

# Trade, Openness, and Economic Growth

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**\*\*\* *This is a working paper* \*\*\***

## **Trade, Openness, and Economic Growth**

The impact of trade on economic performance remains a contentious topic. There are sizable segments of both free traders and protectionists in both major political parties. The experience of the last two decades would appear to reinforce the free trade position. Since 1982, the size of the trade sector (exports + imports as a share of GDP) has approximately doubled. Imports have increased more rapidly than exports and the U.S. is now running a sizable trade deficit. The rapid growth of trade and expansion in the size of the trade deficit have been associated with solid economic growth, an increase in employment of 35 million, and a reduction in the unemployment rate to a 30-year low. These figures are inconsistent with the protectionist position that trade is harmful to the economy and that imports (and trade deficits) lead to job losses and reductions in employment. Despite this, the protectionist position continues to enjoy considerable credibility among political leaders and in the media.

However, protectionism has little support among economists. Surveys indicate that more than 80 percent of all economists favor free trade and believe that it enhances economic prosperity. Very few other issues attract this level of agreement. Moreover, both the *Economic Report of the President* and the Congressional response issued by the Joint Economic Committee have generally been supportive of free trade in recent years.

This paper uses cross-country data to analyze the impact of open international markets on per capita income and economic growth. Section I briefly analyzes the economics of international trade. Section II analyzes the factors underlying cross-country variations in the size of the trade sector. Section III uses the estimates for the actual size of the trade sector relative to the expected, as well as data for tariffs, black-market exchange rate premiums, and restrictions on capital movements to develop a Trade Openness Index (TOI) covering 97 countries and four time periods (1980-82, 1985-87, 1990-92, and 1995-97). The final section uses the Trade Openness Index to analyze the impact of openness over a lengthy period of time on per capita income and economic growth.

### **I. Trade, Income, and Economic Growth**

Economists stress the importance of the law of comparative advantage. According to this law, trade is mutually advantageous and makes it possible for trading partners to produce a larger output than would otherwise be the case. With exchange, the trading partners are able to specialize in those economic activities they do best — those for which they are a low-cost producer. When each specializes in this manner, they are able to focus more of their resources on producing things that they do well, and, as a result, derive mutual gain from the production of a larger joint output.

Most people recognize these factors when considering the impact of trade on the income level and welfare of individuals and regions. For example, most recognize that it makes sense for an architect or a teacher to hire an electrician to deal with electrical problems. The architect and the teacher will be better off using their time to do those things they do best (developing engineering plans and teaching) and then allocating the income derived from these activities to pay for the electrical services. Correspondingly, most recognize that the residents of Florida and

Nebraska, for example, will be able to produce a larger joint output and derive mutual gains when Nebraskans specialize in the production of wheat and other grain products and Floridians specialize in the production of oranges and other citrus products. This specialization will make it possible for both to generate a higher level of income.

The same is true for nations. It does not make sense for the residents of a nation to attempt to produce all, or even most, products domestically. Like the architect, teacher, Nebraskans and Floridians, people in different nations will be better off if they specialize in the production of those goods and services that they are able to produce at a low cost, while trading for those items for which they are high-cost producers. Open markets will direct participants to specialize in precisely this manner. When a domestic firm is a low-cost producer, the supplier will be able to compete quite effectively. On the other hand, high-cost producers will find it very difficult to compete in the global marketplace. Thus, markets tend to direct the resources of a nation towards the production of those things that they do best.

The issue is never whether a good should be produced domestically or abroad. It is always about how the domestic resources are going to be used. As more domestic resources are utilized to produce those items that can be produced domestically at a low cost, a nation will be able to produce a larger output level and achieve a higher standard of living.

International trade may also improve the performance of an economy by promoting the dissemination of innovative products and production processes. Economic growth increasingly involves brainpower, innovation, and the application of technology. Observation of, and interaction with, individuals employing different technologies often induces others to emulate successful approaches. Trade across geographic areas and national boundaries is also likely to encourage modifications that improve the original technology and/or make it more suitable for the local area. Therefore, the dissemination and development of innovative ideas and new technologies is enhanced by international trade.

Summarizing, there are good reasons to believe that more open economies will grow more rapidly and achieve higher income levels than those with substantial barriers that retard trade. Of course, other factors such as the security of property rights and the stability of monetary policy will also influence economic growth and prosperity. As we proceed, we will investigate the relationship between trade openness and economic growth. We will consider the potential indirect effects of trade, as well as its more direct effects.

## **II. The Determinants of the Size of the Trade Sector**

Even from within a free market where participants are able to choose their activities freely and exchange goods without governmental distortion (taxes, tariffs, quotas, regulations or other standards of manufacture to name a few), there are structural differences among nation-states that change the expected level of international trade toward which a country gravitates. Gravity models have been used in empirical international trade analysis extensively. The standard model attempts to estimate the flow of trade between two countries with such variables as the distance between the two trading partners, the relative size of each economy, and the

physical size of their respective nation-states. EQ-1 demonstrates the standard form of the Gravity model used in international trade.

$$\text{EQ-1: } trade_{i \leftrightarrow j} = f(GDP_i, GDP_j, Dist_{i,j}, pop_i, pop_j, area_i, area_j)$$

The larger a country, by either a physical or population measure, the greater the opportunity for economies of scale and/or comparative advantage to exist (within its own borders). This would suggest that two elements of structural importance for trade would be both population and physical area.

Given the transactions cost involved with overland versus ocean-bound transport, countries with coastline possess a natural advantage relative to those that are landlocked. Countries with sizable allotments of coastline possess a greater opportunity to exploit lower cost trade with other nation-states. This would suggest that the kilometers of coastline (as it interacts with the physical size of the economy) might also be a structural factor that will influence the size of the trade sector.

$$\text{EQ-2: } trade_{i \leftrightarrow j} = f(GDP_i, GDP_j, Dist_{i,j}, pop_i, pop_j, area_i, area_j, coastline_i, coastline_j)$$

The issue of *natural highways* (navigable waterways) was addressed by the authors, but the data set that developed was fraught with discontinuities in the assumptions of what "navigable" meant<sup>1</sup>. For a litany of reasons, navigable waterways were omitted from consideration as a structural element in determining the size of the trade sector for any given economy.

The authors sought to create a measure which would serve as a gauge of demand external to any given nation-state's economy incorporating the increasing costs for exchange that distance introduces. Utilizing data that is both cross-sectionally and longitudinally real, the real PPP GDP for countries that make up more than 99% of the world's GDP were used in conjunction with the great-circle algorithm to create the Distance Adjusted Demand Scalar (*DADS*).<sup>2,3,4</sup>

<sup>1</sup> 'Navigable' was defined by a variety of criteria: by variable draft craft (water depths), for a variable number of months (some rivers are navigable only during the rainy season), etc. Further, the fact that rivers are continually being deepened (and thus made navigable) and/or incorporated into reservoirs behind dams or other physical structures makes this seemingly structural variable exceptionally subjective, time-series, and most importantly, policy oriented.

<sup>2</sup> The data used was collected from a number of sources that include the World Bank (*World Development Index 1999*), the Penn World Table (vrs. 5.6a), the International Monetary Fund (*International Financial Statistics Yearbook*, various editions), OECD (*Economic Outlook*, 4/1999), and Central Intelligence Agency (*Handbook of International Economic Statistics*, 1998). The data are PPP and in constant 1998 US dollars. To eliminate the effects of business cycles,  $GDP_n$  values are smoothed over a three year period (e.g.  $GDP_t = (GDP_t + GDP_{t+1} + GDP_{t+2})/3$ ). In order to combat general non-stationarity issues, the data was de-trended.

<sup>3</sup> The great circle algorithm finds the shortest distance between two points on a sphere (around the outside surface). It is commonly applied in the gravity model literature for measurement of the  $DIST_{i,j}$  variable. Also commonly accepted is the use of the nation-state's capital as the point from which to measure distances; with only a few exceptions, this is how the authors of this study progressed. There were a few countries, like Canada and China with large mass and a capital located in a position that misrepresents its economic center (if indeed population centers are a better measure). In a few cases, a more 'central' metropolitan community of significant size was chosen. Also, in

$$\text{EQ-3: Distance Adjusted Demand Scalar } DADS_i = \sum_{j=1}^{N(j \neq i)} \left( \frac{GDP_j}{Dist_{i,j}} \right)$$

The DADS provides an estimate for how close each country is to the mass of the world's GDP. This scalar will be large for countries that are located close to centers of world demand. This is in contrast to countries that are located far from major GDP concentrations. Exhibit 1 shows the largest and smallest DADS for the data set of 97 countries that are used later in this study for the analysis of the effects of openness on growth and income.<sup>5,6</sup> The demand scalar analysis indicates that several European countries (Luxembourg, Belgium, Netherlands, etc.) are located most favorably relative to the distribution of the world's GDP. In contrast, the United States, New Zealand, Australia, Fiji, and Argentina are least favorably located relative to the concentrations of demand around the world.

In a bilateral analysis (the most common application of the gravity model) data are introduced country-by-country using a functional form like EQ(s) 1-2. After every country in such an analysis is paired with each of the remaining nation-states, the estimated size of the trade sector is summed from its estimated parts. The authors of this study simplify EQ-2 to reflect those factors that most directly effect the size of the trade sector for country  $i$ , and substitute DADS in for  $GDP_j$ .

$$\text{EQ-4: } trade_i = f(GDP_i, DADS_i, pop_i, area_i, coastline_i)$$

The result is a modified gravity model for international trade using aggregated measures instead of bilateral pairings. The aggregated model has fewer data constraints and thus allows for a greater number of nations to be included. Using data collected from more than 99% of the world's measured output, this initial approach for the estimation of size of the trade sector delivers notable statistical results.

Moving  $GDP_i$  to the left-hand side of the EQ-4 yields the basic structural form of the trade-share estimation model.

$$\text{EQ-5: } \frac{trade_i}{GDP_i} = f(DADS_i, pop_i, area_i, coastline_i)$$

Using only fundamental structural variables, the authors of this study are able to explain 55 percent of the variation in the size of the trade sector. This can be seen in exhibit 2 (equation

a few cases the capital cities of two countries were within a very short distance of each other skewing the DADS measure considerably. In these cases, a central metropolitan community of reasonable size was chosen.

<sup>4</sup> The denominator of the DADS equation uses a square root transformation of the  $dist_{i,j}$  variable. This transformation was chosen to reflect diminishing increasing costs to distance for international trade.

<sup>5</sup> DADS is calculated using data from 160 to 190 countries (depending on the time period) using time series data from 1975 – 1997.

<sup>6</sup> Appendix A-1 includes DADS values for each of the 97 countries in the principle data set for 1980-2, 1985-7, 1990-2, and 1995-7.

1). Using a linear regression analysis, and data for the 88 countries of the sample for which we had complete time series data (from 1975-1997), all of the structural elements of EQ-5 are significant and have the expected sign.<sup>7</sup> Signs for both land-area and population are both negative, reinforcing the theory. Larger countries (by either population or geographic size measures) possess greater opportunities for economies of scale and comparative advantage to exist within their own borders. Signs for DADS and coastline are both positive, as theory would suggest. The greater the opportunities for ocean-bound transport, the lower the transactions cost of exchange for those most distant demand opportunities. The positive sign on DADS suggests that proximity to demand matters. If a nation-state is located amongst large demand economies (like central Europe) their opportunities for fruitful and cost-efficient exchange are more plentiful than a more economically remote economy (like New Zealand) where almost any international exchange necessarily includes the cost of long-distance transport.

When EQ-5 is analyzed by time period, the results are similar. Exhibit 3 shows EQ-5 for each of the respective 5-year time periods<sup>8</sup>. DADS, area, and working population are each significant across time periods<sup>9</sup> and have the expected sign. The coastline variable maintains its expected sign but is significant in only half of the time periods. The rigor of this model, even by time period (a smaller sample), suggests that it has merit for predicting significant variation in the size of the trade sector. The adjusted R-squared falls in later time periods reflecting a possible change in the way goods are sold in the most recent past. The innovations of the information age and the movement toward more encompassing free trade zones may be reducing the fundamental transactions costs to international exchange.

Mature economies often produce and consume more services. This may reduce the size of the trade sector as a share of the economy. Most services are not traded internationally, as a result, the model may over-estimate the expected size of the trade sector for a mature economy. The inclusion of the per capita income measures is designed to adjust for this potential problem.

$$\text{EQ-6: } \frac{\text{trade}_i}{\text{GDP}_i} = f(\text{DADS}_i, \text{pop}_i, \text{area}_i, \text{coastline}_i, \text{percap}_i)$$

The results from this analysis are seen in exhibit 2 (equation 2). The results show that as income rises, so does the size of the trade sector, but for higher income economies (per capita income squared) the combined effect of the two variables is negative. Despite the fact that the newly included variables are each significant and have the expected sign, the adjusted R-squared does not change significantly.

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<sup>7</sup> Note that in appendix A-2 the same analysis is done for the complete set of data for which all observations are available (including for those variables in equations 1-4). The data of exhibit A-2 will be used later in the construction of the Trade Openness Index (1980-1997).

<sup>8</sup> Note that in appendix A-3 the same analysis is done for the complete set of data for which all observations are available.

<sup>9</sup> Each are significant across time periods with the exception of DADS in 1995-7.

Introducing major categories of policy tools (like tariff, black market exchange rate premium, and capital market restriction measures) can add to the explanatory power of a model estimating cross-country variations in the size of the trade sector.<sup>10</sup>

$$\text{EQ-7: } \frac{\text{trade}_i}{\text{GDP}_i} = f(\text{DADS}_i, \text{pop}_i, \text{area}_i, \text{coastline}_i, \text{tar}_i, \text{bmkt}_i, \text{cap}_i)$$

Exhibit 2 (equation 3) shows the analysis of the functional form found in EQ-7. Higher ratings for the tariff and capital market restriction variables are indicative of a less intrusive tariff policy and more liberal capital markets. Because these should enhance the size of the trade sector, their expected sign is positive. When exchange rate controls are absent, the black market in foreign exchange will be eliminated. As the black market exchange rate premium increases, this is indicative of more restrictive exchange rate controls, which will reduce the size of the trade sector. Thus the expected sign for the black market premium variable is negative. Each of the elements of EQ-7 is statistically significant and has the expected sign.<sup>11</sup> When the 3 policy variables are incorporated into EQ-5, the R-squared increases to .63. This indicates that the basic structural model (EQ-5) plus the variables reflecting tariff policy, capital market regulation, and exchange rate controls (EQ-7) explains 63% of the variation in the size of the trade sector across 88 countries over a 22 year time period.

In order to test the maturing economies hypothesis related to services distorting the product mix and thus the predicted trade share of the economy, the per capita income variables are added to EQ-7.

$$\text{EQ-8: } \frac{\text{trade}_i}{\text{GDP}_i} = f(\text{DADS}_i, \text{pop}_i, \text{area}_i, \text{coastline}_i, \text{percap}_i, \text{tar}_i, \text{bmkt}_i, \text{cap}_i)$$

Numerous factors influence the openness of an economy. Tariffs restrain international trade by artificially increasing the prices of foreign goods and resources relative to those produced domestically. Quotas restrain the quantity of foreign goods that can be imported. When tariffs and quotas reduce imports, they limit the ability of foreigners to acquire the currency necessary to purchase a nation's exports. Thus, trade barriers that reduce imports will simultaneously reduce exports. Exchange rate controls can also be a major deterrent to trade. If a nation's currency is not convertible, it will be difficult for domestic citizens to acquire the foreign exchange required for the purchase of goods abroad. Furthermore, foreigners will be reluctant to accept a nonconvertible currency. Therefore, like tariffs and quotas, exchange rate controls will restrain international trade.

<sup>10</sup> The tariff and capital market restriction data were collected from *Economic Freedom of the World*, various issues. These figures are scaled from 0 to 10. The black-market exchange rate premium data were collected from Currency Data and Intelligence, Inc., *World Currency Yearbook*, (various issues). These figures were scaled and then logged in order to preserve differences in small premiums while discounting the differences in the most extreme outliers.

<sup>11</sup> Note that in appendix 2 the same analysis is done for the complete set of data for which all observations are available (including for those variables in equations 1-4).

Many countries either prohibit foreigners from undertaking domestic investments or require governmental approval before such investments can be undertaken. Various types of capital market regulations may also limit investments abroad. In addition, regulations may make it difficult for foreigners to establish marketing and distribution networks.

Exhibit 2 (equation 4) shows the results of the analysis of EQ-8. As the per capita measure is highly correlated with 2 of the policy variables (tariffs and black market exchange rates), they no longer yield the expected results. The signs for the per capita variables are inverted and only one of the two per capita measures is significant. This is a common problem in aggregated macro models (not to mention time-series cross-sectional data).

When EQ-7 is analyzed by time period, the results are similar. Exhibit 4 shows EQ-7 for each of the respective 5-year time periods<sup>12</sup>. The results are more modest. Only area, working population, and the black market exchange rate measures are significant across time periods and have the expected sign. The tariff measure is significant for the first of the three time periods, but the relationship (couched in this model) is less significant in the last decade. The adjusted R-squared for this model ranges between .62 and .70 – a robust relationship – and suggests that the elements of this analysis help determine a substantial degree of the fluctuations in the size of the trade sector, irrespective of time period. It is upon these results that the Trade Openness Index (TOI), possessing each of EQ-7's regressors, is founded.

### III. Derivation of a Trade Openness Index

Building on the model of the prior section, we constructed a Trade Openness Index (TOI), designed to capture the effects of policies that reduce the size of the trade sector. The TOI has four general components: (a) tariff rates, (b) the black-market exchange rate premium, (c) restrictions on capital movements, and (d) the actual size of the trade sector compared to the expected size.

There are three dimensions to the tariff rating: revenue derived from taxes on international trade as a share the trade sector, the mean tariff rate, and the standard deviation of tariff rates. These data were assembled for as many countries as possible. Higher ratings were assigned to countries with smaller revenues from taxes on international trade as a share of the trade sector, lower mean tariff rates, and a smaller standard deviation of tariffs. The data for each of these three dimensions were transformed to a 0-10 scale that reflects the actual data.<sup>13</sup>

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<sup>12</sup> Note that in appendix A-4 the same analysis is done for the complete set of data for which all observations are available.

<sup>13</sup> Countries that did not impose taxes on international trade and therefore had no revenues from this source were given a rating of 10. For most countries, the revenue from taxes on international trade was less than 15 percent of the trade sector (exports + imports). As international trade tax revenues increase from 0 to 15 percent, the assigned rating declines from 10 to 0. If international trade tax revenues were 15 percent or more of the trade sector, the country was assigned a rating of 0. The same procedure was utilized to transform the data for mean tariff rates and the standard deviation of tariffs to a 0-10 scale. In order to avoid distortion of the distribution, a few extreme observations were capped. This procedure generates a 0-10 distribution that coincides with that of the actual data. See James Gwartney and Robert Lawson, *Economic Freedom of the World: 2000 Annual Report*, (Vancouver: Fraser Institute, 2000) or visit <http://www.freetheworld.com> for additional details.

The size of the black-market exchange rate premium is indicative of the restrictiveness of exchange rate controls. A high black-market premium is indicative of tight restrictions on the convertibility of a currency. Thus, countries with higher black-market premiums were assigned lower ratings. The average of the black-market premiums during each three-year period (1975-77, 1980-82, 1985-87, 1990-92, and 1995-97) was used to assign the rating.<sup>14</sup>

The capital market restriction ratings are from Economic Freedom the World. Descriptive information on capital market restrictions supplied by the International Monetary Fund were used to place countries in various categories and assign 0 to 10 ratings. The greater the restrictions on capital movements into and out of the country, the lower the country's rating.<sup>15</sup>

The fourth component of the TOI is the actual size of the trade sector compared to the expected. The expected size of the trade sector is adjusted for country size (working age population and area), locational characteristics (miles of coastline and the Distance Adjusted Demand Scalar), and world GDP. Data from the larger data set in Appendix A-2 were used with EQ(s) 5&6 to determine whether the actual size of the trade sector exceeded or fell short of its expected size. The residuals from both models (EQ(s) 5&6) were weighted equally and used to assign the 0 to 10 ratings for this component. The larger the actual size of the trade sector relative to the expected, the higher the country's rating.

The ratings for each of these four components — tariffs, black-market exchange premiums, capital market restrictions, and the actual size of trade sector relative to the expected — are used to derive the TOI for 1980-82, 1985-87, 1990-92, and 1995-97. The data permitted derivation of the TOI for all 4 periods for 97 countries. These TOI figures are presented in the Appendix (Exhibit A-5). The TOI figures for each of the four time periods during 1980-1997 were averaged and used to derive the TOI (1980-1997) for the entire period. Exhibit 5 presents these figures and uses them to rank the openness of the 97 countries in our study.

#### **IV. The Impact of Openness on GDP and Economic Growth: An Empirical Analysis**

It takes time for markets to adjust to changes in the openness of an economy. It also takes time for a change in policy to acquire credibility. Initially, decision-makers may be unsure whether a policy change is temporary or permanent. Until credibility is acquired, the response of traders, entrepreneurs, investors, and other decision-makers will be limited. As a result of these factors, the year-to-year relationship between openness and economic growth is likely to be a loose one.

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<sup>14</sup> The data for the black-market exchange rate premium are from Currency Data and Intelligence, Inc., *World Currency Yearbook*, (various issues).

<sup>15</sup> If domestic investments by foreigners and foreign investments by citizens are unrestricted, the country is given a rating of 10. When these investments are restricted only in a few industries (for example banking, defense, and telecommunications), countries were assigned a rating of 8. When investments are permitted, but regulatory restrictions slow the mobility of capital, a country is given a rating of 5. When either domestic investments by foreigners or foreign investments by citizens require approval from government authorities, a country receives a rating of 2. A 0 rating is assigned when both domestic investments by foreigners and foreign investments by citizens requires government approval. See *Economic Freedom the World: Annual Report 2000* for additional details.

As policies of openness persist, decision-makers will eventually be convinced that the more liberal policies can be counted on to persist in the future. As this happens, the adjustments stressed by economic theory will come into play. Trade will increase and resources will begin to move toward the production of goods and services that can be supplied domestically at a low cost and away from those that can be supplied only at a high cost. In addition, trade will stimulate innovation and the adoption of ideas that have been successful elsewhere. Therefore, economies that are open over lengthy time periods should achieve more rapid growth rates and higher levels of per capita GDP than those that are persistently closed.<sup>16</sup>

Data required for the derivation of the Trade Openness Index in 1980-82, 1985-87, 1990-92, and 1995-97 were available for 97 countries. The average of the index for these four periods was derived and the countries arrayed from high to low. Countries with persistently high TOI ratings would rank at the top, while those with persistently low ratings would be at the bottom. Exhibit 6 lists the countries with the 12 highest and 12 lowest average TOI ratings during 1980-1997. Hong Kong, Singapore, Belgium, Panama, Luxembourg, and Germany head the list; the United States ranks seventh, tied with the United Kingdom and the Netherlands. In contrast, the least open economies—Myanmar, Bangladesh, Sierra Leone, Burundi, Iran, Uganda, and Syria—persistently followed policies that restricted trade.

If trade makes a difference, the countries with persistently high openness ratings should have higher levels of income and grow more rapidly than those with persistently low ratings. As Exhibit 6 shows, this was indeed the case. The GDP per person of the 12 most open economies in 1997 averaged \$23,730—eight times the average of \$2,783 for the 12 least open economies. The 12 most open economies grew, on average, 2.3 percent a year during 1980-97, compared to *minus* 0.3 percent a year for the 12 least open economies. The striking differences in both the income levels and growth rates suggest that openness make a difference.

Exhibit 7 illustrates the impact of trade openness on real per capita GDP and economic growth for a broader range of countries. Countries were ranked from highest to lowest based on their TOI (1980-1997) rating and the distribution was divided into quartiles. The top group was comprised of the 24 countries with the highest TOI (1980-1997) ratings, the second group the 24 countries with the next highest ratings, and so on. As Exhibit 7 (top frame) shows, the quartile with the highest TOI ratings had an average per capita GDP of \$21,285, more than twice the level of the second-highest quartile. In turn, the average per capita income of the second quartile was nearly twice that of the third quartile. The quartile of countries with the lowest ratings also had the lowest average levels of income.

The bottom frame of Exhibit 7 illustrates the relationship between the TOI (1980-1997) rating and the annual growth rate of GDP during the same period. The top quartile of countries with the highest TOI ratings achieved an average annual growth rate of 2.4% during 1980-1997.

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<sup>15</sup>For an excellent analysis of the relationship between international trade in economic growth, see Jeffrey A. Frankel and David Romer, "Does Trade Cause Growth?," *American Economic Review*, June 1999.

The GDP growth of the next quartile of countries averaged 1.7%. The average growth rates of the two lowest quartiles were 0.6% and 0.3%, respectively.

Exhibits 6 and 7 indicate that there is a positive relationship between trade liberalization as measured by the TOI index and per capita real GDP and its growth. However, this simplified analysis does not provide information on the statistical significance of the relationships. Neither does it reveal whether openness exerts an independent impact. We now turn to an investigation of these issues.

Economic theory indicates that factors other than openness will also influence the income levels and growth rates of countries. The security of property rights and stability of monetary policy are two additional factors that are likely to influence economic performance. Measures of cross-country differences for these two variables were developed for 94 of the 97 countries in our study. The monetary stability variable is simply the standard deviation of inflation rate for five-year periods ending in 1980, 1985, 1990, and 1995.<sup>17</sup> The property rights variable is from a *Country Risk Guide* survey. This survey tabulates the information supplied by experts familiar with conditions in various countries around the world. In the property rights area, the survey provides information for three key indicators: (1) risk of confiscation, (2) risk of contract repudiation, and (3) the presence of rule of law. The views of survey participants might be influenced by a country's rate of growth and other indicators of economic performance. In order to minimize bias from the source, we used the first available ratings that could be obtained from the early 1980s.<sup>18</sup>

Exhibit 8 presents the results of regression analysis that include the variables for standard deviation of the inflation rate and the security of property rights, as well as TOI (1980-1997). Exhibit 8, equation 1 shows the simple relationship between the TOI measure of openness and real per capita GDP. The results illustrate that the relationship between a country's average TOI rating during 1980-97 and the country's 1997 per capita GDP is positive and highly significant. The R-squared indicates that this variable alone explains 56 percent of the variability in 1997 per capita GDP among our 97 countries. Exhibit 8, equation 2 includes the inflation variability and property rights variables in the model. Both of these variables are significant at the 90% level or higher. The TOI measure of openness remains highly significant ( $t = 5.04$ ). The R-squared indicates that the three variables of this simple model explained 71% of the cross-country variation in per capita GDP.

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<sup>17</sup>The following formula was used to determine the 0-to-10 scale rating for each country:  $(V_{\max} - V_i) / (V_{\max} - V_{\min})$  multiplied by 10.  $V_i$  represents the country's standard deviation of the annual rate of inflation during the last five years. The values for  $V_{\min}$  and  $V_{\max}$  were set at zero and 25 percent, respectively. This procedure will allocate the highest ratings to the countries with least variation in the annual rate of inflation. A perfect 10 results when there is no variation in the rate of inflation over the five-year period. Ratings will decline toward zero as the standard deviation of the inflation rate approaches 25 percent annually. The rating distribution will be the image of the actual data except for the cropping of a small number of extremely high observations. See James Gwartney and Robert Lawson, *Economic Freedom of the World: 2000 Annual Report* or visit <http://www.freetheworld.com> for additional details.

<sup>18</sup> The property rights variable is the area rating for 'Legal Structure and Property Rights' from Gwartney and Lawson, *Economic Freedom of the World: 2000 Annual Report*. The data used to construct this rating are from PRS Group, *International Country Risk Guide* (various issues).

Exhibit 8 also analyzes the impact of openness, price stability, and secure property rights on variations in growth rates. Exhibit 8, equation 3 looks at the simple relationship between the TOI measure of openness and the growth rate of real per capita GDP during 1980-97. The t-ratio for the TOI is highly significant and the R-squared indicates that openness explains 15 percent of the cross-country variation in growth. Some have argued that high-income countries are more likely to be open and that they also grow more rapidly. If this were the case, the observed positive relationship between openness and growth would be spurious. In order to provide insight on this issue, per capita GDP from the beginning the period was incorporated into the model. As Exhibit 8, equation 4 shows, the TOI remains significant even when per capita GDP from the beginning of the period is included as an independent variable.

Exhibit 8, equation 5 includes the variability of inflation and property rights variables, along with openness and per capita GDP from the beginning of the period in the model. All of the variables have the expected sign and are significant at the 95% level of confidence or higher. This indicates that even after accounting for the impact of cross-country differences in variability of inflation, security of property rights, and income at the beginning the period, the TOI measure of openness continues to exert a statistically significant impact on long-term growth. The four variables in the model of Exhibit 8, equation 5 explained 33 percent of the variation in cross-country growth rates during 1980-97. The coefficient for per capita GDP from the beginning the period is negative and significant in the more comprehensive model (Exhibit 8, equation 5). The negative sign indicates that, other things constant, countries with lower incomes at the beginning of the period grew more rapidly than those with higher incomes. This is consistent with the convergence hypothesis.

The size of the openness coefficient fell when the inflation and property right variables were added to the model. This indicates that the more open economies also follow policies that are more consistent with price stability and the maintenance of secure property rights. To some degree, this may reflect an indirect impact of openness. When an economy is open — and both labor and capital are free to enter and exit — policymakers have a strong incentive to establish an environment that is attractive for investment in physical capital, education, and technology. Failure to do so will result in low investment rates, capital flight, and a "brain drain." Thus, in addition to its direct effects, openness indirectly promotes growth by encouraging the adoption of sound policies in other areas.

## **Conclusion**

The results presented here indicate that the economies that are more open over lengthy periods of time grow faster and achieve higher per capita income levels than economies that are more closed. Openness continues to exert a positive and statistically significant impact on both growth and per capita income even after differences in the variability of inflation and the security of property rights are taken into account.

### **Exhibit 1: Distance Adjusted Demand Scalar (DADS)**

*(Using square-root transform on the distance measure for diminishing increasing costs attributable to increased distance in international exchange)*

**DADS 1995-7  
Top 10**

Luxembourg	401.7
Belgium	389.3
Netherlands	367.1
Switzerland	348.5
France	327.6
Austria	326.9
Denmark	321.4
Hungary	319.9
United Kingdom	318.5
Germany	317.7

**DADS 1995-7  
Bottom 10**

Mauritius	196.4
Uruguay	195.4
South Africa	189.7
Brazil	187.0
Chile	185.1
Argentina	183.8
Fiji	181.9
Australia	177.5
New Zealand	172.1
United States	167.1

## Exhibit 2: Determinants of the Size of the Trade Sector: A Panel Analysis

Dependent Variable				
Log of Trade Sector as a Share of GDP				
<i>(t-statistic is in parenthesis)</i>				
	(1)	(2)	(3)	(4)
<b>DADS</b>	.002 (4.35)*	.001 (2.98)*	.001 (1.86)***	.001 (3.31)*
<b>Log of area</b>	-.135 (9.45)*	-.133 (9.27)*	-.122 (9.33)*	-.120 (9.30)*
<b>Log of working population</b>	-.120 (6.75)*	-.119 (6.74)*	-.114 (7.0)*	-.120 (7.41)*
<b>Log of world GDP</b>	.350 (3.73)*	.349 (3.62)*	.138 (1.56)	.137 (1.54)*
<b>Coastline</b>	.003 (3.59)*	.002 (2.96)*	.002 (2.39)**	.002 (3.12)*
<b>Per capita income</b>		.022 (2.44)**		-.027 (2.92)*
<b>Per capita income<sup>2</sup></b>		-.001 (2.00)**		.0004 (1.27)
<b>Tariff measure</b>			.056 (6.0)*	.075 (7.28)*
<b>Black market measure</b>			-.058 (5.04)*	-.056 (4.81)*
<b>Capital measure</b>			.015 (2.01)**	.028 (3.53)*
<b>Intercept</b>	.922 (.94)	.903 (.89)	2.81 (3.06)*	2.67 (2.88)*
<b>N</b>	440	440	440	440
<b>Adj R-Squared</b>	.55	.55	.63	.65

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\* significant at 99% level      \*\* significant at 95% level      \*\*\* significant at 90% level

### Exhibit 3: Determinants of the Size of the Trade Sector: A Time Period Analysis

Dependent Variable Log of Trade Sector as a Share of GDP ( <i>t</i> -statistic is in parenthesis)						
	75-7	80-2	85-7	90-2	95-7	Panel
<b>DADS</b>	.002 (2.08)**	.002 (2.17)**	.002 (2.50)**	.002 (1.71)** *	.002 (1.27)	.002 (4.35)*
<b>Log of area</b>	-.117 (3.94)*	-.142 (4.67)*	-.135 (4.48)*	-.146 (4.36)*	-.139 (3.56)*	-.140 (9.45)*
<b>Log of working population</b>	-.165 (4.42)*	-.117 (3.07)*	-.125 (3.34)*	-.100 (2.39)**	-.094 (1.98)** *	-.120 (6.75)*
<b>Coastline</b>	.002 (1.48)	.003 (1.66)***	.003 (1.82)** *	.003 (1.41)	.003 (1.60)	.003 (3.59)*
<b>Log of world GDP</b>						.350 (3.73)*
<b>Intercept</b>	4.41 (17.17)*	4.49 (16.57)*	4.35 (15.84)*	4.56 (14.54)*	4.64 (12.10)*	.922 (.94)
<b>N</b>	88	88	88	88	88	440
<b>Adj R-Squared</b>	.61	.58	.60	.53	.44	.55

\* significant at 99% level

\*\* significant at 95% level

\*\*\* significant at 90% level

### Exhibit 4: Determinants of the Size of the Trade Sector: A Time Period Analysis

Dependent Variable Log of Trade Sector as a Share of GDP ( <i>t</i> -statistic is in parenthesis)						
	75-7	80-2	85-7	90-2	95-7	Panel
<b>DADS</b>	.0005 (.73)	.001 (.94)	.0002 (.25)	.001 (.82)	.002 (1.45)	.001 (1.86)***
<b>Log of area</b>	-.094 (3.46)*	-.125 (4.69)*	-.105 (3.94)*	-.134 (4.35)*	-.138 (4.38)*	-.122 (9.33)*
<b>Log of working population</b>	-.168 (5.02)*	-.118 (3.56)*	-.146 (4.46)*	-.089 (2.28)**	-.070 (1.82)***	-.114 (7.0)*
<b>Coastline</b>	.001 (.66)	.001 (.92)	.001 (.54)	.001 (.74)	.003 (1.61)	.002 (2.39)**
<b>Tariff measure</b>	.047 (2.64)**	.047 (2.73)*	.065 (3.49)*	.038 (1.50)	.026 (.89)	.056 (6.00)*
<b>Black market measure</b>	-.087 (2.11)**	-.065 (3.86)*	-.011 (1.97)** *	-.072 (3.18)*	-.120 (6.10)*	-.058 (5.04)*
<b>Capital measure</b>	.013 (.74)	.0004 (.03)	.023 (1.55)	.009 (.55)	-.011 (.73)	.015 (2.01)**
<b>Log of world GDP</b>						.138 (1.56)
<b>Intercept</b>	4.33 (17.61)*	4.46 (18.68)*	4.29 (18.06)*	4.48 (14.94)*	4.53 (13.94)*	2.81 (3.06)*
<b>N</b>	88	88	88	88	88	440
<b>Adj R-Squared</b>	.70	.70	.71	.62	.65	.63

\* significant at 99% level

\*\* significant at 95% level

\*\*\* significant at 90% level

## Exhibit 5: Trade Openness Index

(average 1980-97)

Country	Index	Country	Index
1 Hong Kong	9.9	50 Kenya	5.0
2 Singapore	9.8	51 Tunisia	5.0
3 Belgium	9.0	52 Cote d'Ivoire	5.0
4 Panama	8.8	53 Gabon	4.9
5 Luxembourg	8.5	54 Paraguay	4.9
6 Germany	8.5	55 China	4.8
7 United Kingdom	8.4	56 Sri Lanka	4.8
8 United States	8.4	57 Dem Rep of the Congo	4.8
9 Netherlands	8.4	58 Ecuador	4.7
10 Switzerland	8.1	59 Zambia	4.6
11 Malaysia	7.9	60 Turkey	4.6
12 Canada	7.7	61 Cyprus	4.6
13 Sweden	7.7	62 Cameroon	4.6
14 Ireland	7.5	63 Hungary	4.5
15 Norway	7.4	64 Colombia	4.5
16 New Zealand	7.4	65 Honduras	4.4
17 Italy	7.3	66 Belize	4.4
18 Taiwan	7.1	67 Zimbabwe	4.4
19 Spain	7.1	68 Guatemala	4.3
20 Australia	7.1	69 Senegal	4.3
21 Denmark	7.1	70 Barbados	4.2
22 Uruguay	6.9	71 Malawi	4.2
23 Austria	6.9	72 Niger	4.2
24 Portugal	6.7	73 Peru	4.2
25 Finland	6.5	74 Dominican Republic	4.1
26 Venezuela	6.5	75 Central African Republic	4.0
27 Thailand	6.4	76 Trinidad & Tobago	4.0
28 Japan	6.4	77 Bahamas	3.8
29 South Korea	6.4	78 El Salvador	3.7
30 France	6.3	79 Pakistan	3.7
31 Chile	6.2	80 Egypt	3.7
32 South Africa	6.2	81 Nepal	3.6
33 Jordan	6.2	82 Nicaragua	3.4
34 Israel	6.1	83 India	3.3
35 Indonesia	6.0	84 Brazil	3.3
36 Botswana	6.0	85 Tanzania	3.1
37 Philippines	6.0	86 Algeria	3.0
38 Fiji	5.9	87 Madagascar	3.0
39 Rep of the Congo	5.7	88 Nigeria	2.9
40 Bolivia	5.5	89 Argentina	2.8
41 Greece	5.5	90 Ghana	2.8
42 Jamaica	5.5	91 Syria	2.4
43 Malta	5.4	92 Uganda	2.4
44 Mali	5.4	93 Iran	2.0
45 Iceland	5.3	94 Burundi	1.4
46 Mexico	5.3	95 Sierra Leone	1.4
47 Morocco	5.3	96 Bangladesh	0.6
48 Costa Rica	5.1	97 Myanmar	0.2
49 Mauritius	5.0		

## Exhibit 6: Trade Openness, Income, and Growth

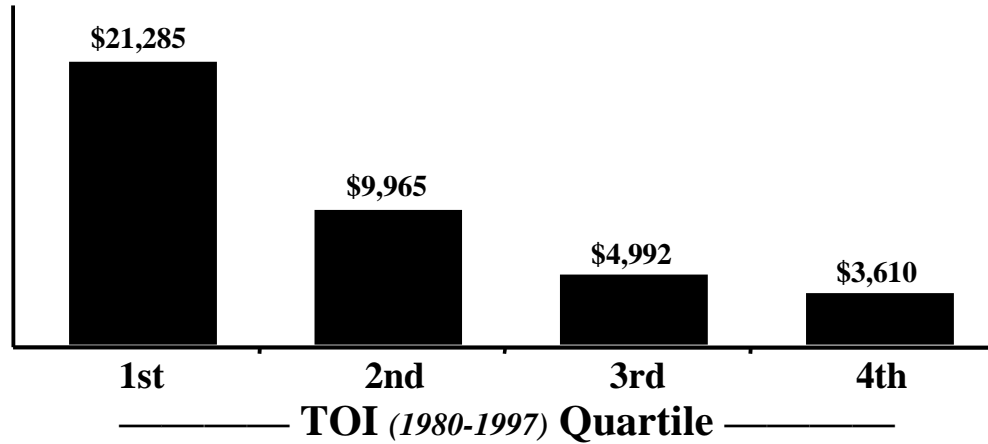
	Trade Openness Index (avg) 1980-97	Real GDP per person 1997	Avg annual growth of real GDP per person 1980-97
<i>Most open economies</i>			
Hong Kong	9.9	\$26,150	4.7%
Singapore	9.8	\$30,756	5.8%
Belgium	9.0	\$23,763	1.7%
Panama	8.8	\$7,521	0.7%
Luxembourg	8.5	\$36,190	3.7%
Germany	8.5	\$22,693	1.6% *
United Kingdom	8.4	\$21,825	1.8%
United States	8.4	\$30,610	1.6%
Netherlands	8.4	\$22,717	1.6%
Switzerland	8.1	\$27,985	0.8%
Malaysia	7.9	\$11,274	4.2%
Canada	7.7	\$23,272	1.2%
<i>Average</i>	8.6	\$23,730	2.3%
<i>Least open economies</i>			
Algeria	3.0	\$4,887	-0.9%
Madagascar	3.0	\$971	-2.2%
Nigeria	2.9	\$935	-0.9%
Argentina	2.8	\$10,600	0.4%
Ghana	2.8	\$1,913	-0.1%
Syria	2.4	\$3,182	1.0%
Uganda	2.4	\$1,117	2.2% *
Iran	2.0	\$6,206	-0.2%
Burundi	1.4	\$646	-1.2%
Sierra Leone	1.4	\$538	-3.9%
Bangladesh	0.6	\$1,117	2.4%
Myanmar	0.2	\$1,287	1.7%
<i>Average</i>	2.1	\$2,783	-0.3%

\* Data for Germany are for West Germany only prior to unification.  
Due to data restrictions, Uganda's average annual growth is based upon growth only since 1982. For entire series, see Appendix, exhibit A-5.

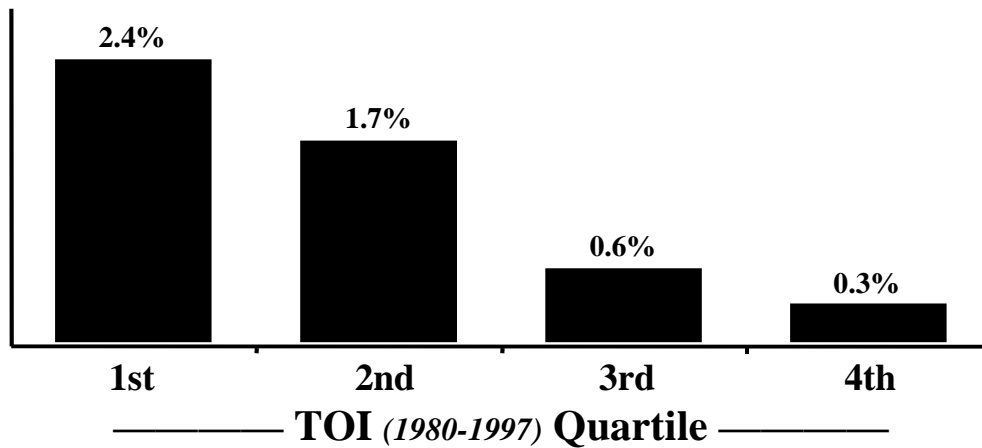
**Exhibit 7: The Relationship Between Trade Openness (TOI), Real GDP per capita, and the Growth Rate of Real GDP per capita**

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**Per capita  
GDP 1997  
(1998 \$)**



**Average Annual  
Growth Rate of  
GDP per capita**



## Exhibit 8: TOI, Convergence, and Key Policy Variables

	Dependent Variable		Dependent Variable		
	Real GDP per capita 1997		Average Annual Growth Rate of per capita GDP (LC)		
	<i>(t-statistic is in parenthesis)</i>		<i>(t-statistic is in parenthesis)</i>		
	(1)	(2)	(3)	(4)	(5)
<b>Trade Openness Index</b>	3436.7 (11.15) *	1749.9 (5.04) *	.44 (4.15) *	0.543 (3.76) *	0.301 (2.13) **
<b>Per capita GDP 1980</b> <i>(in \$1,000's)</i>				-.467 (1.06)	-.135 (2.89) *
<b>Property rights measure 1980</b>		1828.9 (6.43) *			.332 (2.66) *
<b>Period inflation measure</b>		459.7 (1.91) ***			.363 (3.98) *
<b>Intercept</b>	-8428.0 (4.83) *	-12600.0 (6.97) *	-1.058 (1.77) ***	-1.264 (2.01) **	-3.778 (5.03) *
<b>n</b>	97	94 <sup>a</sup>	97	97	94 <sup>a</sup>
<b>Adj R-Squared</b>	.56	.71	.15	.16	.33

\* significant at 99% level      \*\* significant at 95% level      \*\*\* significant at 90% level

<sup>a</sup> The three countries in the group of 97, but not part of the group of 94 include: Nepal, Belize, and Fiji. These omissions were made due to data limitations regarding the property rights measure.

### Exhibit A-1: Distance Adjusted Demand Scalar (DADS)

*(Using square-root transform on the distance measure for diminishing increasing costs attributable to increased distance in international exchange)*

	1975-7	1980-2	1985-7	1990-2	1995-7
Algeria	312.6	307.8	302.1	297.5	287.7
Argentina	189.5	189.7	187.6	185.4	183.8
Australia	167.1	168.5	170.0	174.5	177.5
Austria	365.9	359.4	351.7	341.6	326.9
Bahamas, The	262.9	261.3	259.1	254.9	250.9
Bangladesh	226.5	228.8	233.0	239.2	245.9
Barbados	236.2	234.8	232.0	228.4	225.0
Belgium	439.7	428.8	416.9	407.3	389.3
Belize	253.5	253.1	250.3	246.5	243.1
Bolivia	207.9	207.3	204.6	201.3	199.5
Botswana	205.0	204.4	202.1	200.9	199.6
Brazil	194.8	193.4	191.0	189.3	187.0
Burundi	328.6	324.4	318.9	311.4	299.4
Cameroon	228.2	226.6	223.7	221.9	218.6
Canada	286.1	283.4	282.1	277.6	273.2
Central African Republic	228.2	226.8	224.5	222.8	219.7
Chile	192.6	191.7	189.4	186.6	185.1
China	220.3	221.7	220.6	222.9	216.5
Colombia	225.9	224.8	222.0	218.6	215.6
Congo, Dem. Rep.	213.9	213.2	211.4	210.5	208.6
Congo, Rep.	218.1	216.9	214.7	213.1	210.4
Costa Rica	237.1	236.5	233.9	230.4	227.5
Cote d'Ivoire	230.4	228.8	225.7	223.2	219.4
Cyprus	289.5	286.5	283.8	280.7	273.9
Denmark	357.0	350.6	344.0	335.1	321.4
Dominican Republic	246.5	245.0	242.4	238.7	235.0
Ecuador	222.3	221.7	219.2	215.9	213.7
Egypt, Arab Rep.	273.2	270.3	267.2	264.7	258.8
El Salvador	245.7	245.4	242.6	239.0	235.9
Fiji	175.3	176.4	177.8	179.5	181.9
Finland	322.3	318.3	315.0	304.8	291.5
France	363.2	355.1	348.0	340.1	327.6
Gabon	223.9	222.8	220.2	218.2	215.0
Germany	350.9	343.8	337.6	330.1	317.7
Ghana	230.0	228.5	225.5	222.9	219.2
Greece	305.5	301.9	297.7	292.5	282.9
Guatemala	246.6	246.3	243.8	240.2	237.0
Honduras	246.0	245.4	242.7	239.1	235.9
Hong Kong, China	228.8	233.3	241.7	252.1	267.1
Hungary	354.8	349.2	342.2	334.3	319.9
Iceland	285.8	282.5	279.7	274.9	268.0
India	215.5	215.8	216.5	218.2	218.4
Indonesia	192.5	194.2	197.0	201.5	206.7
Iran, Islamic Rep.	257.2	258.0	256.5	256.2	251.9
Ireland	349.0	341.8	335.5	328.6	316.9
Israel	277.2	275.0	272.5	270.0	264.2
Italy	313.8	308.3	303.2	297.2	287.2
Jamaica	249.1	248.0	245.5	241.6	238.1
Japan	195.1	197.2	203.5	209.1	221.8
Jordan	281.5	279.1	276.5	274.5	269.4
Kenya	217.0	216.2	215.0	214.8	213.5

## Exhibit A-1: Distance Adjusted Demand Scalar (DADS)

(Continued)

	1975-7	1980-2	1985-7	1990-2	1995-7
<b>Korea, Rep.</b>	247.1	252.1	261.9	272.2	286.7
<b>Luxembourg</b>	455.9	444.9	431.1	421.3	401.7
<b>Madagascar</b>	197.3	197.3	196.9	197.6	197.8
<b>Malawi</b>	206.2	205.6	204.4	204.1	203.0
<b>Malaysia</b>	207.1	210.0	214.1	220.5	228.0
<b>Mali</b>	238.4	236.6	233.3	230.4	226.0
<b>Malta</b>	312.5	308.9	303.6	298.4	288.6
<b>Mauritius</b>	193.6	193.9	194.0	195.3	196.4
<b>Mexico</b>	240.2	237.5	237.3	234.2	232.0
<b>Morocco</b>	289.1	285.2	280.5	276.4	268.5
<b>Myanmar</b>	222.2	225.2	229.9	237.5	246.0
<b>Nepal</b>	233.8	235.4	239.2	244.6	249.9
<b>Netherlands</b>	412.6	403.3	393.1	383.9	367.1
<b>New Zealand</b>	166.1	167.2	168.2	169.8	172.1
<b>Nicaragua</b>	241.4	241.0	238.4	235.0	232.1
<b>Niger</b>	242.7	240.8	237.4	234.7	230.2
<b>Nigeria</b>	233.4	231.8	229.6	227.1	223.2
<b>Norway</b>	331.9	326.5	321.5	313.7	301.9
<b>Pakistan</b>	242.1	241.9	243.7	247.3	248.4
<b>Panama</b>	236.0	235.2	232.5	229.1	226.3
<b>Paraguay</b>	205.6	204.8	201.7	198.3	196.8
<b>Peru</b>	207.0	206.6	204.3	201.8	199.8
<b>Philippines</b>	213.2	217.1	224.7	233.3	244.8
<b>Portugal</b>	301.6	296.9	292.0	287.5	278.9
<b>Senegal</b>	237.7	235.8	232.6	229.5	225.2
<b>Sierra Leone</b>	231.7	230.0	226.7	223.8	219.9
<b>Singapore</b>	207.4	211.2	215.0	222.1	230.7
<b>South Africa</b>	191.2	190.8	190.1	190.2	189.7
<b>Spain</b>	306.3	302.8	297.5	291.9	282.7
<b>Sri Lanka</b>	215.3	216.7	219.3	223.9	228.6
<b>Sweden</b>	328.1	323.7	319.6	310.7	298.4
<b>Switzerland</b>	388.2	380.8	371.4	363.5	348.5
<b>Syrian Arab Republic</b>	281.8	279.0	276.6	274.5	268.6
<b>Taiwan</b>	236.5	242.4	254.4	267.3	288.0
<b>Tanzania</b>	210.6	210.2	209.2	209.2	208.4
<b>Thailand</b>	215.8	218.5	222.9	228.8	236.6
<b>Trinidad and Tobago</b>	234.9	233.5	230.6	227.1	223.8
<b>Tunisia</b>	319.1	315.1	309.3	303.9	293.5
<b>Turkey</b>	292.3	289.5	285.7	280.8	271.3
<b>Uganda</b>	220.4	219.6	218.1	217.5	215.5
<b>United Kingdom</b>	350.8	345.8	337.3	331.3	318.5
<b>United States</b>	169.4	170.9	168.8	168.4	167.1
<b>Uruguay</b>	205.2	203.4	199.4	196.0	195.4
<b>Venezuela</b>	231.2	230.4	228.2	224.6	221.7
<b>Zambia</b>	206.3	205.7	204.2	203.6	202.2
<b>Zimbabwe</b>	203.9	203.4	201.9	201.3	200.3

## Exhibit A-2: Determinants of the Size of the Trade Sector: A Panel Analysis

	Dependent Variable Log of Trade Sector as a Share of GDP <i>(t-statistic is in parenthesis)</i>			
	(1)	(2)	(3)	(4)
<b>DADS</b>	.002 (4.91)*	.002 (3.65)*	.001 (2.06)**	.001 (3.69)*
<b>Log of area</b>	-.111 (8.61)*	-.108 (8.33)*	-.10 (8.34)*	-.100 (8.61)*
<b>Log of working population</b>	-.145 (9.4)*	-.143 (9.37)*	-.138 (9.76)*	-.140 (10.11)*
<b>Log of world GDP</b>	.418 (4.91)*	.424 (4.93)*	.189 (2.35)**	.176 (2.21)**
<b>Coastline</b>	.003 (3.25)*	.002 (2.64)*	.001 (1.75)***	.002 (2.67)*
<b>Per capita income</b>		.028 (3.27)*		-.022 (2.48)**
<b>Per capita income<sup>2</sup></b>		-.001 (2.92)*		-.0001 (.45)
<b>Tariff measure</b>			.058 (7.04)*	.075 (8.29)*
<b>Black market Measure</b>			-.053 (5.17)*	-.049 (4.74)*
<b>Capital measure</b>			.017 (2.72)*	.033 (4.67)*
<b>Intercept</b>	.138 (.16)	.027 (.03)	2.22 (2.68)*	2.21 (2.68)*
<b>n</b>	532	532	532	532
<b>Adj R-Squared</b>	.53	.54	.62	.64

\* significant at 99% level      \*\* significant at 95% level      \*\*\* significant at 90% level

### Exhibit A-3: The Determinants of the Size of the Trade Sector: A Time Period Analysis

Dependent Variable Log of Trade Sector as a Share of GDP ( <i>t</i> -statistic is in parenthesis)						
	75-7	80-2	85-7	90-2	95-7	Panel
<b>DADS</b>	.002 (2.14)**	.002 (2.44)**	.002 (2.40)**	.002 (1.88)***	.002 (2.05)**	.002 (4.91)*
<b>Log of area</b>	-.108 (3.75)*	-.112 (3.92)*	-.118 (4.48)*	-.113 (3.82)*	-.105 (3.26)*	-.111 (8.61)*
<b>Log of working population</b>	-.174 (4.82)*	-.154 (4.55)*	-.153 (4.92)*	-.138 (3.94)*	-.115 (3.06)*	-.145 (9.40)*
<b>Coastline</b>	.002 (1.46)	.002 (1.41)	.003 (1.74)***	.002 (1.25)	.003 (1.43)	.003 (3.25)*
<b>Log of world GDP</b>						.418 (4.91)*
<b>Intercept</b>	4.37 (17.3)*	4.38 (16.73)*	4.41 (17.58)*	4.47 (15.38)*	4.44 (13.77)*	1.38 (.16)
<b>n</b>	94	102	109	110	117	532
<b>Adj R-Squared</b>	.59	.57	.60	.50	.42	.53

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\* significant at 99% level      \*\* significant at 95% level      \*\*\* significant at 90% level

## Exhibit A-4: The Determinants of the Size of the Trade Sector: A Time Period Analysis

Dependent Variable Log of Trade Sector as a Share of GDP <i>(t-statistic is in parenthesis)</i>						
	75-7	80-2	85-7	90-2	95-7	Panel
<b>DADS</b>	.0004 (.65)	.001 (1.22)	.0002 (.32)	.001 (.65)	.002 (1.93)** *	.001 (2.06)**
<b>Log of area</b>	-.086 (3.32)*	-.094 (3.69)*	-.092 (3.92)*	-.102 (3.79)*	-.104 (3.87)*	-.100 (8.34)*
<b>Log of working population</b>	-.176 (5.47)*	-.157 (5.25)*	-.157 (5.74)*	-.124 (3.85)*	-.093 (2.93)*	-.138 (9.76)*
<b>Coastline</b>	.001 (.614)	.001 (.55)	.001 (.39)	.001 (.35)	.002 (1.25)	.001 (1.75)***
<b>Tariff measure</b>	.054 (3.21)*	.042 (2.57)**	.063 (3.77)*	.043 (2.13)**	.032 (1.34)	.058 (7.04)*
<b>Black market measure</b>	-.086 (2.13)**	-.064 (3.76)*	-.011 (2.01)**	-.071 (3.16)*	-.119 (6.23)*	-.053 (5.17)*
<b>Capital measure</b>	.01 (.61)	.007 (.46)	.022 (1.67)** *	.020 (1.40)	-.006 (.43)	.017 (2.72)*
<b>Log of world GDP</b>						.189 (2.35)**
<b>Intercept</b>	4.29 (18.21)*	4.36 (18.66)*	4.29 (19.42)*	4.40 (16.48)*	4.33 (15.55)*	2.22 (2.68)*
<b>N</b>	94	102	109	110	117	532
<b>Adj R-Squared</b>	.70	.67	.71	.61	.61	.62

\* significant at 99% level

\*\* significant at 95% level

\*\*\* significant at 90% level

### Exhibit A-5: Trade Openness Index (TOI)

*(The TOI have 4 elements: composite tariff, capital freedom, & black-market exchange rate-premium measures, and the average of the fit to EQ(s) 5 & 7)*

	1980-2	1985-7	1990-2	1995-7
<b>Algeria</b>	3.8	2.4	2.7	3.0
<b>Argentina</b>	1.5	0.9	2.0	6.9
<b>Australia</b>	6.1	7.0	7.4	7.8
<b>Austria</b>	6.4	6.4	7.0	7.9
<b>Bahamas, The</b>	3.8	4.0	3.5	3.9
<b>Bangladesh</b>	0.2	0.0	0.2	2.1
<b>Barbados</b>	4.8	4.2	3.5	4.4
<b>Belgium</b>	9.0	9.1	8.8	8.9
<b>Belize</b>	4.1	3.5	4.6	5.3
<b>Bolivia</b>	3.2	5.2	6.1	7.5
<b>Botswana</b>	5.7	5.4	6.4	6.5
<b>Brazil</b>	3.0	1.4	4.1	4.9
<b>Burundi</b>	1.0	1.9	1.6	1.3
<b>Cameroon</b>	3.4	5.2	4.8	4.9
<b>Canada</b>	7.6	7.7	7.5	7.9
<b>Central African Republic</b>	3.3	4.4	3.6	4.8
<b>Chile</b>	5.9	5.3	6.7	7.0
<b>China</b>	3.1	4.9	4.0	7.3
<b>Colombia</b>	3.5	3.8	4.4	6.2
<b>Congo, Dem. Rep.</b>	2.7	5.8	5.1	5.4
<b>Congo, Rep.</b>	5.6	5.3	5.3	6.7
<b>Costa Rica</b>	2.7	3.9	5.8	8.1
<b>Cote d'Ivoire</b>	3.9	5.1	4.5	6.3
<b>Cyprus</b>	3.8	5.0	4.4	5.1
<b>Denmark</b>	7.0	6.9	6.7	7.7
<b>Dominican Republic</b>	2.1	4.7	3.4	6.4
<b>Ecuador</b>	2.9	3.7	5.2	7.1
<b>Egypt, Arab Rep.</b>	3.5	1.8	3.5	5.9
<b>El Salvador</b>	2.2	2.4	4.0	6.3
<b>Fiji</b>	6.1	5.7	5.8	6.0
<b>Finland</b>	6.4	6.2	5.7	7.8
<b>France</b>	5.0	6.4	7.0	7.0
<b>Gabon</b>	3.7	5.3	5.3	5.5
<b>Germany</b>	8.3	8.8	8.5	8.3
<b>Ghana</b>	0.0	1.2	4.4	5.4
<b>Greece</b>	4.8	5.2	5.5	6.5
<b>Guatemala</b>	3.3	1.9	5.2	6.9
<b>Honduras</b>	3.2	2.2	5.3	7.1
<b>Hong Kong, China</b>	9.7	9.9	10.0	10.0
<b>Hungary</b>	3.1	4.0	4.3	6.6
<b>Iceland</b>	4.4	5.6	5.0	6.2
<b>India</b>	3.0	2.7	3.4	4.2
<b>Indonesia</b>	6.3	5.7	6.0	6.1
<b>Iran, Islamic Rep.</b>	1.7	0.8	2.8	2.7
<b>Ireland</b>	7.2	7.2	7.2	8.4
<b>Israel</b>	6.0	6.0	6.2	6.2
<b>Italy</b>	7.2	7.0	6.7	8.1
<b>Jamaica</b>	3.9	5.5	5.4	7.1
<b>Japan</b>	6.2	6.3	6.6	6.5
<b>Jordan</b>	6.2	5.9	6.2	6.6
<b>Kenya</b>	4.3	4.4	3.9	7.5

## Exhibit A-5: Trade Openness Index (TOI)

(Continued)

	1980-2	1985-7	1990-2	1995-7
<b>Korea, Rep.</b>	5.9	5.9	6.8	6.9
<b>Luxembourg</b>	8.5	8.7	8.5	8.4
<b>Madagascar</b>	2.0	2.7	3.3	3.8
<b>Malawi</b>	3.2	4.4	4.3	4.9
<b>Malaysia</b>	7.8	7.9	7.9	7.9
<b>Mali</b>	4.2	5.7	5.7	6.0
<b>Malta</b>	5.2	5.5	5.6	5.5
<b>Mauritius</b>	3.6	4.8	4.8	7.0
<b>Mexico</b>	1.8	4.6	6.9	7.7
<b>Morocco</b>	4.5	5.6	5.2	5.7
<b>Myanmar</b>	0.7	0.0	0.0	0.0
<b>Nepal</b>	3.2	3.8	3.0	4.4
<b>Netherlands</b>	8.4	8.3	8.1	8.6
<b>New Zealand</b>	7.1	6.9	7.7	7.8
<b>Nicaragua</b>	1.6	0.6	4.6	6.8
<b>Niger</b>	4.0	4.6	4.0	4.2
<b>Nigeria</b>	2.8	2.7	3.4	2.9
<b>Norway</b>	6.7	7.3	7.8	7.6
<b>Pakistan</b>	2.2	3.9	4.0	4.8
<b>Panama</b>	9.0	8.5	8.4	9.5
<b>Paraguay</b>	2.7	3.6	5.8	7.3
<b>Peru</b>	4.1	1.9	3.7	7.0
<b>Philippines</b>	5.2	5.4	5.9	7.4
<b>Portugal</b>	6.0	6.2	6.9	7.8
<b>Senegal</b>	3.6	4.6	4.1	4.7
<b>Sierra Leone</b>	1.0	0.9	2.1	1.7
<b>Singapore</b>	9.5	10.0	9.9	9.9
<b>South Africa</b>	6.5	6.0	6.1	6.3
<b>Spain</b>	6.6	6.7	7.3	7.9
<b>Sri Lanka</b>	4.5	4.4	4.2	6.0
<b>Sweden</b>	6.5	7.4	8.2	8.6
<b>Switzerland</b>	8.3	8.3	7.9	7.9
<b>Syrian Arab Republic</b>	2.0	2.0	2.4	3.2
<b>Taiwan</b>	7.0	6.7	7.4	7.5
<b>Tanzania</b>	2.3	2.1	2.6	5.5
<b>Thailand</b>	5.9	5.9	6.2	7.6
<b>Trinidad and Tobago</b>	2.9	2.8	3.3	7.1
<b>Tunisia</b>	3.5	4.3	5.8	6.3
<b>Turkey</b>	2.8	5.0	4.3	6.4
<b>Uganda</b>	2.9	1.1	1.8	3.7
<b>United Kingdom</b>	8.5	8.6	8.2	8.5
<b>United States</b>	8.5	8.3	8.3	8.4
<b>Uruguay</b>	6.3	7.0	7.1	7.4
<b>Venezuela</b>	7.9	4.9	6.4	6.8
<b>Zambia</b>	4.6	3.7	3.9	6.3
<b>Zimbabwe</b>	3.8	3.3	4.8	5.5