloped countries, solely by the static gains from trade in any given year on the usual assumption of given production capabilities. . .we would grossly underrate the importance of trade.[9]

Haberler thought that changes in the productive capacity of a nation (i.e., dynamic changes) could be broken down into two large categories: (1) changes in productive capacity that were autonomous to international trade, and (2) changes in productive capacity that were induced by trade or trade policy. It is the second of these origins of change in productive capacity that is of interest for this study. According to Haberler there are four reasons for trade adding to the productive capacity of a nation.

(i) International trade provides the material means for economic growth. Physical capital, raw materials, intermediate goods, and some finished products enter countries as trade opens. These imported goods may lay the foundation for the export industries. Sometimes they are brought with foreign corporations as

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[9] Ibid. p. 10.

multinationals prepare to exploit the cheap resources that are to be produced. In addition to the short run possibility of an increase in employment, the addition to the infrastructure of the country provides an industrial base for future economic expansion.

(ii) International trade acts as means and vehicle for the dissemination of technical knowledge. More modern techniques are introduced to the indigenous society. New ideas may be hand-tailored to meet the country's specific needs.

(iii) Trade acts as a vehicle for the international movement of liquid financial assets or financial capital. With an increased inflow of foreign exchange each country may utilize the funds to increase productive capacity of their nation. The foreign exchange may be used to purchase needed physical capital to enhance the productivity of the labor force.

(iv) International trade is a country's best anti-monopoly policy because trade favors free competition. A monopolist in a less developed country may not be able to survive if they charge monopolist prices against competitive pressures of world trade.

The argument that international trade may act as an engine of economic development may be summarized by an examination of Figure 2. Figure 2 gives "static" gains from trade, (see Figure 1 for a full explanation) as well as "dynamic" gains accruing to a country through international trade. As time passes, one would expect the productive capacity of a country to increase independent of international trade.

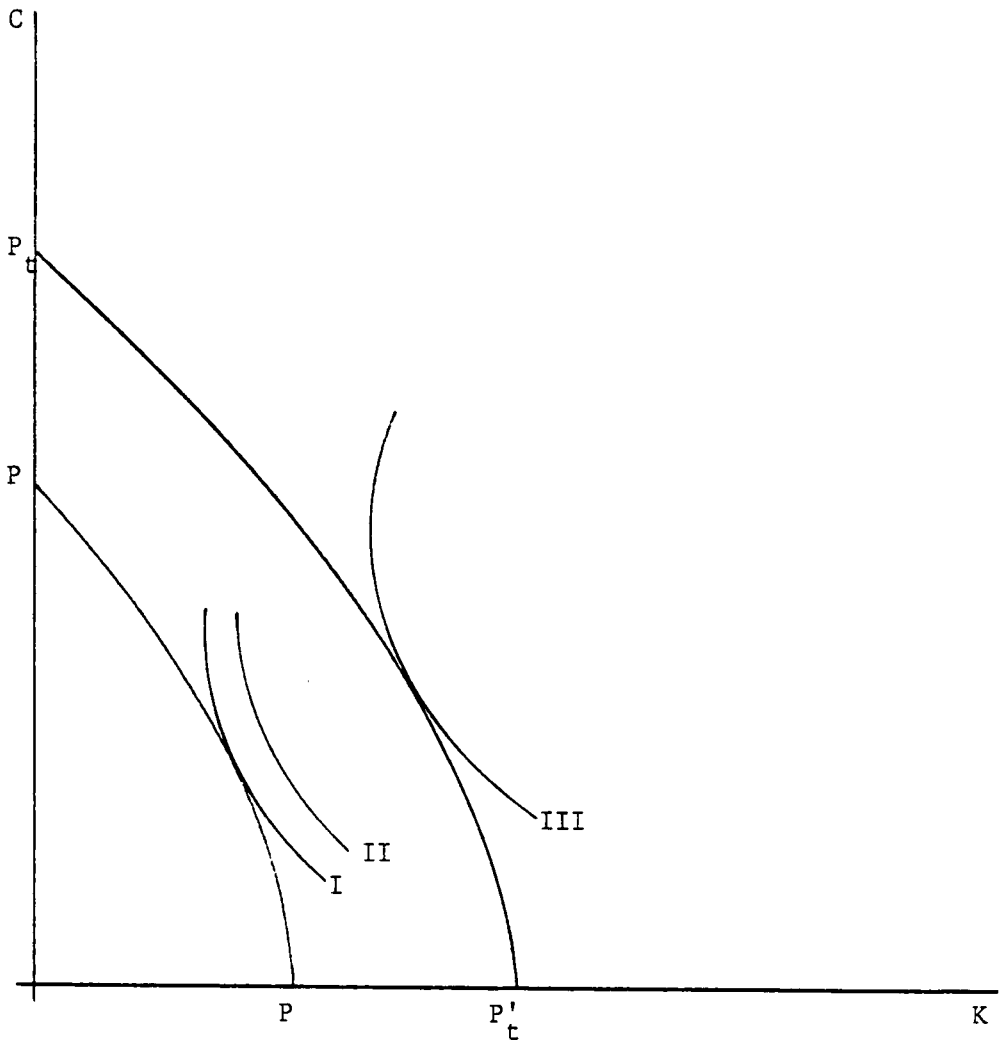


FIGURE 2

DYNAMIC GAINS FROM TRADE

This is represented by an outward shift of the country's production possibilities curve. Changes in productive capacity induced by international trade may also be represented by an outward shift of the production possibilities curve. This study will attempt to ascertain if trade induced shifts of a country's production possibilities curve are significant.

Examining Figure 2 "static" gains from trade are represented by consumption shifting from indifference curve I in autarky to indifference curve II after international trade begins. This shift is clearly indicative of an increase in consumer welfare as indifference curve II lies above indifference curve I. If the shift over time of the production possibilities curve from PP' to P_tP_t' is initiated by trade induced movement along the production possibilities curve, we may conclude that international trade acts as a stimulus to economic development.

In order to decompose the outward shift of the production possibilities curve into trade induced changes in productive capacity and changes in productive capacity that are autonomous to international trade, this study will focus on the relationship between growth rate of exports and productive capacity. If exports are related to the economic development of less developed countries, there should be a positive and significant relationship between the rate of growth of exports and economic development. Isolation of the effect of exports on productive

capacity growth will help indicate the relationship between international trade and economic development.[10]

Previous studies have used data from many different countries and regressed the percentage change in the dependent variable on the percentage change in the independent variable cross-sectionally. This study will utilize time series data for individual countries. An advantage of this methodology will be that one will be able to account for diversity among the less developed countries present in today's world economy. The international economy could well be divided into two categories: more developed countries and less developed countries. Less developed countries may be subdivided into major oil exporting countries and non-major oil exporting countries. Within non-major oil exporting countries, further subdivision is necessary because of diversity between less developed countries today. Non-major oil exporting countries may be classified as high income countries, middle income countries, and low income countries. Time series data will enable this study to carefully examine each of the different categories of less developed countries individually. Long run welfare effects (i.e., both "static" and "dynamic") of international trade may thus be represented by the shift in consumption from indifference curve I to indifference curve III.

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[10] Attempts have been made to formulate rigorous models of the trade engine theory [see Findlay (1980), Taylor (1981)] however these models rest on extreme assumptions (no internal growth, complete specialization, etc.). Also, there have been attempts to specify a trade engine model with Walrasian assumptions [see Armington (1969), Deppler and Ripley (1978)].

CHAPTER II

LITERATURE SURVEY

Bela Balassa (1978b) investigated the relationship between exports and economic growth. He chose countries that had previously established an industrial base. Balassa's approach limits his study in that he looks at only one possible subgrouping, newly industrialized countries. The hypothesis tested is whether export oriented development strategies lead to higher rates of growth than do strategies which emphasize import substitution. He believed that this should happen because of "traditional" international trade arguments. Balassa found a high positive correlation between export growth and growth of gross national product. The author estimated an equation featuring foreign and domestic capital and labor as the independent variables. He then reestimated the equation with the addition of the export variable. Balassa found that addition of exports changed R^2 by 19 percent. Regression coefficients were significant at the 5 percent level. Balassa's methodology was to calculate rates of change in variables for the years 1960-73. He also estimated the equations for some subperiods. Balassa then regressed the rates of change cross-sectionally to yield the results mentioned above.

In order to attempt to discern intercountry differences, Balassa

> . . . calculated by using actual export growth rates for the individual countries, with hypothetical values derived from the same equation on the assumption that each country had the average export growth rate calculated for the group as a whole.[11]

From this analysis Balassa concluded that open economies performed much better than closed economies for the period. Korea's gross national product would have been 37 percent less if they had not followed an export oriented development strategy. Taiwan would have grown 25 percent less if she had been "average." At the same time, relatively closed economies such as Chile, India, and Mexico would have been 14, 12, and 8 percent larger respectively. This implies,

> . . . that trade orientation has been an important factor contributing to intercountry differences in the growth of incomes.[12]

However, Balassa thinks that these favorable results underestimate the effect of export growth on incomes. This is because the method does not take into account the effect of export growth on other variables in the equation. Also, factors such as increased domestic savings and improved balance of payments situation affect growth possibilities of the country.

Michael Michaely (1977) sought empirical verification for the hypothesis that ". . . a rapid growth of exports accelerates the economy's growth."[13] In his survey of previous studies, Michaely found

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[11] Bela Balassa, "Exports and Economic Growth," Journal of Development Economics, Vol. 5, No. 2, June 1978, p. 186.

[12] Ibid. p. 188.

[13] Michael Michaely, "Exports and Economic Growth: An Empirical Investigation," Journal of Development Economics, Vol. 4, 1977, p. 49.

> . . . [t]hey all, however, share a common fault: they correlate growth, measured by change in national product (whether total or per capita) with the change in exports. Since exports are themselves part of the national product an autocorrelation is present; and a positive correlation of the two variables is almost inevitable, whatever their true relationship. . . . Obviously, this has no indication of causal relationship and no explanatory value for the purpose at hand.[14]

Michaely thought the solution to the problem was to examine export bias by which he meant the proportion of exports in the national product. Michaely chose the period 1950-73, and calculated the percentage change for each of the variables and then regressed the results cross-sectionally. He found that a statistically significant positive correlation did exist. However, the correlation was much stronger among the more developed of the less developed countries. "This seems to indicate that growth is affected by export performance only once countries achieve some minimum level of development."[15] He further found that export proportions as such have no bearing on a country's growth performance. It is the change in export growth which seems to be significant.[16]

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[14] Ibid. pp. 49-50.

[15] Ibid. p. 52.

[16] Michaely's results have been criticized [Balassa (1978b), Kavoussi (1984)] on the basis that economic growth may occur only when either factors of production are increasing or technical progress is occuring. If there is no growth of factors or rapid technological progress, no country may grow regardless of the rate of growth of exports. A positive correlation between growth rates of exports and economic growth will occur if and only if resources are growing and/or factor productivity is increasing. The correlation between export growth and economic growth is not automatic. His measure of export expansion has also been criticized on the grounds that it is biased

Juergen B. Donges and James Riedel (1977) examine two crucial empirical issues. The first is whether or not export expansion efforts are responsive to governmental promotion efforts. The second deals with whether or not lack of effective demand is the "ultimate" obstacle to the expansion of manufactured exports in less developed countries. In order to examine the first proposition, Donges and Riedel estimate the equation:

$$\ln(E/P) = a + bt + cD + d(D \cdot t) + e$$

where:

E ≡ value of exports in year t

P ≡ export price deflator

t ≡ year

D ≡ dummy variable equalling 0 for years prior to policy change and 1 for years after the policy change.

A significant positive value for the coefficient d is indicative that policy has had a positive influence on export performance. Eight out of twelve countries examined exhibited a strong positive relationship between policy and economic growth. To test the effect of exchange rate policy, the authors utilized the model:

$$\ln E = a + b\ln R + c\ln I + e$$

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against economies who had a high ratio of exports to GNP in the initial year of the period over which export performance was measured.

where:

E ≡ value of manufactured exports (deflated)

R ≡ real effective exchange rate

I ≡ index of industrial production.

The model explains about 90 percent of the variation in exports over time. The exchange rate proved significant, but industrial production showed little consistency. Hence, one might conclude that the export supply function is sensitive to financial incentives. Thus, countries should maintain an "appropriate" exchange rate. Further tests (following Balassa's revealed comparative advantage) indicated that during the 1960's period of trade liberalization, some product diversification did occur.

The second major concern which the authors address is whether or not demand is the "ultimate" obstacle to export expansion in less developed countries. Donges and Riedel view the question as ". . . essentially an empirical issue."[17] High income industrialized countries dominate the market for less developed country's exports. The primary reason for this concentration is that there are few countries which export goods to the less developed countries. Expansion of less developed country exports does not necessarily imply an increase in the penetration of industrial country markets because considerable potential

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[17] Juergen B. Donges and James Riedel, "The Expansion of Manufactured Exports in Developing Countries: An Empirical Assessment of Supply and Demand Issues," Weltwirtschaftliches Archiv, Vol. 113, No 1, p. 74.

for inter-country substitution prevails. The authors do not deny that tariff and other barriers discriminate.

In conclusion, Donges and Riedel found that economic policy does appear to be effective in promoting export expansion and diversification in less developed countries. And finally, they found that demand constraints are not as severe as most less developed countries believe.

Kravis (1970) discusses the relationship between international trade and economic growth from both a historical perspective and an analytical perspective. Kravis concludes that,

> . . . [a] more warranted metaphor that would be generally applicable would be to describe trade expansion as a handmaiden of successful growth rather than as an autonomous engine of growth.[18]

However, this is not to say that Kravis is a trade pessimist.[19] He determined that international trade could play as important a role today as it did in the nineteenth century. The conditions are no less favorable today. He bases his conclusions on the evidence that trade did not successfully differentiate between high growth and low growth countries in the nineteenth century. Trade may still play the "handmaiden's" role.

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[18] Irving B. Kravis, "Trade as a Handmaiden of Growth: Similarities between the Nineteenth and Twentieth Centuries," Economic Journal, Vol. 80, December 1970, p. 850.

[19] Some have suggested that there exists a negative relationship between economic growth and an increase in exports [see Ball (1962)] however, this notion has been refuted [see Massell (1964)].

Kravis begins his argument by stating opinions of several well known economists. He begins with Nurkse, who thought that less developed country growth in the nineteenth century was due to favorable demand conditions in more developed countries. Exports of primary products to more developed countries of the day led the developing countries to be known as the "granaries of the world." Nurkse was pessimistic about the prospects for growth in the twentieth century due to depressed demand conditions. Kravis goes further to mention Prebisch and the argument of Prebisch that world-wide terms of trade turned against less developed countries. According to Kravis, Myrdal argues that international trade actually tends to perpetuate backward sectors. Finally, Kravis concludes that Nurkse's advice for balanced growth was taken, which led to emphasis on external factors rather than internal or supply factors.

Kravis next examines the proposition that international trade is directly related to economic growth by tracing the nineteenth century experience of three groups of nations. First, he analyzes what he terms successful less developed countries of the nineteenth century. To accomplish this objective he states four conditions that would hold if Nurkse were correct. These conditions are: (1) large and/or growing share of exports in domestic production; (2) a relation between the timing of exports and gross national product; (3) a concentration of exports in sectors marked by relatively rapid growth and/or rapid growth of industries linked to the export industries; and finally (4) attraction of foreign capital to industries supported by exports. Using the United States as an example of a successful less developed country

of the nineteenth century, Kravis found that the United States does not fit any of the four conditions.

Second, Kravis examined unsuccessful countries and found that "other conditions"[20] were the crux of success or failure. Supply factors were what determined rapid growth of stagnation. Export growth did not successfully differentiate between countries which experienced rapid economic growth, and countries which did not. A country's initial endowment of resources and their exploitation of these resources were what was important, according to Kravis.

Third, Kravis examined the countries of the center, or the industrialized countries of the day. In order for the "spillover idea of growth"[21] to be plausible, the industrialized countries' demand for primary products should increase. This could come through a constant marginal propensity to import and industrialized country growth higher than the less developed countries growth. However, Kravis found that this did not happen. Increasing demand for primary products could come from a rising marginal propensity to import. Industrialized countries' marginal propensity to import did increase, but Kravis thinks it doubtful that this helped the less developed countries. Kravis goes on to say ". . . rapid growth in the periphery may have served to stimulate growth in the center rather than vice versa."[22]

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[20] Ibid. p. 854.

[21] Ibid. p. 856.

[22] Ibid. p. 856.

If trade were an engine of growth, in that demand for foodstuffs in the center increased, traditional suppliers of primary products should have benefited, according to Kravis. If internal change in less developed countries is to be accredited with growth in the "new" countries, new rather than traditional suppliers should be the ones to supply the increase in exports to the "old" countries. According to Kravis, new suppliers did benefit. The obvious implication is that supply side factors are important. For example, the United States with her abundant natural resources grew because of the land which was available to be brought under production. The United States did not grow because of demand for her products by foreign countries. Kravis said that there is

> . . . little basis for a broad generalization connecting favorable external demand conditions created by an expansionary centre with successful economic development at the periphery.[23]

Kravis did not ". . . deny that trade was a stimulating factor."[24] The most important role played by international trade, according to Kravis, was the fact that a relatively open market allowed countries to find industries for which a comparative advantage existed and hence to avoid high cost and low efficiency goods. Kravis concludes,

> . . . [t]he mainsprings of growth were internal; they must be sought in the land and the people, and in the system of social and economic organization.[25]

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[23] Ibid. p. 858.

[24] Ibid. p. 858.

[25] Ibid. p. 859.

Kravis next examines twentieth century trade opportunities. The main concern of "trade pessimists" has been with the position of less developed countries in expansion of world trade. However, growth rates of international trade are high for less developed countries relative to industrialized countries in the nineteenth century. What may be said is that less developed countries are not sharing fully in the booming world markets of the post World War II period. Kravis cites statistics which indicate that the percentage of world trade commanded by the less developed countries has fallen from 26 percent in 1953 to 16 percent in 1966. Less developed countries' share of primary exports has fallen from 47 to 35 percent during the same period.

Kravis concludes by stating

> . . . international trade cannot provide a differential diagnosis to explain the varying growth records of countries in the nineteenth century.[26]

External demand is neither a necessary nor sufficient condition for economic growth. International trade is but one of many factors which affect economic growth. According to Kravis, those countries which have done well do not owe their success to passive acceptance of favorable market conditions for their products. Their success comes because they raised their share in the markets and diversified their exports at home. Success in economic growth is due to internal factors.

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[26] Ibid. p. 869.

Michalopoulos and Jay (1973) utilize a cross-country regression analysis and

> . . . concentrate primarily on investigating the neoclassical thesis that export growth is beneficial to GNP growth by enabling the LDC economy to sustain increases in productivity through increased competition, specialization, and improved resource allocation.[27]

"Traditional" reasons for a positive correlation between growth of exports and gross national product are given.

> In a dynamic setting the net effect would be improved efficiency in resource utilization and faster growth in factor productivity.[28]

This is equivalent to what Haberler termed increases in productive capacity. It is represented by an outward shift of the production possibilities curve.

> Thus the argument can be made, that (a) productivity growth would be higher in countries which are better placed in international trade, in the sense that their exports are rising rapidly; and that (b) such countries would experience more rapid growth in output. As a result, the link between export growth and output growth is productivity growth generated from increased specialization, competition, and other factors attendant to the opening of an economy to international trade.[29]

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[27] Constantine Michalopoulos and Keith Jay, "Growth of Exports and Income in the Developing World: A Neoclassical View," Agency for International Development, Discussion paper no. 28, November 1973, p. 2.

[28] Ibid. p. 2.

[29] Ibid. p. 3.

The authors propose to test whether or not gross national product is affected by changes in export growth rate. They utilize the Cobb Douglas production model:

$$Y = AK_d^{\alpha}K_f^{\beta}L^{\gamma}$$

where:

$Y \equiv$ output

$K_d \equiv$ domestic capital

$K_f \equiv$ foreign capital

$L \equiv$ labor force

$A \equiv$ a constant.

Michalopoulos and Jay then differentiate this equation with respect to time and find variables for foreign and domestic investment. Assuming that foreign capital and domestic capital are multiples of gross national product in the base year, and substituting these results into the production function equation, the resultant equation was estimated for 39 less developed countries for the decade 1960-69. The results were (after converting to logarithms):

$$Y = .25K_d + .20K_f + .66L$$

The statistics are all significant at the 1 percent level. The value of R^2 is 0.53. The authors note, "This is hardly a novel finding."[30]

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[30] Ibid. p. 6.

Michalopoulos and Jay next attempt to determine if the unexplained variation in gross national product is related to export growth. This residual is usually attributed to technological change.

> Thus we can simply hypothesize that, ceteris paribus, productivity growth would be greater, the faster the growth of the export sector and hence the rate at which overall efficiency in resource utilization is increased over time through participation in international trade.[31]

To test this hypothesis, Michalopoulos and Jay regressed the residuals on the rate of growth of exports to yield:

$$Y_{res} = -.07 + .04X$$

where:

$Y_{res} \equiv$ difference between the actual and estimated values of Y

$X \equiv$ export growth rate.

The statistic relating the rate of growth of exports to the residuals indicates that exports are a significant factor in the determination of the rate of growth of gross national product. The authors test this relationship further by reestimating the production function including export growth as a separate variable. The results were,

$$Y = .24K_d + .12K_f + .60L + .04X$$

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[31] Ibid. p. 7.

As with the earlier specification, all statistics were highly significant. The value of R^2 changed from 0.53 to 0.71. Therefore, addition of exports to the function meant that the percentage of the relationship explained by the independent variables increased by 18 percentage points.

In reaction to Kravis's (1970) influential article, Michalopoulos and Jay examine the possibility that the relationship between export growth and growth of gross national product is due to both gross national product and exports being positively related to the growth of inputs (i.e, internal factors). They therefore test the relationship between export growth and the growth of primary inputs. Their results are given in the following equation:

$$X = .18K_d + 1.98K_f + 1.42L$$

Coefficients for K_d and L are highly insignificant. The value of R^2 is a paltry 0.07. The statistical significance of the relation between exports and foreign capital indicates that countries which have a strong export performance attract aid and private capital inflows.

> In light of these findings we are inclined to reject the hypothesis that export growth is a handmaiden to GNP growth in which both are dependent on growth of primary inputs. Export growth does contribute substantially to explaining GNP growth, over and above the contribution of primary inputs.[32]

In conclusion, Michalopoulos and Jay found that growth rates of gross national product and exports are highly correlated. Exports

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[32] Ibid. p. 9.

explain approximately 18 percent of the variation in growth rate of gross national product. Second, export growth is not the "handmaiden" of gross national product growth. They

> . . . believe that these findings help us clarify the role of exports in economic growth. It is clear that good export performance is not related to rapidly rising demand for traditional commodities. The "engine of growth" has not worked in the traditional way; but it has worked nevertheless. It has worked successfully for those countries which have maintained a competitive edge and broken into new commodity markets. The picture that emerges is that countries do well in expanding exports if they maintain an open economy and seek to diversify their export structure rather than rely on rising demand for traditional commodity exports. Countries with such characteristics also exhibit rapid growth in output. The crucial link appears to be productivity growth. This growth in turn is likely to be higher in open economies, not sheltered through trade controls, which take advantage of the gains from specializations through trade.[33]

Kavoussi (1984) explores the relationship between exports and economic growth utilizing an intercountry statistical analysis covering the years 1960-78. His purpose is to

> . . . examine the association between the growth of exports and economic performance, using a large sample of developing countries. Furthermore, it [the paper] investigates whether this relationship is significantly affected by the level of economic development already achieved and the commodity composition of exports.[34]

Kavoussi's study is unique in that he looks at more than one category of less developed country. Hence, his study will indicate whether or not

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[33] Ibid. p. 22.

[34] Rostam M. Kavoussi, "Export Expansion and Economic growth: Further Empirical Evidence," Journal of Development Economics, Vol. 14, 1984, pp. 241-242.

low income less developed countries exhibit positive correlation between export growth and economic growth. Kavoussi found that for his entire sample (73 countries), export growth and real growth rate of gross national product proved to be positively correlated and highly significant.

> This is a noteworthy finding given the large size of the sample and the diversity of the countries with regard to income level and commodity composition of exports.[35]

In order to examine whether the relationship between growth rate of exports and economic growth is affected by the level of economic development, Kavoussi divided his sample into two groups based on per capita gross national product. Those with per capita income below $360 (in 1978 dollars) were considered low income, while those with income above this figure were considered middle income countries. Regressing growth rate of gross national product on rate of growth of exports, Kavoussi found that both low and middle income countries exhibited a positive and highly significant relationship between the two variables. The value of R^2 is larger for the middle income countries (0.543 versus 0.411), but both are highly significant.

The effect of the commodity composition of exports is next examined by Kavoussi. He distinguishes between countries which are exporters of primary products and those which export primarily manufactured goods. Among low income less developed countries, the coefficient of correlation does not change significantly. However, exclusion of

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[35] Ibid. p. 243.

exporters of manufactured goods from the middle income countries does prove substantial. Results remain statistically significant.

Kavoussi examines the effect which exports have on factor productivity by adopting a standard neoclassical growth model. Output is assumed to be a function of capital stock (K) and the labor force (L). His methodology is to estimate the production function without exports and then reestimate with the addition of an export variable. Kavoussi found that addition of the export variable increased the R^2 from 0.49 to 0.57. The coefficient of the export variable is positive and highly significant, indicating that exports do add to the productive capacity of the country. Conducting the same experiment with the data divided into both low and middle income countries indicates export expansion is important in both.

To test the hypothesis that the effect of the growth rate of exports on factor productivity in middle income countries is due to the high proportion of manufactures in exports, Kavoussi writes the coefficient of the export variable as a linear function of the commodity composition of exports. This eliminates manufactures from the export variable. Results seem to indicate that in low income less developed countries, export expansion enhances factor productivity regardless of the composition of exports. Significantly, the results are different for middle income countries. If less developed countries rely on primary exports as their income level increases, the favorable effect on factor productivity diminishes. If, however, the countries are able to shift to manufactured exports, the effect on factor productivity is greatly enhanced.

In conclusion, Kavoussi has shown that even in a diverse sampling of less developed countries, growth rate of exports and growth of gross national product are positively related. The relationship between growth and exports is not limited to countries with relatively high incomes. Export expansion tends to enhance a country's factor productivity. Interestingly,

> . . . despite the fact that export expansion does not appear to affect factor productivity in primary-oriented middle-income countries, growth rates of exports and GNP are positively correlated in these economies. This result seems to indicate that if primary exports contribute to economic growth in more advanced developing countries, they do so mainly through the acceleration of the rate of capital formation.[36]

The 1979 Nobel Lecture was delivered by Sir W. Arthur Lewis on the subject of trade as an engine of economic growth. He assumes that there is a link between growth of international trade and prosperity of less developed countries.

> For the past hundred years the rate of growth of output in the developing world has depended on the rate of growth of output in the developed world.[37]

Lewis believes that less developed countries are connected and thus are in some measure dependent on industrialized countries.[38] The mechanical

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[36] Ibid. p. 249.

[37] W. Arthur Lewis, "The Slowing Down of the Engine of Growth," The American Economic Review, Vol. 70, No. 4, September 1980, p. 555.

[38] Riedel (1984) attacks this proposition on grounds that constancy in the relationship is a statistical anomoly. He feels that relationship between export performance and growth in less developed countries is due to differences in export composition. The engine of

linkage (i.e., the engine) is international trade. If more developed countries are prosperous, they will purchase goods from the less developed countries, and thus the prosperity of the industrialized countries may be transmitted to the less developed countries. Lewis assumed that this relationship holds and does not attempt to perform an empirical test of the hypothesis.

The Nobel Lecture is unique in that Lewis takes a much longer run view of economic processes than do most economists. He sees the international economy in terms of very long run (or secular) trends. What Lewis terms "great depressions" are cyclical downswings which last approximately ten years before the world economy recovers. However, these ten year cycles are not the long run on which Lewis bases his argument. There are more protracted cycles which overshadow the shorter cyclical swings in economic output. Lewis believes that the international economy entered into a secular downturn in economic activity in 1974. He states: ". . . that there is nothing strange in the idea that the next two decades may turn out to be difficult."[39] If the entire world is suffering from a depression, less developed countries will suffer most, because the linkage to the industrialized countries will retard their attempts to grow. They will not be able to sell their exports in the depressed markets of more developed countries.

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growth hypothesis has been altered by economic change in less developed countries over the last three decades.

[39] Ibid. p. 559.

Solution of the problem, according to Lewis, is for less developed countries to increase trade among themselves. He assumes that world trade will only increase at the rate of 4 percent per annum, while less developed countries desire to increase their output at 6 percent per annum. To take up the slack in demand, less developed countries need to "throw off their dependence"[40] on more developed countries as sources of imports. Lewis sees trade among less developed countries as the only solution to slower economic growth in the world economy. The engine of growth is intact but in need of a supplemental source of fuel.

The "new conventional wisdom"[41] is discussed by Tyler (1981). This wisdom stresses importance of export promotion and expansion. His goal is to provide additional statistical proof for the engine of growth hypothesis. Tyler wants to extend Balassa's[42] work by increasing the number of countries in the sample. However, Tyler limits himself to middle income countries.[43]

Tyler found "a positive and significant relationship between GDP growth and export growth for the middle income developing countries."[44]

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[40] Ibid. p. 560.

[41] William G. Tyler, "Growth and Export Expansion in Developing Countries: Some Empirical Evidence," Journal of Development Economics, No. 9, 1981, p. 121.

[42] Balassa (1978b).

[43] Balassa's study (1978b) was even more restrictive because he looked only at eleven countries which had an established industrial base. Balassa's sample also included obvious high performers which ensured the positive results which Balassa obtained.

[44] Ibid. pp. 124-125.

These results are hardly unique.[45] He further extends his analysis by examining a Cobb Douglas production function incorporating capital stock (K), labor force inputs (L), and exports (E). Hence, the function takes the form:

$$Y = AK^{\alpha}L^{\beta}E^{\gamma}$$

The value of R^2 increases only slightly with addition of exports to the equation, but the coefficient for export expansion is significantly different from zero.

One of the earliest[46] statistical studies on the possible relationship between economic growth and international trade is that of Emery (1967). He addresses the problem of similtaneity when he says,

> . . . [t]here are substantial grounds for believing that there is a causal relationship between exports and economic growth, and that this relationship is one of interdependence rather than one of unilateral causation. There are also grounds for believing, however, that exports are a key factor in promoting economic growth and that it is generally a rise in exports that stimulates an increase in aggregate economic growth, rather than vice versa.[47]

He bases this conclusion on the overwhelming logical evidence[48] of the importance of exports in a country's economy. His main conclusion is

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[45] See for instance, Balassa (1978b), Donges and Riedel (1977), Emery (1967), Kavoussi (1984), Michaely (1977) for similar results.

[46] The earliest statistical study utilizing data for more than a few countries is Haring and Humphrey (1964).

[47] Robert F. Emery, "The Relation of Exports and Economic Growth," Kyklos, No. 20, 1967, p. 470.

[48] The reasons include (1) an increase in production of capital

that higher rates of export growth tend to be associated with high economic growth. However, Emery is quick to indicate that his results do not prove the engine of growth hypothesis, they are only a further step in support of it.

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goods, (2) ability to take advantage of international division of labor, (3) concentration of investment in the most efficient sector of the economy, (4) specialization in comparative advantage goods increases productivity, (5) utilization of economies of scale, (6) international competition keeps cost low as firms strive for more efficient operations, (7) stimulus to investment in the various processing industries associated with primary exports, (8) investment in ancillary industries set up to supply and service the main export industries, (9) inducement to foreign investment, (10) technological innovations, (11) marketing innovations, (12) increase in managerial skills, (13) and an indirect stimulus to increased consumption as consumers gradually become aware of foreign consumer products.

CHAPTER III

METHODOLOGY

In order to attempt to determine the relationship between economic development and international trade, this study will perform regression analysis on several infrastructure variables with respect to exports. Neither of these variables by themselves would serve as a good indicator of economic development. However, it is hoped that taken as a whole the results will shed some light on the possible relationship between economic development and international trade.

Infrastructure variables selected may be subdivided into two main categories. The first category might be referred to as indicators of economic growth. Other studies have only used gross national product or gross domestic product as an indicator of economic growth or economic development. In order to compare results obtained when the below mentioned infrastructure variables are used as proxies for economic development with results from other studies, this study will examine the effects of exports on (1) gross domestic product. If growth rate of gross domestic product is increasing economic growth is occuring. (2) Gross fixed capital formation is another infrastructure variable which shows economic growth. If physical capital is directly related to exports, one might conclude foreign exchange flowing into the less developed country from sale of exports is being utilized to add to the country's productive capacity.

Infrastructure variables which are indicative of economic development comprise the second main category. An indicator of the

country's (1) transportation system (energy used in transportation) points to economic development because of the pivotal role transportation plays in the development of a country. The transportation proxy is given in thousands of tons of oil equivalent. An efficient system of transportation is a necessity if economic development is to spread throughout the country and thereby avoid the development of enclaves of modernity alongside the traditional sector. (2) Education will also be examined alongside exports to determine if exports affect education. The education proxy is total enrollment at the primary level. If a country's human capital is increasing, the foundation for sound economic development is being laid. If education is positively related to exports, it is possible that income from export sales is helping to finance the growth of human capital. (3) Communication (number of radio receivers in use) is another infrastructure proxy this study will examine. Is communication infrastructure dependent upon exports? Economies across the world are becoming increasingly dependent on communications systems. Less developed countries are not exempt. If less developed countries build a solid communications base, they will be in a position to increase their competitiveness in the international economy. Each country's (4) energy requirement will be regressed on exports to ascertain if a relationship exists. Energy requirement is the amount of energy needed in a given year. It is expressed in thousands of tons of oil equivalent. Energy requirement might be considered a general indicator of economic development. If a country is increasing its intake of energy, the country's productive capacity (i.e., production possibilities curve

shifting to the right) would likely be increasing. Increased energy consumption is indicative of an increase in physical capital. In turn, physical capital is necessary to produce goods which might lead to an increased standard of living.

For each of these infrastructure variables, certain ceteris paribus conditions prevail. Other "things" are held constant. It is recognized that exports sales are but a small fraction of total economic growth and development. Many other factors affect economic growth and development. By isolating on exports it will be possible to determine if international trade may play an important role in the economic development of less developed countries.

In order to correct data for differences in units, all money figures will be expressed in terms of millions of United States dollars and deflated with 1980 as the base year to remove effects of inflation. Then all data will be converted to logarithms so that coefficients will give elasticities.

Data sources are as follows:

(1) Energy Requirement: Workshop on Energy Data of Developing Countries, International Energy Agency, OECD, Paris, 1983.; Energy Balances of Developing Countries, International Energy Agency, OECD, Paris, 1984.

(2) Gross Fixed Capital Formation - International Financial Statistics Yearbook, International Monetary Fund, Washington, 1984.

(3) Transportation: Workshop on Energy Data of Developing Countries, International Energy Agency, OECD, Paris, 1983.; Energy Balances of Developing Countries, International Energy Agency, OECD, Paris, 1984.

(4) Education: UNESCO Statistical Yearbook, United Nations Educational, Scientific, and Cultural Organization, Paris, 1970-1984.

(5) Communication: Statistics on Radio and Television, United Nations Educational, Scientific, and Cultural Organization, Paris, 1979.; UNESCO Statistical Yearbook, United Nations Educational, Scientific, and Cultural Organization, Paris, 1978-1984.

(6) Gross domestic product: International Financial Statistics Yearbook, International Monetary Fund, Washington, 1984.

Attempts were made to estimate a model with a specification similar to that of the stock adjustment model.[49] In the context of examining international trade and its relationship to economic development, the assumption is made that there exists a desired "level" or "stock" of economic development. Perhaps a target rate of growth of gross domestic product could represent a desired level of economic development. Also, various levels of infrastructure meet the criterion of a desired stock. The hypothesis to test is whether exports are related to the desired level of economic development. In any given period adjustment from the current level of infrastructure to the desired level may not be complete. Lack of resources, technological constraints, shortage of foreign exchange, etc., might be responsible for this "partial adjustment."[50] If the stock adjustment model is:

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[49] For a precisely formulated rationale see, Z. Griliches, "Distributed Lags: A Survey," Econometrica, Vol. 35, January 1967, p. 43.

[50] Robert S. Pindyck and Daniel L. Rubinfeld, Econometric Models and Economic Forecasts, Second Edition, 1981, p. 235.

$$I^* = \alpha + \beta X + \varepsilon,$$

where:

I^* ≡ desired infrastructure

X ≡ exports,

then the adjustment process may be represented:

$$I - I_{-1} = \gamma(I^* - I_{-1}),$$

where:

I ≡ current value of infrastructure

I_{-1} ≡ past value of infrastructure

Hence, rate of closing of the gap between desired infrastructure and the actual value is a function of the coefficient γ. Substituting for I^* in the equation showing the adjustment process and solving for I yields:

$$I = \gamma\alpha + \gamma\beta X + (1 - \gamma)I_{-1} + \gamma\varepsilon.$$

This specification is equivalent in form to the geometric lag[51] model. Because of this equivalence it is possible to calculate not only

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[51] The geometric lag model assumes that the weights of the lagged independent variables in the distributed lag model are all positive and decline geometrically with time. The exact specification is:

$$I = \alpha + \beta\Sigma\lambda^i X + \varepsilon.$$

The only difference between the stock adjustment model and this specification lies in the error term.

the short run coefficient but the long run coefficient as well. The long run elasticity is equal to the reciprocal of one minus the coefficient of the lagged dependent variable multiplied by the short run coefficient. This will give the "dynamic" effect of exports on economic development in addition to the "static" gains attributed by international trade theory.

Unfortunately, when the data was applied to this specification the results were difficult to interpret due to excessive multicollinearity[52] (see Table 1). Abbreviations for countries in Table 1 are as follows: Algeria-Alg, Argentina-Arg, Brazil-Bra, Columbia-Col, Egypt-Egy, India-Ina, Indonesia-Ind, Jamaica-Jam, Kenya-Ken, Korea-Kor, Mexico-Mex, Nigeria-Nig, Saudia Arabia-Sar, Thailand-Tha, and Venezuela-Ven. Abbreviations for dependent variables are: gross national product-GDP, gross fixed capital formation-IF, energy requirement-ER, tranportation-TR, communication-CM, and education-ED. The Table shows the results of the regression of lagged infrastructure variables on current exports, which are the two independent variables in the stock adjustment model. Significant correlation between these variables indicates that multicollinearity is a problem in the stock adjustment model. Statistics listed are regression coefficients, while figures in parentheses are "t" statistics.

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[52] Given the specification of the model there is very little that may be done to reduce multicollinearity. Dropping of variables is not feasible, and it is impossible to increase the sample size. First order differencing may reduce multicollinearity somewhat, but, this will introduce autocorrelation in disturbances that are otherwise independent.

TABLE 1

MULLTICOLLINEARITY TEST

COUNTRY	GDP	IF	ER	TR	CM	ED
ALG	0.7235	0.9884	0.8347	0.7917	0.8804	0.3251
	(9.18)	(9.02)	(8.64)	(11.4)	(13.2)	(10.4)
ARG	1.0356	0.9594	-0.0490	-0.0187	-0.5022	-0.0233
	(22.0)	(17.6)	(-5.7)	(-1.8)	(-1.3)	(-8.9)
BRA	0.7411	0.8272	-0.2639	-0.2209	-0.5022	-0.1750
	(17.5)	(16.4)	(-3.5)	(-2.7)	(-3.6)	(0.33)
COL	0.5552	0.7375	-0.6158	-0.6094	-0.3491	-0.3149
	(5.29)	(3.06)	(-2.5)	(-2.5)	(-3.0)	(-1.9)
EGY	0.4715	1.8255	1.4480	2.9774	0.5282	0.3673
	(1.88)	(2.90)	(3.87)	(5.88)	(4.97)	(5.01)
INA	0.4715	0.5616	0.7961	0.2341	1.3008	0.3637
	(3.59)	(4.35)	(5.59)	(4.07)	(4.27)	(5.78)
IND	0.0707	0.3479	0.2150	0.2546	0.2123	0.0857
	(1.29)	(2.07)	(2.05)	(1.49)	(0.78)	(0.76)
JAM	0.8426	1.5725	-0.1633	0.4018	-0.4419	0.1098
	(6.31)	(6.80)	(-0.9)	(2.59)	(-3.8)	(2.62)
KEN	0.0354	0.0129	0.4077	0.0533	0.0023	0.0476
	(1.53)	(0.06)	(0.95)	(0.98)	(0.41)	(0.94)
KOR	0.2034	0.4400	0.4484	0.9425	0.9371	0.0025
	(4.37)	(4.13)	(6.44)	(8.33)	(6.88)	(0.31)
MEX	0.0076	-0.0592	-0.0453	-0.0547	0.0039	-0.0101
	(0.97)	(-0.6)	(-0.3)	(-0.3)	(0.04)	(-0.1)
NIG	0.5090	0.8483	0.4993	0.9336	0.8724	0.9321
	(6.38)	(5.13)	(5.42)	(6.30)	(5.64)	(1.09)
SAR	0.5403	0.9963	0.5905	0.6714	1.0405	0.3289
	(12.9)	(7.08)	(7.99)	(6.29)	(6.10)	(10.8)
THA	0.5636	0.6319	1.4207	0.9007	0.7210	0.2783
	(16.3)	(8.49)	(13.2)	(16.8)	(7.46)	(14.4)
VEN	0.4512	0.8956	0.5342	0.6733	0.9402	0.3173
	(4.97)	(4.39)	(4.20)	(2.70)	(3.52)	(4.26)

An alternative specification was considered which utilized lagged exports instead of current exports. The different specification has theoretical validity because it is reasonable that some time period will pass before income from export earnings will add to a country's productive capacity. Present export earnings will not be assimilated into the economy this year, but rather will require some time before increasing productivity. Unfortunately, the alternative specification suffers from the same problems as the original specification and was thus dropped from consideration.

Examination of Table 1 reveals some interesting trends about the relationship between exports and economic development. Multicollinearity in the stock adjustment model indicates that a relationship exists between lagged infrastructure and current exports. Existing capital formation (IF) has an apparent positive effect on exports in thirteen of the fifteen countries tested. Two countries, Jamaica and Egypt, have an elasticity coefficient greater than one. Two other countries, Kenya and Mexico exhibit no apparent statistical relationship. Also notice that Mexico and Kenya are on different ends of the development spectrum. Mexico is grouped with the major oil exporting countries, while Kenya is a low income country.

Theoretically, one would expect a positive statistical relationship between lagged infrastructure and current exports. Interestingly, this does not appear to be a universal fact. Argentina, Brazil, Columbia, and Jamaica all have statistically significant negative values for at least one lagged infrastructure variable tested. Both Brazil and Columbia have significant elastities for energy requirement (ER),

transportation (TR), and communication (CM). Hence, one might conclude that while most less developed countries show a positive relationship between lagged infrastructure and current exports, the relationship is not universal. Ten percent of the equations tested show a statistically significant negative relationship. Using gross domestic product as a proxy for economic development fails to reveal anything other than a positive trend.

Multicollinearity between current exports and lagged infrastructure make use of the stock adjustment model infeasible. Hence, methodology employed will be to regress infrastructure variables on exports. Specifically, current exports will serve as the independent variable in the first equation. Simple ordinary least squares estimates will be indicative of any relation between exports and infrastructure (economic development). The equation is:

$$I = \alpha_1 + \beta_1 X + \varepsilon,$$

where:

I ≡ current value of the infrastructure variable

X ≡ current value of exports.

This equation will be estimated for fifteen less developed countries. Exports lagged one year (X_{-1}) will be added to the above equation. This will begin to show the dynamic element in the relationship between economic development and international trade. The equation becomes:

$$I = \alpha_2 + \beta_2 X + \gamma_1 X_{-1} + \varepsilon.$$

Exports lagged two years (X_{-2}) will next be included. The third equation is therefore:

$$I = \alpha_3 + \beta_3 X + \gamma_2 X_{-1} + \delta_1 X_{-2} + \varepsilon.$$

Each of these three equations will be estimated for each of the six infrastructure variables. Because of possible multicollinearity between the lagged independent variables, no further variables will be introduced. Multicollinearity will be a problem with only three independent variables, and addition of more will only increase the likelihood of the problem. A further consideration is the conservation of degrees of freedom, which are in short supply because of the limited number of observations.

In order to introduce a more dynamic element into the model, current exports will be dropped from the specification. Theoretical justification is similar to that discussed earlier with respect to the stock adjustment model. When exports are initially sold, one would expect a certain lag time to pass before the income generated from the sale affects the economy. It would take time for entreprenuers and government to invest the funds in the national economy. If capital structure were to be enhanced with export earnings, results would not become apparent for perhaps several years while additional financial arrangements were executed and actual construction took place.

Therefore, three more sets of equations will be estimated excluding current exports. This will allow exports lagged three years to be introduced. Hence, the forth equation to be estimated is:

$$I = \alpha_4 + \phi_1 X_{-1} + \varepsilon,$$

where:

$I \equiv$ current value of the infrastructure variable

$X_{-1} \equiv$ lagged exports.

Equation number five will introduce exports lagged twice (X_{-2}):

$$I = \alpha_5 + \phi_2 X_{-1} + \psi_1 X_{-2} + \varepsilon.$$

The sixth and final equation will indicate the relationship (if any) between the infrastructure variable and X_{-1}, X_{-2}, and exports lagged three years (X_{-3}). It may be represented:

$$I = \alpha_6 + \phi_3 X_{-1} + \psi_2 X_{-2} + \omega_1 X_{-3} + \varepsilon.$$

No other variables will be introduced into the specification because of the likelihood that exports and various lagged values of exports exhibit multicollinearity.

Autocorrelation is a threat when using time series data. In order to test for autocorrelation the Durbin-Watson test[53] will be utilized. If autocorrelation is significant, autoregressive parameters will be estimated. These parameters will help eliminate the problem of autocorrelation which causes ordinary least square estimates to be

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[53] See J. Durbin, "Estimation of Parameters in Time-Series Regression Models," Journal of the Royal Statistical Society, Ser B, Vol. 22, 1960, pp. 139-153; and J. Durbin and G. S. Watson, "Testing for Serial Correlation in Least Squares Regression," Biometrika, Vol. 38, 1951, pp. 159-177, for a description of the test.

inefficient and their standard errors to be biased downward. This will lead to apparent statistical significance of regression coefficients when in fact the null hypothesis of no relationship should not be rejected.

The method for adjustment of the parameters will be to calculate the Yule-Walker equations.[54] Assuming first order autocorrelation is present when the Durbin-Watson test indicates significant autocorrelation[55] Yule-Walker equations are autocorrelation functions written in terms of autoregressive parameters (i.e., parameters adjusted to remove detrimental effects of autocorrelation). Taking an estimate for the autocorrelation coefficient (the dependent variable in the Yule-Walker equations) and substituting the estimate into the Yule-Walker equations and solving them simultaneously gives estimates of the autoregressive parameters. This is equivalent to using generalized least squares estimated with the "appropriate" weights.

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[54] See G. U. Yule, "On a Method of Investigating Periodicities in Disturbed Series, with Special Reference to Wolfer's Sunspot Numbers," Philosophical Transactions, Vol. A226, 1927, p.267; and G. Walker, "On Periodicity in Series of Related Terms," Proceedings of the Royal Society, Vol. A131, 1931, p.518 for a discussion of the Yule-Walker Equations.

[55] First order autocorrelation is the most elementary form of an autoregressive error process (a first order autoregressive scheme).

CHAPTER IV

RESULTS

Results from the estimation procedure described in the previous chapter will be presented in the following manner. The fifteen countries involved will be arranged according to their level of economic "development." Economic development is assumed to be reflected in different levels of gross domestic product for division of countries into various categories. This division is somewhat arbitrary, but it is the convention adopted by the Handbook of International Trade and Development Statistics (1983) available from the United Nations Conference on Trade and Development (UNCTAD). The categories are:

Major oil exporting countries

- Algeria
- Mexico
- Saudia Arabia
- Venezuela

GDP (1980) above $1500[56]

- Argentina
- Brazil
- Korea

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[56] These countries might be considered "Newly Industrialized Countries" (NICs), however it could easily be argued that only Korea is industrialized. Hence, for purposes of this study this category will be referred to as the "High Income Countries" (HICs).

GDP (1980) between $500 and $1500[57]

Columbia

Jamaica

Nigeria

Thailand

GDP (1980) below $500[58]

Egypt

India

Indonesia

Kenya

The above countries were chosen for the study based on their diversity and data availability.

Throughout the remainder of the study abbreviations will be adopted for the dependent variables or infrastructure variables. The following notation has been adopted:

Gross domestic product ≡ GDP

Gross fixed capital formation ≡ IF

Energy requirement ≡ ER

Transportation ≡ TR

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[57] This grouping has been described as the "Middle Income Countries" (MICs).

[58] This last grouping has been refered to in the literature as "Lower Income Countries" (LICs).

Communication ≡ CM

Education ≡ ED.

Results of the regression equations described in the previous chapter will be presented in tables for the fifteen countries listed above. Data is annual and for the years 1967-82. Tables are arranged in the following manner. Each country has two Tables giving basic statistical results. The first table (Current Exports as First Independent Variable) contains equations which include current exports, while the second table (Lagged Exports as First Independent Variable) omits current exports. This technique allows a larger number of independent variables to be included. The first column indicates which infrastructure variable (dependent variable) is used. Three equations are estimated, with additional lagged independent variables introduced into each subsequent equation. The figures given are coefficients, while numbers in parentheses are "t" statistics. The sixth column is the Durbin-Watson (DW) statistic. If DW is significant at the 1 percent level an asterisk (*), is given in the superscript position for the dependent variable. If this is the case, the reader is asked to refer to tables containing autoregressive parameter estimates. These estimates have been discussed in Chapter III. The tables for autoregressive parameter estimates are arranged in a manner similar to the main tables.

1. Major Oil Exporting Countries

Gross domestic product exhibits a strong statistical relationship with current exports in Algeria (see Table 2). The value of R^2 is

TABLE 2

ALGERIA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	1.815671	0.718240			1.1484	0.9454
	(17.435)	(13.7986)				
GDP	1.821599	0.522464	0.502741		0.9008	0.9627
	(20.160)	(5.1415)	(2.1505)			
GDP	1.817207	0.521935	0.050195	0.173843	1.1964	0.9717
	(21.910)	(5.5985)	(0.3965)	(1.6973)		
IF	0.832514	0.746045			1.4127	0.8877
	(5.2010)	(9.3247)				
IF	0.840203	0.492099	0.266871		0.9635	0.9130
	(5.6830)	(2.9598)	(1.7048)			
IF	0.835064	0.491481	0.084900	0.203376	1.2324	0.9238
	(5.7222)	(2.9962)	(0.3802)	(1.1285)		
ER	7.696596	0.821053			1.1608	0.7606
	(27.699)	(5.9117)				
ER	7.711406	0.331960	0.513978		0.9368	0.8270
	(31.109)	(1.1908)	(1.9584)			
ER	7.700278	0.330621	0.119958	0.440379	1.0030	0.8627
	(33.073)	(1.2633)	(0.3367)	(1.5316)		
TR	6.087387	0.689442			1.7026	0.8071
	(29.941)	(6.7843)				
TR	6.099614	0.285655	0.424338		1.4136	0.8752
	(35.543)	(1.4801)	(2.3353)			
TR	6.091935	0.284731	0.152445	0.303876	1.6419	0.9008
	(37.760)	(1.5701)	(0.6176)	(1.5252)		
CM	6.427881	0.726054			2.2096	0.8119
	(30.487)	(6.8896)				
CM	6.430832	0.628622	0.102392		1.9958	0.8155
	(29.350)	(2.5511)	(0.4414)			
CM	6.436613	0.629318	0.307094	-0.228781	2.0548	0.8286
	(28.906)	(2.5143)	(0.9014)	(-0.382)		
ED	0.520897	0.240486			1.6559	0.8666
	(9.1538)	(8.4551)				
ED	0.524094	0.134914	0.110946		1.2125	0.9077
	(10.551)	(2.4125)	(2.1095)			
ED	0.522136	0.134648	0.041599	0.077504	1.3544	0.9224
	(10.872)	(2.4948)	(0.5661)	(1.3068)		

extremely high also. However, this is due to the fact that time series data is used. Intercept terms are all highly significant. This implies that there are other factors (in addition to exports) which account for the upward trend of GDP. The coefficient for exports lagged one year is also significant at the 5 percent level. Exports apparently bear a positive relationship to GDP in Algeria. Elasticities for exports lagged beyond one year are not statistically significant. This is illustrated by an examination of Table 3 where current exports are excluded from the equations estimated. Gross fixed capital formation also shows a strong positive relationship for both current and lagged exports, but beyond a one year lag the relationship ceases to be statistically significant. However, this does indicate the possibility that export earnings are being used to contribute to the infrastructure of the country.

The other infrastructure variables show markedly similar results in that elasticities are significant at the 5 percent level for both current exports and exports lagged one year. The elasticities for ED are lower than for those of the other infrastructure variables. This indicates that while exports are significantly related to ED, the relationship is not as powerful as it is for the other infrastructure variables. For Algeria to increase her amount of human capital, it will be necessary to increase exports by a larger amount than is necessary to increase IF, CM, TR, etc.

In conclusion, it is apparent that exports do bear a positive relationship with economic development in Algeria. This is a result which one would expect from a country that is a major petroleum

TABLE 3

ALGERIA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	2.028732	0.646437			1.6419	0.8634
	(13.782)	(8.3570)				
GDP	2.024079	0.488726	0.175759		1.3974	0.8732
	(13.572)	(2.4372)	(0.8543)			
GDP	2.018394	0.481032	0.025940	0.177827	1.6383	0.8826
	(13.329)	(2.3625)	(0.0949)	(0.8478)		
IF	1.035298	0.681954			1.0577	0.8363
	(5.9905)	(7.5091)				
IF	1.029866	0.497843	0.205180		0.8739	0.8477
	(5.8791)	(2.1137)	(0.8491)			
IF	1.024917	0.491145	0.074764	0.154798	0.9165	0.8539
	(5.6613)	(2.0177)	(0.2287)	(0.6173)		
ER	7.843012	0.793994			1.0235	0.8024
	(34.695)	(6.6840)				
ER	7.831321	0.397746	0.441593		0.7838	0.8384
	(36.499)	(1.3787)	(1.4920)			
ER	7.818432	0.380302	0.101921	0.403172	1.1942	0.8681
	(38.223)	(1.3828)	(0.2759)	(1.4230)		
TR	6.212863	0.665287			1.3215	0.8478
	(38.419)	(7.8288)				
TR	6.204790	0.391677	0.304921		1.1224	0.8737
	(40.120)	(1.8836)	(1.4293)			
TR	6.195558	0.379183	0.061627	0.288777	1.0920	0.8966
	(41.963)	(1.9101)	(0.2311)	(1.4121)		
CM	6.680051	0.632632			1.1493	0.6953
	(27.803)	(5.0106)				
CM	6.686047	0.835848	-0.226471		1.3776	0.7083
	(27.095)	(2.5193)	(-0.665)			
CM	6.687519	0.837840	-0.187668	-0.046057	1.3681	0.7088
	(25.709)	(2.3955)	(-0.340)	(-0.128)		
ED	0.577518	0.224745			1.1223	0.8539
	(10.828)	(8.0177)				
ED	0.575516	0.575516	0.077999		0.8260	0.8688
	(10.848)	(2.1696)	(1.0659)			
ED	0.573353	0.151829	0.020999	0.067656	0.8616	0.8799
	(10.706)	(2.1085)	(0.2171)	(0.9120)		

exporter. Funds from the sale of oil should be available to add to infrastructure of the country. These results confirm that, for Algeria, exports have increased as the infrastructure of the country has increased. The results do not, of course, indicate that there is necessarily a causal relationship between export growth and economic development. They only indicate that the two series have grown as time has passed and that their growth is significantly related.

Results for the economic growth indicators (GDP and IF) are somewhat similar between Mexico and Algeria. Current exports show a statistically significant relationship in Mexico (see Tables 4 and 5). However, when lagged exports are the first variable tested, they show no relationship with either GDP or IF. Also note that autocorrelation is a problem in Mexico. Dependent variables marked with an asterik (*) in the superscript position indicate that autocorrelation is a problem. Autoregressive parameters are listed in Tables 6 and 7. Autoregressive parameters yield results similar to that of ordinary least squares estimates. The strong relationship between current exports and economic growth infrastructure variables imply that there is a link between economic growth and the growth of exports. However, the relationship is not of a dynamic character in that exports from years past bear no apparent statistical relationship with either GDP or IF. One would expect lagged exports to exhibit perhaps even a stronger relationship with IF than current exports. Intercept statistics are highly significant with respect to GDP implying that there are other sources for output growth. However, the same does not apply for IF. Current exports may be an important source of funding for IF.

TABLE 4

MEXICO: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP*	6.573630	0.566117			0.2663	0.7172
	(23.413)	(5.2817)				
GDP*	5.386292	0.528007	-0.451429		0.6880	0.8034
	(8.7196)	(5.5299)	(-2.094)			
GDP	4.918173	0.470548	-0.228038	-0.347974	0.6363	0.8105
	(4.7785)	(3.3640)	(-0.513)	(-0.580)		
IF	0.434751	0.576917			0.8659	0.8074
	(1.9537)	(6.7909)				
IF	0.326795	0.573451	-0.41054		0.9175	0.8082
	(0.5576)	(6.3307)	(-0.200)			
IF	-0.036170	0.528900	0.132157	-0.269808	0.8516	0.8128
	(-0.037)	(3.9612)	(0.3112)	(-0.471)		
ER*	11.01967	-0.056882			0.0806	0.0134
	(28.536)	(-0.386)				
ER*	13.27389	0.015488	0.857256		0.4935	0.5866
	(20.123)	(0.1519)	(3.7241)			
ER*	13.97878	0.1.2008	0.520878	0.523972	0.5502	0.6163
	(12.962)	(0.6960)	(1.1174)	(0.8341)		
TR*	9.568222	0.032421			0.0923	0.0042
	(24.283)	(-0.215)				
TR*	11.22679	0.043296	0.896895		0.6292	0.6125
	(18.386)	(0.4318)	(3.9620)			
TR*	12.57745	0.123174	0.586338	0.483751	0.6291	0.6370
	(11.806)	(0.8507)	(1.2732)	(0.7795)		
CM*	9.741712	-0.015478			0.1445	0.0056
	(59.908)	(-0.249)				
CM	10.68941	0.014948	0.360398		0.7939	0.5815
	(38.396)	(0.3474)	(3.7097)			
CM	11.04547	0.058652	0.190482	0.264675	0.7939	0.6245
	(24.685)	(0.9645)	(0.9848)	(1.0154)		
ED*	2.445625	-0.020431			0.0742	0.0053
	(11.090)	(-0.243)				
ED*	3.638318	0.017859	0.452568		0.4483	0.5013
	(8.8283)	(0.2804)	(3.1538)			
ED*	4.109622	0.075709	0.228657	0.350342	0.5548	0.5423
	(6.1342)	(0.8315)	(0.7896)	(0.8977)		

TABLE 5

MEXICO: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	3.490097	-0.678683			1.4736	0.2022
	(3.5359)	(-1.669)				
GDP	2.154449	0.587314	-1.775477		1.3593	0.5722
	(2.4380)	(1.1045)	(-2.940)			
GDP	1.341499	0.392046	-1.236122	-0.658746	1.2691	0.5996
	(0.9767)	(0.6570)	(-1.339)	(-0.784)		
IF	-1.732602	-0.287867			1.4950	0.0394
	(-1.666)	(-0.672)				
IF	-3.142615	1.048618	-1.874332		1.3942	0.4864
	(-3.397)	(1.8739)	(-2.950)			
IF	-3.888649	0.869423	-1.379274	-0.604522	1.2772	0.5114
	(-2.669)	(1.3734)	(-1.409)	(-0.679)		
ER*	13.21827	0.850590			0.4616	0.5857
	(25.237)	(3.9433)				
ER*	13.37964	0.697634	0.214510		0.4011	0.5956
	(21.149)	(1.8326)	(0.4963)			
ER	14.60182	0.991198	-0.596350	0.990351	1.0971	0.7097
	(16.958)	(2.6496)	(-1.031)	(1.88810)		
TR*	11.77119	0.878260			0.5504	0.6053
	(22.669)	(4.1069)				
TR*	11.85400	0.799770	0.110077		0.5122	0.6078
	(18.732)	(2.1002)	(0.2546)			
TR	12.99014	0.072668	-0.643700	0.920633	1.1897	0.7034
	(14.694)	(2.7924)	(-1.084)	(1.7030)		
CM*	10.63572	0.353964			0.5872	0.5765
	(47.881)	(3.8694)				
CM*	10.70098	0.292112	0.086744		0.5872	0.5857
	(39.840)	(1.8073)	(0.4727)			
CM	11.12498	0.393955	-0.194559	0.343572	1.2964	0.6638
	(28.620)	(2.3327)	(-0.745)	(1.4455)		
ED*	3.574180	0.445881			0.3931	0.4974
	(10.892)	(3.2995)				
ED*	3.664952	0.359843	0.120664		0.3558	0.5071
	(9.2249)	(1.5052)	(0.4446)			
ED	4.486161	0.557094	-0.424170	0.665438	1.0935	0.6664
	(8.5434)	(2.4419)	(-1.202)	(2.0725)		

TABLE 6

MAJOR OIL EXPORTING COUNTRIES: CURRENT EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
MEX-GDP	6.462434 (36.306)	0.541418 (11.842)			0.9152
MEX-GDP	6.358529 (12.587)	0.551001 (10.013)	-0.061503 (-0.331)		0.9016
MEX-ER	10.97029 (51.626)	-0.033811 (-0.632)			0.0298
MEX-ER	12.40973 (25.084)	-0.043467 (-0.812)	0.586949 (3.1180)		0.4899
MEX-ER	12.72960 (17.551)	-0.004534 (-0.060)	0.400067 (1.4650)	0.260627 (0.7900)	0.4997
MEX-TR	9.529191 (42.033)	-0.004528 (-0.077)			0.0005
MEX-TR	11.16125 (20.336)	-0.012994 (-0.211)	0.662332 (3.2040)		0.4870
MEX-TR	11.55187 (14.731)	0.041390 (0.4970)	0.380672 (1.2690)	0.355485 (1.0070)	0.4943
MEX-CM	9.638049 (68.570)	-0.017171 (-0.420)			0.0134
MEX-ED	2.375666 (17.002)	-0.015232 (-0.401)			0.0122
MEX-ED	3.174324 (9.6840)	-0.017938 (-0.500)	0.315894 (2.5400)		0.3829

TABLE 6 (continued)

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
MEX-ED	3.239167 (7.3000)	-0.000992 (-0.021)	0.190871 (1.1410)	0.121522 (0.6010)	0.3722
SAR-TR	5.683801 (13.887)	0.248233 (1.7390)	0.389076 (2.8350)		0.7331
VEN-GDP	2.990650 (12.716)	0.351753 (3.7240)			0.5162
VEN-IF	1.122893 (1.9020)	0.513581 (2.1670)			0.2653
VEN-ER	9.138238 (30.033)	0.452682 (3.7110)			0.5144
VEN-ER	9.034215 (27.038)	0.324176 (2.5760)	0.181097 (1.4610)		0.5713
VEN-ER	8.889963 (24.356)	0.299294 (2.4970)	0.085174 (0.6660)	0.188019 (1.5820)	0.6377
VEN-TR	7.732946 (14.113)	0.367969 (1.6860)			0.1795
VEN-ED	0.142865 (0.7180)	0.237193 (2.9710)			0.4044
VEN-ED	0.061208 (0.3160)	0.098639 (1.3430)	0.178186 (2.4640)		0.5462
VEN-ED	0.009803 (0.0520)	0.074607 (1.2580)	0.106571 (1.6950)	0.123738 (2.0980)	0.6552

TABLE 7

MAJOR OIL EXPORTING COUNTRIES: LAGGED EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	R^2
MEX-ER	12.43849 (27.581)	0.549578 (3.0290)			0.4333
MEX-ER	12.50288 (25.075)	0.328778 (1.5920)	0.235036 (1.1630)		0.4398
MEX-TR	11.03524 (22.947)	0.597089 (3.0800)			0.4415
MEX-TR	11.08603 (20.082)	0.387807 (1.6280)	0.218200 (0.9330)		0.4273
MEX-CM	10.51576 (37.411)	0.323833 (2.8530)			0.4041
MEX-CM	10.57119 (36.358)	0.158285 (1.1920)	0.178224 (1.3570)		0.4495
MEX-ED	3.153798 (10.762)	0.287900 (2.4410)			0.3318
MEX-ED	3.062634 (10.144)	0.144409 (1.1680)	0.095066 (0.7860)		0.2798
VEN-IF	1.339843 (2.6210)	0.445417 (2.1840)			0.2845
VEN-ED	0.131898 (0.7920)	0.248652 (3.7340)			0.5374
VEN-ED	0.119030 (0.7100)	0.133122 (2.1550)	0.128049 (2.0970)		0.6036

Remaining infrastructure variables ER, TR, CM, and ED do not follow the pattern set by the two variables previously examined. Any relationship between ER, TR, CM, and ED occurs between lagged exports and not current exports. Statistics are significantly autocorrelated 75 percent of the time in Mexico when the equations are estimated. The current value of exports shows no statistically significant elasticity. Some of the coefficients are negative, but these are not significant. Exports lagged one year are significant in every instance. Hence, one might conclude that there is a time lag involved between economic development and international trade in Mexico.

In conclusion, Mexico represents an interesting case. Current exports are significantly related to GDP and IF, while coefficients for all lagged export variables prove to be insignificant. For the four infrastructure variables other than the two mentioned above, lagged exports are statistically significant while current exports are insignificant. There may well be a short run relation between exports and economic growth in Mexico. However, it seems as though infrastructure variables ER, TR, CM, and ED have more of a "dynamic" relationship.

Saudia Arabia is a major oil exporter that exhibits results one might expect with a country which gains much of its income from the sale of petroleum to western industrialized countries. After the Organization of Petroleum Exporting Countries quadrupled the price of crude oil in 1973-74, income flowing to these countries increased substantially. It is possible that this increased flow of funds into major oil exporting countries could be used to add to their economic

infrastructure. This increase in infrastructure should further fuel economic development in the future.

Saudia Arabia's results do little to dispel such thoughts. There exists a powerful statistical relationship between exports and GDP in Saudia Arabia (see Tables 8 and 9). Similar results hold true for the regression of IF on exports. Elasticities are statistically significant. Both current and lagged exports are significant. The value of R^2 is high, but as was the case with Algeria this is probably due to time series data. Intercept terms are significant for GDP indicating that there are sources of economic growth other than international trade in Saudia Arabia. One might conclude that a strong relationship exists between exports and economic growth in Saudia Arabia. It is possible that income from the sale of exports is adding to the economic growth of the country.

In addition to the positive relationship between exports and economic growth, Saudia Arabia has a strong positive relationship between exports and the other development proxies. Each of the elasticities is significant when either current exports or lagged exports is the only independent variable. There is hence a significant statistical relationship between infrastructure and exports in this petroleum exporting country. Interestingly, the elasticity coefficient for CM is 1.227 when current exports are the single independent variable and 1.051 when lagged exports are the single independent variable. This indicates that exports have an exaggerated effect on the CM proxy in Saudia Arabia. If exports increase by 1 percent, CM goes up by 1.227 percent in same year. The number of radio receivers has been increasing

TABLE 8

SAUDIA ARABIA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	2.449561	0.511968			1.5336	0.8958
	(12.595)	(9.7271)				
GDP	2.502123	0.307738	0.200406		1.2854	0.9279
	(14.586)	(2.8701)	(2.1079)			
GDP	2.505408	0.309539	0.013861	0.196682	1.5500	0.9531
	(17.187)	(3.3973)	(0.1184)	(2.2022)		
IF	-1.872396	1.135860			1.0907	0.7940
	(-2.905)	(6.5106)				
IF	-1.674440	0.366697	0.754764		0.8390	0.8758
	(-3.156)	(1.1057)	(2.5667)			
IF	-1.662646	0.373163	0.085066	0.706089	1.0614	0.8758
	(-4.090)	(1.4686)	(0.2606)	(2.8350)		
ER	7.627187	0.616231			1.0081	0.8203
	(27.736)	(7.0861)				
ER	7.688798	0.376803	0.234964		0.9217	0.8481
	(24.553)	(1.9251)	(1.3538)			
ER	7.693493	0.379377	-0.031715	0.281152	1.0792	0.8807
	(26.300)	(2.0749)	(-0.135)	(1.5688)		
TR	4.913560	0.815089			0.8473	0.7828
	(10.273)	(6.2972)				
TR*	5.052106	0.276775	0.528245		0.6181	0.8596
	(12.392)	(1.0861)	(2.3379)			
TR	5.059215	0.280672	0.124549	0.425633	0.7103	0.9004
	(13.974)	(1.2403)	(0.4284)	(1.9189)		
CM	1.664479	1.227152			0.9319	0.6778
	(1.7658)	(4.8104)				
CM	1.761810	0.848971	0.371100		0.8148	0.6923
	(1.8041)	(1.3909)	(0.6857)			
CM	1.765557	0.851026	0.158324	0.224339	0.7918	0.6966
	(1.7273)	(1.3321)	(0.1929)	(0.3582)		
ED	-1.40448	0.313509			1.2872	0.8577
	(-10.48)	(8.1436)				
ED	-1.439538	0.115699	0.194107		0.9818	0.9345
	(-14.07)	(1.8088)	(3.4225)			
ED	-1.437475	0.116829	0.076983	0.123489	0.7278	0.9599
	(-17.03)	(2.2147)	(1.1360)	(2.3882)		

TABLE 9

SAUDIA ARABIA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	2.770289	0.446966			1.4704	0.8685
	(14.955)	(8.5232)				
GDP	2.775076	0.264428	0.193958		1.1837	0.8930
	(15.836)	(2.2098)	(1.5135)			
GDP	2.765239	0.252862	0.010363	0.214366	1.2969	0.9217
	(17.483)	(2.1487)	(0.0675)	(1.8139)		
IF	-1.354896	1.048562			1.0294	0.8606
	(-3.015)	(8.2409)				
IF	-1.337550	0.387134	0.702806		0.8895	0.9186
	(-3.714)	(1.4459)	(2.6717)			
IF	-1.366557	0.353029	0.161411	0.632132	1.3727	0.9635
	(-5.370)	(1.8644)	(0.6534)	(3.3244)		
ER	8.017148	0.536841			1.2517	0.7918
	(27.348)	(6.4688)				
ER	8.024004	0.275384	0.277814		1.1198	0.8237
	(28.352)	(1.3089)	(1.3439)			
ER	8.008187	0.256787	-0.017399	0.344690	1.5026	0.8705
	(31.301)	(1.3489)	(-0.070)	(1.8031)		
TR	5.293290	0.749998			0.8781	0.8430
	(15.356)	(7.6860)				
TR	5.303735	0.351748	0.423163		0.7730	0.8833
	(17.0149	(1.5178)	(1.8585)			
TR	5.281445	0.325542	0.007153	0.485732	0.8846	0.9340
	(21.365)	(1.7694)	(0.0298)	(2.6290)		
CM	2.501611	1.051298			0.8547	0.6327
	(2.9325)	(4.3533)				
CM	2.506936	0.847213	0.216851		0.7837	0.6368
	(2.8171)	(1.2806)	(0.3336)			
CM	2.489906	0.827158	-0.101518	0.371728	0.8321	0.7456
	(2.6952)	(1.2033)	(-0.113)	(0.5385)		
ED	-1.338717	0.286805			1.3475	0.9130
	(-14.20)	(10.747)				
ED	-1.335694	0.171555	0.122461		0.8689	0.9380
	(-16.00)	(2.7646)	(2.0085)			
ED	-1.340012	0.166478	0.041882	0.094084	0.9486	0.9521
	(-17.31)	(2.8910)	(0.5575)	(1.6270)		

faster than exports. On the other hand, the elasticity of education with respect to exports is much smaller, yet statistically significant. The number of pupils enrolled at the primary level has been increasing at a slower steady rate relative to the fast pace of exports in Saudia Arabia. Intercept terms are insignificant for both CM and ED impliying that exports may be important in the development of communication and education in Saudia Arabia.

Saudia Arabia is a fine example of a country which one could choose to show a positive relationship between economic growth or development and international trade. Exports are significantly related to each of the infrastructure variables tested. Both current and lagged exports are significant at the 5 percent level. One could claim that international trade served as an engine for economic development for Saudia Arabia.

Venezuela is the final major oil exporting country which this study will examine. Current exports are significant for each of the infrastructure variables tested (see Tables 10 and 11). As each subsequent lagged export variable is added to the model, the previous year's exports become insignificant. This is indicative of a high degree of mulitcollinearity among lagged exports. This tends to make the statistics difficult to interpret. By adding each lagged variable to the equation separately, interpretation of statistics is somewhat easier. When simple regression is used there is obviously no chance of multicollinearity. Therefore, at least two of the six equations for each infrastructure variables are free from multicollinearity and thus are subject to interpretation. The elasticity coefficients for GDP and

TABLE 10

VENEZUELA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP*	3.044709	0.344409			0.6832	0.5234
	(11.784)	(3.4755)				
GDP	2.943452	0.118488	0.270571		0.8663	0.7133
	(13.766)	(0.9943)	(2.5740)			
GDP	2.826267	0.149741	0.026875	0.265684	1.1283	0.8700
	(18.129)	(1.7592)	(0.2557)	(3.2933)		
IF*	1.043504	0.584058			0.7686	0.3201
	(1.5594)	(2.2757)				
IF	0.844698	0.140486	0.541238		0.7554	0.4758
	(1.3473)	(0.4021)	(1.7236)			
IF	0.554461	0.217893	-0.072333	0.658027	0.9850	0.6802
	(1.0458)	(0.7527)	(-0.202)	(2.3983)		
ER*	9.109787	0.475999			0.3637	0.4972
	(24.209)	(3.2982)				
ER*	8.992060	0.213329	0.314583		0.5973	0.6249
	(25.928)	(1.1037)	(1.8451)			
ER*	8.861554	0.248135	0.043186	0.295883	0.6207	0.7216
	(27.392)	(1.4047)	(0.1980)	(1.7674)		
TR*	6.728148	0.771249			0.5218	0.3635
	(8.3856)	(2.5063)				
TR	6.466165	0.186718	0.700055		0.8904	0.5396
	(8.8805)	(0.4601)	(1.9557)			
TR	6.062319	0.294425	-0.139775	0.915602	0.9282	0.7973
	(11.589)	(1.0308)	(-0.396)	(3.3824)		
CM	5.438625	1.077318			0.8668	0.5786
	(7.5252)	(3.8867)				
CM	5.063761	0.240931	1.001688		1.0924	0.8728
	(11.951)	(1.0203)	(4.8089)			
CM	4.819898	0.305970	0.494554	0.552889	1.4543	0.9495
	(16.670)	(1.9380)	(2.5374)	(3.6951)		
ED*	0.123980	0.254139			0.5243	0.4218
	(0.5300)	(2.8326)				
ED*	0.031164	0.047050	0.248018		0.6048	0.6580
	(0.1623)	(0.4398)	(2.6280)			
ED*	-0.052969	0.069488	0.073058	0.190745	0.5870	0.7775
	(-0.316)	(0.7592)	(0.6465)	(2.1988)		

TABLE 11

VENEZUELA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	3.053776	0.347551			1.1061	0.6850
	(16.778)	(4.8906)				
GDP	2.972184	0.137462	0.249869		1.0285	0.8253
	(20.475)	(1.4843)	(2.8339)			
GDP	2.877029	0.145082	0.068978	0.218669	1.2794	0.9249
	(27.659)	(2.2658)	(0.8588)	(3.4558)		
IF*	0.976690	0.622510			0.7740	0.4673
	(1.9025)	(3.1066)				
IF	0.766789	0.088586	0.635004		0.7818	0.6601
	(1.7464)	(0.3162)	(2.3811)			
IF	0.533960	0.106751	0.203817	0.521257	0.8754	0.7805
	(1.4000)	(0.4496)	(0.6844)	(2.2217)		
ER	9.192490	0.453179			1.0032	0.5792
	(30.809)	(3.8912)				
ER	9.103353	0.226440	0.269664		0.9360	0.6605
	(31.726)	(1.2370)	(1.5473)			
ER	8.962525	0.327718	0.001960	0.323625	0.9645	0.8790
	(33.645)	(1.4927)	(0.0098)	(2.0565)		
TR	6.641549	0.821363			1.0366	0.5298
	(11.112)	(3.5208)				
TR	6.349225	0.077665	0.884492		0.9787	0.7733
	(14.291)	(0.2740)	(3.2777)			
TR	6.066931	0.100271	0.347871	0.648716	1.3051	0.8948
	(18.335)	(0.4923)	(1.3615)	(3.2229)		
CM	5.290125	1.158217			1.4494	0.8596
	(14.628)	(8.2052)				
CM	5.118054	0.720521	0.520559		1.5524	0.9284
	(18.510)	(4.0846)	(3.0997)			
CM	4.936711	0.735043	0.175837	0.416731	2.1136	0.9693
	(24.934)	(6.0308)	(1.1501)	(3.3601)		
ED*	0.075369	0.278585			0.7182	0.6514
	(0.4787)	(4.5334)				
ED*	0.014745	0.124376	0.183403		0.6236	0.7633
	(0.1062)	(1.4036)	(2.1740)			
ED	-0.059082	0.130288	0.043063	0.196655	0.6342	0.8520
	(-0.492)	(1.7632)	(0.4646)	(2.3234)		

IF are significant at the 5 percent level when current exports or exports lagged one year are the single independent variable. This indicates that funds from the sale of exports may well be adding to the economic growth of the country.

Similar analysis is possible for ER, TR, CM, and ED infrastructure proxies. Autocorrelation is significant for both ER and ED (see Tables 6 and7) for autoregressive parameters. Exports are significantly related to each of these four variables when either current exports or exports lagged one year are the single independent variable. Hence, one might conclude that international trade is beneficial to the Venezuelan economy. Not only is there a positive relation between exports and economic growth, but also variables which act as proxies for economic development are significantly related to exports.

There seems to be a time lag in the Venezuelan economy between exports and economic development. Uniquely, exports lagged for three years are statistically significant. This means that three years after the export earnings have entered the economy the earnings are still productive. None of the other major petroleum exporting countries tested exhibited this type of lagged behavior.

2. High Income Countries

Argentina is a country in which GDP bears a close statistical relationship to exports. The "t" statistic for the elasticity of GDP with respect to exports is exceptionally high [(26.487) (see Tables 12 and 13)]. The elasticity of GDP with respect to exports is not only highly statistically significant, but it is also a relatively high

TABLE 12

ARGENTINA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	1.781905	1.178350			1.0335	0.9846
	(7.3757)	(26.487)				
GDP	2.548420	1.710309	-0.619746		1.2572	0.9933
	(11.367)	(9.4387)	(-3.612)			
GDP	2.687155	1.669585	-0.432301	-0.163266	2.4375	0.9939
	(8.5756)	(10.530)	(-1.594)	(-0.898)		
IF	-0.943513	1.198836			1.4569	0.9756
	(-3.042)	(20.992)				
IF	-0.204468	1.711718	-0.597520		1.3150	0.9834
	(-0.471)	(7.0760)	(-2.165)			
IF	-0.465009	1.788190	-0.949512	0.306588	1.4490	0.9853
	(-0.938)	(7.1321)	(-2.213)	(1.0666)		
ER	10.72997	-0.034667			0.8919	0.8126
	(394.00)	(-6.906)				
ER*	10.76079	-0.020222	-0.016829		0.6915	0.8188
	(236.60)	(-0.797)	(-0.582)			
ER	10.74639	-0.015995	-0.036284	0.016946	0.7189	0.8244
	(198.16)	(-0.582)	(-0.773)	(0.5387)		
TR	9.209382	-0.011663			1.0059	0.1311
	(204.90)	(-1.288)				
TR	9.300642	0.052672	-0.073786		1.2828	0.3325
	(139.16)	(1.4143)	(-1.737)			
TR	9.393729	0.025348	0.051938	-0.109546	0.9903	0.7360
	(184.48)	(0.9838)	(1.1794)	(-3.708)		
CM*	9.724643	-0.023667			0.6238	0.0380
	(49.845)	(-0.568)				
CM*	9.693698	-0.045143	0.025020		0.6289	0.0393
	(29.307)	(-0.244)	(0.1190)			
CM	9.930597	-0.114681	0.435049	-0.278787	0.9727	0.1927
	(27.037)	(-0.617)	(1.0854)	(-1.308)		
ED	1.414235	-0.023400			0.9587	0.9270
	(131.51)	(11.817)				
ED	1.424689	-0.016145	-0.008452		0.8021	0.9309
	(80.251)	(-1.632)	(-0.749)			
ED	1.439924	-0.020617	0.012123	-0.017929	1.1860	0.9464
	(76.273)	(-2.158)	(0.7424)	(-1.637)		

TABLE 13

ARGENTINA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	0.527417	1.289655			1.0838	0.9067
	(0.7296)	(10.342)				
GDP	1.340662	1.907590	-0.710573		1.6428	0.9181
	(1.3535)	(3.5419)	(-1.178)			
GDP	1.335569	1.909286	-0.716609	0.005003	1.6443	0.9181
	(1.0524)	(3.0973)	(-0.673)	(0.0071)		
IF	-2.227155	1.313453			1.4942	0.9004
	(-2.917)	(9.9730)				
IF	-1.907155	1.556601	-0.279600		1.6485	0.9021
	(-1.723)	(2.5864)	(-0.415)			
IF	-2.209165	1.657166	-0.637433	0.296668	1.7346	0.9036
	(-1.570)	(2.4247)	(-0.540)	(0.3776)		
ER*	10.78468	-0.039404			0.4902	0.8072
	(320.41)	(-6.787)				
ER*	10.75929	-0.058700	0.022189		0.6386	0.8178
	(224.86)	(-2.256)	(0.7617)			
ER	10.74745	-0.054759	0.008165	0.011626	0.6425	0.8201
	(176.45)	(-1.851)	(0.1597)	(0.3419)		
TR	9.238402	-0.014983			1.0427	0.1990
	(175.85)	(-1.653)				
TR	9.373286	0.087507	-0.117855		1.3095	0.7076
	(201.96)	(3.4676)	(-4.171)			
TR	9.368217	0.089195	-0.123862	0.004979	1.2813	0.7084
	(157.74)	(3.0920)	(-2.485)	(0.1502)		
CM*	9.747041	-0.025378			0.6193	0.0336
	(40.934)	(-0.618)				
CM	10.02309	0.184371	-0.241194		0.7748	0.1587
	(30.862)	(1.0441)	(-1.220)			
CM	10.38779	0.062930	0.190921	-0.358253	0.7095	0.3810
	(29.104)	(0.3630)	(0.6373)	(-1.798)		
ED*	1.443767	-0.026477			0.6956	0.9124
	(100.71)	(-10.71)				
ED*	1.456552	-0.016736	-0.011171		0.5782	0.9192
	(72.311)	(-1.531)	(-0.911)			
ED	1.470506	-0.021409	0.005362	-0.013707	0.7215	0.9273
	(60.082)	(-1.801)	(-0.261)	(-1.003)		

number (1.178). This high value of the elasticity indicates that GDP is increasing faster than exports.

One could interpret the statistic to indicate that exports have some type of a multiplier effect on GDP. While this idea has some theoretical appeal when a time element is involved, it seems to stretch economic reasoning to say that there is a multiplier effect for a given year. Examination of subsequent equations reveals that the elasticity of GDP with respect to exports remains highly significant and relatively large. A similar pattern unfolds for IF. Elasticities are large and "t" statistics are highly significant (1.199 and 20.992 respectively). All intercept terms are significant except those for IF. The "t" statistics for the intercepts are large relative to other countries in the study indicating sources in addition to exports in economic growth of Argentina.

One possible explanation for this phenomenon is that exports for Argentina have not been extremely significant in explaining patterns of economic development. Examination of the raw data (not presented) reveals that exports did not play a significant role in the Argentine economy until the middle to late seventies. From then to the early eighties exports increased at a phenomenal rate. Gross national product and IF increased at a steady rate over the entire period (1967-82). One might conclude that while "t" statistics are highly significant, it does not necessarily follow that there is a causal relationship between exports and GDP or IF. Also, addition of subsequent lagged exports into the equation tells one very little except that multicollinearity is a problem. The elasticities for GDP and IF with respect to exports lagged

one year are significant when lagged exports are the only independent variable. However, when lagged exports are the second variable introduced, elasticities become negative and statistically significant.

When ER is regressed on current exports, elasticity coefficients are negative. The result is backed up by the regression of ER on lagged exports. Both of these equations are significant at the 5 percent level. Does this reveal that as exports increase energy requirement falls? Engine of growth theory suggests that exports add to the productive capacity of the country, yet this result seems to indicate an opposite relationship. Economic logic requires that as exports increase, energy required to produce those exports also increase. The elasticity coefficient is relatively low (-0.009 see Table 14 and 15), nevertheless, a negative coefficient is not predicted by theory. One possible conclusion is that increase in energy requirement has happened independent of the increase in exports. The intercept term is highly significant ("t" statistic is 394.008). This means that economic development in Argentina has occurred independent of exports, or at least suggests that there are other sources for growth of ER. One possible explanation is the "energy crisis." Perhaps Argentina's energy requirement fell as the price of energy increased.

In conclusion, Argentina is a country that has only recently begun to follow an export oriented development policy. The high elasticity coefficients and "t" statistics come purely from the data with no implications for causal relationship. One could possibly use Argentina as a case against the engine of growth hypothesis as development has occurred independent of export performance.

TABLE 14

HIGH INCOME COUNTRIES: CURRENT EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
ARG-ER	10.70925 (137.85)	-0.008946 (-0.297)	-0.035128 (-0.957)		0.5899
ARG-CM	9.214183 (107.10)	-0.044302 (-0.841)			0.0517
ARG-CM	9.284941 (91.371)	-0.035128 (-0.270)	-0.004755 (-0.031)		0.0439
BRA-GDP	2.923686 (18.451)	0.947139 (22.250)			0.9744
BRA-GDP	2.646583 (9.4420)	0.751300 (5.7450)	0.255971 (1.4590)		0.9748
BRA-ER	11.87485 (47.045)	-0.126350 (-1.912)			0.2194
BRA-ER	12.16609 (32.568)	-0.068733 (-0.468)	-0.119314 (-0.627)		0.2965
BRA-TR	10.15438 (37.444)	-0.126458 (-1.764)			0.1931
BRA-TR	10.25648 (27.807)	-0.092933 (-0.647)	-0.040577 (-0.218)		0.2058
BRA-CM	11.02454 (20.825)	-0.388461 (-2.727)			0.3706
BRA-CM	11.07678 (14.023)	-0.458216 (-1.437)	0.073388 (0.1770)		0.4036
KOR-IF	1.506296 (5.9740)	0.484055 (4.5130)			0.6104
KOR-ER	9.183127 (53.963)	0.419385 (5.7650)			0.7188

TABLE 15

HIGH INCOME COUNTRIES: LAGGED EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	R^2
ARG-ER	10.76831	-0.044377			0.6750
	(143.89)	(-3.724)			
ARG-ER	10.76164	-0.044443	0.004901		0.6500
	(164.62)	(-1.733)	(0.1730)		
ARG-CM	9.762272	-0.041459			0.0354
	(25.769)	(-0.663)			
ARG-ED	1.453102	-0.029993			0.7846
	(53.322)	(-6.162)			
ARG-ED	1.467020	-0.016081	-0.014331		0.8489
	(56.131)	(-1.671)	(-1.357)		
BRA-ER	12.03103	-0.152769			0.2147
	(36.931)	(-1.811)			
BRA-ER	12.27509	-0.123477	-0.078245		0.2451
	(24.523)	(-0.857)	(-0.405)		
BRA-ER	12.19315	-0.204875	0.043898	-0.009662	0.3019
	(17.411)	(-1.020)	(0.1710)	(-0.036)	
BRA-TR	10.18565	-0.112632			0.1236
	(30.563)	(-1.301)			
BRA-TR	10.46366	-0.048618	-0.119481		0.1620
	(21.345)	(-0.344)	(-0.632)		
BRA-TR	10.40018	-0.119170	0.017419	-0.038267	0.1910
	(15.602)	(-0.623)	(0.0710)	(-0.148)	
BRA-CM	11.37854	-0.435487			0.2734
	(14.567)	(-2.125)			

Current exports are significantly related to GDP and IF in Brazil (see Tables 16 and 17). This relationship holds when autoregressive parameters (see Tables 14 and 15) are calculated. As was the case in Argentina the "t" statistics are relatively high (22.25 and 29.25 for GDP and IF respectively). Elasticities are high with the coefficient for IF being larger than one. Multicollinearity is once again a problem. This is evident because of the statistical significance of lagged exports when it is the lone independent variable and statistical insignificance when lagged exports are included with the current export variable. This makes it difficult to say anything about the dynamic effect exports might have on infrastructure in Brazil. Intercepts are only significant for GDP, TR, and CM.

As was the case with Argentina, negative elasticity coefficients are significant at the 5 percent level for ER, TR, and CM. However, the results of Brazil and Argentina are distinguished when the autoregressive parameters are calculated. Many of the coefficients become insignificant, indicating that much of the apparent relationship is due to an autocorrelated error process. Note further that values for R^2 drop substantially when autoregressive parameters are calculated. This further implies that much of the negative relationship was due simply to autocorrelation. Negative coefficients for ER may be explained by the "energy crisis." As the price of energy imports rose Brazil may have curtailed her intake of energy in order to conserve resources.

Results for Brazil are markedly similar to those for Argentina. This is not a surprising finding considering the similarities between

TABLE 16

BRAZIL: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP*	2.846618	0.963631			0.8106	0.9825
	(20.146)	(24.819)				
GDP*	2.719891	0.891647	0.101458		0.7216	0.9827
	(7.8945)	(4.9113)	(0.4067)			
GDP	2.756262	0.890360	0.122149	-0.028038	0.7421	0.9828
	(5.5865)	(4.6466)	(0.3757)	(-0.108)		
IF	0.376532	1.218905			1.2166	0.9873
	(2.4828)	(29.249)				
IF	-0.125197	0.933909	0.401686		0.9498	0.9901
	(-0.318)	(5.3871)	(1.6962)			
IF	-0.348699	0.941815	0.274539	0.172296	1.0140	0.9906
	(-0.758)	(5.2878)	(0.9084)	(0.7144)		
ER*	12.28320	-0.193519			0.2704	0.4655
	(53.988)	(-3.095)				
ER*	11.88042	0.422307	0.031887		0.5118	0.4994
	(21.948)	(-1.480)	(0.8227)			
ER	11.36964	0.404238	0.031887	0.393759	0.5563	0.5513
	(15.431)	(-1.417)	(0.0659)	(1.1095)		
TR*	10.41215	-0.143075			0.2486	0.3521
	(48.888)	(-2.444)				
TR*	9.973348	-0.392329	0.351310		0.4743	0.4077
	(19.992)	(-1.414)	(0.9692)			
TR	9.551154	-0.377394	0.111130	0.325467	0.5112	0.4567
	(13.859)	(-1.414)	(0.2454)	(0.9008)		
CM*	11.41048	-0.397385			0.2902	0.7134
	(41.290)	(-5.233)				
CM*	10.89654	-0.689317	0.411461		0.5193	0.7335
	(16.631)	(-1.996)	(0.8673)			
CM	10.22155	-0.665439	0.027468	0.520348	0.7023	0.7664
	(11.591)	(-1.949)	(0.0474)	(1.1257)		
ED	2.070072	0.399181			2.2283	0.0432
	(1.0046)	(0.7050)				
ED	-1.547124	-1.655487	2.895940		2.1580	0.1029
	(-0.641)	(-0.640)	(0.8153)			
ED	4.735746	-1.788841	6.470170	-4.843428	2.4463	0.2740
	(0.7466)	(-0.764)	(1.5527)	(-1.456)		

TABLE 17

BRAZIL: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	1.382674	1.295988			1.1856	0.9411
	(3.7187)	(13.259)				
GDP	1.523302	1.365629	-0.102948		1.3233	0.9414
	(2.0844)	(4.2279)	(-0.227)			
GDP	1.806235	1.368465	0.046331	-0.218132	1.2557	0.9429
	(1.8742)	(4.0494)	(0.0819)	(-0.478)		
IF	-1.525795	1.652834			1.5071	0.9614
	(-4.019)	(16.559)				
IF	-1.652913	1.589882	0.093058		1.4144	0.9616
	(-2.214)	(4.8175)	(0.2011)			
IF	-1.994008	1.586463	-0.086908	0.262973	1.5018	0.9629
	(-2.035)	(4.4604)	(-0.151)	(0.5671)		
ER*	12.51376	-0.243296			0.2134	0.3897
	(35.836)	(-2.650)				
ER*	11.92943	-0.532674	0.427770		0.5085	0.4511
	(18.280)	(-1.846)	(1.0577)			
ER*	11.74531	-0.534519	0.330629	0.141946	0.4625	0.4583
	(13.568)	(-1.770)	(0.6509)	(0.3464)		
TR*	10.56173	-0.174290			0.2289	0.2767
	(32.678)	(-2.051)				
TR*	10.07376	-0.415941	0.357218		0.4952	0.3359
	(16.507)	(-1.542)	(0.9445)			
TR*	9.976039	-0.416920	0.305657	0.075343	0.4673	0.3387
	(12.269)	(-1.469)	(0.6406)	(0.1958)		
CM*	11.93032	-0.512009			0.2930	0.6272
	(26.354)	(-4.302)				
CM	11.93032	-0.901887	0.576334		0.7820	0.6677
	(13.231)	(-2.423)	(1.1042)			
CM	10.45902	-0.908743	0.215470	0.527308	0.6454	0.7040
	(9.8526)	(-2.453)	(0.3459)	(1.0495)		
ED	0.935637	0.678102			2.2128	0.0661
	(0.3200)	(0.8822)				
ED	7.336020	3.847709	-4.685447		2.2790	0.2269
	(1.3993)	(1.6606)	(-1.442)			
ED	12.43044	3.898773	-1.997565	-3.927627	2.5467	0.3476
	(1.9329)	(2.7374)	(-0.529)	(-1.290)		

the two countries regarding level of development. Hence, in spite of the highly significant relationship between exports and both GDP and IF, one might conclude that international trade adds little to economic development in Brazil. After calculation of autoregressive parameters, CM is the only variable which exhibits a significant statistical relationship, and it is negative. If GDP were the only proxy for development examined, one might conclude that the engine of growth is running in high gear in Brazil. However, with a wider range of development proxies this hypothesis comes into question.

Korea shows a positive relationship between each of the infrastructure variables estimated with the exception of ED which has a significant negative relationship (see Tables 18 and 19). Multicollinearity is once again a problem as it has been with other high income countries. This limits interpretable statistics to the equations which are simple regressions. Autocorrelation is very little of a problem in Korea. Only two of thirty six of the equations estimated had significant autocorrelation. When corrective procedures were taken, results changed only slightly.

It is possible that international trade has had a favorable impact on economic development in Korea. Resources from the sale of products abroad may be contributing to enhancement of productivity in Korea. Intercepts are statistically significant for each independent variable. There is nothing in the statistical analysis to indicate that the engine of growth is faltering in Korea.

Negative elasticity of ED with respect to exports implies that as exports increase, ED should actually fall. Education is the number of

TABLE 18

KOREA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	3.557943	0.206911			0.9842	0.5305
	(23.725)	(3.5257)				
GDP	3.527199	0.299568	-0.084520		0.8915	0.5473
	(21.706)	(1.8292)	(-0.608)			
GDP	3.506135	0.303975	-0.026853	-0.056784	0.9051	0.5547
	(19.653)	(1.7715)	(-0.129)	(-0.387)		
IF*	1.250538	0.571873			0.7859	0.7024
	(4.3600)	(5.0949)				
IF	1.313778	0.381281	0.173853		0.8668	0.7147
	(4.2396)	(1.2208)	(0.5666)			
IF	1.298165	0.384548	0.216596	-0.042088	0.8683	0.7154
	(3.7892)	(1.1670)	(0.5420)	(-0.149)		
ER*	9.006578	0.483804			0.9858	0.6985
	(36.780)	(5.0485)				
ER	9.165295	0.005467	0.436329		1.1619	0.8062
	(42.305)	(0.0250)	(2.3571)			
ER	9.295198	-0.014178	0.179242	0.253149	1.4772	0.8416
	(42.710)	(-0.068)	(0.7088)	(1.4188)		
TR	6.324711	0.706454			1.0971	0.6456
	(15.698)	(4.4764)				
TR	6.496621	0.188353	0.472601		1.0440	0.7004
	(15.876)	(0.4568)	(1.3518)			
TR	6.583563	0.170374	0.237313	0.231684	1.1343	0.7132
	(14.856)	(0.3998)	(0.4592)	(0.6353)		
CM	6.679633	0.986318			1.2058	0.6829
	(12.900)	(4.8673)				
CM	6.893960	0.340381	0.589211		1.4275	0.7291
	(13.054)	(0.6395)	(1.3057)			
CM	7.309396	0.253470	-0.548160	1.119947	1.0440	0.8922
	(19.820)	(0.7146)	(-1.274)	(3.6899)		
ED	1.795538	-0.795538			1.0003	0.5556
	(96.391)	(-3.708)				
ED	1.794435	-0.023711	-0.003032		0.9801	0.5570
	(87.430)	(-1.146)	(-0.173)			
ED	1.793773	-0.023573	-0.001219	-0.001869	1.0020	0.5574
	(78.995)	(-1.079)	(-0.046)	(-0.096)		

TABLE 19

KOREA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	3.714251	0.151519			1.3437	0.3958
	(26.803)	(2.6845)				
GDP	3.702519	0.194063	-0.039513		1.4072	0.3994
	(24.044)	(1.0574)	(-0.245)			
GDP	3.700352	0.194556	-0.039513	-0.005810	1.4123	0.3995
	(21.223)	(1.0029)	(-0.139)	(-0.034)		
IF	1.553124	0.474276			1.2766	0.6721
	(6.3322)	(4.7488)				
IF	1.546603	0.496069	-0.020240		1.2892	0.6723
	(5.6604)	(1.5234)	(-0.070)			
IF	1.550247	0.495239	-0.030083	0.009776	1.2872	0.6723
	(5.0110)	(1.4388)	(-0.700)	(0.0323)		
ER	9.168727	0.440637			1.1701	0.8062
	(57.313)	(6.6744)				
ER	9.250038	0.168938	0.252343		1.4635	0.8415
	(57.389)	(0.8795)	(1.4937)			
ER	9.359789	0.143956	-0.044053	0.294373	2.0103	0.8893
	(61.353)	(0.8481)	(-0.021)	(1.9699)		
TR	6.614859	0.621011			1.1114	0.6941
	(21.669)	(4.9960)				
TR	6.692633	0.361143	0.241364		1.1639	0.7081
	(20.143)	(0.9120)	(0.6931)			
TR	6.859838	0.322072	-0.210193	0.448475	1.4263	0.7562
	(19.949)	(0.8444)	(-0.441)	(1.3314)		
CM	7.107632	0.857404			1.6045	0.7180
	(17.865)	(5.2924)				
CM	7.582407	-0.363949	1.134348		1.0334	0.8861
	(26.521)	(-1.084)	(3.8408)			
CM	7.582407	-0.388819	0.839287	0.293047	0.9549	0.8972
	(25.017)	(-1.153)	(1.9960)	(0.9871)		
ED	1.779550	-0.021715			1.0078	0.4987
	(110.40)	(-3.308)				
ED	1.778543	-0.018315	-0.003124		1.0193	0.5001
	(99.154)	(0.8584)	(-0.166)			
ED	1.767684	0.015879	0.026203	-0.029127	0.7905	0.6192
	(99.714)	(-0.805)	(1.0654)	(-1.677)		

pupils enrolled at the primary level. There is no a priori reasoning to indicate why enrollment in school should vary inversely with exports. Possibly this is due to a lagged reaction to fertility changes. If the education proxy were enrollment in tertiary education, a possible explanation might be that as Korea became more involved in the international economy more students sought a foreign education. Hence, explanation could be an international "brain drain." However, it is difficult to envision primary school pupils migrating overseas to find a "better" education.

With the exception of the ED variable, Korea appears to gain from international trade. Economic development is positively related to exports. It is therefore possible that economic infrastructure increases as export earnings are reinvested into the economy.

3. Middle Income Countries

Autocorrelation is a significant problem with the Columbian data (see Tables 20 and 21). Hence, refer to autoregressive parameter estimates (Tables 22 and 23). When current exports are the first independent variable, GDP is the only infrastructure variable which does not exhibit significant autocorrelation. Note that elasticities of GDP with respect to current exports are significant at the 5 percent level. When subsequent lagged values are introduced, elasticities with respect to each of the lagged variables are not significant. If infrastructure is regressed on lagged exports exclusively, however, coefficients are significant. This indicates that Columbia, like the high income countries, exhibits multicollinearity between lagged exports.

TABLE 20

COLUMBIA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	2.660002	0.698996			0.8968	0.7747
	(16.873)	(6.1507)				
GDP	2.526483	0.586405	0.199965		0.8125	0.7875
	(10.724)	(3.1557)	(0.7746)			
GDP	2.063446	0.613542	0.083381	0.401343	1.0589	0.8189
	(4.7340)	(3.3687)	(0.3111)	(1.2490)		
IF*	0.843838	0.726359			0.4083	0.4921
	(2.7343)	(3.2649)				
IF*	0.497164	0.434022	0.519197		0.4028	0.5427
	(1.1034)	(1.2213)	(1.0516)			
IF*	-0.263844	0.478622	0.327590	0.659613	0.5305	0.5926
	(-0.310)	(1.3440)	(0.6252)	(1.0498)		
ER*	10.80099	-0.439258			0.4980	0.3839
	(44.406)	(-2.618)				
ER*	10.97599	-0.291687	-0.262090		0.5488	0.4114
	(31.358)	(-1.057)	(-0.683)			
ER*	11.22487	-0.306272	-0.199428	-0.215714	0.6327	0.4228
	(16.159)	(-1.055)	(-0.466)	(-0.421)		
TR*	8.696554	-0.419592			0.3183	0.3154
	(33.637)	(-2.251)				
TR*	8.858630	-0.282918	-0.242734		0.4127	0.3367
	(22.624)	(-0.916)	(-0.566)			
TR*	9.553684	-0.323654	-0.067733	-0.602446	0.5866	0.4166
	(12.982)	(-1.052)	(-0.149)	(-1.140)		
CM*	8.422473	-0.357003			0.6511	0.4880
	(55.066)	(-3.237)				
CM*	8.577444	-0.226549	-0.231689		0.7102	0.5293
	(38.014)	(-1.273)	(-0.937)			
CM	9.154798	-0.260386	-0.086322	-0.500429	0.7022	0.6472
	(23.383)	(-1.592)	(-0.358)	(-1.733)		
ED*	1.588457	-0.159711			0.3210	0.2516
	(13.786)	(-1.922)				
ED*	1.713752	-0.054054	-0.187648		0.4168	0.3214
	(10.153)	(-0.406)	(-1.014)			
ED*	1.982218	-0.067988	-0.120054	-0.232696	0.5703	0.3871
	(6.1653)	(-0.519)	(-0.607)	(-0.982)		

TABLE 21

COLUMBIA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	2.410779	0.837188			1.1174	0.5758
	(7.6906)	(3.8644)				
GDP	2.093094	0.778116	0.272210		1.0830	0.5905
	(3.3670)	(3.1874)	(0.5981)			
GDP	1.803575	0.814228	0.155550	0.279635	1.2143	0.6070
	(2.2653)	(3.1466)	(0.3068)	(0.6147)		
IF*	0.411527	0.990831			0.6712	0.4745
	(0.9046)	(3.1517)				
IF*	-0.240716	0.869550	0.558877		0.7045	0.5108
	(-0.272)	(2.4997)	(0.8618)			
IF	-0.388460	0.87060	0.499321	0.142701	0.7029	0.5134
	(-0.336)	(2.3681)	(0.6791)	(0.2162)		
ER*	11.03354	-0.579054			0.7659	0.3457
	(31.744)	(-2.411)				
ER	11.21007	-0.546231	-0.151253		0.7994	0.3515
	(16.050)	(-1.991)	(-0.296)			
ER	11.21832	-0.547209	-0.147925	-0.007973	0.7995	0.3514
	(12.286)	(-1.847)	(-0.255)	(-0.015)		
TR*	8.914453	-0.550171			0.6601	0.2810
	(23.218)	(-2.073)				
TR	9.538044	-0.434218	-0.534327		0.7616	0.3448
	(12.894)	(-1.495)	(-0.987)			
TR	9.676387	-0.450613	-0.478560	-0.133620	0.7468	0.3490
	(10.038)	(-1.441)	(-0.780)	(-0.243)		
CM	8.622145	-0.477870			0.9640	0.4530
	(37.631)	(-3.018)				
CM	9.142216	-0.381166	-0.445625		0.8513	0.5478
	(21.747)	(-2.309)	(-1.448)			
CM	9.188904	-0.386699	-0.426805	-0.045094	0.8397	0.5489
	(16.739)	(-2.172)	(-1.221)	(-0.144)		
ED*	1.724418	-0.246387			0.5132	0.3102
	(10.758)	(-2.224)				
ED*	1.978846	-0.199078	-0.218008		0.6431	0.3687
	(6.3939)	(-1.638)	(-0.962)			
ED	2.008974	-0.202648	-0.205863	-0.029099	0.6378	0.3698
	(4.9696)	(-1.546)	(-0.800)	(-0.126)		

TABLE 22

MIDDLE INCOME COUNTRIES: CURRENT EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
COL-IF	1.385451 (5.6010)	0.400063 (2.3210)			0.2930
COL-IF	1.147700 (3.3550)	0.383873 (1.7850)	0.184572 (0.7740)		0.3554
COL-IF	1.007963 (1.6460)	0.427608 (1.9270)	0.203625 (0.8150)	0.012970 (0.0350)	0.4425
COL-ER	10.39276 (39.179)	-0.251782 (-1.341)			0.1215
COL-ER	10.52358 (30.859)	-0.329179 (-1.462)	0.007073 (0.0290)		0.1954
COL-ER	10.21574 (17.852)	-0.330281 (-1.593)	-0.051052 (-0.216)	0.300687 (0.8630)	0.3265
COL-TR	8.252081 (36.030)	-0.199081 (-1.247)			0.1069
COL-TR	8.264791 (26.296)	-0.291549 (-1.472)	0.106541 (0.4850)		0.1663
COL-TR	8.348786 (15.843)	-0.330265 (-1.730)	0.081300 (0.3790)	0.029177 (0.0920)	0.2618
COL-CM	8.183358 (53.533)	-0.184245 (-1.312)			0.1255

TABLE 22 (continued)

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
COL-CM	8.286839 (41.185)	-0.217079 (-1.666)	-0.064028 (-0.430)		0.3006
COL-ED	1.402756 (8.2910)	-0.102376 (-0.857)			0.0535
COL-ED	1.432689 (6.6690)	-0.158012 (-1.153)	-0.055762 (-0.362)		0.1101
COL-ED	1.343165 (3.1710)	-0.196156 (-1.275)	0.029996 (0.1620)	0.140256 (0.5240)	0.2008
JAM-IF	-0.125741 (-0.666)	0.868467 (2.8070)			0.3774
JAM-IF	-0.225005 (-0.060)	0.931056 (2.3490)	0.232123 (0.4710)		0.4661
JAM-ER	7.782946 (59.660)	0.001246 (0.0080)			0.0000
NIG-ED	1.631842 (0.5430)	0.539284 (0.4440)			0.0149
THA-IF	-5.979314 (-44.69)	0.605422 (6.1140)			0.7570
THA-IF	-5.922904 (-42.81)	0.196029 (1.3790)	0.401118 (2.8740)		0.7835

TABLE 23

MIDDLE INCOME COUNTRIES: LAGGED EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	R^2
COL-IF	1.401787 (4.1420)	0.367517 (1.5620)			0.1690
COL-IF	1.235313 (1.6640)	0.499805 (1.7600)	-0.039252 (-0.082)		0.2397
COL-ER	10.29017 (33.144)	-0.135950 (-0.630)			0.0320
COL-TR	8.068920 (27.081)	-0.030676 (-0.148)			0.0018
COL-ED	1.320203 (6.8400)	-0.016480 (-0.123)			0.0013
COL-ED	1.249714 (2.7810)	-0.122981 (-0.716)	0.172952 (0.5830)		0.0657
JAM-IF	-0.060071 (-0.209)	0.458929 (1.0410)			0.0828
JAM-ER	7.749450 (65.571)	0.207639 (1.0450)			0.0834
NIG-ED	-1.170380 (-0.413)	1.805367 (1.5780)			0.1718
NIG-ED	-3.059699 (-0.929)	0.472695 (0.3470)	2.238013 (1.6880)		0.3265
NIG-ED	-2.720918 (-0.640)	0.523388 (0.3100)	2.458061 (1.4650)	-0.444629 (-0.266)	0.3124
THA-IF	-5.862166 (-47.34)	0.556263 (6.0780)			0.7705
THA-IF	-5.860913 (-45.66)	0.431169 (2.7660)	0.141193 (0.8970)		0.8012

Interpretation of equations other than the simple regression equations is therefore very difficult. The results of the simple regression of GDP on current exports and then lagged exports indicate a positive relationship between exports and GDP. It is possible that export earnings are being utilized to increase productivity in Columbia. Therefore, there may be a link between international trade and economic growth in Columbia.

Ordinary least squares estimates imply a significant relationship between IF and both current and lagged exports. Examination of the autoregressive parameters further support this conclusion. Statistics remain significant at the 5 percent level. All intercept statistics are significant. There are other sources for economic growth and development in Columbia than exports. Energy requirement, TR, and CM all show a negative relationship when current exports are the single independent variable. Introduction of further lagged variables causes statistics to become insignificant. Once again multicollinearity is the probable culprit. There also exists a statistically significant negative relationship when ER or CM is regressed on lagged exports exclusively. Examination of autoregressive parameters (Tables 22 and 23) reveals that this supposed negative relationship is due to the autocorrelated error process. Autoregressive parameters become statistically insignificant. The value of R^2 falls to between 0.1069 and 0.1255. These low R^2 values are noteworthy when one considers that time series data is being estimated. One could very well conclude that no relationship exists between economic development and international trade in Columbia.

Economic growth (as approximated by GDP and IF) exhibits a positive relationship with exports in Columbia. Economic development (as approximated by ER, TR, CM, and ED) on the other hand bears no apparent statistical relationship to international trade. If one were to isolate GDP as a proxy for economic development, it would be easy to conclude international trade may add to a Columbia's development. Utilization of other proxies for economic development yields contrary results. The engine of growth may be responsible for economic growth in Columbia, but there is no statistical link between economic development and exports (as given by proxies ER, TR, CM, and ED).

Amongst countries other than major oil exporters, multicollinearity between lagged independent variables appears to be the rule rather than the exception. Jamaica also shows multicollinearity very similar to that of Argentina, Brazil, Korea, and Columbia. Interpretation of elasticities will be difficult in all but the simple regression equations. Tables 24 and 25 reveal that a significant positive relationship exists between GDP, IF, and TR when current exports are the single independent variable. Intercepts for equations where IF is the independent variable are negative and statistically significant. The "t" statistics for the intercepts of ED are exceptionally large. Elasticities for GDP and IF with respect to current exports remain statistically significant after the introduction of subsequent lagged exports. Exports lagged one year exhibit a similar relationship with the same three infrastructure variables. Autoregressive parameters yielding various elasticities with respect to current exports remain statistically significant. One might thus conclude that the statistical

TABLE 24

JAMAICA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	1.219079	0.938200			1.0894	0.8162
	(18.465)	(6.9898)				
GDP	1.180880	0.798123	0.215055		1.0220	0.8239
	(13.256)	(3.1567)	(0.6608)			
GDP	1.182134	0.798580	0.219372	-0.007328	1.0332	0.8239
	(10.739)	(2.9873)	(0.5540)	(-0.021)		
IF*	-0.427615	1.484271			0.7301	0.6991
	(-2.961)	(5.0558)				
IF*	-0.430467	1.473814	0.016055		0.7227	0.6992
	(-2.163)	(2.6088)	(0.0221)			
IF	-0.297128	1.522415	0.475095	-0.779282	1.1748	0.7352
	(-1.287)	(2.7168)	(0.5724)	(-1.107)		
ER*	7.947997	-0.038107			0.6886	0.0095
	(137.58)	(-0.324)				
ER	7.901429	-0.208875	0.262173		0.7493	0.0899
	(103.51)	(-0.964)	(0.9401)			
ER	7.850441	-0.297992	0.086638	0.297992	1.1182	0.1984
	(88.682)	(-1.058)	(0.2721)	(1/1037)		
TR	6.113916	0.491200			2.2273	0.7121
	(132.00)	(5.2162)				
TR	6.036830	0.208521	0.433986		2.1499	0.8118
	(116.93)	(1.4231)	(2.3009)			
TR	6.016915	0.201262	0.365423	0.116394	2.0529	0.8193
	(96.248)	(1.3257)	(1.6250)	(0.6105)		
CM	6.597968	-0.454433			1.8524	0.8555
	(238.16)	(-8.069)				
CM	6.618129	-0.380500	-0.113506		1.5421	0.8650
	(179.34)	(-3.633)	(-0.842)			
CM	6.613943	-0.382062	-0.127919	0.024468	1.6189	0.8655
	(145.30)	(-3.456)	(-0.781)	(0.1762)		
ED	-1.003006	0.088331			1.3920	0.2637
	(-45.82)	(1.9847)				
ED	-0.998643	0.104365	-0.024615		1.4664	0.2673
	(-33.18)	(1.2216)	(-0.224)			
ED	-0.991872	0.106829	-0.001335	-0.039521	1.4709	0.2772
	(-26.85)	(1.1907)	(-0.100)	(-0.351)		

TABLE 25

JAMAICA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	1.103063	1.076405			1.3696	0.6485
	(9.5646)	(4.5045)				
GDP	1.091310	1.029660	0.071219		1.2569	0.6493
	(7.7049)	(2.6661)	(0.1589)			
GDP	1.224627	0.998226	0.530578	-0.715149	1.6840	0.7389
	(8.1901)	(2.8379)	(1.0957)	(-1.757)		
IF*	-0.547165	1.606625			0.6528	0.4944
	(-2.429)	(3.2796)				
IF	-0.470276	2.019831	-0.629539		1.0866	0.5181
	(-1.657)	(2.6098)	(-0.701)			
IF	-0.171958	1.949494	0.398345	-1.600252	1.2447	0.6715
	(-0.600)	(2.8907)	(0.4290)	(-2.050)		
ER*	7.921795	0.036750			0.6596	0.0053
	(108.34)	(0.2426)				
ER	7.876311	-0.144156	0.275620		1.1171	0.0987
	(92.028)	(-0.617)	(1.0180)			
ER	7.775519	-0.120391	-0.071670	0.540675	1.4362	0.4590
	(95.849)	(-0.631)	(-0.273)	(2.4480)		
TR	6.016499	0.559026			2.0057	0.7736
	(115.99)	(6.1316)				
TR	5.994025	0.569636	0.136190		1.7685	0.7840
	(96.187)	(3.3524)	(0.6908)			
TR	6.017108	0.564193	0.215726	-0.123824	1.8119	0.7925
	(80.536)	(3.2101)	(0.8916)	(-0.609)		
CM	6.655228	-0.524149			1.1265	0.6869
	(129.23)	(-4.912)				
CM	6.657391	-0.515546	-0.013108		1.0844	0.6870
	(105.15)	(-2.986)	(-0.065)			
CM	6.609588	-0.504374	-0.177819	0.256428	1.1656	0.7384
	(93.348)	(-3.028)	(-0.776)	(1.3302)		
ED	-1.008810	0.088801			1.1193	0.1580
	(-34.12)	(1.4367)				
ED	-1.004022	0.107061	-0.029013		1.1612	0.1634
	(-27.70)	(1.0834)	(-0.253)			
ED	-1.003960	0.107046	-0.028799	-0.000333	1.1614	0.1634
	(-22.64)	(1.0263)	(-0.201)	(-0.003)		

relationship is not due to autocorrelation in the error process. Economic growth is positively correlated with exports in Jamaica. Interestingly, TR behaves in a similar fashion. Export earnings might well enhance transportation in Jamaica.

A statistically significant negative relationship exists between CM and both current and lagged exports. There is no significant autocorrelation and hence this result may not be traced to that origin. The values of R^2 are also quite high. One expects to find high values of R^2 when examining time series data but not when the relationship is negative. The value of R^2 may be high in time series data due to the time trend involved. One expects macroeconomic series to increase in magnitude with time based on a priori economic logic. Economies are expected to grow. A statistically significant negative elasticity coefficient indicates as exports increase CM falls. A high R^2 indicates that much of the relationship is explained by exports.

Economic growth is related to international trade in Jamaica. A significant positive relationship exists. Once again, it is feasible that the engine for economic growth is functioning in Jamaica. Examination of other infrastructure variables yield paradoxical results. Energy used in transportation bears a statistically significant positive relation to exports, while the elasticity of CM with respect to exports is negative and significant at the 5 percent level. Energy requirement and ED show no significant statistical relationship. It is feasible export earnings are being utilized to enhance the transportation network in Jamaica. However, one must bear in mind that regression analysis in no way proves any causal relationship. Rather it indicates that there

may be a causal relationship as postulated by economic theory. All of the statistics taken together do not lend much support to the proposition that international trade may be an engine of economic development in Jamaica.

Positive elasticities are statistically significant at the 5 percent level for five of six infrastructure variables tested in Nigeria (see Tables 26 and 27). Only ED shows an insignificant relationship. Intercepts are statistically significant except for IF and ED. Autocorrelation is not a great problem in Nigeria as only ED exhibits significant autocorrelation. When autoregressive parameters are examined, (see Tables 22 and 23) results do not change. Some multicollinearity exists. Multicollinearity is not as great a problem in Nigeria as in other countries in this study. In economics, multicollinearity is a matter of degree not kind. That is, some mullticollinearity usually exists, but it is hoped that it will not be severe enough to render interpretation impossible.

These results lend support to the hypothesis that international trade is favorable to economic growth and development in Nigeria. The fact that exports and GDP, IF, ER, TR, and CM are growing in a statistically significant manner implies that it is possible for international trade to aid the development process in Nigeria. Significance of lagged exports indicates that a dynamic element is present in the relationship between international trade and economic development. Exports lagged several years still tend to have a significant effect on infrastructure. International trade may have a favorable effect on economic development in Nigeria.

TABLE 26

NIGERIA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	3.243389	0.320174			0.8983	0.7389
	(21.215)	(5.5930)				
GDP	3.221976	0.245118	0.086014		0.9939	0.7746
	(21.446)	(2.9781)	(1.2421)			
GDP	3.233498	0.238732	0.000604	0.092032	1.1135	0.8146
	(22.472)	(3.0284)	(0.0067)	(1.3924)		
IF	0.377198	0.824081			1.0954	0.7902
	(1.1031)	(6.4362)				
IF	0.278046	0.476555	0.398266		0.7621	0.9104
	(1.1782)	(3.6862)	(3.6614)			
IF	0.293160	0.468179	0.286235	0.120715	0.7610	0.9214
	(1.2568)	(3.6636)	(1.9562)	(1.1266)		
ER	9.390402	0.376402			1.0354	0.4798
	(29.752)	(3.1850)				
ER	9.311778	0.100823	0.315814		1.1788	0.6997
	(36.780)	(0.7269)	(2.7062)			
ER	9.338701	0.085903	0.116247	0.215038	1.3224	0.8020
	(43.027)	(0.7224)	(0.8538)	(2.1568)		
TR	5.349964	0.863933			1.3018	0.6831
	(11.290)	(4.8689)				
TR	5.208709	0.368834	0.567385		1.5279	0.8749
	(16.751)	(2.1418)	(3.9160)			
TR	5.251192	0.345291	0.252480	0.339317	2.0710	0.9438
	(23.596)	(2.8321)	(1.8086)	(3.3192)		
CM	5.73359	0.964027			1.3296	0.7157
	(11.718)	(5.2620)				
CM	5.603106	0.507489	0.523194		1.7717	0.8529
	(15.082)	(2.4935)	(3.0553)			
CM	5.653608	0.479502	0.148851	0.403364	2.0769	0.9348
	(21.650)	(3.3516)	(0.9087)	(3.3626)		
ED*	1.324089	0.670346			0.5405	0.0137
	(0.2889)	(0.3906)				
ED	0.381769	-2.632492	3.785060		0.8487	0.2977
	(0.0935)	(-1.346)	(2.0111)			
ED	0.724216	-2.822269	1.246676	2.735172	0.6912	0.4466
	(0.1892)	(-1.346)	(0.5193)	(1.5558)		

TABLE 27

NIGERIA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	3.480852	0.237429			1.7497	0.5747
	(21.689)	(3.8556)				
GDP	3.486236	0.136768	0.103677		1.6035	0.6256
	(22.064)	(1.2964)	(1.1656)			
GDP	3.486468	0.117163	-0.008891	0.142117	1.6618	0.6980
	(23.310)	(1.1650)	(-0.708)	(1.4695)		
IF	0.781352	0.692645			1.7937	0.7885
	(2.7722)	(6.4047)				
IF	0.788805	0.533268	0.143553		1.6096	0.8043
	(2.7724)	(2.9122)	(0.8962)			
IF	0.789241	0.516928	-0.067226	0.266106	1.7237	0.8452
	(2.9593)	(2.8777)	(-0.331)	(1.5431)		
ER	9.418261	0.378095			1.3587	0.6838
	(46.621)	(4.8776)				
ER	9.429644	0.156244	0.219228		1.3624	0.7905
	(54.656)	(1.4344)	(2.2572)			
ER	9.429790	0.153063	0.148579	0.089194	1.3490	0.8039
	(53.593)	(1.2916)	(1.1096)	(0.7840)		
TR	5.598247	0.795222			1.8444	0.8175
	(18.962)	(7.0197)				
TR	5.616740	0.449422	0.356160		1.6918	0.8936
	(23.748)	(2.8458)	(2.6750)			
TR	5.617185	0.412621	0.140615	0.272152	1.3727	0.9237
	(27.257)	(2.9701)	(0.8965)	(2.0422)		
CM	6.139081	0.836681			2.0880	0.7615
	(16.686)	(5.9267)				
CM	6.161239	0.422341	0.426753		1.7455	0.8535
	(20.362)	(2.0904)	(2.5053)			
CM	6.161602	0.392125	0.251492	0.221266	1.5896	0.8722
	(20.686)	(1.9546)	(1.1094)	(1.1489)		
ED*	-2.398491	2.158909			0.6187	0.2005
	(-0.708)	(1.6607)				
ED*	-2.263620	-0.363044	2.597506		0.6330	0.3351
	(-0.698)	(-0.168)	(1.4233)			
ED*	-2.264665	-0.275986	3.102465	-0.637507	0.5266	0.3413
	(-0.666)	(-0.121)	(1.1985)	(-0.290)		

Thailand is the final middle income country this study will examine. Statistics are significant for each infrastructure variable tested (see Tables 28 and 29). A highly significant negative relationship exists for the intercept when IF is the dependent variable. Intercept terms for ED are not significant. Elasticities range from 0.215 for ED to 1.114 for ER. One might conclude that while exports have a significant effect on infrastructure in Thailand, the effect is not the same for each of the variables tested. Exports do not have a uniform relation with all segments of the economy. Energy requirement exhibits an exaggerated effect when exports increase. Energy requirement increases in percentage terms more than do exports. This may indicate that industrialization is a significant factor in the production of goods for sale in foreign countries. Energy requirement will increase roughly in proportion with industrialization because energy is needed for production processes. If ER is increasing, it is possible that physical capital is increasing and thus establishing the basis for strong economic growth in the future. Exports might be based on internal infrastructure rather than vice versa.

Statistical significance of ED is a result that is unique to Thailand among middle income countries and has interesting application to development possibilities. The education variable (ED) is the number of students enrolled at the primary level. This is similar to what we would consider elementary school. It is particularly important that individuals in less developed countries achieve at least some degree of literacy. One might term what is necessary in less developed countries "functional" literacy. By this it is meant that individuals obtain a

TABLE 28

THAILAND: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	2.524191	0.504290			1.5903	0.9469
	(47.174)	(14.010)				
GDP	2.532229	0.445504	0.056669		1.5717	0.9479
	(43.191)	(3.1594)	(0.4324)			
GDP	2.555366	0.413130	-0.082532	0.167504	1.1948	0.9563
	(43.090)	(2.9851)	(-0.499)	(1.3121)		
IF*	-6.039220	0.647928			0.7600	0.8329
	(-45.28)	(7.0613)				
IF*	-5.971946	0.120387	0.513509		0.4910	0.8794
	(-47.85)	(0.4079)	(1.8610)			
IF	-5.941523	0.060518	0.281767	0.295328	0.6549	0.8919
	(-45.98)	(0.1999)	(0.7680)	(0.9634)		
ER	8.158502	1.114515			1.2144	0.8693
	(42.113)	(8.5524)				
ER	8.093377	1.590815	-0.459148		1.2529	0.8813
	(39.643)	(3.2398)	(-1.006)			
ER	8.129518	1.540244	-0.676589	0.261653	1.3088	0.8851
	(36.665)	(2.9757)	(-1.095)	(0.5482)		
TR	7.136939	0.683796			1.8137	0.9149
	(76.374)	(10.878)				
TR	7.118040	0.822014	-0.133240		2.0806	0.9178
	(70.054)	(3.3637)	(-0.586)			
TR	7.100984	0.845881	-0.030621	-0.123483	2.1110	0.9202
	(64.242)	(3.2791)	(-0.099)	(-0.519)		
CM	7.307064	0.800023			1.2239	0.8274
	(44.617)	(7.2620)				
CM	7.384503	0.233667	0.545958		1.2590	0.8588
	(45.077)	(0.5931)	(1.4908)			
CM	7.426244	0.175262	0.294829	0.302189	1.1898	0.8683
	(42.508)	(0.4299)	(0.6060)	(0.8035)		
ED	1.596046	0.215129			1.7824	0.9421
	(66.752)	(13.376)				
ED	1.608906	0.121074	0.090667		1.9705	0.9557
	(69.582)	(2.1771)	(1.7541)			
ED	1.616008	0.111136	0.047935	0.051421	1.9705	0.9600
	(66.628)	(1.9634)	(0.7097)	(0.9849)		

TABLE 29

THAILAND: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	2.633917	0.455912			1.9735	0.8959
	(58.880)	(9.7304)				
GDP	2.656051	0.219476	0.235438		1.3722	0.9130
	(40.688)	(1.2563)	(1.4005)			
GDP	2.658854	0.212890	0.197101	0.046860	1.3872	0.9135
	(38.321)	(1.1474)	(0.8314)	(0.2424)		
IF*	-5.944675	0.621606			0.5981	0.8771
	(-58.91)	(8.4495)				
IF*	-5.917096	0.323950	0.307905		0.6748	0.8914
	(-58.50)	(1.1420)	(1.0858)			
IF	-5.909025	0.171692	-0.047480	0.550954	0.9675	0.9292
	(-67.77)	(0.6765)	(-0.159)	(2.0677)		
ER	8.456485	0.966477			1.5946	0.7567
	(36.305)	(5.8488)				
ER	8.504895	0.449366	0.514929		1.3128	0.7720
	(34.896)	(0.6890)	(0.8204)			
ER	8.526812	0.392375	0.181189	0.405490	1.1788	0.7800
	(33.399)	(0.5747)	(0.2100)	(0.5701)		
TR	7.305668	0.603416			1.4928	0.8248
	(61.798)	(7.1950)				
TR	7.307135	0.587738	0.015613		1.4727	0.8248
	(57.187)	(1.7188)	(0.0474)			
TR	7.304621	0.594275	0.053677	-0.046515	1.4813	0.8251
	(53.660)	(1.6323)	(0.1154)	(-0.123)		
CM	7.437838	0.755361			1.4151	0.8538
	(55.995)	(8.0160)				
CM	7.468958	0.422950	0.331009		1.2306	0.8655
	(54.236)	(1.1476)	(0.9334)			
CM	7.462972	0.438515	0.421613	-0.110746	1.3156	0.8666
	(51.034)	(1.1212)	(0.8437)	(-0.272)		
ED	1.636514	0.199169			2.1157	0.9347
	(73.151)	(12.549)				
ED	1.643094	0.129178	0.069696		1.9448	0.9429
	(72.644)	(2.1341)	(1.1965)			
ED	1.645650	0.122529	0.030996	0.047304	1.7121	0.9470
	(70.196)	(1.9542)	(0.3869)	(0.7242)		

level of literacy which enables them to comprehend instructions on packages. If functional literacy were achieved it would greatly aid development opportunities in the third world. Results of this study indicate that a positive relationship exists between ED and exports in Thailand. It is therefore possible that income generated from the sale of exports is helping Thailand to gain functional literacy and hence aid in economic development.

In conclusion, Thailand has a statistically significant relationship between exports and infrastructure. As with many of the countries in this study, multicollinearity among lagged independent variables prohibits interpretation of equations containing more than one explanatory variable. It is feasible, however, that international trade is functioning as an engine of economic development in Thailand.

4. Low Income Countries

Current exports bear no significant relationship to GDP (see Tables 30 and 31) in Egypt. This is a result which will frequently surface as the study investigates low income countries. Low income countries are frequently excluded from studies investigating the possible relationship between international trade and economic growth or development. This exclusion is made on the grounds that some level of development is necessary in order for the engine of growth to operate properly. If lower income countries were included in studies which use cross-section analysis across countries, results would be biased downward. While elasticities are insignificant at the 5 percent level, when current exports are the independent variable a statistically significant

TABLE 30

EGYPT: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	2.750718	0.489926			1.0775	0.2159
	(10.703)	(1.7407)				
GDP	2.601579	-0.601579	0.702421		1.3908	0.4858
	(11.443)	(-0.079)	(2.2915)			
GDP	2.553703	-0.014625	0.350758	0.418435	1.4488	0.5849
	(11.706)	(-0.047)	(0.9314)	(1.4659)		
IF*	-0.292860	1.965824			0.7608	0.3994
	(-0.441)	(2.7044)				
IF	-0.716206	0.500760	1.993900		0.9126	0.6494
	(-1.291)	(0.6258)	(2.6701)			
IF	-0.915411	0.548895	0.530680	1.741046	1.2166	0.8465
	(-2.339)	(0.9832)	(0.7855)	(3.3999)		
ER*	8.395884	1.282630			0.5562	0.3662
	(18.076)	(2.5208)				
ER*	8.161145	0.470274	1.105588		0.6123	0.5317
	(18.679)	(0.7463)	(1.8802)			
ER*	8.033308	0.501163	0.166592	1.117286	0.5185	0.7066
	(21.788)	(0.9529)	(0.2617)	(2.3159)		
TR	5.764955	2.227075			1.1237	0.5623
	(11.215)	(3.7592)				
TR	5.540647	1.340815	1.056461		1.0821	0.6475
	(10.974)	(1.8414)	(1.5548)			
TR	5.376474	1.380485	-0.149438	1.434868	1.2828	0.8101
	(13.608)	(2.4495)	(-0.219)	(2.7756)		
CM*	8.225788	0.410290			0.5267	0.3660
	(55.346)	(2.5198)				
CM*	8.173805	0.230395	0.244831		0.4916	0.4453
	(53.722)	(1.0499)	(1.1956)			
CM*	8.156318	0.234621	0.116380	0.152840	0.3338	0.4772
	(51.797)	(1.0445)	(0.4281)	(0.7418)		
ED*	1.164237	0.310226			0.5447	0.4652
	(12.718)	(3.0932)				
ED*	1.126550	0.179803	0.177501		0.4587	0.5579
	(12.367)	(1.3685)	(1.4447)			
ED*	1.111338	0.183479	0.065768	0.132948	0.3671	0.6116
	(12.210)	(1.4131)	(0.4186)	(1.1163)		

TABLE 31

EGYPT: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	2.592681	0.685661			1.3703	0.4855
	(13.691)	(3.2219)				
GDP	2.548699	0.341120	0.418775		1.4390	0.5848
	(14.108)	(1.1382)	(1.5467)			
GDP	2.543910	0.340095	0.323722	0.110006	1.4978	0.5918
	(13.444)	(1.0856)	(1.8683)	(0.3917)		
IF	-0.546101	2.314297			1.0281	0.6356
	(-1.162)	(4.3804)				
IF	-0.727614	0.892380	1.728279		1.2689	0.8300
	(-2.134)	(1.5774)	(3.3817)			
IF	-0.779261	0.881327	0.703375	0.186139	2.3628	0.9230
	(-3.214)	(2.1954)	(1.4723)	(3.2955)		
ER*	8.320894	1.406480			0.7205	0.5056
	(22.300)	(3.3541)				
ER*	8.204775	0.496839	1.105629		0.5803	0.6770
	(25.614)	(0.9350)	(2.2031)			
ER*	8.166006	0.488524	0.336277	0.890385	0.3106	0.7898
	(29.916)	(1.0811)	(0.6253)	(2.1976)		
TR	5.996114	1.914354			1.0735	0.5280
	(12.348)	(3.5079)				
TR	5.848789	0.760246	1.402757		0.9372	0.6835
	(13.849)	(1.0851)	(2.2163)			
TR	5.795026	0.748740	0.335856	1.234744	1.0867	0.8058
	(16.583)	(1.2942)	(0.4878)	(2.3804)		
CM*	8.252069	0.392243			0.6222	0.3841
	(61.928)	(2.6193)				
CM*	8.236591	0.270986	0.147383		0.4539	0.4139
	(59.659)	(1.1832)	(0.7123)			
CM*	8.233798	0.270388	0.091971	0.064129	0.4406	0.4196
	(56.737)	(1.1255)	(0.3217)	(0.2977)		
ED*	1.187628	0.292543			0.6251	0.4751
	(14.395)	(3.1551)				
ED*	1.174113	0.186673	0.128680		0.4957	0.5255
	(14.093)	(1.3507)	(1.0307)			
ED*	1.167701	0.185305	0.001439	0.147268	0.4208	0.5925
	(14.319)	(1.3726)	(0.0089)	(1.2166)		

relationship exists between lagged exports and GDP. This implies that some time must pass before benefits from export earnings are injected into the Egyptian economy.

Remaining infrastructure variables exhibit a positive relationship with exports. Autocorrelation is a problem with Egyptian data. Nearly 53 percent of the equations have significant autocorrelation. Examination of autoregressive parameters (see Tables 32 and 33) reveals however that while autocorrelation is rampant, it is not severe. Most of the elasticity coefficients retain their significance at the 5 percent level. This is not true with the elasticity of IF with respect to current exports. This elasticity is interesting because of the magnitude of the coefficient. The ordinary least square estimate is 1.966, while the autoregressive parameter falls to 0.914 and loses its significance at the 5 percent level. Therefore, relationship between current exports and IF is due to the autocorrelation inherent in the error process. This is interesting because in each of the groups of countries other than low income countries, GDP and IF have moved together. This is true in Egypt as well. All intercepts are statistically significant except IF.

Elasticity of TR with respect to current exports is interesting because of the magnitude of the coefficient. The elasticity coefficient is 2.227. When exports change by 1 percent TR changes by more than 2 percent. Energy used in transportation has increased at more than twice the speed that exports have. A type of multiplier process might be inferred. However, it is unlikely that such a process occurs in a less developed country such as Egypt. One assumes a well functioning market

TABLE 32

LOW INCOME COUNTRIES: CURRENT EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
EGY-IF	0.576922	0.913739			0.2244
	(1.4120)	(1.9390)			
EGY-ER	8.746586	0.845333			0.3115
	(29.158)	(2.4250)			
EGY-ER	8.763937	0.243066	0.645408		0.3557
	(26.176)	(0.6230)	(1.8340)		
EGY-ER	8.401625	0.348423	0.291120	0.706737	0.6084
	(24.046)	(1.1950)	(1.0470)	(2.7650)	
EGY-CM	8.163642	0.471697			0.5501
	(80.971)	(3.9870)			
EGY-CM	8.226073	0.201859	0.222665		0.4814
	(70.939)	(1.4290)	(1.7600)		
EGY-CM	8.162144	0.205816	0.098000	0.217474	0.5275
	(55.567)	(1.5620)	(0.7700)	(1.8980)	
EGY-ED	1.198833	0.263945			0.5256
	(20.119)	(3.7950)			
EGY-ED	1.198112	0.130259	0.146150		0.5440
	(17.919)	(1.7760)	(2.1800)		
EGY-ED	1.167232	0.129787	0.088360	0.104146	0.5453
	(13.515)	(1.8240)	(1.3060)	(1.6670)	
INA-IF	1.947143	0.681452			0.6789
	(8.0410)	(5.2420)			
INA-ER	10.71176	0.605927			0.4635
	(31.777)	(3.3510)			
INA-ER	10.61351	0.310600	0.364128		0.5088
	(28.455)	(1.3210)	(1.5730)		

TABLE 32 (continued)

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
INA-TR	9.323358 (68.666)	0.206960 (2.8420)			0.3832
INA-TR	9.184990 (66.973)	0.106797 (0.9530)	0.176522 (1.6200)		0.5786
INA-CM	7.629106 (11.340)	1.146097 (3.1770)			0.4371
INA-CM	7.202778 (11.135)	0.522934 (1.0850)	0.852888 (1.7180)		0.6022
INA-ED	3.667121 (30.529)	0.247594 (402620)			0.5829
INA-ED	3.620625 (28.531)	0.176994 (1.9940)	0.128246 (1.4730)		0.6462
IND-IF	2.122900 (7.2080)	0.038606 (0.3600)			0.0099
IND-IF	1.526860 (2.8780)	0.157243 (1.1820)	0.168458 (1.1540)		0.1590
IND-ER	10.63301 (64.037)	0.100467 (1.6740)			0.1773
IND-ER	10.45797 (37.444)	0.143134 (2.1500)	0.052998 (0.7600)		0.2976
IND-TR	8.169800 (34.657)	0.030835 (0.4110)			0.0128
IND-TR	7.904014 (17.316)	0.086685 (0.8410)	0.076803 (0.6420)		0.0656
IND-CM	8.445483 (17.895)	0.034244 (0.2280)			0.0040

TABLE 32 (continued)

DEP. VAR.	INTCPT	X	XLAG	XLAG2	R^2
IND-CM	8.552456 (10.229)	0.056616 (0.3030)	-0.029825 (-0.137)		0.0186
IND-ED	2.842577 (17.652)	0.006343 (0.1400)			0.0015
IND-ED	2.829159 (9.1690)	0.016338 (0.2400)	-0.002092 (-0.260)		0.0081
KEN-ER	8.872857 (49.062)	0.005462 (0.2440)			0.0046
KEN-ER	8.914233 (53.177)	0.012705 (0.4340)	0.012029 (0.4110)		0.0222
KEN-TR	6.412715 (32.925)	0.000479 (-0.020)			0.0000
KEN-TR	6.486509 (35.944)	0.002452 (0.0870)	0.005266 (0.1860)		0.0031
KEN-TR	6.505573 (41.781)	0.017052 (0.4660)	0.030119 (0.7680)	0.033426 (0.9100)	0.1073
KEN-CM	6.272681 (272.91)	-0.002133 (-0.779)			0.0469
KEN-CM	6.269431 (287.44)	-0.000824 (-0.199)	0.002286 (0.5530)		0.0460
KEN-ED	0.814172 (4.8880)	0.007093 (0.3770)			0.0108
KEN-ED	0.847038 (5.3870)	0.016377 (0.6550)	0.017014 (0.6800)		0.0531
KEN-ED	0.349898 (5.8390)	0.028701 (0.9050)	0.039928 (1.1630)	0.031030 (0.9760)	0.1753

TABLE 33

LOW INCOME COUNTRIES: LAGGED EXPORTS
AS FIRST INDEPENDENT VARIABLE
AUTOREGRESSIVE PARAMETERS

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	R^2
EGY-ER	8.850997 (33.425)	0.786790 (2.5720)			0.3545
EGY-ER	8.629808 (31.771)	0.380469 (1.3340)	0.702270 (2.6460)		0.5681
EGY-ER	8.389535 (28.613)	0.339838 (1.4080)	0.454571 (1.9870)	0.682831 (2.6760)	0.7147
EGY-CM	8.309430 (85.347)	0.327265 (2.8870)			0.4098
EGY-CM	8.298169 (69.219)	0.153291 (1.1380)	0.210056 (1.6890)		0.4162
EGY-CM	8.255322 (48.545)	0.156237 (0.9680)	0.179910 (1.1460)	0.087888 (0.5340)	0.3800
EGY-ED	1.250078 (21.444)	0.215089 (3.2060)			0.4614
EGY-ED	1.255379 (17.339)	0.120305 (1.5860)	0.099832 (1.4070)		0.4143
EGY-ED	1.220275 (13.063)	0.108689 (1.3040)	0.055150 (0.6880)	0.117250 (1.3590)	0.4474
INA-ER	10.76146 (32.896)	0.602427 (3.3880)			0.4890
INA-TR	9.228133 (75.137)	0.261900 (3.9280)			0.5625
INA-CM	7.432996 (12.791)	1.291675 (4.0940)			0.5827
INA-ED	3.681012 (32.034)	0.275743 (4.4200)			0.6195

TABLE 33 (continued)

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	R^2
IND-IF	2.029146 (6.0170)	0.105614 (0.7640)			0.0464
IND-ER	10.89950 (53.209)	0.004121 (0.0490)			0.0002
IND-TR	8.182286 (28.396)	0.039741 (0.3490)			0.0100
IND-CM	8.748793 (17.942)	-0.061986 (-0.330)			0.0090
IND-ED	2.878662 (15.533)	-0.008874 (-0.125)			0.0013
KEN-ER	8.923183 (54.797)	0.006066 (0.2420)			0.0048
KEN-TR	6.485912 (36.943)	0.003702 (0.1560)			0.0020
KEN-TR	6.522026 (43.955)	0.021847 (0.6390)	0.029584 (0.8650)		0.0798
KEN-TR	6.573201 (62.713)	0.019833 (0.9550)	0.036127 (1.5390)	0.030475 (1.2530)	0.2546
KEN-CM	6.268834 (302.61)	0.002615 (0.7290)			0.0424
KEN-ED	0.859430 (5.6110)	0.009556 (0.4400)			0.0159
KEN-ED	0.885142 (6.1270)	0.023509 (0.7990)	0.022453 (0.7630)		0.0801
KEN-ED	0.820817 (5.0740)	0.027402 (1.2220)	0.043397 (1.5640)	0.054425 (1.8040)	0.3133

for a multiplier analysis. This type of market structure is not in existence in Egypt.

Statistics indicate that it is possible for funds from the sale of exports to influence the Egyptian economy in a favorable manner. Economic growth does not show as strong a realtionship in Egypt as in some of the more developed of less developed countries, but from a statistical standpoint it is possible that the engine of growth is influencing the Egyptian economy.

Both current and lagged values of exports are significant at the 5 percent level for each of the infrastructure variables tested in India. Elasticities are not excessively large relative to other countries tested (see Tables 34 and 35). All intercept terms are significant at the 5 percent level. Autocorrelation is significant in thirteen of the thirty-six equations. Autoregressive parameters suggest that autocorrelation is not excessive as the magnitude of coefficents changes little, and none of the elasticities lose their statistical significance. For IF, ER, TR, CM, and ED, exports lagged twice show statistical significance. Hence, a dynamic realtionship exists between exports and infrastructure in India.

India is frequently considered a "basket case" country implying an inability to develop. These results indicate a contrary situation. Positive relationships between exports and infrastructure are as strong in India as in any of the countries examined. It is every bit as possible that trade may be as strong an engine of growth in India as in high income countries.

TABLE 34

INDIA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	4.220896	0.354363			1.1833	0.6396
	(27.252)	(4.4181)				
GDP	4.166856	-0.075556	0.467497		1.6799	0.9071
	(50.154)	(-0.832)	(5.3666)			
GDP	4.160544	-0.068086	0.412603	0.051485	1.7892	0.9102
	(47.899)	(-0.716)	(3.0820)	(0.5554)		
IF*	1.964095	0.667826			0.5463	0.7045
	(7.7985)	(5.1206)				
IF	1.915975	0.284493	0.416356		0.8891	0.7703
	(8.1663)	(1.1115)	(1.6925)			
IF	1.852111	0.360423	-0.138335	0.520241	1.5857	0.8677
	(9.7846)	(1.7400)	(-0.474)	(2.5752)		
ER*	10.82513	0.573647			0.8115	0.6197
	(41.370)	(4.2335)				
ER*	10.78289	0.237567	0.365455		0.3712	0.6801
	(42.527)	(0.8575)	(1.3746)			
ER	10.72272	0.308684	-0.157128	0.490128	1.0478	0.7833
	(48.381)	(1.2711)	(-0.459)	(2.0694)		
TR*	9.189089	0.274411			0.6435	0.5364
	(61.867)	(3.5677)				
TR*	9.157693	0.026747	0.269311		0.5776	0.6606
	(68.199)	(0.1823)	(1.9128)			
TR	9.113495	0.079308	-0.116921	0.362245	1.7841	0.8737
	(104.64)	(0.8321)	(-0.871)	(3.8970)		
CM*	7.526752	1.220772			0.4360	0.5242
	(11.115)	(3.4812)				
CM*	7.380925	0.060438	1.261753		0.5990	0.6588
	(12.181)	(0.0913)	(1.9860)			
CM*	7.175736	0.302793	-0.520432	1.671502	1.4978	0.8828
	(19.007)	(0.7334)	(-0.894)	(4.1483)		
ED*	3.701357	0.262749			0.4935	0.6634
	(33.965)	(4.6561)				
ED	3.683308	0.119115	0.156188		0.4941	0.7197
	(35.057)	(1.0375)	(1.4178)			
ED	3.653950	0.153815	-0.098797	0.239149	1.3624	0.8450
	(43.985)	(1.6921)	(-0.772)	(2.6973)		

TABLE 35

INDIA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	4.142236	0.403518			1.3764	0.9007
	(54.118)	(9.9875)				
GDP	4.137642	0.346048	0.060882		1.5927	0.9051
	(52.527)	(3.6796)	(0.6802)			
GDP	4.131493	0.358246	0.010285	0.042765	1.5012	0.9064
	(49.107)	(3.4476)	(0.0614)	(0.3647)		
IF	2.008855	0.657631			1.3578	0.7419
	(9.0667)	(5.6230)				
IF	1.973351	0.213791	0.470493		1.7261	0.8232
	(10.224)	(0.9267)	(2.2451)			
IF	1.936143	0.287383	0.164320	0.258778	1.5201	0.8389
	(9.7670)	(1.1737)	(0.4161)	(0.9367)		
ER*	10.86033	0.566619			0.8069	0.6566
	(46.400)	(4.5862)				
ER	10.82656	0.144450	0.447521		0.7816	0.7443
	(50.926)	(0.5691)	(1.8525)			
ER	10.76819	0.259894	-0.032773	0.405946	0.8516	0.7904
	(51.994)	(1.0160)	(-0.079)	(1.4065)		
TR*	9.166682	0.291959			0.6257	0.6595
	(76.494)	(4.6155)				
TR	9.140173	-0.038439	0.351298		1.5492	0.8640
	(114.65)	(-0.414)	(3.8777)			
TR	9.104064	0.031979	0.054172	0.251132	1.1487	0.9307
	(148.68)	(0.4228)	(0.4447)	(2.9428)		
CM*	7.400626	1.312930			0.6256	0.6585
	(13.703)	(4.6055)				
CM	7.277651	-0.224434	1.629683		1.3399	0.8758
	(21.229)	(-0.548)	(4.1835)			
CM	7.123674	0.080107	0.362670	1.070883	1.3439	0.9357
	(26.842)	(0.2444)	(0.6869)	(2.8954)		
ED*	3.722135	0.257051			0.7272	0.6896
	(37.782)	(4.9430)				
ED	3.705691	0.051478	0.217918		1.0401	0.7957
	(44.049)	(0.5125)	(2.2796)			
ED	3.670054	0.121962	-0.075325	0.247849	0.8707	0.8833
	(53.657)	(1.4437)	(-0.554)	(2.6002)		

Indonesia shows no statistical relationship between GDP and exports when either current exports or exports lagged one year are the single independent variable (see Tables 36 and 37). This result implies exports have no immediate effect on GDP in Indonesia. A similar relationship is exhibited between IF and both current and lagged exports. Intercepts are significant for each independent variable. Ordinary least squares estimates of the elasticity of IF with respect to lagged exports are statistically significant. However, when one examines the autoregressive parameter (see Tables 32 and 33), the coefficient becomes insignificant. Therefore, any apparently significant relationship is due to the autoregressive error process. Interestingly, while current or lagged exports bear no statistical relationship with either GDP or IF, a statistically significant relationship emerges when exports lagged twice are introduced. Relative to other countries, elasticity coefficients are not very large, but it is unique that this lagged export variable is significant. A time lag is involved before export earnings affect the Indonesian economy.

Similar results are obtained when ER, TR, CM, and ED are examined. No short run trend emerges. Exports lagged twice have a statistically significant effect on infrastructure variables. Elasticity of CM with respect to exports lagged twice is large (1.046). Also, note that R^2 climbs from 0.0177 to 0.6594 when exports lagged twice are introduced into the equation.

Autocorrelation is significant with each of the sets of equations except for the three GDP equations. However, the autoregressive parameters are not very different from the ordinary least squares

TABLE 36

INDONESIA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	4.062321	0.067922			1.0679	0.1029
	(26.809)	(1.1234)				
GDP	3.875151	0.058585	0.189912		1.0921	0.2992
	(21.582)	(1.0401)	(1.6735)			
GDP	3.697832	0.024689	0.052475	0.144128	1.4763	0.5593
	(21.924)	(0.5005)	(1.0988)	(2.3046)		
IF*	2.076195	0.139662			0.6269	0.0955
	(6.3912)	(1.0775)				
IF*	1.613574	0.116586	0.222230		0.5020	0.3585
	(4.3995)	(1.0134)	(2.0250)			
IF	1.125312	0.023251	0.119146	0.396869	1.2561	0.7912
	(4.5398)	(0.3207)	(1.6975)	(4.3180)		
ER*	10.58817	0.165495			0.4613	0.2773
	(52.442)	(2.0543)				
ER*	10.36505	0.154366	0.107176		0.4137	0.4038
	(42.161)	(2.0017)	(1.4570)			
ER	10.04181	0.092574	0.038931	0.262744	1.3209	0.7961
	(58.958)	(1.8586)	(0.8072)	(4.1605)		
TR*	7.969414	0.163190			0.2317	0.0682
	(17.481)	(0.8971)				
TR*	7.502427	0.139869	0.224328		0.1796	0.2084
	(13.317)	(0.7916)	(1.3308)			
TR	6.645877	-0.023841	0.043489	0.696221	0.8963	0.9048
	(28.718)	(-0.352)	(0.6637)	(8.1139)		
CM*	8.626727	0.038166			0.2190	0.0015
	(11.678)	(0.1295)				
CM*	8.378440	0.025781	0.119270		0.2317	0.0177
	(8.5295)	(0.0837)	(0.4058)			
CM	7.091447	-0.220239	-0.152445	1.046094	1.2012	0.6594
	(10.350)	(-1.099)	(-0.786)	(4.1178)		
ED*	2.758641	0.056428			0.1793	0.0162
	(8.3034)	(0.4257)				
ED*	1.525271	0.044787	0.112105		0.1695	0.0858
	(5.8814)	(0.3325)	(0.8726)			
ED	1.871131	-0.080258	-0.260000	0.531698	1.5698	0.8933
	(10.770)	(-1.579)	(-0.528)	(8-2535)		

TABLE 37

INDONESIA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	4.004260	0.095447			1.0618	0.2234
	(30.749)	(1.7787)				
GDP	3.735921	0.052176	0.153467		1.4388	0.5470
	(25.805)	(1.1360)	(2.6729)			
GDP	3.785187	0.049018	0.239164	-0.106098	1.9553	0.5813
	(24.031)	(1.0499)	(2.0712)	(-0.859)		
IF*	1.870505	0.233246			0.5662	0.2926
	(7.0495)	(2.1333)				
IF*	1.161182	0.118865	0.405659		1.2665	0.7888
	(5.5017)	(1.7752)	(4.8465)			
IF	1.284513	0.110958	0.620203	-0.265604	2.1892	0.8360
	(6.1027)	(1.7785)	(4.0194)	(-1.609)		
ER*	10.70526	0.121762			0.7243	0.1650
	(53.405)	(1.4741)				
ER*	10.18462	0.037908	0.297742		1.4928	0.7178
	(60.040)	(0.7026)	(4.4260)			
ER	10.18737	0.037633	0.302524	-0.005920	1.4050	0.7178
	(53.070)	(0.6614)	(2.1497)	(-0.039)		
TR*	7.810728	0.237545			0.2556	0.1588
	(19.522)	(1.4408)				
TR*	6.609097	0.043778	0.687208		0.8476	0.9035
	(33.502)	(0.6995)	(8.7840)			
TR	6.612297	0.043573	0.692776	-0.006892	0.8496	0.0170
	(29.619)	(0.6585)	(4.2331)			
CM*	8.435257	0.121706			0.2391	0.0170
	(12.460)	(0.4363)				
CM*	6.751677	-0.149777	0.962833		0.9697	0.6137
	(10.929)	(-0.764)	(3.9300)			
CM	6.790370	-0.152450	1.035361	-0.089789	1.0049	0.6148
	(9.7308)	(-0.737)	(2.0230)	(-0.164)		
ED*	2.623971	0.116336			0.2012	0.0757
	(8.8218)	(0.9492)				
ED*	1.747315	-0.025028	0.501356		1.1039	0.8637
	(10.511)	(-0.475)	(7.6047)			
ED	1.636067	-0.017895	0.307833	0.239581	1.2789	0.9037
	(10.343)	(-0.382)	(2.6547)	(1.9321)		

parameters. International trade could be an engine of growth in Indonesia. Exports appear to bear a significant relationship to each of the infrastructure variables tested. This relationship is, however, unique to Indonesia. There is apparently a two year time lag involved. Exports have no immediate affect on the Indonesian economy. It takes time for the positive effects which could take place to come into effect. Export earnings must be assimilated into the economy. In Indonesia, this assimilation is not as fast as in other countries tested. Possibly this is due to Indonesia being "less developed" than some of the other countries tested. Markets are not as developed in Indonesia as they are in some of the other countries examined. Nevertheless, it is possible for trade to exert a positive influence on economic development in Indonesia.

Kenya is the final country this study will examine. Neither current nor lagged exports are statistically significant at the 5 percent level when they are the single independent variable and GNP is the dependent variable (see Tables 38 and 39). When current and lagged exports are included in the same equation both become statistically significant. Because both are insignificant when they are the single independent variable, it is likely their significance when both are included is due to multicollinearity. Hence, one might conclude that GDP bears no statistical significance to exports in Kenya. The traditional proxy for economic growth shows no relationship to international trade. In contradistinction to this result is the relationship between IF and current exports. It is very powerful. The elasticity coefficient for each of the three equations, including

TABLE 38

KENYA: CURRENT EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	X	XLAG	XLAG2	DW	R^2
GDP	1.637616	0.034050			1.3750	0.2711
	(36.979)	(2.0226)				
GDP	1.605422	0.035615	0.035353		1.3376	0.5606
	(42.047)	(2.5945)	(2.5668)			
GDP	1.596255	0.036179	0.035818	0.009623	1.1780	0.5820
	(38.461)	(2.5602)	(2.5266)	(0.6798)		
IF	0.109140	0.773931			1.4767	0.9944
	(2.3797)	(44.391)				
IF	0.092808	0.774725	0.017935		1.6946	0.9950
	(1.9159)	(44.500)	(1.0264)			
IF	0.071498	0.776037	0.019014	0.022368	1.6674	0.9958
	(1.4484)	(46.169)	(1.1277)	(1.3285)		
ER*	9.055306	0.026211			0.3119	0.0502
	(100.15)	(0.7626)				
ER*	9.024039	0.027731	0.045336		0.7297	0.1356
	(94.211)	(0.8055)	(0.9937)			
ER	8.982000	0.030318	0.036465	0.044129	0.9180	0.2766
	(91.972)	(0.9118)	(1.0932)	(1.3248)		
TR*	6.667073	0.015427			0.4041	0.0289
	(94.045)	(0.5724)				
TR*	6.644717	0.016513	0.024550		0.5257	0.1015
	(87.751)	(0.6068)	(0.8987)			
TR*	6.609382	0.018688	0.026339	0.037092	0.6125	0.2673
	(86.719)	(0.7201)	(1.0118)	(1.4269)		
CM*	6.270727	0.001400			0.1464	0.0034
	(329.07)	(0.1934)				
CM*	6.262558	0.001797	0.008790		0.3387	0.1410
	(318.79)	(0.2546)	(1.2654)			
CM	6.249924	0.002575	0.009610	0.013262	0.9154	0.4420
	(354.16)	(0.4286)	(1.5944)	(2.2033)		
ED*	0.948363	0.038302			0.2558	0.0680
	(8.4334)	(0.8960)				
ED*	0.899298	0.040686	0.053881		0.3667	0.2014
	(7.7798)	(0.9793)	(1.2921)			
ED*	0.839656	0.044358	0.056901	0.062607	0.6114	0.3815
	(7.4056)	(1.1490)	(1.4693)	(1.6190)		

TABLE 39

KENYA: LAGGED EXPORTS AS FIRST INDEPENDENT VARIABLE

DEP. VAR.	INTCPT	XLAG	XLAG2	XLAG3	DW	R^2
GDP	1.637183	0.033765			0.9163	0.2646
	(36.699)	(1.9894)				
GDP	1.630435	0.034107	0.007494		0.8168	0.2777
	(33.267)	(1.9313)	(0.4252)			
GDP	1.645764	0.033199	0.006830	-0.017116	0.7762	0.3465
	(31.894)	(1.8723)	(0.38639	(-0.973)		
IF	0.783699	-0.016608			1.9343	0.0005
	(1.2698)	(-0.070)				
IF	0.804669	0.017670	-0.023290		1.9393	0.0014
	(1.1767)	(-0.071)	(-0.095)			
IF	0.888780	0.022645	-0.026934	-0.093924	1.9468	0.0161
	(1.1829)	(-0.087)	(-0.105)	(-0.369)		
ER*	9.048769	0.033099			0.7174	0.0795
	(101.36)	(0.9745)				
ER	9.010644	0.035031	0.042345		0.8596	0.2098
	(98.278)	(1.0603)	(1.2844)			
ER	8.972725	0.037278	0.043987	0.042342	0.8503	0.3414
	(96.845)	(1.1709)	(1.3554)	(1.3411)		
TR*	6.659443	0.023814			0.4907	0.0684
	(95.631)	(0.8988)				
TR*	6.627037	0.052456	0.035993		0.5402	0.2250
	(94.126)	(1.0034)	(1.4216)			
TR*	6.600544	0.027026	0.037140	0.029584	0.4823	0.3319
	(91.218)	(1.0869)	(1.4977)	(1.1998)		
CM*	6.264161	0.008890			0.3498	0.1355
	(351.93)	(1.3128)				
CM	6.252357	0.009488	0.013110		0.9044	0.4306
	(390.46)	(1.6445)	(2.2768)			
CM	6.237268	0.010383	0.013764	0.016849	0.7401	0.9229
	(956.53)	(4.6337)	(6.1592)	(7.5825)		
ED*	0.935581	0.052067			0.4072	0.1248
	(8.5603)	(1.2522)				
ED*	0.881563	0.054804	0.059997		0.5964	0.2908
	(8.0833)	(1.3946)	(1.5299)			
ED*	0.821605	0.058356	0.062594	0.066952	0.4701	0.4995
	(8.1019)	(1.6747)	(1.8011)	(1.9347)		

current exports, is approximately 0.77. Relative to other countries tested this figure is not exceptionally large, but it does indicate a substantial effect that exports may have on IF. What is exceptional about the elasticity of IF with respect to current exports is the magnitude of the "t" statistic. It ranges from 44.391 to 46.169 for the three equations with IF as the dependent variable (see Tables 38 and 39). All intercepts are significant at the 5 percent level. Interestingly, no statistical relationship emerges between IF and the lagged value of exports. All of the rather substantial relationship that exports and IF exhibit is confined to the current period. No apparent time lag is involved. Gross domestic product exhibits no relationship with international trade. Gross fixed capital formation shows a powerful relationship to international trade. If GDP were the only dependent variable examined, one would conclude that trade has no beneficial effects in Kenya. Using IF as a proxy for economic growth reveals that exports are related to gross fixed capital formation and thus may be an important factor in economic growth in Kenya.

When the remaining infrastructure variables are regressed on exports the coefficients are insignificant at the 5 percent level. Autocorrelation is evident in 75 percent of the equations in which ER, TR, CM, and ED are dependent variables. There are no statistically significant relationships with any of the equations which involve autocorrelation. The only significant trend emerging involves CM. When CM is regressed on exports lagged once, twice, and three times, each of the elasticity coefficients is statistically significant at the 5 percent level. Thus, there may be a relationship between CM and exports

in Kenya. Taking all of the infrastructure variables together implies that international trade does not have a significant effect on economic development in Kenya.

5. Conclusion

International trade may be an engine of economic growth and or economic development in approximately two thirds of the countries examined in this study. Each of the countries grouped with major oil exporters exhibited a statistically significant relationship between exports and economic growth and development. This is a result one would expect to find, because much of these countries's incomes derive from sales to foreign countries. For high income countries results were somewhat different. A positive correlation exits between international trade and economic growth. Gross domestic product is related to exports in each of the three high income countries examined. When the four infrastructure variables related to economic development are examined, only Korea is found to have significant relationships. Among high income countries, international trade may well be totally disassociated with economic development. If no positive relationship exists, it is highly unlikely there is any underlying causal relationship. Data for middle income countries yield similar results. Gross domestic product was found to be highly and positively correlated with exports in each middle income country tested. However, when ER, TR, CM, and ED were regressed on exports, no significant positive relationship was found in either Columbia or Jamaica. International trade may have been an engine of economic growth, but it certainly is no link for economic

development. In low income countries, results were even more mixed. India proved to have significant positive relationships for both economic growth and development, while Kenya had no significant relationship for either growth or development. Egypt and Indonesia both exhibited relatively weak relationships between exports and either economic growth or development.

This study indicates that while for some countries it is possible for international trade to act as an engine for economic development, for other countries it is highly unlikely that trade has contributed significantly to economic development. A regression analysis cannot "prove" any economic theory. It may only indicate if the theoretical relationship is empirically feasible. Regression may "back up" economic theory. If an economic theory is proposed and subsequent empirical work indicates that the hypothesized theoretical relationships do not exist, one might conclude that the theory is at best a special case applicable at select times in select situations.

International trade as an engine of economic growth is just such a theory. It performs well on paper, but when real world complexities arise which deviate from given assumptions, the theory proves to not be a "general theory." It appears that international trade may not act as a mechanical link between western industrialized countries and less developed countries. Also, level of development is not an assurance of any link. High income countries were found which do not have a positive relationship between exports and economic development. Some low income countries did exhibit a positive relationship. The high correlation found in major oil exporting countries is more likely simply due to the

fact that both of the series have tended to increase as time has passed. This is not to say that petroleum exporters do not benefit economically from the sale of their assets, but rather that there is no solid evidence of an "engine" by which economic development at the center is transmitted to the periphery.

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