4-1-1994

Openness and Economic Growth: A Cross-Country Analysis

Kevin R. Kroymann
University of Nebraska at Omaha

Openness and Economic Growth:
A Cross-Country Analysis

A Thesis

Presented to the

Department of Economics

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Master of the Arts, Economics

University of Nebraska at Omaha

by

Kevin R. Kroymann

April, 1994

Thesis Acceptance

Acceptance for the faculty of the Graduate College, University of Nebraska, in partial fulfillment of the requirements for the degree Master of the Arts, Economics, University of Nebraska at Omaha

Committee

Name	Department	
Shuxia Lin	Economics	4/19/94
Mark E. Wohar	Economics	4/20/94
[signature]	ISQA	4/20/94

Bun Song Lee

Chairman

4-20-94

Date

ABSTRACT

This thesis analyzes the relationship between openness and economic growth. Although long standing and well accepted economic theory clearly shows the gains from open trade between nations, developing countries have followed the protectionist policies of Import Substituting Industrialization (ISI) for a large portion of the twentieth century. The application of ISI by developing nations is characterized by multiple and overlapping protective measures which give rise to high effective rates of protection. These high effective rates of protection create a bias against exports, prevent emerging industries in developing countries from achieving economies of scale and give rise to economic dualism.

For these reasons and others, the 1980s saw a shift away from ISI to the policies of export-oriented industrialization (EOI). EOI strives to make neutral the incentives between domestic and foreign production of a good. Trade liberalization in the form of EOI has been shown to enhance the economic performance of numerous developing countries.

Numerous efforts made to explain the strong, positive relationship between openness and economic growth rely upon empirical analysis based upon neoclassical production functions. A review of this work shows that this empirical analysis is often based on small data sets which cover a

limited time span. In addition, this work does not utilize demographic variables as sources of growth. Most important of all, these works tend to concentrate on measures of exports assuming away any condition of import shortage.

This thesis alleviates these shortcomings by developing an economic growth model which assumes that marginal factor productivities differ between the export and domestic sectors of an economy, utilizes demographic variables as sources of growth and accounts for import shortage conditions through the inclusion of an imports growth variable. Finally, empirical analysis based on a large cross country data set confirms the assumptions made by the model.

TABLE OF CONTENTS

(TABLE OF CONTENTS continued)

LIST OF TABLES

(LIST OF TABLES continued)

CHAPTER I

INTRODUCTION: OPENNESS AND ECONOMIC GROWTH

The relationship between openness and economic growth is at the center of an ongoing debate as to whether a developing nation should follow a policy of open trade or surround itself with the protective measures of import substituting industrialization. Indeed, this very issue is the basis for the current debates concerning the North American Free Trade Agreement and trade negotiations with Japan.

This thesis analyzes the relationship between openness and economic growth. Long standing and well accepted economic theory clearly shows the gains from open trade between nations. These gains from traded include a more beneficial resource allocation as predicted by Ricardo's (1817) theory of comparative advantage, technology transfer externalities (Mill 1907), and the creation of a Schumpeterian environment.

Despite these gains, developing countries have followed the protectionist policies of ISI for a large portion of the twentieth century. The multiple and overlapping measures associated with import substituting industrialization give rise to high effective rates of protection (Balassa 1971). These high effective rates of protection create a bias against exports (*World Development Report 1987*), create opportunities for rent seeking, prevent emerging markets from

achieving economies of scale (Balassa 1971) and give rise to economic dualism (Krugman and Obstfeld 1991).

For these reasons and the outstanding economic performance of developing countries which concentrated on exports (Dornbusch 1992), the 1980's saw a shift away from ISI to the policies of export-oriented industrialization (EOI). EOI strives to make neutral the incentives between domestic and foreign production of a good. Trade liberalization in the form of EOI has been shown to enhance the economic performance of numerous developing countries (Michaely, Papageorgiou and Choksi 1991). The definitive example of EOI success is found in the economic experience of the four Asian Tiger nations of Singapore, Hong Kong, Korea and Taiwan who were able to exploit their comparative advantage in unskilled labor to achieve equitable economic growth (Chowdhury and Islam 1993).

Numerous efforts made to explain the strong, positive relationship between openness and economic growth rely upon empirical analysis based upon neoclassical production functions. Reviews of this work by Edwards (1993) and Harrison (1991) show that this empirical analysis is often based on small data sets which cover a limited time span. In addition, this work does not utilize demographic variables as sources of growth. Most important of all, these works tend to concentrate on some measure of exports assuming away any condition of import shortage.

This thesis overcomes these shortcomings by developing an economic growth model based on the assumption that marginal factor productivities of the export and domestic sectors of an economy could differ. In addition, this model utilizes demographic variables as sources of growth. Most important of all, this model accounts for conditions of import shortage through the inclusion of an imports growth variable.

Empirical analysis performed on a data set consisting of 93 countries for the period from 1960 to 1985 confirms the assumptions made by the model. First, demographic variables are shown to be significant sources of growth. Second, both exports and imports create beneficial externalities within an economy. Finally, a condition of import shortage is shown to exist.

CHAPTER II

THE GAINS FROM TRADE

Economists have long recognized the gains from open trade between nations. In fact, it is generally recognized that "development of industry is likely to be severely handicapped if it is deprived of the ability to trade widely (*World Development Report 1987*, 2)." John Stuart Mill (1907) describes the benefits received from "foreign commerce" in his *Principles of Political Economy*. While referring to the

work of David Ricardo, he writes of the principle of comparative advantage:

> Setting aside its enabling countries to obtain commodities which they could not produce themselves at all; its advantage consists in a more efficient employment of the productive forces of the world. If two countries which trade together attempted, as far as was physically possible, to produce for themselves what they now import from one another, the labor and capital of the two countries would not be so productive, the two together would not obtain from their industry so great a quantity of commodities, as when each employs itself in producing, forth for itself and for the other, the things in which its labor is relatively most efficient (384-385).

Mills also notes the direct gains to consumers:

> . . . the gains of merchants, when they enjoy no exclusive privilege, are no greater than the profits obtained by the employment of capital in the country itself . . . Commerce is virtually a mode of cheapening production and in all such cases the consumer is the person ultimately benefited . . .(387-388)

Finally, Mills writes of the indirect gains from trade:

> One is, the tendency of every extension of the market to improve the processes of production. A country which produces for a larger market than its own, can make greater use of machinery, and is more likely to make inventions and improvements in the processes of production. . . . There is another consideration, . . . A people may be in the quiescent, indolent, uncultivated state, with all their tastes either fully satisfied or entirely undeveloped, and they may fail to put forth the whole of their productive energies for want of any sufficient object of desire. The opening of a foreign trade, by making them acquainted with new objects, or tempting them by the easier acquisition of things which they had not previously thought attainable, sometimes works as a sort of industrial revolution in a country whose resources were previously undeveloped for want of energy and ambition in the people: inducing those who were satisfied with scanty comforts and little work to

> work harder for the gratification of their new tastes, and even to save and accumulate capital, for the still more complete satisfaction of those tastes at a future time (389).

Since the time of John Stuart Mill, the gains from trade have become more defined. Rudinger Dornbusch (1992) gives the following list.

> . . . improved resource allocation in line with social marginal costs and benefits; access to better technologies, inputs and intermediate goods; and economy better able to take advantages of economies of scale and scope; greater domestic competition; availability of favorable growth externalities, like the transfer of know-how; and a shake-up of industry that may create a Schumpeterian environment especially conducive to growth (73-74).

This list can be broken down into items of comparative advantage, technology transfer externalities, and creation of a Schumpeterian environment.

Comparative Advantage

David Ricardo (1817), in *The Principles of Political Economy and Taxation*, first presented a comparative advantage model based on labor productivity. Ricardo's model of comparative advantage can best be understood by comparing it to the concept of absolute advantage attributed to Adam Smith's 1776 work, *The Wealth of Nations* (Lee 1992). Smith's concept of absolute advantage holds that, in a two country, two good model where labor is the only input, the home country will import a good from the foreign country only if that good is produced more efficiently in terms of labor cost

per unit by the foreign country. Unlike absolute advantage, comparative advantage holds that, even if the foreign country is more efficient in the production of both goods, there is sill room for beneficial trade. This is because the foreign nation, rather than producing both goods, will choose to specialize in the production of goods in which it is "most" efficient relative to the home country, i.e., in which it receives the highest marginal returns.

This comparison can also be analyzed in an opportunity cost and relative price framework (Krugman and Obstfeld 1991, 12-17). In the previously mentioned model, two nations, Home and Foreign, use one input of labor to produce goods A and B. Given this, the opportunity cost of producing one unit of good A in terms of good B in Home is the ratio of the units of labor required to produce one unit of A to the units of labor required to produce one unit of B. The opportunity cost of producing A in terms of B in Foreign is obtained in a similar matter. Home is said to have an absolute advantage in the production of good A if the units of labor required to produce one unit of A in Home is less than the units of labor required to produce one unit of A in the Foreign. Home has a comparative advantage, however, only if the opportunity cost of producing A in terms of B in Home is less than that of Foreign.

Not surprisingly, the Ricardian model holds that even though a country has an absolute advantage in the production

of a good, it will not necessarily produce it. This is due to the influence of relative prices. For example, Home will specialize in the production of good A, if the opportunity cost of producing good A is less than the relative price of A defined as the ratio of good A's price to good B's price. Bela Balassa (1963) presents evidence which supports this aspect of the Ricardian model (231-238). Specifically, Balassa, using data from 1951, shows that even though "U.S. productivity exceeded British in all 26 sectors . . . by margins ranging from 11 to 366 percent . . . Britain actually had larger exports than the U.S." in 12 of the sectors (Krugman and Obstfeld 1991, 29). As you can see, Balassa's results illustrate the gains from trade predicted by the Ricardian model of comparative advantage.

The principle advantage of openness in the context of the Ricardian model is that trade allows industries with a comparative advantage to take advantage of larger markets. These larger markets enable firms, previously limited to production for the domestic market, to expand and produce for foreign nations as well. Firms which obtain higher returns by exploiting comparative advantage will be able to pull resources away from less competitive sectors of the economy. As the firm expands to service larger markets it will benefit from increasing marginal products or economies of scale. These economies of scale would not be available in the presence of an inward-oriented trade regime.

To sum up, Ricardo's theories show how nations with a comparative advantage can use openness to obtain more optimal resource allocation and economies of scale.

Technology Transfer Externalities

W. Arthur Lewis (1955) states that the transfer of technology depends on a people's receptiveness to new ideas or their "attitudes toward innovation (177-180)." According to Lewis, technology transfer will occur most rapidly in societies that accommodate differences of opinion and are accustomed to change. Societies which have the best "attitudes toward innovation" have religious variety, allow political diversity and are situated in locations which facilitate the coming together of people from different industries or parts of the world. On the other hand, "A country which is isolated, homogenous, proud, and authoritarian is by contrast unlikely to absorb new ideas quickly when it meets them (Lewis 1955, 180)."

As you can see, openness fits very well with Lewis' best "attitudes toward innovation." Openness, by its very nature forces domestic industries to adopt the most efficient production processes if they are to prosper in the export and import competitive sectors of an economy. Rudiger Dornbusch (1992) points out that openness allows multinational companies to "bring direct foreign investment, technology and knowledge" to a lesser developed nation (75). In any event,

an open trading policy exposes a developing country's economy to more efficient methods of production.

Creation of a Schumpeterian Environment

In addition to "attitudes towards innovation," W. Arthur Lewis (1955) points out that technology transfer also depends on the perceived profit that will come with the adoption of the new technology. This leads to a discussion of the creation of a Schumpeterian environment.

Joseph A. Schumpeter (1934) holds that economic development is based on the pursuit of entrepreneurial profits. He defines entrepreneurial profits as the surplus over the costs of production inputs. This includes an appropriate wage for entrepreneurial labor, appropriate rents for entrepreneurial land and capital, and a premium for risk (66). This pursuit is based on the "carrying out of new combinations" which he defines in the following list.

> (1) The introduction of a new good--that is one which consumers are not yet familiar--or of a new quality of good.
> (2) The introduction of a new method of production, that is one not yet tested by experience in the branch of manufacture concerned . . .
> (3) The opening of a new market, that is a market into which the particular branch of manufacture of the country in question have not previously entered . . .
> (4) The conquest of a new source of supply of raw materials or half-manufactured goods . . .
> (5) The carrying out of the new organization of any industry, like the creation of a monopoly position . . . (1934, 66)

William J. Baumol (1990) expands Schumpeter's list by adding other combinations here defined as (6) and (7).

> (6) . . . innovative acts of technology transfer that take advantage of opportunities to introduce already-available technology (usually with some modification to adapt it to local conditions) to geographic locales whose suitability for the purpose had previously gone unrecognized or at least unused.
> (7) . . . innovations in rent seeking procedures, for example, discovery of a previously unused legal gambit that is effective in diverting rents to those who are first in exploiting it (897).

Baumol makes these additions in order to help develop his hypothesis. He defines entrepreneurs "to be persons who are ingenious and creative in finding ways that add to their own wealth, power, and prestige" and holds that the contribution these entrepreneurs make in a society depends on the allocation of their talents between productive activities such as (2) in Schumpeter's list and "unproductive entrepreneurship" such as (7) above. This allocation of entrepreneurial talent depends on the rewards society gives for each activity. Baumol defines the societal reward structure as "the rules of the game."

Openness is one choice society can make when it contemplates "the rules of the game." According to Dornbusch (1992), if a country chooses to be, in W. Arthur Lewis' terms, "isolated, homogenous, proud, and authoritarian", "only a narrow range of specialized intermediate goods or capital goods can be profitably produced" eliminating "a full

range of technological possibilities, which rely on a potentially broader range of technological inputs (74)." Dornbusch (1992) reinforces this idea by pointing out how the 1964 Ford Falcon is still being made in Argentina with the American tooling of that era (74).

As you can see, the gains from trade can be seen in more efficient resource allocation as shown by the Ricardian model, the benefits of technology transfer which come from exposure to foreign trade and the creation of a Schumpeterian environment.

CHAPTER III

NEGATIVE EFFECTS OF IMPORT SUBSTITUTING INDUSTRIALIZATION

Although long standing and well accepted economic theory clearly shows the gains from open trade between nations, developing countries have followed the protectionist policies of ISI for a large portion of the twentieth century. These protectionist policies came to light in the 1950's work of Raul Prebisch and Hans Singer. Prebisch and Singer based their work on the following premises:

> (1) a secular deterioration in the international price of raw materials and commodities would result, in the absence of industrialization in the LDCs, in an ever-growing widening of the gap between rich and poor countries; and
> (2) in order to industrialize, the smaller countries required (temporary) assistance in the

form of protection to the newly emerging manufacturing sector(Edwards 1993, 1358).

As Secretary General of the United Nations Economic Commission for Latin America during this time, Prebisch's work was "particularly influential in Latin America (Edwards 1993, 1358-1359)." In fact, ISI policies of domestic industry development guarded by a protectionist shield of tariffs, import licenses and import quantity restrictions dominated economic development policy for developing nations until the late 1980's.

Import substituting industrialization is the definitive example of an inward oriented trade regime. ISI fosters the development of domestic industries behind a protectionist shield of tariffs, overvalued exchange rates, import licenses and import quantity restrictions. This protectionist shield is justified with the concept of the infant industry argument. The infant industry argument is based on the premise that "developing countries have a potential comparative advantage in manufacturing;" however, developing countries are not able to exploit this potential comparative advantage because initial domestic attempts in manufacturing would not be able to compete with "well-established manufacturing in developed countries (Krugman and Obstfeld 1991, 241)." As a result, temporary protection of the industry through government intervention is justified until the domestic industry becomes competitive.

Infant industry arguments are especially appropriate when imperfect capital markets thwart manufacturing start ups due to their lack of immediate profits and when an infant industry generates positive "social benefits for which they are not compensated (Krugman and Obstfeld 1991, 243)." Government intervention to protect infant industries with inward-oriented trade strategies in these circumstances, however, still represents the second best alternative. The best solution would be to deal directly with the problem by subsidizing the infant industry or reimbursing the infant industry for the social benefits it generates. In any event, protectionist trade regimes justified by the infant industry arguments of ISI represent a second best solution.

High Effective Rates of Protection

Effective rates of protection are measures of the effective impact of protectionist trade regimes. Balassa (1971) defines the effective rate of protection as the "percentage excess of domestic value added, obtainable by reason of the imposition of tariffs and other protective measures on the product and its inputs, over foreign or world market value added (4)." Unlike nominal rates of protection which measure the impact of tariffs on products thereby affecting decisions made by consumers, effective rates of protection measure the impacts of protectionist trade regimes on the production process and its inputs. Specifically,

effective rates of protection affect decisions made by producers and "thus the allocation of resources among industries (Balassa 1971, 5)."

Effective rates of protection are important because of their effect on allocative efficiency. Unfortunately, developing countries concentrating on the application of ISI rarely base their actions on a consistent plan.

> Rather, the existing system of protection in many developing countries can be described as the historical result of actions taken at different times and for different reasons. These actions have been in response to the particular circumstances of the situation, and have often been conditioned by the demands of special interest groups. The authorities have generally assumed a permissive attitude toward request for protection and failed to inquire into the impact of the measures applied on other industries and on the allocation of resources in the national economy. The interaction of tariffs and exchange rates and their effects on exports have been generally disregarded; nor have the implications of duties on raw materials and intermediate products for the protection of finished manufactures been taken into account (Balassa 1971, xv).

The end result of this haphazard approach to implementing protectionist measures are unrealistically high effective rates of protection as shown in Table 1. For the most part, effective rates of protection of over 100 are seen in manufacturing sectors while much lower or even negative rates of protection are seen in the primary industries.
The unrealistically high effective rates of protection as shown by the examples in Table 2 have numerous consequences for developing nations following a program of import

substituting industrialization. These include a bias against exports, the creation of incentives for unproductive entrepreneurship, inefficiencies related to economies of scale and economic dualism.

Table 1:--Effective Rates of Protection of Various Industry Groups for Select Developing Countries

Industry Group	Brazil (1960)	Chile (1961)	Pakistan (1963-64)	Philippines (1965)
Mining & energy	25	-2	na	-25
Total Primary Production	52	21	na	-1
Machinery	100	98	139	103
Total Manufacturing	113	182	271	61

Source: Bela Balassa, *The Structure of Protection in Developing Countries*, (Baltimore: Johns Hopkins Press, 1971), 54.

Bias Against Exports

One inevitable outcome of high effective rates of protection is a bias against exports. Bias against exports refers to the effects changes in relative prices caused by protectionist policies have on the different sectors within an economy (Krugman and Obstfeld 1991, 93-112). Assuming that the output of an economy can be divided into importables, exportables and nontradables; protectionist policies such as tariffs, import licenses, and import quantity restrictions all serve to raise the domestic price of importables relative to the price of exportables determined by the world market.

This creates incentives in favor of domestic production of importable goods instead of domestic production of exportables. Moreover, the higher relative price of importables causes domestic consumption to switch to the lower relatively priced exportable goods.

> Exporting is then discouraged by both the increased cost of imported inputs and the increased cost of domestic inputs relative to the price received by exporters. This rise in the relative cost of domestic inputs may occur through domestic inflation or an appreciation of the exchange rate following the imposition of barriers to imports. In effect, protection puts a tax on exports (*World Development Report 1987, 78*).

The "export tax," (*1987 World Development Report*), is an implicit tax on exports due to the relative price changes caused by the implementation of import protectionistic policies (80). Table 2 shows the "shift parameter," a factor which measures the amount of import protection which is "shifted" to the export sector due to relative price changes. The strength of this shift factor is dependent on whether the "factors used to produce importables and nontradables are similar (*World Development Report 1987, 80*). If the factors used in the production of nontradables and importables are substitutes, the shift parameter will be stronger than if the factors used in both exportables and nontradables are close substitutes. As you can see, over 50 percent of the import protection burden is generally shifted to the export sector with values reaching a maximum of close to 100 percent in Columbia. In short, bias against exports

is one negative consequence of ISI induced protectionist policies.

Table 2:--Shift Parameter Estimates in Selected Developing Countries

Country	Period	Shift Parameter
Cote d'Ivoire	1970-84	0.43
Uruguay	1959-80	0.53
Chile	1959-80	0.55
Argentina	1935-79	0.57
Mauritius	1976-82	0.59
El Salvador	1962-77	0.70
Brazil	1950-78	0.70
Cote d'Ivoire	1960-84	0.82
Mauritius	1976-82	0.85
Columbia	1970-78	0.95

Source: The World Bank, *World Development Report 1987*, (New York: Oxford University Press, 1987), 80.

Incentives for Unproductive Entrepreneurship

Another consequence of ISI induced protectionism is that high effective rates of protection encourage rent seeking. Protectionism, as one of the "rules of the game" provides incentives for the carrying out of "unproductive entrepreneurship" combinations such as rent seeking. Protected industries lobby hard in order to insure that the protectionist policies continue. This is because

protectionist polices give firms in the import competing sector of the economy more market power than they normally would have.

Jagdish Bhagwati (1978) finds evidence of three broad classes of illegal activities or unproductive entrepreneurship including "abuses in awarding, claiming and disposing of licenses; . . . illegal trade transactions such as smuggling and faked invoicing;" and attempts to seek "better exchange rates in the black market (65). Bhagwati (1978) found the "most notable instances of illegality" to be associated with attempts to thwart import control efforts (66-68). For example, in India, the Estimates Committee of the Indian Parliament found several abuses in the system for obtaining import licenses including applying for licenses "on the basis of forged quota certificates" or "on the basis of false turnover by producing certificates from a Chartered Accountant obtained by misrepresentation." In addition, Bhagwati (1978) notes the large scale occurrence of illegal, import license resale in Turkey. Finally, Bhagwati (1978) finds one of the most notorious instances of illegality in the experience of Ghana where the "political system has been characterized by subordination to the goal of economic profit to its participants (67)." To be specific, it was common for the Ghanaian Minister of Trade to exact a ten percent commission on the face value of all import licenses he granted. In any event, the "rules of the game" used by

exchange control regimes create incentives for unproductive entrepreneurship.

Inefficiencies Related to Economies of Scale

Instead of focusing, through trade with other nations, on the production of goods in which they have a comparative advantage, developing nations following ISI are forced to focus on production for the domestic market. Krugman and Obstfeld point out that oftentimes a developing country's markets are so small that they do not allow for an efficient scale of production (1991, 246). However, high effective rates of protection like those presented in Table 2 give rise to monopoly profits. This encourages several firms to enter a market which is not even big enough for one firm to have an efficient scale of production.

One way in which firms can achieve economies of scale is through vertical specialization which is achieved "through the manufacturing of parts, components, and accessories of a given product in separate establishments (Balassa 1971, 76)." Unfortunately, due to the protectionist measures implemented under ISI in a developing country, "efficient scale operations will hardly be possible in the manufacturing of parts, components, and accessories" even when the final assembly of these items takes place on a large scale (Balassa 1971, 78)."

Considerable costs are associated with this "backward integration" of the production process. For example, Baranson (1969) found that in Brazil, the excess cost of the domestic manufacture of automobiles increases from 6 to 71 percent when the country moves from mere assembly of vehicles to where 99 percent of the vehicle's content is being produced domestically (36). In another example, Balassa (1971) compares Norway and Chile. He points out that the "Legal requirements on the minimum proportion of nationally fabricated components have . . . been progressively increased in Chile: from 27 percent in 1964 to 32 percent in 1965 and again to 45 percent in 1966." On the other hand, Norway has no domestic auto production. However, Norway has five times the number of automobiles Chile does. Balassa (1971) attributes this to Norway's participation in the international division of the production process. Specifically, Norway manufactures component parts for assembly abroad and imports the final product. In any event, ISI prevents the manufacturing industries from developing economies of scale.

Economic Dualism

A final consequence of ISI is economic dualism. "A dual economy is one in which there is a 'modern' sector (typically producing manufactured goods that are protected from import competition) that contrasts sharply with the rest of the

economy (Krugman and Obstfeld 1991, 249)." The concept of economic dualism can be traced to the work of James R. Harris and Michael P. Todaro. Harris and Todaro (1970) observed that "Despite the existence of positive marginal products in agriculture and significant levels of urban unemployment, rural-urban labor migration not only continues to exist, but . . . appears to be accelerating (126)." In formulating a model to explain this phenomena, Harris and Todaro (1970) acknowledged the "existence of a politically determined minimum urban wage at levels substantially higher than agricultural earnings (126)." Their model holds that it is in response to these "expected" urban-rural wage differences that migration continues in spite of high levels of urban unemployment.

Expected urban-rural wage differences can be attributed directly to the policy of ISI development followed by developing countries. Wide-ranging direct interventions by government included

> minimum wage laws, interest rate controls, tariff concession on imported capital inputs, artificially high and multiple exchange rates, and tax concessions on investment and capital equipment. These microeconomic inefficiencies led to predictable effects: rather low labour absorption as the use of (scarce) physical capital was artificially encouraged at the expense of (abundant) semi-skilled labour; [and] discrimination against export-oriented and agricultural activities . . . (Chowdhury and Islam 1993, 43)

As you can see, developing nations following the principles of ISI fail to take advantage of the one resource in which they are relatively well endowed: unskilled labor. Instead, ISI encourages the use of capital intensive production processes.

The use of capital intensive production in developing countries leads to several contrasts (Krugman and Obstfeld 1991, 249). These include high value of output per worker in the modern sector of the economy, high wages for workers in the modern sector (up to ten times that of agricultural workers), low returns to capital in the industrial sector, and a persistent unemployment problem in the urban areas.

Lloyd G. Reynolds (1965) found evidence of these contrasts in Puerto Rico. For example, in 1952, the average agricultural worker earned almost 50 percent of the wages of the average factory worker. Ten years later, the average wage earner in agriculture brought home one-third of the average factory worker's income (28). Krugman and Obstfeld (1991) present an even more striking example of a dual economy. This is seen in India where only 6 million of a total population over 700 million are employed in the manufacturing sector (249-250). Despite the small number of people employed by the manufacturing sector, it accounts for 15 percent of India's gross national product. Moreover, the manufacturing sector pays wages that are more than six times those paid in the agricultural sector. Finally, since 1960,

workers in the manufacturing sector have seen their wages rise by almost 80 percent while agricultural workers have seen an increase of only 5 percent. In any event, India's economy shows the contrasts associated with economic dualism.

To sum up, the protectionist polices of ISI have several negative consequences. These include a bias against exports, the creation of incentives for unproductive entrepreneurship, production processes which lack economies of scale and economic dualism.

CHAPTER IV

CHARACTERISTICS OF EXPORT-ORIENTED INDUSTRIALIZATION

The 1980s saw a shift away from the protectionist policies of import substituting industrialization.

The Shift Away From Import Substituting Industrialization

Dornbusch (1992) gives additional reasons for this shift (69-70) besides the negative effects of ISI documented in Chapter III. First, he points to a growing sense of "anti-statism," which holds that government through "overly intrusive" protectionist policies is not the way to achieve economic development. Second, Dornbusch emphasizes the poor economic performance of developing countries especially in Latin America where "populist macroeconomic policies . . . engendered debt crises and hyperinflation."

Sebastian Edwards (1993) supports Dornbusch's emphasis by comparing the poor performance of Latin American countries "which had followed with almost religious zeal the dictates of import substitution" to the "rapidly growing East Asian countries that had aggressively implemented outward oriented strategies (1359-1360)." The results of Edward's comparisons are presented in Table 3. As you can see, there is a dramatic difference in growth rates between these two sets of nations especially in the 1980's.

Table 3:--Annual Growth Rate of Real GDP;

	1965-80	1980-89
A. Selected Latin American Countries		
Argentina	3.5	-0.03
Brazil	8.8	3.0
Chile	1.9	2.7
Columbia	5.8	3.5
Mexico	6.5	0.7
Peru	3.9	0.4
Venezuela	3.7	1.0
Latin American Average	6.0	1.6
B. Selected East Asian Countries		
Hong Kong	8.6	7.1
Indonesia	8.0	5.3
Korea	9.6	9.7
Malaysia	7.3	4.9
Singapore	10.1	6.1
Thailand	7.2	7.0
East Asian Average	7.2	7.9

Source: Sebastian Edwards, "Openness, Trade Liberalization, and Growth in Developing Countries," Journal of Economic Literature 31 (September 1993), 1360.

Third, Dornbusch refers to the information explosion which occurred in the 1980's. People not only know of the existence of other goods, they also know the prices of goods in other countries. A final reason Dornbusch points to is that of pressure from the World Bank. Due to the success of outward oriented nations, trade liberalization is now a "condition for World Bank Lending."

Export-Oriented Industrialization

Unlike ISI, EOI strives to make neutral the incentives between export and domestic production or "between the purchases of domestic goods and foreign goods (Chowdhury and Islam 1993, 44)." Actually, most nations following EOI do use some form of protectionism. When compared to nations practicing ISI, however, EOI economies usually favor tariffs over quantity restrictions.

In addition to its primary benefits of allocative and dynamic efficiency, EOI generates the additional benefits of increased utilization of economies of scale, "enlarged technological and social capabilities as a result of exposure to foreign know-how" and more equitable economic growth (Chowdhury and Islam 1993, 44). Moreover, the incentives for entrepreneurial talent under EOI in the import competing sector are quite different. Rather than rent seeking, productive entrepreneurship types of activities such as the

introduction of a new method of production will be rewarded by society.

This chapter examines the benefits of EOI development by looking at the economic performance of both economies which have been deemed to undertake periods of trade liberalization and the newly industrializing economies (NIE) of east Asia also known as the four Asian Tigers of Hong Kong, Korea, Singapore and Taiwan.

Economic Performance and Trade Liberalization

Adopting policies related to EOI can be characterized as trade liberalization in the sense that EOI strives to make neutral the incentives between domestic and foreign production. This allows developing nations to participate in the international division of labor and specialize in the production of goods in which they have a comparative advantage. Resources, rather than being attracted to the high profits associated with protected, import competing industries, are allocated according to their marginal product. Openness not only increases the variety of goods but also provides cheaper and higher quality intermediate goods which raise productivity.

Michaely, Michael, Demetris Papageorgiou and Armeane M. Choksi (1991) show that making the choice for trade liberalization or EOI manifests itself in the form of increased gross domestic product (GDP) growth rates. In

Table 4, the real annual growth rate of GDP of 19 separate countries is shown for periods of time before, during and after 31 separate trade liberalization episodes categorized as to their strength and longevity.

Michaely et. al. (1991) define trade liberalization as "any change that makes the country's trade system more 'neutral'" and manifests itself in one of two ways (14-15). The first is a change in the method of intervention such as moving from quantity restrictions to tariffs. The second is a change in the price system in such a way that relative prices are changed altering the effective rates of protection. This is most commonly achieved through devaluation of the currency.

The strength of the liberalization episode is based upon an annual index of trade liberalization developed by Michaely et. al. (1991) for 19 countries covering the 35 year span from approximately 1950 to 1985. The index uses an ordinal scale from 1 to 20 where 1 represents the highest amount of intervention possible and 20, a system of completely free trade. The index is somewhat arbitrary as it does reflect the judgment of the authors. Sustained episodes of liberalization are those which have not been reversed at any time.

Table 4:--Summary of GDP Performance For Given Trade Liberalization Episodes (Real Annual Rate of Growth)

Type of Episode*	Number	PtL	T	T+1	T+2	T+3	AVG-T	AVG
All	31	4.4	4.7	5.4	5.3	6.0	5.6	5.3
Strong	17	3.5	4.9	4.8	5.2	6.2	5.4	5.3
Weak	14	5.6	4.4	6.2	5.4	5.7	5.7	5.4
Sustained	16	4.7	6.1	5.4	5.8	6.8	6.0	6.0
Collapsed	15	4.1	3.2	5.5	4.6	5.2	5.1	4.6

*PtL, average of three years up to liberalization; T, year of liberalization; T+1, one year after liberalization; T+2, two years after liberalization; T+3, three years after liberalization; AVG-T, average of three years after T; AVG, average of T plus three years after liberalization.

Note: The nineteen countries involved in Michaely et. al.'s study included Argentina, Brazil, Chile, Columbia, Greece, Indonesia, Israel, Korea, New Zealand, Pakistan, Peru, Philippines, Portugal, Singapore, Spain, Sri Lanka, Turkey, Uruguay, Yugoslavia.

Source: Michael Michaely, Demetrius Papageorgiou, and Armeane M. Choksi, *Liberalizing Foreign Trade: Lessons of Experience in the Developing World*, Vol. 7 (Cambridge: Basil Blackwell, Inc., 1991), 88.

It is evident from Table 4 that countries which underwent strong trade liberalization episodes experienced significant increases in their real annual growth rates of GDP. Specifically, these countries had an average real annual growth rate of 5.4 percent in the three years following the initial year of the liberalization. This compares to 3.5 percent for the three years prior to the liberalization. Even when the experience of these nations is combined with

that of nations whose trade liberalization episodes were characterized as weak, the average annual real rate of GDP growth for AVG-T was 5.6 percent, a full 1.2 percent higher than the 4.4 percent value for PtL. As you can see, trade liberalization leads to increased economic performance.

The Economic Experience of the Four Asian Tigers

Although the work of Michaely et. al. (1991) clearly shows the increased economic performance which comes from trade liberalization, the definitive example of EOI success can be found in the economic experience of the newly industrialized economies of East Asia which include Hong Kong, Singapore, Korea and Taiwan also known as the Four Asian Tigers. The economic performance of these four nations is often pointed out as shining examples of EOI achievement.

The Switch to EOI

EOI development policies have not always been the case among the Asian Tigers.

> Starting in the years around 1960, these countries (i.e. Korea, Taiwan and Singapore) made policy changes that by the middle of the 1960's combined selective protection for certain import competing sectors with a virtual free trade regime for exporters--by which we mean that exporters could obtain inputs . . . at world market prices, while the effective exchange rate for exporters was close to that which would have ruled under free trade. Overall effective protection for industry was zero for Korea, and, of course, Hong Kong, and low for Taiwan and Singapore. The consequential growth of exports was phenomenal, far exceeding what anyone could have predicted or did predict (Little 1982, 141).

As you can see, the Asian Tigers switched from ISI to EOI.

The effects of this switch were dramatic. This can be seen in Table 5 which shows the percentage of exports in GDP for various years of the Asian Tigers compared with other sectors of the world economy. As you can see, none of the other sectors including those of developed market economies can even come close to the export performance of the NIE's of East Asia.

Table 5:--Exports as a Percentage of GDP for Various Years in NIE's and Other Sectors of the World Economy

	Exports of Goods and Services (% GDP)		
Economy	1965	1980	1987
Hong Kong	71	88	123
Korea	9	34	45
Singapore	123	205	191
Taiwan	19	53	58
Argentina	--	7	10
Brazil	7*	11	20
Mexico	4*	7	6
India	4*	7	6
Developed Market Economies	11†	20	17
Developing Market Economies	16†	26	24

*Data from year 1970.
†Data from year 1960.

Source: Anis Chowdhury and Iyanatul Islam, *The Newly Industrialising Economies of East Asia*, (New York: Routlegde, 1993), 74.

Comparative Advantage Among the Four Asian Tigers

Along with the increases in Exports as a percentage of GDP has come outstanding GDP growth. From 1960 to 1985 Korea, Singapore, Taiwan and Hong Kong have achieved respective annual GDP growth rates of 5.72, 5.86, 6.18 and 5.91 percent. A large part of these growth rates can be explained by the Asian Tiger's exploitation of their comparative advantage in unskilled labor as shown in Table 6.

Table 6 shows revealed comparative advantages for the four factors of unskilled labor, human capital, technology and physical capital. The real comparative advantage (RCA) index is the ratio of the product in questions share of an individual country's exports to that products share in world exports (Chowdhury and Islam 1993, 76). An RCA greater than one signifies that a country has a comparative advantage in production of the product in question. As you can see, with the exception of Singapore, all of the Asian Tigers have exploited their comparative advantage in unskilled labor. Korea has even achieved comparative advantage in the production of goods requiring human capital. In addition, all four nations have obtained comparative advantage in technology intensive production. Finally, none of the Asian Tigers have achieved a comparative advantage in physical capital intensive production.

Table 6:--Revealed Comparative Advantage Indices for the Newly Industrialising Countries of East Asia

Intensive Factor	Year	Hong Kong	South Korea	Singa-pore	Taiwan
Unskilled Labor	1970	7.10	5.43	0.94	--
	1976	6.91	6.06	0.94	--
	1980	6.48	5.63	0.93	6.14
	1985	5.74	4.18	0.72	5.58
Human Capital	1970	0.45	0.20	0.39	--
	1976	0.70	0.76	0.61	--
	1980	1.23	1.19	0.51	0.81
	1985	0.87	1.84	0.43	0.78
Technology	1970	1.59	0.62	0.63	--
	1976	2.06	1.39	1.76	--
	1980	1.59	1.46	1.80	1.81
	1985	1.45	1.16	1.19	1.44
Physical Capital	1970	0.13	1.16	0.26	--
	1976	0.18	0.39	0.45	--
	1980	0.23	0.74	0.56	0.43
	1985	0.44	0.53	0.59	0.48

Source: Anis Chowdhury and Iyanatul Islam, *The Newly Industrialising Economies of East Asia*, (New York: Routledge, 1993), 80.

The Incidence of Poverty Among The Asian Tigers

The implementation of EOI among the Asian Tigers has had surprising effects on the incidence of poverty. Unlike India where ISI has led to a dual economy, the incidence of poverty among the newly industrializing economies of east Asian has actually fallen. Table 7 shows just how dramatic the fall in poverty has been among the Asian Tigers. For example, both Hong Kong and Korea have reduced the incidence of poverty from over 35 percent in the early 1960s to under

10 percent in the late 1970s and early 1980s. Moreover, Singapore almost eliminated the incidence of poverty during this same period by reducing it from 19.2 to 0.3 percent. In any event, the implementation of EOI among the four Asian Tigers has reduced the incidence of poverty.

Table 7 :--The Incidence of Poverty Among the Newly Industrializing Economies of East Asia

Country	Year	Poverty Incidence Total (%)
Hong Kong	1963-4	35.6
	1973-4	3.5
Korea	1965	40.9
	1976	14.8
	1982	7.7
Singapore	1953-4	19.2
	1972-3	7.0
	1977-8	1.5
	1982-3	0.3
Taiwan	1975	5.0

Source: Anis Chowdhury and Iyanatul Islam, *The Newly Industrialising Economies of East Asia*, (New York: Routledge, 1993), 218.

To sum up, both the Asian Tigers switching to EOI and countries undergoing trade liberalization have seen significant increases in their economic growth rates. More importantly, the newly industrializing economies of East Asia can attribute part of their success to exploiting their comparative advantage in unskilled labor. Finally, the economic performance of the Asian Tigers has not created dual economies but actually reduced the incidence of poverty.

CHAPTER V

A REVIEW OF NEOCLASSICAL GROWTH MODELS AND THE GAINS FROM TRADE

Many researchers have tried to illustrate the gains from trade by including openness variables in regression analysis based on neoclassical production function growth models. Reviews of this work by Edwards (1991) and Harrison (1991) show that although the results of these works generally show a positive relationship between openness and economic growth, this empirical analysis is often based on small data sets which cover a limited time span. Second, the results vary according to their significance and by the approach used. In addition, this work usually does not utilize demographic variables as sources of growth. Most important of all, these works tend to concentrate on some measure of exports assuming away any condition of import shortage.

Edwards Literature Review

Sebastion Edwards (1991) summarizes a select group of researcher's work on growth of exports, growth of GDP growth, and conditions in the world market. This summary can be found in Table 12 in the appendix. A quick glance at this chart reveals three things. First, practically all of the studies reviewed here deal with a relatively small group of nations. Second, most of these studies concentrate on the coefficient of the growth rate of exports regressor: $(\dot{X}/X)$.

Finally and most important of all, as a group, these studies show a significant, positive relationship between the $(\dot{X}/X)$ regressor and economic growth.

Harrisons's Work

Ann Harrison (1991) also deals with openness and economic growth. Like Edwards, she reviews recent literature on openness and economic growth and arrives at the following conclusions. Table 13 in the Appendix is a reproduction of Harrison's review. First, Harrison (1991) points out that although many studies show a positive relationship between openness and growth, "the debate is by no means resolved (9). For example, the review shows that results for microeconomic studies and causality tests are often ambiguous or even conflicting. Second, independent "openness" variables are seldom "free of methodological problems." For instance, limited time spans and small sample sizes are methodological problems which frequently plague openness studies.

Harrison's own empirical analysis supports these conclusions. The analysis is based on a general production function that has the growth of GDP being a function of the capital stock, average years of education, population, labor force, agricultural land and technological change. Openness variables are used to evaluate their impact on technological change which is represented as the growth in GDP after controlling for the changes in resource use. Dummy

variables are used to account for unobserved country-specific differences. The seven different variables used as proxies for openness are defined in Table 8. Harrison uses these measures for a cross-section study of developing countries over time to determine whether they yield the same results.

Table 8:--Harrison's Regressions Variables

Variable	Definition	Source
TR I: Trade Liberalization Index, 1960-84	Index derived from observations on exchange rate and commercial policies.	Papageorgiou, Michaely, and Choksi, 1990
TR II: Trade Liberalization Index, 1978-88	Derived from country sources on tariffs and nontariff barriers.	Thomas, Halevi, and Stanton, 1991
BLACK: Black Market Premium, various years	Measures deviation of the black market rate from the official exchange rate.	International Currency Analysis, Inc.
DOLLAR: Index of Price Distortion	Relative price of consumption goods from Summer-Heston is purged of its non-traded component by taking the residual from a regression of this index on urbanization, land and population.	Dollar (1991)
TRADE SHARES	Ratio of exports and imports to GDP.	World Bank
MOVEMENT TOWARDS INTERNATIONAL PRICES	Current and constant national accounts price indexes are used to drive the relative price of a country's tradables. This measure is transformed to measure the movement toward unity based on a benchmark of the relative price of consumption goods for 1980.	Summers and Hestion (1988)

Source: Ann Harrison, "Openness and Growth: A Time Series, Cross Country Analysis for Developing Countries," (World Bank, November, 1991), 11-12.

As previously mentioned, the results of Harrison's empirical analysis support the conclusions she draws from the review of growth and openness literature. Harrison runs the same set of regressions for annual, six year average and entire period average data. Predicted signs of the coefficients are positive for both trade liberalization indexes, trade shares and movement towards international prices. The predicted sign is negative for the bias against agriculture, black market premium and the price distortion measure. The results of Harrison's regressions are summarized in table 9. As you can see, the results generally show an appropriate positive or negative relationship between the openness variables presented here and economic growth. The strength of these relationships is not absolutely convincing. The 37 regressions run here show an openness variable to be significant at the five percent level in only four instances. Only thirteen of the regressions show an openness variable significant at the ten percent level. This leaves over 50 percent of the openness variables insignificant. Moreover, five of the remaining 19 insignificant variables show the wrong sign. Finally, the results vary over the different data sets.

In short, the results presented in this section generally show a positive relationship between openness and economic growth. Unfortunately, these results vary according to their significance of the relationship and to the "methodology"

used. In addition, the empirical analysis is often based on small data sets which cover a limited time span. Furthermore, demographic variables are not utilized as sources of growth. More importantly, the work shown in Edward's (1993) literature review, in Harrison's (1991) and even in Harrison's own regression results do not account for conditions of import shortage.

Table 9: Harrison's Regression Results

	Annual Data		Six Year Averages		Entire Period Averages	
	Levels & Differences		Levels & Differences		Levels & Differences	
Openness Variable	(1)	(2)	(3)	(4)	(5)	(6)
Trade Liberalization Index (1960-84)	>0†	>0	>0*	>0	<0	>0
Trade Liberalization Index (1978-88)	>0*	>0	-	-	<0	<0
Black Market premium 1/	>0*	>0*	>0*	>0	>0*	>0
Trade Shares	>0	>0*	<0	>0*	>0	>0*
Price Distortion Measure	>0*	<0	>0*	>0*	<0	>0
Movements Towards World Prices	-	>0*	-	>0	-	>0
Bias Against Agriculture 1/	>0†	>0	>0†	>0*	>0	>0

*Indicates significant at the 5% level.
†Indicates significant at the 10% level

For purposes of comparison, a value of ">0" indicates that more openness (less distortion) positively affects growth. Consequently, for the black market premium, price distortion measures, and bias against agriculture, this table will show ">0" when a higher level of distortion negatively affects growth.

Source: Ann Harrison, "Openness and Growth: A Time Series, Cross Country Analysis for Developing Countries," (World Bank, November, 1991), 31.

CHAPTER VI

MODEL DEVELOPMENT

This chapter develops a model which overcomes the shortcomings of previous work identified in Chapter V. First, this chapter performs an in-depth review of four economic growth models which use neoclassical production functions. These four models address issues pertinent to the development of the model presented by this thesis. In the first, Feder (1982) incorporates the possibility for differences in marginal factor productivities between export and domestic production sectors. In the second, Edwards (1991) shows how openness affects the absorption of technology in an economy. The third model by Lee and Lin (1991) utilizes demographic variables as sources of growth. The fourth model by Esfahani (1991) investigates the role exports have in reducing "import shortages." Finally, elements of these models are used to develop an economic growth model which overcomes the shortcomings presented in Chapter V by developing an economic growth model which assumes that marginal factor productivities could possibly differ between the export and domestic sector of an economy, utilizes demographic variables as sources of growth and accounts for import shortage conditions through the inclusion of an imports growth variable.

Neoclassical Production Functions and Differences in Marginal Factor Productivities

One route researchers have taken while investigating the relationship between openness and economic growth is to focus on the differences in marginal factor productivities of various sectors of an economy. The definitive work on this subject is "On Exports and Economic Growth" by Gershon Feder (1982).

In this work, Feder points to various empirical studies which show "that exports contribute to GDP growth more than just the change in the volume of exports (59)." This can be accounted for by "highlighting various beneficial aspects of exports, such as greater capacity utilization, economies of scale, incentive for technological improvements and efficient management due to competitive pressure abroad. According to Feder (1982), all of this implies "that there are substantial differences between marginal factor productivities in export oriented and non-export oriented industries, such that the former have higher factor productivity (59-60)." Therefore, a country that adopts an outward orientation such as EOI which makes neutral the incentives between export and domestic production will benefit from higher GDP growth due to closer-to-optimal resource allocation.

Feder (1982) uses three assumptions to help develop his model (60). First, a country's economy is composed of two separate sectors: one focusing on the production of export

goods and the other focusing on the production of domestic goods. Second, each sectors production is a function of their respective resource allocations. Finally, non-export sector output is a function of export production volume.

Feder (1982) incorporates these functions in the following model (61-63).

(1) $$N = F(K_N, L_N, X)$$

(2) $$X = G(K_X, L_X)$$

where N stands for non-export production; X represents export production; K_N, K_X stand for respective sector capital stocks; and L_N, L_X are respective sector labor forces

The marginal factor productivity differentials across sectors are accounted for in the following equation:

(3) $$\left(\frac{G_K}{F_K}\right) = \left(\frac{G_L}{F_L}\right) = 1 + \delta$$

where the subscripts denote partial derivatives and δ measures the extent of productivity differential in favor of exports. If $\delta = 0$, no productivity differential exists and resources are optimally allocated across sectors.

Differentiating both equations (1) and (2) gives

(4) $$\dot{N} = F_K \cdot I_N + F_L \cdot \dot{L}_N + F_X \cdot \dot{X}$$

(5) $$\dot{X} = G_K \cdot I_X + G_L \cdot \dot{L}_X$$

where I_N and I_X are respective sectoral gross investments, $\dot{L}_N$ and $\dot{L}_X$ are sectoral changes in labor, F_X describes the marginal externality effect of exports on the output of non-exports, $\dot{N}$ equals the change in non-export production and $\dot{X}$

is the change in exports. Since GDP, Y, is by definition equal to $N + X$ it follows

$$\dot{Y} = F_K \cdot (I_N + I_X) + F_L \cdot (\dot{L}_N + \dot{L}_X) + F_X \cdot \dot{X} + \delta \cdot (F_K \cdot I_X + F_L \cdot \dot{L}_X). \tag{6}$$

Total investment, I, is defined as $(I_N + I_X)$. In a similar manner, total change in the labor force, $\dot{L}$ is defined as $(\dot{L}_N + \dot{L}_X)$. In addition, equation (3) and (5) can be manipulated to yield

$$F_K \cdot I_X + F_L \cdot \dot{L}_X + \frac{\delta}{1+\delta} \cdot (G_K \cdot I_X + G_L \cdot \dot{L}_X) = \frac{\dot{X}}{1+\delta}. \tag{7}$$

Using this result in equation (6) gives

$$\dot{Y} = F_K \cdot I + F_L \cdot \dot{L} + \left(\frac{\delta}{1+\delta} + F_X\right) \cdot \dot{X}. \tag{8}$$

Given that a linear relationship exists between the real marginal productivity of labor and the average output per laborer in the economy, it follows

$$F_L = \beta \cdot \left(\frac{Y}{L}\right). \tag{9}$$

Denoting $F_X = \alpha$ and dividing eq. (8) throughout by Y yields

$$\frac{\dot{Y}}{Y} = \alpha \cdot \left(\frac{I}{Y}\right) + \beta \cdot \left(\frac{\dot{L}}{L}\right) + \left(\frac{\delta}{1+\delta} + F_X\right) \cdot \left(\frac{\dot{X}}{X}\right) \cdot \left(\frac{X}{Y}\right) \tag{10}$$

Notice that if marginal productivities are equal in both sectors ($\delta = 0$) and inter-sectoral externalities do not exist ($F_X = 0$), the term on the right hand side of the equation disappears and it becomes a standard neoclassical growth equation. This would be the case for large developed economies.

Using eq. (10) as the basis of his empirical analysis, Feder finds proof of his assumptions. To obtain this proof, Feder uses 1964-73 average data for two samples of semi-industrialized economies in an ordinary least squares regression. Feder (1982) uses ten year averages to avoid the "substantial random effects" and the "existence of lagged responses" found in annual data (65). Regression results for semi-industrialized LDC's, 1964-73, are shown in Table 14 in the appendix. Remarkably, $\bar{R}^2$ almost doubles when $\left(\frac{\dot{X}}{X}\right)\cdot\left(\frac{X}{Y}\right)$ is added as a regressor to the explanatory equation. As you can see, Feder's regressions give strong evidence that different marginal factor productivities exist across sectors and that exports have beneficial externality effects upon the output of non-exports.

Neoclassical Production Functions and Technology Absorption

Another way to analyze the relationship between openness and economic growth is to look at how openness affects the absorption of technology in a neoclassical production function setting. Sebastian Edwards (1991) looks at this relationship. Citing the aforementioned work of W. Arthur Lewis (1955), Edwards (1991) "assumes that more open economies are more efficient in absorbing exogenously generated innovations (4)." Rather than focus on the effect of increasing returns or learning-by-doing, Edwards (1991)

chooses to investigate the effect a country's trade policy has on the rate of technology absorption. Edwards' (1991) emphasis is incorporated in the aggregate production of a small country as follows (6-10).

(11) $$Y_t = F(K_t, L_t)A_t$$

where Y is total output, K is the capital stock, L is the labor force and A is the level of technological know-how in the country. Changes in the last parameter are interpreted as "technological progress."

Edwards (1991) assumes that "technological process" or "knowledge accumulation" comes from two sources (7). The first consists of local technological improvements. Edwards considers this to be positively related to the "gap between the stocks of world and domestic knowledge." The second consists of the absorption of technology created in more advanced nations. The ability to absorb foreign technology improvements is positively related to the openness of an economy. Edwards captures these relationships in the equation (12) which defines the rate of technological improvement.

(12) $$\frac{\dot{A}}{A} = \left(\alpha + \delta\left(\frac{W - A}{A}\right)\right) + \beta w$$

where α is the rate of domestic rate of technological improvement, a constant; $\delta\left(\frac{W - A}{A}\right)$ is a measure of the gap between the level of domestic and world technology--

technology absorption will be faster in country with a larger "gap"; β is the proportion of the world's technology growth absorbed domestically; and W is the world's rate of technology improvement. The amount of the world's technology growth absorbed domestically is a negative function of the level of trade distortions, r, in the economy so that

(13) $$\beta = \beta(r); \beta < 0.$$

The amount of domestic technology improvement is captured in equation (4).

(14) $$\left(\alpha + \delta\left(\frac{W - A}{A}\right)\right)$$

Edwards incorporates this framework in the following equation which serves as the basis for his regressions (1991, 11).

(15) GROWTHj = a0 + a1INVGDPj + a2GAPj + a3rj + uj

which holds that the real GDP per capita growth rate depends on the ratio of aggregate investment to GDP, the "gap" between the world level of technology and the domestic level of technology, and the measure of trade intervention.

Edwards uses a cross section of 30 developing countries to develop data which, for the most part, consists of 1970-82 averages. The variables, their definition, the expected sign of the variables and their source are presented in Table 15 in the appendix. Variables referred to as Leamer Indices

were obtained from "Measures of Openness," a 1987 paper by Edward Leamer.[1]

Edwards regression results are shown in Table 16 in the appendix. As you can see, Edwards' regressions strongly validate his assumptions. Not only are all but one of the openness variables strongly significant, but all the coefficients have the expected sign. Furthermore, both GAP variables are also strongly significant. In any event, Edward's empirical work shows that a positive relationship exists between openness and economic growth.

The Effect of Demographic Variables on Economic Growth

Demographic parameters are noticeably absent in the previous two growth functions which describe the relationship between openness and the growth rate of GDP. Lee and Lin (1991) analyze the relationship between demographic variables and economic growth and find significant relationships. Lee and Lin (1991) "extend previous analysis on the effect of government size on economic growth by considering the effect of demographic changes on investment (both physical and human capital) and economic growth (5)."

---

[1]In this paper, "Leamer uses a traditional Heckscher-Ohlin general equilibrium model of trade as his theoretical framework. 'Predicted' comparative advantage trade ratios are computed using a regression analysis that considers three goods aggregates and seven factors of production. Leamer then defines a rate of intervention which 'measures the extent to which trade is distorted by policy, positively or negatively' (p.26). For every country this intervention index is defined as the ratio of the sum of the absolute value of the residuals from the regression to GNP (Edwards 1991, 45)."

The analysis which follows will concentrate on their work regarding economic growth. Lee and Lin (1991) use a neoclassical production function which incorporates the old and youth dependency ratios as "determinants of economic growth (5)." They do this with the following model.

(16) $$y_t = f(k_t, g_t, l_t)$$

where $y_t = Y_t/P_t$ equals the real aggregate output per capita, $k_t = K_t/P_t$ is the capital stock per capita, $g_t = G_t/P_t$ is government expenditure per capita and $l_t = L_t/P_t$ equals the ratio of labor force to population.

Totally differentiating eq.(16) gives

(17) $$dy_t = f_1 dk_t + f_2 dg_t + f_3 dl_t$$

$$where\ f_1 = \frac{dy_t}{dk_t}, f_2 = \frac{dy_t}{dg_t}, f_3 = \frac{dy_t}{dl_t}, and$$

$$dk_t = \left[\left(\frac{dK_t}{P_t}\right) - \left(\frac{dP_t}{P_t}\right)\left(\frac{K_t}{P_t}\right)\right],$$

$$dg_t = \left[\left(\frac{dG_t}{P_t}\right) - \left(\frac{dP_t}{P_t}\right)\left(\frac{G_t}{P_t}\right)\right],$$

$$dl_t = \left[\left(\frac{dL_t}{P_t}\right) - \left(\frac{dP_t}{P_t}\right)\left(\frac{L_t}{P_t}\right)\right].$$

Dividing eq. (17) by y_t yields

(18) $$\frac{dy_t}{y_t} = f_1\left(\frac{dK_t}{Y_t}\right) - \left[f_1\left(\frac{K_t}{Y_t}\right) + f_2\left(\frac{G_t}{Y_t}\right) + f_3\left(\frac{L_t}{Y_t}\right)\right]\left(\frac{dP_t}{P_t}\right) + f_2\left(\frac{dG_t}{G_t}\right)\left(\frac{G_t}{Y_t}\right) + f_3\left(\frac{L_t}{L_t}\right)\left(\frac{dL_t}{L_t}\right)$$

Let v_1 be defined as the youth dependency ratio (the ratio of youth dependents younger than age 15 to the labor force) and v_2 be defined as the old age dependency ratio (the ratio of elderly dependents older than 64 to the labor force). The relationship between labor force and population can then be defined as

(19) $$L_t = \frac{P_t}{(1+v_1+v_2)}$$

Totally differentiated, eq. (4) becomes

(20) $$\frac{dL_t}{L_t} = \frac{dP_t}{P_t} - \frac{dv_1}{(1+v_1+v_2)} - \frac{dv_2}{(1+v_1+v_2)}$$

substituting (20) into eq. (18) yields

(21) $$\frac{dy_t}{y_t} = b_1\left(\frac{dK_t}{Y_t}\right) + b_2\left(\frac{dP_t}{P_t}\right) + b_3\left(\frac{G_t}{Y_t}\right) + b_4 v_1 + b_5 v_2$$

where $b_1 = f_1$,

$$b_2 = \left[f_1\left(\frac{K_t}{Y_t}\right) + f_2\left(\frac{G_t}{Y_t}\right)\right],$$

$$b_3 = f_2\left(\frac{G_t}{G_t}\right),$$

$$b_4 = f_3\left(\frac{L_t}{Y_t}\right)\left[\frac{dv_1}{v_1(1+v_1+v_2)}\right], \text{ and}$$

$$b_5 = f_3\left(\frac{L_t}{Y_t}\right)\left[\frac{dv_2}{v_2(1+v_1+v_2)}\right].$$

Equation (21) states that the growth rate of per capital output is a function of investment share in total output, the population growth rate, government expenditure share in total output and the youth and old dependency ratios (Lee and Lin 1991, 7).

Lee and Lin (1991) use the model as stated by equation (21) to perform regressions using a cross country data set composed of 121 market economies. The variables they use, the definition of these variables and the predicted sign of these variables are shown in Table 17 in the appendix. The results of Lee and Lin's regressions on the growth rate of real GDP per capita are shown in Table 18 in the appendix. From this table, it is evident that strong relationships exist between GDP per capita growth rate and the demographic variables of old and youth dependency ratios.

Neoclassical Production Functions and Import Shortages

The significant, positive relationship between exports and GDP is usually associated with the positive externalities of more efficient resource allocation, economies of scale, technology transfer and more efficient management due to competition. Hadi Saleh Esfahani (1991) argues, however, that this positive relationship has mainly "been due to the contribution of exports to the reduction of import 'shortages' which restrict the growth of output in many" developing countries (93). This argument is especially

appropriate when a developing nation is not able to obtain significant amounts of foreign aid or capital.

Esfahani (1991) goes on to say that the condition of "import shortage" is usually assumed away in studies of the relationship between exports and economic growth. This assumption neglects the "function of exports in SICs[semi-industrialized countries] as the main source of foreign exchange for the much needed imports of intermediate and capital goods (94)." In addition, Esfahani (1991) is careful to "distinguish between the shortage-reducing and externality effects of" EOI (94). The shortage reduction effects can only be achieved through the promotion of exports. The externality effects can also be achieved through foreign assistance or borrowing. Esfahani (1991) concludes that give the "extent foreign lending and aid are condition[ed] on export performance, outward-oriented policies would be the key to long term development (94)."

Esfahani (1991) incorporates his arguments into the following model which is very similar to the work of Feder.

(22) $$Y = D + X$$

(23) $$D = \theta X + F(K_d, L_d, N_d)$$

(24) $$X = H(K_x, L_x, N_x)$$

(25) $$N = J(M, R)$$

As you can see, the economy's total output, Y, is made up of domestic production, D, and export production, X. Each sector's output is a function of its respective capital, K_d

and K_x; labor, L_d and L_x; and intermediate good endowment, N_d and N_x. The intermediate good, N, is "assumed to be a composite good, aggregating intermediate good imports, M, with a portion of domestic products, R. θ is a positive parameter associated with the positive externalities of exports.

Like Feder, Esfahani describes the difference between marginal factor productivities of inputs in the following equation where capital letter subscripts denote partial derivatives.

(26) $$\frac{H_K}{F_K} = \frac{H_L}{F_L} = \frac{H_N}{F_N} = 1 + \delta$$

δ will be zero if the factors are perfectly mobile between sectors.

Esfahani derives his equation upon which he bases his regressions in the same manner as Feder. First, he differentiates eqs. (23) and (24) to achieve

(27) $$dD = F_K d K_d + F_L d L_d + F_N d N_d + \theta dX \quad \text{and}$$

(28) $$dX = H_K d K_x + H_L d L_x + H_N d N_x .$$

Using eq. (26) and assuming the full employment of all factors, (27) can be written as

(29) $$dX = (1+\delta)\begin{bmatrix} F_K(dK - d K_d) + F_L(dL - d L_d) \\ + F_N(dN - d N_d) \end{bmatrix}.$$

Esfahani then solves eq. (29) for $F_K d K_d + F_L d L_d + F_N d N_d$, substitutes the results into (24), and adds dX to both sides to achieve

$$dY = dD + dX = F_K dK + F_L dL + F_N dN + \left(\frac{\delta}{1+\delta} + \theta\right) dX \quad . \tag{30}$$

Substituting $J_M dM + J_R dR$ for dN and denoting the growth rate of each variable by its corresponding lower case letter yields

$$y = \frac{K}{Y} F_K k + \frac{L}{Y} F_L l + \frac{M}{Y} F_N J_M m + \frac{R}{Y} F_N J_R r + \frac{X}{Y}\left[\frac{\delta}{1+\delta} + \theta\right] x \quad . \tag{31}$$

This equation, after some additional manipulation serves as the model for Esfahani's regressions.

Esfahani uses the cross-sectional data of Feder's 31 SICs for three periods including 1960-1973, 1973-81, and 1980-1986 in his regressions. Esfahani draws the following conclusions with regards to his results (1991, 110-111). First, The explanatory power of the regressions is increased by including import variables in all cases. Second, regressions run without export variables show that most of the explanatory power comes from imports. In addition, he rejects the null hypothesis of no import shortage. Finally, he concludes "that most SICs have on average suffered from import 'shortage' and their exports have mainly provided foreign exchange for relieving this input constraint (Esfahani 1991, 111).

Model Development

The section which follows develops the model used in the empirical analysis of this study. This thesis overcomes the shortcomings of previous work by pulling together elements from the four, previously analyzed, works to create an economic growth model. This model accounts for the beneficial externalities that arise from both imports and exports, utilizes demographic variables as sources of growth, incorporates the effects of technology growth and accounts for conditions of import shortage through the inclusion of an imports growth variable.

This model can be defined by equations (32) through (35).

(32) $$Y = X + N$$

(33) $$X = J(K_X, L_X, A_X, M_X)$$

(34) $$N = F(K_N, L_N, A_N, (X + M)_N)$$

(35) $$X + M = G(K_X, L_X, A_X)$$

Like Feder, this model assumes that the production of an economy, Y, occurs in two distinct sectors. The production of the export sector, X, and the production of the domestic sector, N, is a function of the allocation of capital, labor and technology between the two sector. Unlike Feder, however, this model goes further by assuming that imports are intermediate goods used exclusively in the production of exports. As equation (33) shows, the level of imports, M, is a factor in the production of exports. Equation (35) shows the production of exports and the consumption of imports is a

function of the amounts of capital, labor and technology allocated to the export sector. The level of imports and exports, as seen in equation (34), are now a factor in the production of domestic goods due to the beneficial externalities which they provide to the domestic sector.

The inclusion of imports in the model is based on the following discussion. The Ricardian theory of comparative advantage predicts that a country with an outward oriented trade regime (EOI) will import goods in which it does not have a comparative advantage. In a developing country with a comparative advantage in unskilled labor, these imports would often include intermediate and capital goods which could be used to achieve greater efficiency or the manufacture of new items. Esfahani (1991) has shown that the procurement of these intermediate or capital goods is inevitably linked to a nation's ability to obtain foreign exchange through export promotion. In other words, import liberalization goes hand in hand with export promotion.

Interestingly enough, a common feature of trade liberalization is growth in imports. For example, Mexico started a liberalization period in 1985. Not surprisingly, import penetration, which had averaged 11.3 percent from 1980 to 1985, average 14.5 percent from 1986 to 1990 during which import penetration reached a level of 17 percent (Dornbusch, 1992, 79).

The ratio of respective marginal factor productivities for equations (33) and (34) is defined as follows where capital subscripts denote partial derivatives.

$$\frac{G_K}{F_K} = \frac{G_L}{F_L} = \frac{G_A}{F_A} = 1 + \delta \tag{36}$$

Here, δ measures the extent of productivity differential in favor of exports and imports. If this factor equals zero and factors are equally mobile across sectors, no productivity differential exists.

Differentiating eqs. (32) through (35) gives the following where the dot superscript denotes the first derivative or the change of the respective variable

$$\dot{Y} = \dot{X} + \dot{N}, \tag{37}$$

$$\dot{X} = J_K I_X + J_L \dot{L}_X + J_A \dot{A}_X + J_M \dot{M}_X, \tag{38}$$

$$\dot{N} = F_K I_N + F_L \dot{L}_N + F_A \dot{A}_N + F_{(X+M)}(X \dot{+} M)_N \text{ and} \tag{39}$$

$$(X \dot{+} M) = G_K I_X + G_L \dot{L}_X + G_A \dot{A}_X. \tag{40}$$

Here, $\dot{Y}$ is the change in overall output, $\dot{X}$ is the change in exports and $\dot{N}$ is the change in production for the domestic sector. Given (37), it follows that

$$\begin{aligned} \dot{Y} = {} & F_K I_N + F_L \dot{L}_N + F_A \dot{A}_N + F_{(X+M)}(X \dot{+} M)_N \\ & + J_K I_X + J_L \dot{L}_X + J_A \dot{A}_X + J_M \dot{M}_X \end{aligned} \tag{41}$$

Given (38), and assuming

$$J_K I_X = G_K I_X,$$
$$J_L \dot{L}_X = G_L \dot{L}_X \text{ and}$$
$$J_A \dot{A}_X = G_A \dot{A}_X,$$

it follows

$$\begin{aligned}\dot{Y} &= F_K I_N + F_L \dot{L}_N + F_A \dot{A}_N + F_{(X+M)}(\dot{X}+\dot{M})_N \\ &+(1+\delta)F_K I_X + (1+\delta)F_L \dot{L}_X + (1+\delta)F_A \dot{A}_X + J_M \dot{M}_X\end{aligned} \tag{42}$$

Define total investment, $I \equiv (I_N + I_X)$, and total change in the labor force, $\dot{L} \equiv (\dot{L}_N + \dot{L}_X)$, and total change in the level of technology, $\dot{A} \equiv (\dot{A}_N + \dot{A}_X)$. Given these relationships, eqs. (35) and (38) imply

$$\begin{aligned}F_K I_X + F_L \dot{L}_X + F_A \dot{A}_X &= \left(\frac{1}{1+\delta}\right)\left(G_K I_X + G_L \dot{L}_X + G_A \dot{A}_X\right) \\ &= \frac{(\dot{X}+\dot{Y})}{1+\delta}\end{aligned} \tag{43}$$

Using this result in eq. (39) yields

$$\dot{Y} = F_K I + F_L \dot{L} + F_A \dot{A} + \left[\frac{\delta}{1+\delta} + F_{(X+M)}\right](\dot{X}+\dot{M}) + J_M \dot{M} \tag{44}$$

Suppose a linear relationship exist between real marginal productivity of labor in a given sector and average output per laborer in the economy. Suppose also that a linear relationship exists between real marginal productivity of technology sector and the average output per unit of technology. Finally, suppose a similar linear relationship exists between the real marginal productivity of imports used in the export sector and the output per unit of imports. It follows

$$F_L = \beta_7\left(\frac{Y}{L}\right), \tag{45}$$

(46) $$F_A = \beta_8\left(\frac{Y}{A}\right) \text{ and}$$

(47) $$J_M = \beta_6\left(\frac{Y}{M}\right).$$

Dividing eq. (12) by Y and letting

(48) $$F_X = \alpha \text{ and}$$

(49) $$\gamma = \left[\frac{\delta}{1+\delta} + F_{(X+M)}\right].$$

it follows that

(50) $$\frac{\dot{Y}}{Y} = \alpha\left(\frac{I}{Y}\right) + \beta_7\left(\frac{\dot{L}}{L}\right) + \beta_8\left(\frac{\dot{A}}{A}\right) + \gamma\left(\frac{X+M}{X+M}\right)\left(\frac{X+M}{Y}\right) + \beta_6\left(\frac{\dot{M}}{M}\right).$$

From eq. (4) in Lee and Lin's model,

(51) $$\frac{\dot{L}}{L} = \frac{\dot{P}}{P} - \frac{\dot{v}_1}{(1+v_1+v_2)} - \frac{\dot{v}_2}{(1+v_1+v_2)}.$$

v_1 is the old age dependency ratio, the percentage of people age 65 and above in the total population. v_2 is the youth dependency ratio, the percentage of people age 14 and below in the total population. Similar to Edwards model, technology growth is defined as follows

(52) $$\frac{\dot{A}}{A} = \phi + \xi\left(\frac{W-A}{A}\right) + \beta_4(r)$$

where ϕ is a constant endogenous rate of growth; ξ is measure of how much faster technology growth is given the "gap", $\left(\frac{W-A}{A}\right)$, between the domestic technology and the stock of world technology; and β_4 measures the extent to which the rate of absorption of world technology, r, affects overall technology growth.

Substituting eqs. (51) and (52) into eq. (50) gives

$$\frac{\dot{Y}}{Y} = \alpha\left(\frac{I}{Y}\right) + \beta_0\left(\frac{\dot{P}}{P}\right) + \beta_1 v_1 + \beta_2 v_2 + \beta_3\left(\frac{W-A}{A}\right) + \beta_4(r)$$

(53)

$$+\gamma\left(\frac{(\dot{X}+\dot{M})}{(X+M)}\right)\left(\frac{X+M}{Y}\right) + \beta_5\left(\frac{\dot{M}}{M}\right)$$

$$where\ \beta_0 = \beta_7, \beta_1 = \beta_7\left(-\frac{\dot{v}_1}{v_1(1+v_1+v_2)}\right),$$

$$\beta_2 = \beta_7\left(-\frac{\dot{v}_2}{v_2(1+v_1+v_2)}\right), \beta_3 = \beta_8\xi$$

$$\beta_4 = \beta_8.$$

Equation (53) holds that the growth in output is a function of the level of investment share, the growth rate of the population, the old age dependency ratio, the youth dependency ratio, the gap between world and domestic technology, the rate at which world technology is absorbed, the product of the growth rate of exports plus imports, the level of trade shares and the level of import growth. It follows that equation (53) serves as the basis for the explicit regression equation which follows.

$$GR(Y/TP) = \alpha(I/Y) + \beta_0 GR(TP) + \beta_1 DO + \beta_2 DY + \beta_3 (Y/TP)_{60}$$

(54)

$$+\beta_4 SCHOOL + \gamma NEWFEDER + \beta_5 GR(M) + \beta_6 (Y/TP)_{60}^2$$

As you can see, the growth rate of per capita income is used as a proxy for income growth, initial GDP per capita income serves as a proxy for the "gap" between domestic and world

technology and *SCHOOL* is a proxy for the rate at which world technology is absorbed domestically. The square of the initial GDP per capita variable is included to determine the sign of the rate at which the gap between world and domestic technology affects economic growth.

Given the above analysis, it is expected that the sign of the coefficient will be positive on the level of investment, the growth of the labor force, the level of education, the Feder style variable for exports and imports and the rate of imports growth and negative for the technology "gap." The coefficient for both the young and dependency ratios depend on their respective growth rates. If their respective growth rates are positive, then their sign will be negative and vice versa (Lee and Lin 1991, 8). Convergence hypothesis which holds that less developed countries grow faster than industrial nations predicts that the sign of the last variable in (54) would be negative.

CHAPTER VII

ANALYSIS OF DATA AND REGRESSION RESULTS

This section will define the variables used in the regressions and analysis the data as presented in Tables 10, 20 and 21.

Definition of Regression Variables

In general, the data used for the regressions represents 26 year average or average annual growth rates for the 1960 to 1985 period and appear in real terms.

GR(Y/TP): The annual growth rate of real GDP per capita for the sample period derived by taking the logarithm of the ratio of 1985 GDP per capita to 1960 GDP per capita and dividing by 25 ("Penn World Table," 1991).

I/Y: The 1960 to 1985 average of the ratio of public and private investment to real GDP (Summers and Heston, 1991).

Y/TP: The real GDP per capita for the year 1960 which is the initial year of the 1960 to 1985 sample period. Like Edwards, this variable is used a proxy for the technology gap ("Penn World Table," 1991).

GR(TP): The annual growth rate of the population for the sample period derived by taking the logarithm of the ratio of 1985 population to 1960 population and dividing by 25 ("Penn World Table," 1991).

SCHOOL (1960 & 1975): The average of the proportion of relevant age group enrolled in secondary schools for the years 1960 and 1975 (*World Development Report* 1979). School is used as a proxy for the rate at which world technology is absorbed.

DO(DY): The young (old) dependency ratio is the number of people zero to 14 years of age (65 years of age and older)

divided by the labor force population of ages 15 to 65. This variable is the average of the years 1981 and 1988 (*World Table 1984*) (*World Development Report 1990*).

GR(EX): The growth rate of exports from the year 1966 to 1985 (*World Tables 1987*).

GR(IM): The growth rate of imports from the year 1966 to 1985 (*World Tables 1987*).

AV(OP): The average of trade shares, the ratio of exports and imports to GDP, over the 1960 to 1985 period ("Penn World Table," 1991)

GR(X+M): The annualized growth of exports and imports from the year 1965 to 1985 ("Penn World Table," 1991).

NEWFEDER: Feder style variable which represents the product of AV(OP) and GR(X+M).

Analysis of Data

Table 10 presented on the following page presents the averages of major variables by groups of nations classified according to income. These classifications are taken from the *World Development Report 1988*. The nations which provide the data are listed by income classification in Table 19 in the appendix.

As you can see, the highest level of real per capita income growth is achieved by the 18 Upper Middle Income nations at 3.18 percent. The 28 Lower Middle Income Nations

Table 10:--Means of Regression Variables by Groups of Countries

Variable	Time Period	Total Mean	27 Low Income Nations	28 Lower Middle Income Nations	18 Upper Middle Income Nations	20 Industrial Nations
GR(Y/TP)	1960-85	2.01	0.71	2.30	3.18	2.31
Y/TP_{60}	1960-85	3350	716	1378	2782	10179
$(Y/TP_{60})^2$	1960-85	104531255	604811	2223418	10379847	472799192
I/Y	1960-85	18.22	11.90	15.96	23.18	25.44
SCHOOL	1960 & 1975	28.97	8.24	18.86	34.89	65.78
GR(TP)	1960-85	2.14	2.53	2.51	2.19	1.07
DO	1981 & 1988	5.84	3.09	3.56	6.38	12.27
DY	1981 & 1988	36.73	45.75	41.40	33.60	20.81
AVOP	1965-85	36.43	24.36	28.08	43.88	57.72
GR(X+M)	1965-85	4.28	1.62	5.03	5.99	5.29
NEWFEDER	1965-85	160.48	19.67	135.46	273.75	283.66
GR(EX)	1966-85	4.52	2.49	5.03	4.74	6.34
GR(IM)	1966-85	3.03	2.09	3.08	3.92	3.40

Note: The definition of the variables are presented below.

GR(Y/TP): annual growth rate of real GDP per capita for 1960-85

Y/TP_{60}: initial real GDP per capita 1960

$(Y/TP_{60})^2$: square of the initial real GDP per capita for 1960

I/Y: average investment share in output for 1960-85

SCHOOL: average of the proportion of relevant age group enrolled in secondary schools for 1960 and 1975

GR(TP): average annual population growth rate for 1960-85

DO: average of old age dependency ratio for 1981 and 1988

DY: average of youth dependency ration for 1981 and 1988

AVOP: average annual level of trade shares for 1960-85

GR(X+M) annual growth rate of the sum of exports and imports for 1966-85

NEWFEDER: product of AVOP and GR(X+M)

GR(EX): annual growth rate of exports for 1966-85

GR(IM): annual growth rate of imports for 1966-85

GR(M) annual growth rate of imports for 1966-85

and 20 Industrial Nations have a virtually identical GDP per capita growth rate at 2.30 and 2.31 percent respectively.

The lowest level of growth is achieved by the 27 Low Income Nations. As one would expect, the average of initial GDP per capita increases over the range of nations from a low of 716 to a high of 10179.

The average level of investment share follows the same pattern. Interestingly, the Upper Middle Income Nations achieved almost 50 percent higher GDP per capita growth than Industrial Nations despite having an average investment share over two percent lower.

Unlike investment share, the SCHOOL variable approximately doubles with each income classification. The 65.78 percent level found in industrial nations is four times the 8.24 percent level found in Low Income Nations.

The average annual growth of population decreases across income classifications as expected. The Industrial Nations have an annual growth rate of only 1.07 percent while the Low Income nations have an average rate of 2.53 percent.

The old age and youth dependency ratios behave in opposite fashions. The old age dependency ratio increases across income classifications while the average youth dependency ratio decreases across income classifications. One would expect that life expectancy and therefore the old age dependency ratio would increase with standards of living.

Average trade shares increase across the range of nations with the highest income Industrial Nations having the largest trade shares and Low Income Nations having the lowest. The growth in trade shares follows the same pattern. It follows logically that the Feder variable which is a product of these variables would behave in a similar manner.

With regards to import and export growth, both increase across the range of nations. An interesting deviation from the established pattern is found for the growth in imports variable. Like the established pattern, it follows an increasing trend across nations. However, the trend peaks with Upper Middle Income Nations at a growth rate of 3.92 percent. It then declines to a level of 3.40 percent for the Industrial Nations. Following arguments presented earlier, this trend could be accounted for by reasoning that Industrial Nations already have an established intermediate goods sector. Upper Middle Income Nations, in a push for export expansion, need a higher rate of import growth in order to compensate for their lesser developed intermediate goods sectors relative to that of the Industrial Nations. Their lesser developed intermediate sector cannot provide a sufficient quantity of intermediate capital goods to fuel the fire of export-oriented industrialization. Furthermore, given that developing nations are relatively well endowed with unskilled labor, the theory of comparative advantage requires that they export goods which intensively use

unskilled labor and import intermediate capital goods. This was previously seen in the example of the Four Asian Tiger Nations.

An interesting observation is the striking difference in NEWFEDER variable values for Low Income and the top two income classifications. The average value for the NEWFEDER variable of the Low Income Nations is less than one tenth that of the Industrial and Upper Middle Income Nations.

Table 20 presents data for the four "Asian tiger" nations known for their recent extraordinary economic performance. Evidence of their policies of EOI is easily found. For example, both their annualized rates of growth for imports and exports far outdistance the performance of Industrial Nations. Another striking feature is the growth rates of real GDP per capita.

Table 21 presents data for the Industrialized nations of West Germany, Japan, United States and United Kingdom. West Germany, the United States and the United Kingdom all represent mature economies with established capital goods sectors. Their export growth rates are average for Industrialized Nations. Japan's export growth rate and economic growth rate stick out, however. These values are comparable to that of the Asian Tigers.

Analysis of Regression Results

The goal in the development of the model presented by equation (53) in Chapter VI is to overcome the shortcomings of previous work. The model does this by accounting for the beneficial externalities that arise from both imports and exports, utilizing demographic variables as sources of growth, incorporating the effects of technology growth and allowing for conditions of import shortage through the inclusion of an imports growth variable. Regression results reported in Table 11 presented on the following page confirm the assumptions made by the model.

First, the majority of the variables are generally significant across all six regressions at the five percent level. The exceptions to this statement are found in the AV(OP) variable and DO variable. This would seem to indicate that a strong relationship does not exist between the growth of GDP per capita and the old dependency ratio or averagetrade shares. Especially strong relationships are found between economic growth and export growth, import growth, the youth dependency ratio and initial GDP per capita. Finally, I/Y and GR(TP) become insignificant with the addition of the NEWFEDER variable. Correlation matrix values of 0.475 and -0.278 respectively for the NEWFEDER-I/Y, NEWFEDER-GR(TP) pairs indicate that serial correlation is not present.

Table 11:--Regression Results Using Data from All 93 Countries

Regression	a	b	c	d	e	f	g
Intercept	-0.365	1.109	1.180	0.086	0.511	1.657	0.984
I/Y	0.058	0.059	0.057	0.047	0.051	0.029	0.036
1960-85	(2.541)	(2.593)	(2.420)	(2.178)	(2.630)	(1.376)	(1.832)
GR(TP)	0.349	1.069	1.036	1.043	0.758	0.556	0.548
1960-85	(1.312)	(2.964)	(2.744)	(3.094)	(2.442)	(1.665)	(1.766)
Y/TP	-3.44E-4	-0.001	-0.001	-4.22E-4	-0.001	-4.58E-4	-4.76E-4
1960	(2.936)	(3.917)	(3.909)	(3.436)	(4.58)	(4.01)	(4.474)
$(Y/TP)^2$	2.17E-9	3.60E-9	3.63E-9	2.85E-9	3.60E-9	3.42E-9	3.50E-9
1960	(1.773)	(2.77)	(2.772)	(2.315)	(3.266)	(2.982)	(3.281)
SCHOOL	0.050	0.029	0.029	0.026	0.034	0.031	0.034
1960 & 1975	(3.438)	(1.949)	(1.96)	(1.904)	(2.706)	(2.362)	(2.780)
DO		0.142	0.130	0.137	0.111	0.026	0.053
1981 & 1988		(1.342)	(1.17)	(1.388)	(1.237)	(.276)	(0.597)
DY		-0.077	-0.077	-0.059	-0.055	-0.052	-0.047
1981 & 1988		(2.986)	(2.962)	(2.412)	(2.489)	(2.236)	(2.158)
AV(OP)			0.002				
1965-85			(0.318)				
GR(EX)				0.122			
1966-85				(3.661)			
GR(IM)					0.206		0.151
1966-85					(5.846)		(3.777)
NEWFEDER						0.004	0.002
1965-85						(2.236)	(2.634)
R^2	0.497	0.569	0.569	0.628	0.694	0.669	0.717
Adj. R^2	0.468	0.533	0.528	0.593	0.664	0.637	0.687
F	17.177	16.025	13.886	17.742	23.766	21.184	23.39

Note: Numbers in parentheses are t-statistics.

The addition of demographic variables to the equation raised the explanatory power of the regression considerably. The addition of DO and DY also caused GR(TP) to become significant. However, the old age dependency variable does not become significant in any of the regression. Overall, the demographic variables of DY and GR(TP) are significant contributors to economic growth.

The significant, negative coefficient consistently found for initial GDP per capita indicates that per capita GDP growth increases with the gap between domestic and world technology. The positive sign on the square of initial GDP per capita shows that the increase of GDP growth with the technology gap increases at a decreasing rate. This confirms the earlier prediction of the convergence hypothesis.

Interesting results are achieved with regards to the regressions which contain openness variables. First, the average level of trade shares is found to be insignificant while the average annual growth rates of exports and imports and the NEWFEDER variable are strongly significant. The significant positive coefficients found for the NEWFEDER variable indicate that marginal factor productivities do vary between the domestic and export sectors of an economy. They also indicate that beneficial externalities exist for both imports and exports. In addition, the strong, positive coefficients for average annual imports growth confirm that conditions of import shortage exist. Furthermore, the

strongest coefficient among the openness variables is that of the import growth variable.

Overall, the explanatory power of the regressions is raised considerably with the exception of the AVOP variable. Finally, although the addition of both the growth rate of exports and imports considerably raise the R^2 achieved, the highest explanatory power is achieved with Regression g which represents the complete model as designated in equation (54).

In addition to supporting the arguments of the model, the results also compare quite readily to those achieved by the models reviewed earlier. Like Feder, an extraordinary increase in R^2 is achieved with the addition of the NEWFEDER and GR(M) variables to the regression. In a similar manner, the strong association between SCHOOL and Y/TP (1960) help to confirm the arguments made by Edwards. Furthermore, the high levels of significance of the youth dependency ratio support the work of Lee and Lin. Finally, the regressions in Table 11 present results similar to that of Esfahani. Not only do the regressions show that the inclusion of the import variables raise the explanatory value of the regressions; but they also show that most of explanatory power comes from the import variable.

To sum up, the results shown in Table 11 not only support the arguments made in the chapter on model development, but they also support the work done in the four models analyzed earlier

CONCLUSION

In summation, this thesis analyzes the relationship between openness and economic growth. Although long standing and well accepted economic theory clearly shows the gains from open trade between nations, developing countries have followed the protectionist policies of Import Substituting Industrialization (ISI) for a large portion of the twentieth century. The application of ISI by developing nations is characterized by multiple and overlapping protective measures which give rise to high effective rates of protection. These high effective rates of protection create a bias against exports, prevent emerging industries in developing countries from achieving economies of scale and give rise to economic dualism.

For these reasons and others, the 1980s saw a shift away from ISI to the policies of export-oriented industrialization (EOI). EOI strives to make neutral the incentives between domestic and foreign production of a good. Trade liberalization in the form of EOI has been shown to enhance the economic performance of numerous developing countries.

Numerous efforts made to explain the strong, positive relationship between openness and economic growth rely upon empirical analysis based upon neoclassical production functions. A review of this work shows that this empirical

analysis is often based on small data sets which cover a limited time span. In addition, this work does not utilize demographic variables as sources of growth. Most important of all, these works tend to concentrate on measures of exports assuming away any condition of import shortage.

This thesis alleviates these shortcomings by developing an economic growth model which assumes that marginal factor productivities differ between the export and domestic sectors of an economy, utilizes demographic variables as sources of growth and accounts for import shortage conditions through the inclusion of an imports growth variable. Finally, empirical analysis based on a large cross country data set confirms the assumptions made by the model in the following manner.

First, demographic variables are found to be significant sources of economic growth. Second, while import and export growth are found to be significant sources of economic growth, the average level of trade shares is not. Third, the level of exports and imports create beneficial externalities within an economy. Fourth, marginal factor productivities differ between the domestic and export sectors of an economy. Finally, a condition of import shortage is found to exist.

These results indicate that support should be given for measures such as the North American Free Trade Agreement and pressure put on Japan to open up its markets.

REFERENCES

Balassa, Bela. "An Empirical Demonstration of Classical Comparative Cost Theory." *Review of Economics and Statistics* 4 (August, 1963): 231-238.

_____. *The Structure of Protection in Developing Countries*. Baltimore: Johns Hopkins Press, 1971.

Baranson, Jack. "Automotive Industries in Developing Countries." World Bank Occasional Staff Papers No. 8. Washington D.C.: World Bank (1969): 36.

Baumol, William J. "Entrepreneurship: Productive, Unproductive, and Destructive." *Journal of Political Economy* 98:5 (1990): 893-921.

Bhagwati, Jagdish. *Foreign Trade Regimes and Economic Development: Anatomy and Consequences of Exchange Control Regimes*. New York: National Bureau of Economic Research, 1978.

Chowdhury, Anis and Iyanatul Islam. *The Newly Industrialising Economies of East Asia*. New York: Routledge, 1993.

Dornbusch, Rudiger. "The Case for Trade Liberalization in Developing Countries." *Journal of Economic Perspectives* 6:1 (1992): 69-85.

Edwards, Sebastian. "Trade Orientation, Distortions and Growth in Developing Countries." National Bureau of Economic Research Working Paper No. 3716 (May, 1991).

_____. "Openness, Trade Liberalization, and Growth in Developing Countries." *Journal of Economic Literature* 31 (September 1993): 1358-1393.

Esfahani, Hadi Salehi. "Exports, Imports, and Economic Growth in Semi-Industrialized Countries." *Journal of Development Economics* 35 (1991): 93-116.

Feder, Gershon. "On Exports and Economic Growth." *Journal of Development Economics* 12 (1982): 59-73.

Harris, John R. and Michael P. Todaro. "Migration, Unemployment and Development: A Two-Sector Analysis." *American Economic Review* 60 (March 1970): 126-43.

(REFERENCES continued)

Harrison, Ann. "Openness and Growth: A Time Series, Cross Country Analysis for Developing Countries." *World Development Report Policy Research Working Papers*. World Bank. No. 809 (November 1991).

Krugman, Paul R. and Maurice Obstfeld. *International Economics Theory and Policy Second Edition*. New York: Harper Collins, 1991.

Lee, Bun Song. Lecture on International Trade. University of Nebraska at Omaha, August 24, 1992.

Lee, Bun Song and Shuanglin Lin. "Government Size, Demographic Changes, and Economic Growth." Omaha: University of Nebraska at Omaha (July 1991).

Lewis, W. Arthur. *The Theory of Economic Growth*. Homewood: Richard D. Irwin 1955.

Little, I.M.D. *Economic Development: Theory, Policy and International Relations*. New York: Basic Books, 1982.

Michaely, Michael, Demetris Papageorgiou and Armeane M. Choksi. *Liberalizing Foreign Trade Volume 7: Lessons of Experience in the Developing World*. The International Bank for Reconstruction and Development/The World Bank. Cambridge: Basil Blackwell, Inc., 1991.

Mill, John Stuart. *Principles of Political Economy*. New York: D. Appleton and Company, 1907.

"The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988." *The Quarterly Journal of Economics*. 106 (1991): 327-368.

Reynolds, Lloyd G. "Wages and Employment in a Labor-Surplus Economy." *American Economic Review* 55 (March 1965): 19-39.

Ricardo, David. *The Principles of Political Economy and Taxation*. 1817.

Schumpeter, Joseph A. *The Theory of Economic Development*. Cambridge: Harvard University Press, 1934.

World Development Report. The World Bank. New York: Oxford University Press, (Various Years).

(REFERENCES continued)

World Tables: The Third Edition Volume II Social Data. The World Bank. Baltimore: Johns Hopkins University Press, 1983.

World Tables 1987: The Fourth Edition. The World Bank. New York: World Bank, 1987.

APPENDIX

Table 12:--Edward's Literature Summary

Author	Methodology	Results
Balassa (1985)	Uses production function approach with (°X/X) as regressor. Compares results for sample of 11 countries in 1960-73 with results for 1973-79 that includes 43 countries adversely affected by the 1973 oil shock.	Finds that coefficient of (°X/X) is higher in the 1973-79 period than in the earlier period.
Ram (1985)	Production function framework on 73 countries for 1960-70 and 1970-77. Breakdown of sample justified by oil shock.	For both periods coefficient of (°X/X) significantly positive; higher in 1970-77.
Kavoussi (1985)	Decomposes sources of exports growth using Kravis (1970) technique. Constructs outward orientation ranking. Classifies countries between those facing "favorable" and "unfavorable" world market conditions. Computes Spearman rank coefficients between outward orientation and GDP growth in two periods: 1967-73 and 1973-77.	Found that countries facing favorable market conditions exhibited a significantly stronger correlation between (°X/X) and GDP growth than those facing unfavorable conditions.
Ram (1987)	Production function approach on time series and cross sections. Divides sample in "before oil shock" (1960-72) and "after oil shock" (1973-82). Sample also divided between low and middle income countries.	In the vast majority of cases the estimated coefficient of (°X/X) for the 1973-82 period exceeds that of the earlier period.
Rana (1988)	Comment on Balassa's (1985) paper. Uses balanced sample of 43 nations for before and after 1973. Estimates pooled regressions using both OLS and a random effects procedure.	All estimate of (°X/X) are significantly positive; those for post-73 smaller than those for earlier period.

(Table 12 continued)

Gray & Singer (1988)	Uses Kavoussi's (1985) exports decomposition technique on 1967-73 and 1973-83. Divides countries between those facing "above average" world demand and "below average" demand. Spearman rank coefficient.	Spearman coefficient significantly positive for countries facing above-average world demand; insignificant for those facing low world demand conditions.
Kohli & Singh (1989)	Feder's model is estimated on 41 countries using samples for 1960-70 and 1970-81. Sample also divided between "outward oriented" and "non-outward oriented" countries.	Coefficients of (°X/X) always significant for earlier period; not always in the later period.

Source: Sebastian Edwards, "Openness, Trade Liberalization, and Growth in Developing Countries," *Journal of Economic Literature*, 31 (September 1993), 1384.

Table 13:--Harrison's Summary Evidence on Openness and Growth

Openness Measure	Countries	Period	Impact	Source
I. Measures Based on Trade Shares				
			Coefficient on openness	
Deviation from predicted trade	45	1973-78	Significant, >0	Balassa (1985)
Deviation from predicted trade from Leamer (1988)		1982	Significant, >0	Edwards (1989)
Changes in trade shares	19	1960-85	Significant, >0	Helliwell and Chung (1990)
Trade Shares	81 LDCs	1960-85	Weakly significant, >0	Quah and Rauch (1990)
II. Price-based and administrative measures				
Bhalla/Lau (1991), using the relative price of tradables to international prices	60	1960-87	Raises GDP growth	Bhalla and Lau (1991)
Relative domestic price of investment goods to international prices	98	1960-65	Raises GDP growth per capita	Barro (1990)
Relative price of traded goods	95	1960-85	Raises GDP growth per capita	Dollar (1990)
Effective rate of protection in manufacturing	47	1950-1980	Lower protection raises GDP growth	Heitger (1987)
Trade liberalization index from Choksi (1989)	20	1964-84	Weak evidence of increased productivity	Phillips and Havrylyshyn (1990)
Trade liberalization index from Halevi	35	1975-85	Export incentives positively affect GDP per capita growth, insignificant impact of import restrictiveness	Lopez (1990)

(Table 13 continued)

Trade liberalization index from Halevi-Thomas		1978-88	Trade reform positively affects GDP growth	Thomas/ Nash (1991)
III. Micro and Productivity Studies				
Deviation from predicted export share	108	1960-82	Positive	Syrquin and Chenery (1989)
Export growth	4	1955-78	Positive	Nishimizu and Robinson (1984)
Export growth	17	1950-80	Positive	Nishimizu and Page (1990)
Export growth	4	1976-88	Positive	Tybout (1990)
Import penetration	17	1950-73 1973-85	Ambiguous Negative	Nishimizu and Page (1990)
Import substitution (IS) (1-import penetration)	4	1955-78	IS negatively affects TFP	Nishimizu and Robinson (1984)
Import substitution	4	1976-88	IS positively affects TFP	Tybout (1990)
Effective rates of protection and domestic resource costs	1	1963-76	Ambiguous	Krueger and Tuncer (1982)
Change in import shares	UK	1979-79	Ambiguous	Geroski (1989)
IV. Causality Tests				
Methodology			Exports cause growth?	
Granger tests	37	1950-81	For only 4 countries	Jung and Marshall (1985)
White specification test	73	1960-77	Yes	Ram (1985)
Granger, Sims tests	4 (Asian NICs)		Sometimes	Hsiao (1987)
Granger tests	Austria	1965	No, but productivity growth causes exports	Kunst and Marin (1989)

Source: Ann Harrison, "Openness and Growth: A Time Series, Cross Country Analysis for Developing Countries," *World Development Report Policy Research Working Papers*, World Bank No. 809 (November 1991), 26.

Table 14:--Feder's Regression Results

Variable (parameter)	Extended sample (including marginal cases)		Limited sample (excluding marginal cases)	
	Conventional neoclassical model	Eq.(10)	Conventional neoclassical model	Eq. (10)
I/Y (α)	0.284	0.178	0.311	0.196
	(4.311)	(3.542)	(2.973)	(2.432)
L/L (β)	0.739	0.747	0.853	0.737
	(1.990)	(2.862)	(1.652)	(1.976)
$(\dot{X}/X)\cdot(X/Y)$		0.422		0.390
		(5.454)		(3.985)
Constant	-0.010	0.002	-0.016	0.0
	(0.554)	(0.180)	(0.611)	(0.001)
$\bar{R}^2$	0.370	0.689	0.331	0.653
No. of Observations.	31	31	19	19

Note: Numbers in parentheses are t-values.

Source: Gershon Feder, "On Exports and Economic Growth," *Journal of Development Economics*, 35 (1991), 65.

Table 15: Edwards Regression Variables

Variable	Definition	Expected Sign	Source
INVGDP	1970-82 averages of the rate of growth of real GDP per capita	positive	Summer and Heston (1989)
GAP: RGDP70	A technology gap proxy based on the initial real GDP per capita in 1970	negative	Summer and Heston (1989)
GAP: RD	A technology gap proxy based on the number of engineers engaged in R&D per 1,000 inhabitants	negative	Unesco's Statistical Yearbook (various years)
OPEN1	Overall openness index obtained from Leamer's unscaled trade model	positive	Leamer (1988)
OPEN2	Overall openness index calculated from the residuals of Leamer's scaled trade model	positive	Leamer (1988)
OPENM1	Manufacturing openness index from Leamer's unscaled trade model	positive	Leamer (1988)
OPENM2	Manufacturing openness index from Leamer's scaled heteroskedastic trade model	positive	Leamer (1988)

Source: Sebastian Edwards, "Trade Orientation, Distortions and Growth in Developing Countries," National Bureau of Economic Research Working Paper No. 2908 (May, 1991), 13-14.

Table 16: Edwards' Regression Results

EQUATION	6.2	6.2	6.3	6.4	6.5	6.6
CONSTANT	-0.141	-1.999	-0.160	-1.510	0.376	0.056
	(0.128)	(-1.753)	(0.152)	(1.483)	(0.264)	(0.039)
INVGDP	0.282	0.336	0.289	0.307	0.187	0.206
	(5.614)	(5.729)	(6.073)	(5.767)	(2.955)	(3.285)
RGDP70	-0.120	-0.128	-0.125	-0.127		
	(6.066)	(5.389)	(6.512)	(5.935)		
RD					-4.310	-4.674
					(2.547)	(2.681)
OPEN1	2.004				2.305	
	(3.785)				(3.975)	
OPEN2		2.910				
		(1.523)				
OPENM1			3.730			4.352
			(4.069)			(2.672)
OPENM2				9.148		
				(2.859)		
Adj. R^2	0.760	0.693	0.772	0.717	0.501	0.472
N	30	30	30	30	26	26

Source: Sebastian Edwards, "Trade Orientation, Distortions and Growth in Developing Countries," National Bureau of Economic Research Working Paper No. 2908 (May, 1991), 118.

Table 17:--Lee and Lin's Regression Variables

Variable	Definition	Source
Gr(Y/TP)	The logarithm of the ratio of the year 1985's GDP per capita to that of the initial year's (1960)	Summers and Heston (1988)
Y/TP	Initial per capita real GDP (1960)	" "
DY(DO)	The average of the young (old) dependency ratio for the years 1981 and 1988	*World Table* (1984) and *World Development Report* (1988)
TP	The average of total population from 1960 to 1985	Summers and Heston (1988)
G/Y	The average of the ratio of total government expenditure to total real GDP	" "
Gr(TP)	Average annual growth rate of the population derived in the same manner as Gr(Y/TP)	" "
I/Y	The average ratio of private and public investment to total real GDP for the years 1960 to 1985	" "
PR	Dummy variable for political rights.	Gastil (1987)
Africa	Dummy variable equal to 1 for African nations and 0 otherwise	
Latin America	Dummy variable equal to 1 for Latin American nations and 0 otherwise	
School	The average of the fraction of relevant age group enrolled in secondary school for the years 1965 and 1987	*World Development Report* (1990)

Source: Bun Song Lee and Shuanglin Lin, "Government Size, Demographic Changes, and Economic Growth," University of Nebraska at Omaha (July, 1991), 8-11.

Table 18:--Lee and Lin's Regression Results

Eq.	6a	6b	6c	6d	6f	6g	6h	6i
Constant	.003	.015	.005	.014	.002	.013	.003	.014
	(.29)	(1.6)	(.32)	(.87)	(.17)	(1.43)	(.21)	(.80)
Y/TP	-.007	-.007	-.009	-.008	-.007	-.007	-.009	-.009
1960	(4.12)	(4.19)	(4.69)	(4.70)	(4.09)	(4.12)	(4.52)	(4.62)
$(Y/TP)^2$	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
1960	(3.06)	(3.02)	(3.52)	(3.51)	(3.09)	(3.05)	(3.38)	(3.49)
G/Y	-.001	-.001	.0005	-.0005	-.0007	-.0007	-.0005	-.0005
60-85	(3.04)	(3.02)	(1.70)	(1.77)	(2.66)	(2.60)	(1.73)	(1.82)
DY			-.0005	-.0004			-.0005	-.0004
81 & 88			(2.36)	(2.00)			(2.29)	(1.91)
DO			.001	.001			.001	.001
81 & 88			(2.23)	(1.88)			(2.21)	(1.79)
D			.000	.000			.000	.000
60 & 85			(1.45)	(1.21)			(.55)	(.19)
TP			.0001	.0001			.0001	.0001
60-85			(1.47)	(.87)			(1.37)	(.91)
TP2			-.000	-.000			-.000	-.000
60-85			(1.60)	(1.15)			(1.55)	(1.24)
PR					.004	.003	.003	.004
					(.80)	(.70)	(.73)	(.90)
Africa		-.013		-.009		-.012		-.010
		(2.79)		(2.00)		(2.72)		(2.03)
Latin		-.012		-.008		-.010		-.008
America		(3.30)		(2.01)		(2.76)		(1.97)
I/Y	.114	.117	.093	.099	.109	.113	.091	.095
	(4.10)	(4.47)	(3.56)	(3.85)	(3.96)	(4.31)	(3.33)	(3.53)
School	.046	.029	.023	.016	.043	.028	.022	.016
	(3.28)	(2.02)	(.62)	(1.07)	(3.18)	(1.98)	(1.49)	(1.05)
Gr(TP)	.167	.160	1.288	1.125	.177	.162	1.342	1.138
	(.75)	(.75)	(3.01)	(2.63)	(.80)	(.76)	(3.01)	(2.54)
Adj. R2	.5698	.6148	.6406	.6556	.5638	.6043	.6112	.6277
Obs.	88	88	87	87	87	87	86	86

Source: Bun Song Lee and Shuanglin Lin, "Government Size, Demographic Changes, and Economic Growth, University of Nebraska at Omaha (July, 1991), 35.

Table--19: Ninety-three Countries in Data Set by Income Classification

Area	27 Low Income Nations	28 Lower Middle Income Nations	18 Upper Middle Income Nations	20 Industrial Nations
Africa	-Benin -Botswana -Burundi -Central African Republic -Ethiopia -Ghana -Kenya -Lesotho -Madagascar -Malawi -Mali -Mauritania -Niger -Rwanda -Senegal -Sierra Leone -Sudan -Tanzania -Togo -Uganda -Zaire -Zambia	-Cameroon -Congo, People's Republic -Egypt, Arab Republic -Liberia -Mauritius -Morocco -Nigeria -Tunisia	-Algeria -Gabon -South Africa	
Asia	-China -India -Nepal -Pakistan -Sri Lanka	-Indonesia -Philip-pines -Syrian Arab Republic -Thailand	-Hong Kong -Israel -Korea, Republic of -Malaysia	-Japan -Kuwait -Saudi Arabia

(Table 19 continued)

Europe		-Turkey	-Greece -Portugal -Yugo-slavia	-Austria -Belgium -Denmark -Finland -France -Germany, Federal Republic of -Ireland -Italy -Netherlands -Norway -Spain -Sweden -Switzerland -United Kingdom
Oceania		-Papua New Guinea		-Australia -New Zealand
South America		-Brazil -Bolivia -Chile -Columbia -Ecuador -Paraguay -Peru	-Argentina -Uruguay -Venezuela	
Central and North America	-Haiti	-Costa Rica -Dominican Republic -El Salvador -Guatemala -Honduras -Jamaica Nicaragua	-Mexico -Panama -Trinidad & Tobago	-Canada -United States

Note: Income classifications are from *World Development Report 1988.*

Table 20:--Means of Regression Variables of the Newly Industrializing Economies of East Asia

Variables	Time Period	Hong Kong	Singapore	Republic of Korea	Taiwan
GR(Y/TP)	1960-85	5.91	5.86	5.72	6.18
Y/TP	1960-85	2323	2409	923	964
(Y/TP)2	1960-85	5396329	5803281	851929	929296
I/Y	1960-85	21.18	29.24	24.30	22.92
SCHOOL	1960 & 1975	46.50	42.50	43.00	0.00
GR(TP)	1960-85	2.32	1.76	2.02	2.32
DO	1981 & 1988	7.60	5.10	4.80	NA
DY	1981 & 1988	24.40	26.20	29.40	NA
AVOP	1965-85	120.87	148.31	29.96	NA
GR(X+M)	1965-85	9.27	0.00	16.28	NA
NEWFEDER	1965-85	1120.95	0.00	487.89	NA
GR(X)	1966-85	10.24	5.59	19.75	NA
GR(M)	1966-85	8.37	6.65	12.56	NA

Note: NA stands for not available. The definition of the variables are presented below.

GR(Y/TP): annual growth rate of real GDP per capita for 1960-85
Y/TP_{60}: initial real GDP per capita 1960
$(Y/TP_{60})^2$: square of the initial real GDP per capita for 1960
I/Y: average investment share in output for 1960-85
SCHOOL: average of the proportion of relevant age group enrolled in secondary schools for 1960 and 1975
GR(TP): average annual population growth rate for 1960-85
DO: average of old age dependency ratio for 1981 and 1988
DY: average of youth dependency ration for 1981 and 1988
AVOP: average annual level of trade shares for 1960-85
GR(X+M) annual growth rate of the sum of exports and imports for 1966-85
NEWFEDER: product of AVOP and GR(X+M)
GR(EX): annual growth rate of exports for 1966-85
GR(IM): annual growth rate of imports for 1966-85
GR(M) annual growth rate of imports for 1966-85

Table 21:--Means of Regression Variables of Various Industrial Nations

Variables	Time Period	West Germany	Japan	United States	United Kingdom
GR(Y/TP)	1960-85	2.63	5.54	2.08	2.07
Y/TP	1960-85	6038	2701	9983	6370
(Y/TP)2	1960-85	36457444	7295401	99660289	40576900
I/Y	1960-85	27.63	31.46	16.97	18.03
SCHOOL	1960 & 1975	61.50	84.50	77.50	71.50
GR(TP)	1960-85	0.38	1.00	1.12	0.30
DO	1981 & 1988	14.90	7.40	11.65	15.20
DY	1981 & 1988	17.40	20.80	22.20	19.90
AVOP	1965-85	55.00	24.31	17.49	42.45
GR(X+M)	1965-85	5.69	9.86	6.05	3.70
NEWFEDER	1965-85	313.16	239.65	105.80	156.92
GR(X)	1966-85	6.39	9.60	4.16	3.87
GR(M)	1966-85	4.11	4.32	5.79	2.48

Note: The definition of the variables are presented below.

GR(Y/TP): annual growth rate of real GDP per capita for 1960-85

Y/TP_{60}: initial real GDP per capita 1960

$(Y/TP_{60})^2$: square of the initial real GDP per capita for 1960

I/Y: average investment share in output for 1960-85

SCHOOL: average of the proportion of relevant age group enrolled in secondary schools for 1960 and 1975

GR(TP): average annual population growth rate for 1960-85

DO: average of old age dependency ratio for 1981 and 1988

DY: average of youth dependency ration for 1981 and 1988

AVOP: average annual level of trade shares for 1960-85

GR(X+M) annual growth rate of the sum of exports and imports for 1966-85

NEWFEDER: product of AVOP and GR(X+M)

GR(EX): annual growth rate of exports for 1966-85

GR(IM): annual growth rate of imports for 1966-85

GR(M) annual growth rate of imports for 1966-85