Openness, Growth, and Development: Evidence from a Panel of Developing Countries

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Abstract

This paper examines the interaction between openness, growth, and development using a panel of forty-seven developing countries and five-year averages for the period, 1965-1990. Its primary objective is to determine whether there is a direct link between the level of development and openness, while controlling for the indirect effect of openness through its impact on economic growth. Using a two-equation simultaneous-equations model of development and growth and three alternative measures of openness, our findings suggest that openness has a positive influence on both economic growth and human development. We also find that while economic growth makes a positive contribution to development, the converse is not true in that the more developed a nation the slower its growth rate.

1. Introduction

Over the last several decades, the argument that the benefits of increasing per-capita GDP will "trickle down" to all segments of the community has been proven ineffective. As a result, economic growth is no longer considered universally as a final goal in and of itself, but rather as a means through which the ultimate objective of human development in terms of education, health and the overall standard of living can be reached. However, economic growth might not necessarily translate into human development as countries vary in their ability to convert income into conditions that are conducive to human development.

The newest growth strategies focus on export-promotion and outward-orientation. Development economists and international economic and development agencies now support openness, rather than isolation or import-substitution, as the method for spawning growth. Recent studies (Bahmani-Oskooee and Niroomand, 1999; Barro, 1991; Dollar, 1992; Harrison, 1996) have found support for the argument that openness exerts a positive impact on growth.

While the openness-growth nexus has received much attention in the literature, little has been done to investigate the effect of openness on human development. This paper attempts to fill his void by investigating the interaction between openness, growth, and development. Its primary objective is to determine whether there is a direct link between the level of development and openness, while controlling for the indirect effect of openness through its impact on growth.

Section 2 reviews the literature on the relationships between openness, growth and development with a view towards identifying the major factors that contribute to growth and development. Section 3 builds on the findings of Section 2 and specifies a simultaneous-equations model of growth and development and describes the data used in this study. Section 4 presents the results followed by Section 5, which summarizes this work.

2. Background

This section reviews the literature with a view towards identifying the channels through which openness affects growth and development. The section ends with a discussion of the relationship between economic growth and development.

a. Openness and Growth

Sinha and Sinha (1999) argue that openness is linked to economic growth primarily through exports. They summarize the traditional literature on the effect of exports on growth by identifying three channels of influence. First, exports generate domestic income by providing an outlet for excess supply of goods when domestic demand is low (Colombatto, 1990). Second, in the long run, exports promote technical progress and saving while improving the country's credit rating making it easier to obtain foreign loans (Krueger, 1978). Finally, policies aimed at promoting exports improve total factor productivity (Balassa, 1978).[1]

In addition to traditional theories, the new endogenous growth theory also suggests that trade policy affects long-run growth through its impact on technological change (McCallum, 1996). However, this theory does not specify whether trade policies affect growth positively or negatively. Trade could introduce new technologies that would spur growth, or it could lower the expected profits, which would decrease growth (Harrison, 1996).

The available empirical literature provides ample evidence concerning the positive effect of openness on economic growth. Barro (1991) first touched on this issue when he examined the effect of market distortions on economic growth. Market distortions are considered a measure of protectionary policies of a country, and the more open an economy, the lower the level of market distortion. Barro found that there was a statistically significant negative relationship between the level of distortions and the growth of output per capita.

[1] For a recent and comprehensive review of the empirical literature on export-led growth see Giles and Williams (2000).

Using time-series data for sixteen Latin American countries, Sinha and Sinha (1999) found that for fifteen of the countries in their sample, openness was positively related to economic growth. Bahmani-Oskooee and Niroomand (1999) found a positive long-run relationship between openness and economic growth in nineteen of the twenty-two countries they studied. Dollar (1992) found that the more outward-oriented the economy, the higher the growth rate. He constructed an index of openness based on purchasing power parity and relative prices. This is a weighted-average of the exchange rate distortions and variability indicating deviations from the optimal relative price level given the existence of non-tradable goods. Distortions are calculated as the difference between the actual price level of consumption goods and the predicted values from a regression model of the price level. This represents a measure of the protectionary policies of the economy in terms of the degree to which the domestic currency is overvalued. The lower the distortion and the lower the variation, the lower the value of Dollar's openness index thus the more outward-oriented or open the economy. Dollar found a negative relationship between his index of openness and economic growth for a cross-section of 95 developing countries, implying that the more open an economy is the faster it grows over time.[2]

Harrison (1996) examined the relationship between openness and economic growth using several measures of openness. She found that the results were sensitive to the choice of the period of study. Only one of the seven openness measures had a positive relationship with growth when pure cross-sectional, period averages were used. Better results were found when the data were averaged over five-year periods. However, the best results were found when annual data were used in that six of the seven openness variables had a positive and statistically significant relationship with economic growth.

[2] Dollar's measure of openness is but one of several alternatives used in the literature. Other measures include the share of trade in GDP, the black market premium, and indicies of trade liberalization.

b. Openness and Development

Unlike the relationship between openness and growth, little work is available on the effect of openness on development. On an intuitive level it may be argued that, whereas openness affects economic growth primarily through exports, it influences development through imports. If used efficiently, imports of capital, both physical and human, as well as technology and new ideas could enhance a country's development capacity. For example, better medical equipment and better-trained medical staff can improve the general health of the population and thus contribute to human development. Another contributing factor is efficient water treatment facilities and sewer systems. Similarly, imports of modern agriculture equipment, technical services, and farming methods can expand a nation's capacity to produce food. Openness to the exchange of scholars and students can improve the quality of education. It should be noted that some if not all of these factors also enhance the growth capacity of the economy as they represent investment in the country's social and economic infrastructure.

As far as empirical analysis of the effect of openness on development is concerned, to our knowledge the only study is by Eusufzai (1996) who found a positive correlation between these two variables. He considered several human development variables including infant mortality rate, the proportion of population with access to safe water, the United Nations' Human Development Index (HDI), and the UN's income-distribution-adjusted HDI. Eusufzai reconstructed Dollar's openness index and used it to calculate Pearson's correlation coefficients between the openness index and each development variable. He found that most of the development variables were statistically significantly correlated with the openness index in the expected direction.

While Eusufzai's work is a step in the right direction, it is open to criticism as it relies on correlation analysis, which does not control for other influences. Moreover, he did not consider the possible interaction between growth and development and thus was unable to determine the channel through which openness affects human development. Perhaps in recognition of these facts Eusufzai (1996, p. 336) suggests

that "a more rigorous econometric approach would provide a more solid footing for the evidence." This is what motivates our study, as we use a simultaneous-equations model to examine the effect of openness on growth and development while allowing for the possible interaction between economic growth and human development.

c. The Relationship between Growth and Development

With the emergence of development economics following World War II, an emphasis was placed upon the role of economic growth. The idea was that increased production would broaden the material base of the economy leading to improvements in the standard of living. Although it was realized that wealthy members of society would probably gain the most from increases in output per capita, at least in the early stages of development, it was thought that these benefits would eventually "trickle down" to the less fortunate so that in the end everyone would be better off. However, lack of evidence of such a trickle-down effect casts doubt on the growth-led development proposition.

In developing countries, despite the increase in GDP per capita, the poorest portion of the population still remains as poor, if not poorer, as the gap between the rich and the poor has broadened. The United Nations (UN Human Development Report, 1996) categorizes this type of growth in three ways: jobless growth, ruthless growth and voiceless growth. Jobless growth occurs when the overall economy grows, but the opportunities for employment do not increase. When the benefits of growth go only to the elite of the society, and the rest of the population becomes more impoverished, growth is called ruthless. Voiceless growth happens when economic growth does not increase political freedom of the population. As various examples of these types of growth emerged, the idea that growth and development are one and the same began to be challenged.

In the 1970's a distinction was made between growth and development. Economic growth remained concerned with the increase in production per capita, whereas economic development came to encompass the overall welfare of the population in terms of education,

health, nutrition, etc. As this distinction emerged, so did a debate about the relationship between the two notions. Four strands of thought have been advanced in this regard. Some contend that economic growth and economic development are unrelated, in the sense that each can exist without the other. Others argue that growth and development are highly interdependent as policies that foster growth, also enhance development. Yet others posit that economic development is the force driving economic growth. Finally, the dominant view appears to be that economic development is a direct result of economic growth, while recognizing that growth is a necessary, but not a sufficient condition for development (Mazumdar, 1996; Nafziger, 1984).

3. Model Specification and Measurement

Our aim is to investigate the effect of openness on economic growth and development while controlling for the interaction between the latter two. We specify a simultaneous-equations model in which human development and economic growth are endogenous, while openness and a number of other economic, demographic, and policy variables are exogenous.[3]

a. Development and its Key Determinants

As it became apparent in the late sixties and early seventies that GDP (or GNP) was an inadequate measure of development, several new indices of development that combined income with a number of development indicators were constructed. This campaign to find a measure that adequately described development, or the standard of living, became known as the "social indicator movement" (Tilak, 1992). In 1970, the UN published its Social Development Index, which was an attempt to measure structural changes in a country. It was based on seven indicators, including enrollment in vocational education, circulation of newspapers, consumption of energy, and foreign trade. However, it soon became evident that the index needed to look at indi-

[3] Frankel and Romer (1997) and Cyrus *et al.* (1997) study the relationship between growth and openness using a simultaneous-equation model that treats openness as endogenous. However, neither study incorporates a separate equation for development.

cators of general welfare as well. This led to the construction of the Physical Quality of Life Index by the UN's Overseas Development Council. The result was a composite index of life expectancy of infants, infant mortality, and literacy rates. Although this index was popular, it was considered too simplistic to adequately represent the level of development in a country.

From these attempts, and several others, the two most recognized development measures have emerged. The first is the Human Suffering Index (HSI), constructed by Camp and Speide in 1987. This index is based on ten indicators including GNP per capita, inflation rate, growth of labor force, growth of urban population, infant mortality rate, daily per capita calorie supply, percentage of the population with access to safe water, per capita energy consumption, literacy rate, and an index of personal freedom.

The HSI has been subjected to several criticisms the most notable of which has to do with the inclusion of the growth of urban population stemming from two competing views as to how it affects development. An increase in urban population indicates a shift away from agriculture towards more skilled labor and services, which suggests a positive relationship between urbanization and development (Fryer, 1965; Hamilton and Mills, 1984; Tilak, 1992). On the other hand, rapid growth of urban population can hinder development, as cities in less developed countries do not have adequate sanitation, employment opportunities, food supply and housing. Furthermore, the HSI merely ranks countries according to their level of human suffering relative to other countries. This ranking can be performed as easily by using each of the ten indicators separately with little difference in the results. Overall, the HSI may be considered a useful summary measure, but it is of little use for empirical research on development.

Another index is the Human Development Index (HDI) constructed by the UN Development Program, which is the most widely accepted statistical indicator of development. The HDI is constructed from three basic indicators: longevity (life expectancy at birth), standard of living (per capita real GDP), and educational attainment (adult literacy and combined primary, secondary, and tertiary enrollment

rates). Although the HDI has received criticism for not being comprehensive enough, it is the most accepted measure currently available, and thus it is the measure used in this study to proxy development. Given this choice, *we must exercise care when choosing determinants of development to avoid variables that are already incorporated into the HDI so as to reduce the likelihood of spurious correlation.* With this in mind, we consider the following as some of the major determinants of human development.

Openness: As mentioned earlier, there is no conclusive measure of openness. In this paper we alternatively use three most widely used measures. One is the ratio of trade to GDP, denoted TRADE henceforth, which is the most popular measure of openness (e.g., Bahmani-Oskooee and Niroomand, 1999). This is the sum of exports and imports divided by GDP. Based on the discussion in the previous section, we expect this to be positively related to development.

The second measure of openness is the black market premium (BMP), which indicates the overvaluation of the currency and thus the distortion away from openness. A negative relationship can be expected between the black market premium and development, as the greater the premium the greater the market distortion and thus the less outward-orientated the economy.

The final popular measure of openness is that constructed by Dollar (1992). This is a measure of the distortion and instability of the general price level. The higher this index, the greater the distortions and instability so that one expect a negative relationship between Dollar's openness index (DOI) and development.

Economic Growth: Recall that there are several competing hypotheses concerning the relationship between growth and development, ranging from the two being unrelated to being interrelated with each being a necessary condition for the other. In our empirical analysis, we measure growth in terms of the growth rate of real GDP per capita in 1985 international prices, which we denote RGDPG.

Urbanization: Fryer (1965) suggests several development criteria that are based on the demographic characteristics of the population such as the urban/rural mix. Agrarian economies are typically less

developed where a large portion of the population is concerned mainly with basic survival. The ability of the population to move to non-agrarian employment creates a push towards development. However, there is the possibility of a bi-directional causality between the two variables— As the labor force moves toward non-agrarian employment, the economy becomes more developed. At the same time, as the economy develops, it creates greater opportunities for employment in industries and services in urban areas. The uncertainty of the relationship between urbanization and development suggests that the effect of this variable is *a priori* indeterminate. In our subsequent empirical analysis, we measure this variable in terms of urban population growth rate and denote it UPOPG.

Education: Much of the literature assigns an active role to the government for establishing the foundation of development through physical and social infrastructure (Bottorf and Savitt, 1995; Schumpeter, 1934; Stiglitz, 1997). Stiglitz lists six roles for governments with respect to economic development: educational, technological, physical, environmental, financial, and social infrastructure. The UN also discusses the role of public expenditure ratio and social allocation ratio in economic development. The social allocation ratio is the percentage of GDP that is used for social programs such as education and basic health services. An increase in this ratio is expected to increase the level of development. We do not include a measure of public expenditures in our development equation, rather we include it in our growth equation based on the fact that there is significant evidence suggesting that government capital expenditures, especially infrastructure investment, are a primary determinant of growth. We do, however, include a measure of social allocation in our development equation. Our measure, denoted ED, is the ratio of government expenditures on education to GDP.

Infant Mortality: Eusufzai (1996), among others, found a negative correlation between infant mortality rate and development. The measure used in this paper is infant deaths per thousand births and it is denoted MORT.

Safe Water: Eusufzai also found a positive and statistically sig-

nificant correlation between development and the percentage of population that has access to safe drinking water. We include this variable in our development equation and label it SW.

Based on the above discussion, we specify the following development equation,

$$1)\ HDI_{it} = \alpha_0 + \alpha_1 RGDPG_{it} + \alpha_2 OPEN_{it} + \alpha_3 SW_{it} + \alpha_4 MORT_{it} + \alpha_5 ED_{it} + \alpha_6 UPOPG_{it} + u_{it}$$

Here HDI is the human development index; RGDPG is the growth rate of real GDP per capita; OPEN is set alternatively equal to one of the three measures of openness discussed above namely Dollar's openness index (DOI), trade (imports plus exports) as a share of GDP (TRADE), and black market premium (BMP); SW is the percentage of the population with access to safe drinking water; MORT is the infant mortality rate (deaths per thousand births); ED is the ratio of government expenditures on education to GDP; UPOPG is the urban population growth rate; u is a random error term; i = 1, 2, …, n is the ith country; and t = 1, 2, …,T is the time index.

b. Growth and its Key Determinants

Historically, the literature has combined the determinants of economic growth with those of development. Given that we are interested in the interaction between growth and development, we include in our growth equation some of the primary determinants of growth that do not enter the development equation, in addition to the level of development, and the degree of openness.

Investment: All theories of growth suggest that investment is an important determinant of growth (Dollar, 1992; Nafziger, 1984; UNDP, 1996; Solow, 1957). This includes not only investment by the private sector but also public infrastructure capital. In our growth equation, we include total investment, private plus public, as a percent of GDP and call it INV.

Industrialization: It is well known that the degree to which a country is industrialized is a major determinant of economic growth. We control for this factor by including a variable that measures the percentage of the labor force that is employed in the industrial sector, LIND.

Military Expenditures: Some have found that a large share of military expenditures in the government's budget has a negative impact on growth. Between 1960 and 1987, military expenditures in developing countries rose three times as fast as those in industrial nations (Bottorf and Savitt, 1995; Barro, 1991). The internal turmoil and external conflict that are usually associated with military buildups decrease the productive capacity of the economy by destroying part of its capital stock, labor force, and the infrastructure base of the nation. The most damaging, however, is the opportunity cost of these resources in terms of forgone social and physical infrastructure projects that could have been developed. To control for this possible effect, we incorporate a variable, denoted DEF, which measures the ratio of government expenditures on defense to GDP.

Population Growth: Another well-known factor that can hamper growth in developing nations is rapid population growth, which we denote POPG in our model of growth.[4]

We incorporate the above variables are incorporated in the following growth equation,

$$\textbf{2)}\ RGDPG_{it} = \beta_0 + \beta_1 HDI_{it} + \beta_2 OPEN_{it} + \beta_3 INV_{it} + \beta_4 LIND_{it} + \beta_5 DEF_{it} + \beta_6 POPG_{it} + v_{it}$$

Where INV is the ratio of real investment, public and private, to real GDP; LIND is the percentage of the labor force that is employed in the industrial sector; DEF is the ratio of government defense expenditures to GDP; POPG is the growth rate of population; and all other variables and notations are as defined previously.

[4] This negative relation between population growth and economic growth is implied by the neoclassical growth theory. The new endogenous growth theory, on the other hand, predicts that population growth can be positively related to economic growth in advanced economies.

4. Results

We estimate the model in Equations 1 and 2 using pooled cross-section/time-series data for forty-seven countries over a twenty-five year period (1965-1990) using five-year averages.[5] The data are from the United Nations Development Reports, the World Bank Social Indicators of Development database, the Penn World Table v5.6, and the Barro and Lee dataset.

We include in each equation a set of country dummy variables so that the pooled model is in effect a fixed-effect specification.[6] We estimate Equations 1 and 2 using two-stage least squares.[7] The results for the human development model (Equation 1) are reported in Table 1 and those for the growth model (Equation 2) are in Table 2. Each column of these tables shows the results for one of the three alternative measures of openness.[8]

We begin with the results in Table 1 and note that the estimated coefficients on the variables representing access to safe drinking water (SW) and infant mortality rate (MORT) have the expected signs and are statistically significant at the 1% level across all three equations.[9] Estimates of the coefficient on growth of urban population (UPOPG) are negative in all three equations and statistically significant at the 5% level or better suggesting that increased urbanization

[5] A list of the countries in the sample is found in appendix.

[6] As Wooldridge (1999) notes, the fixed-effect specification in preferred to the alternative random-effect model when there is a large number of cross-section observations relative to time periods and the cross-sectional units are not randomly drawn from a larger sample. Both of these conditions are met in the present panel—There are 47 countries and 5 time periods, and the countries are chosen based on data availability.

[7] For instruments, in addition to the exogenous variables in Equations 1 and 2, we also include a trend variable, the logarithm of government consumption spending, exchange rates, and enrollment in primary school.

[8] We do not report the estimated coefficients on the country-specific dummy variables to conserve space.

[9] When estimating the development equation with TRADE as the measure of openness (second column) we encountered a high degree of multicollinarity between TRADE and SW and MORT. We handled the problem by removing the linear influence of TRADE on each of the other two regressors prior to estimation.

hampers human development. The results concerning the effect of public expenditures on education (ED) are contrary to our *a priori* expectations as the estimated coefficient is either statistically insignificant (first two columns) or when significant, it has an unexpected (negative) sign (last column.) This may be due to the fact that public spending on education is not a good proxy for what Stiglitz (1997) calls "social allocation ratio."

Turning to the effect of growth on development, the results in Table 1 indicate that the estimated coefficient on the growth of per capita real GDP is positive regardless of the measure of openness used. However, while the point estimates are statistically significant at the 1% level when DOI and TRADE are used as measures of openness (the first two columns), it is not significant when BMP is used (last column).[10] All in all, these results provide qualified support for the general consensus that, all else the same, economic growth leads to development.

Finally, consider the effect of openness on development. Recall from the discussion in the previous section that if increased openness is to foster human development, we should find HDI to be negatively correlated with Dollar's openness index (DOI) and black market premium (BMP), while being positively correlated with the share of trade in GDP (TRADE). The results in Table 1 indicate that the estimated coefficients associated with all three of these measures have the expected signs and are statistically significant at the 10% level or better. These results lead us to conclude that openness to international trade does foster development.

Having discussed our findings concerning human development, we now turn to the estimated growth equations presented in Table 2. In all three equations, the estimate of the coefficient on the proportion of the labor force that is employed in the industrial sector

[10] The estimated equation in the last column of Table 1 appears to be markedly different from the other two equations in several ways. For example, it has the largest standard error of estimate and the lowest value of the log-likelihood function of the three equations.

(LIND) has the expected positive sign but is statistically significant only in the first and third equations. On the other hand, the estimate of the effect of military expenditures (DEF) is never statistically significant. The estimated effect of the share of private and public investment in output (INV) is positive and highly statistically significant regardless of the measure of openness employed, a finding that is consistent with the neoclassical growth theory.[11] The estimated coefficient on population growth (POPG) is negative and statistically significant at the 1% level in all equations. This, too, is consistent with the prediction of the neoclassical growth theory and the general consensus that rapid population growth has a negative impact on economic growth.

Now consider the results concerning the growth effects of the two variables of interest to us: human development and openness. As far as the former is concerned, we find that in all three equations the estimated effect is negative and statistically significance at the 1% level. The negative sign implies that as an economy develops, it experiences a reduction in its rate of economic growth. Indeed, this has been the experience of many highly developed economies, but whether one should expect the same phenomenon in early stages of development is not clear. Finally, observe that regardless of the measure used, the estimated parameter associated with openness has the expected sign and is statistically significant at the 10% level or better in all cases. This is consistent with the recent findings by Bahmani-Oskooee and Niroomand (1999), Barro (1991), Dollar (1992), and Harrison (1996), and Sinha and Sinha (1999), among others that open trade policies have a positive impact on economic growth.

[11] As in the case of the development equation, here, too, we encountered high multicollinearity when estimating the growth equation with TRADE as the measure of openness, which led us to remove the linear influence of TRADE on INV prior to estimation.

5. Summary

The empirical study presented in this paper is based on a synthesis of three different strands of research found in the literature. One is concerned with the interaction between development and growth, another deals with the effect of openness on economic growth, and the third looks at the impact of openness on development. In this paper, we used a two-equation simultaneous-equations model of human development and economic growth with each equation containing one of three alternative measures of openness as a regressor, in addition to other conditioning factors.

We found evidence suggesting that openness has a positive impact on both human development and economic growth. Both of these findings are consistent with our general understanding of the process of growth and development. We also found that while economic growth makes a positive contribution to development, the converse is not true. In fact, according to our results, it appears that development slows growth.

Our investigation can be extended in a number of ways. One would be to treat openness as an endogenous variable. As a first step, one might wish to employ the specification used by Frankel and Romer (1997) and Cyrus *et al* (1997) to endogenize openness.

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• The views expressed in this paper are solely those of the authors' and do not necessarily reflect those of the USAID.

Appendix: Countries in the Sample

Argentina
Bangladesh
Benin
Bolivia
Botswana
Brazil
Chile
Costa Rica
Dominican Republic
Ecuador
Egypt
Ghana
Guatemala
Haiti
India
Indonesia
Iran
Iraq
Jordan
Kenya
Lesotho
Malaysia
Mexico
Nepal
Nicaragua
Niger
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Rwanda
Saudi Arabia
Sierra Leone
Singapore
Somalia
Sri Lanka
Tanzania
Thailand
Togo
Trinidad & Tobago
Turkey
Uruguay
Venezuela
Zaire
Zambia

TABLE 1
Two-stage Least Squares Estimates of Human Development Index, HDI Using Alternative Measures of Openness Five-year Averages for 47 Developing Nations 1970, 1975, 1980, 1985, 1990 (absolute value of t-ratios in parentheses)

	OPEN=DOI	OPEN=TARDE	OPEN=BMP
Constant	0.7699 (20.8266)***	0.4748 (20.4939)***	0.8153 (19.8039)***
SW	0.0023 (7.2005)***	0.0019 (5.9544)***	0.0019 (5.2699)***
MORT	-0.0039 (17.8277)***	-0.0038 (17.3614)***	-0.0040 (16.7793)***
ED	-0.0467 (0.0987)	0.09843 (0.1984)	-0.9388 (1.8552)*
UPOPG	-0.0134 (3.5466)***	-0.0164 (4.1539)***	-0.0084 (1.9951)**
RGDPG	2.4094 (7.1480)***	2.5590 (6.6680)***	0.0482 (0.1408)
OPEN	-0.0009 (5.8153)***	0.0004 (2.6814)***	-0.0101 (1.6753)*
σ	0.0942	0.0951	0.1046
LLF	225.8102	218.8975	201.1279

******* **Significant at the 1% level**
****** **Significant at the 5% level**
***** **Significant at the 10% leve**

GLOSSARY:
RGDPG = real GDP per capita five year growth rate (in 1985 international prices).
LIND = percentage of the labor force that is employed in the industrial sector.
DEF = ratio of total government expenditures on defense to GDP.
INV = public and private investment share of GDP (in 1985 international prices).
POPG = growth rate of population.
HDI = Human Development Index.
OPEN = one of the three measurements of openness:
DOI = re-constructed Dollar Openness Index (in 1985 international prices).
TRADE = export plus imports as a percentage of GDP.
BMP = black market premium [(Black market rate/official rate)-1].

TABLE 2
Two-stage Least Squares Estimates of Growth of Real GDP per capita, RGDPG Using Alternative Measures of Openness Five-year Averages for 47 Developing Nations 1970, 1975, 1980, 1985, 1990 (absolute value of t-ratios in parentheses)

	OPEN=DOI	OPEN=TARDE	OPEN=BMP
Constant	0.1370 (6.1736)***	0.0672 (4.3701)***	0.0495 (2.861)***
LIND	0.0081 (5.9853)***	0.0005 (1.0566)	0.0016 (2.7283)***
DEF	-0.0435 (0.8278)	0.001 (0.0274)	-0.0647 (1.2333)
INV	0.7532 (6.8593)***	0.2259 (4.7490)***	0.2453 (4.7958)***
POPG	-0.0282 (5.6964)***	-0.0105 (2.9076)***	-0.0101 (2.5541)***
HDI	-0.6021 (6.3992)***	-0.0828 (2.9440)***	-0.1326 (3.5876)***
OPEN	-0.0001 (1.7323)*	0.0002 (4.0925)***	-0.0079 (3.6562)***
σ	0.0396	0.0386	0.0418
LLF	429.2090	426.1500	416.8953

*** **Significant at the 1% level**
** **Significant at the 5% level**
* **Significant at the 10% level**

GLOSSARY:
RGDPG = real GDP per capita five year growth rate (in 1985 international prices).
LIND = percentage of the labor force that is employed in the industrial sector.
DEF = ratio of total government expenditures on defense to GDP.
INV = public and private investment share of GDP (in 1985 international prices).
POPG = growth rate of population.
HDI = Human Development Index.
OPEN = one of the three measurements of openness:
DOI = re-constructed Dollar Openness Index (in 1985 international prices).
TRADE = export plus imports as a percentage of GDP.
BMP = black market premium [(Black market rate/official rate)-1]