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This paper was prepared under a cooperative agreement between the Institute for Policy Reform (IPR) and Agency for International Development (USAID), Cooperative Agreement No. PDC# 0095-A-00-9079-00. Views expressed in this paper are those of the author and not necessarily those of IPR or USAID.

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Trade Orientation, Distortions and Growth In Developing Countries

Sebastian Edwards

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Trade Orientation, Distortions and Growth In Developing Countries

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March 1991

Trade policy is a major issue for developing countries that are undergoing economic reform. Using a cross-section database of thirty developing countries, it is shown that countries with more open and less distortive trade policies have grown faster than countries with more restrictive policies. In contrast with studies which rely on subjective ratings of policies, or on measures of tariffs which neglect non-tariff barriers, this study relies on an objective measure of trade policies: indices constructed by Leamer comparing predicted free trade net trade flows with actual net trade flows. Additional determinants of growth are investment, measured as the ratio of gross investment to GDP, and a knowledge gap, measured alternatively as initial GDP per capita and as engineers engaged in R&D per thousand inhabitants. Investment has a positive effect on growth. A negative estimated effect of the knowledge gap implies that poorer countries will catch up, through higher growth, to richer countries. An in-depth sensitivity analysis suggests that these findings are robust to the choice of trade policy indicator, estimation method, sample selection, measurement error correction, equation specification, and the time period used.

I. Introduction

The relation between trade policy and growth is an old and controversial question in economics. Many economists have argued that, with other things given, countries that have "liberalized" their external sectors, and have reduced their impediments to international trade will outperform those countries that have failed to do so.[1] The World Bank and the International Monetary Fund have, in fact, endorsed this view; they routinely condition funds to their member countries on the implementation of "trade liberalization" policies. However, throughout the years a number of authors have expressed great skepticism about the theoretical and empirical validity of this proposition. For instance, a recently published book titled Economic Liberalization: No Panacea is fully devoted to shed doubts on the pro-liberalization approach.[2]

The debate on the relationship between trade policy and economic performance has recently attained new heights as a result of both the Third World debt crisis and of the attempts at reforming the Eastern European economies. A large number of experts have argued that the most efficient way for highly indebted countries to get over the crisis is to "grow out of it". Furthermore, they have pointed out that the only way for this to happen is for these economies to rapidly embrace market-oriented reforms, including the liberalization of their foreign sector.[3] Although this view is becoming increasingly popular, it is still opposed by a number of

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[1] See, for example, Krueger (1989), Balassa (1989), and Bhagwati (1986).

[2] Banuri (1990). See also, recent work by Rodrik (1989).

[3] See Krueger (1988), Balassa et al. (1986), and Lipton and Sachs (1990).

economists.[4] This discussion has also been revitalized by the emergence of a new generation of growth models based on the roles of economies of scale, human capital accumulation and endogenous technological progress, which has brought new elements into the analysis of the way in which trade, and other national policies affect long run economic growth.[5]

Two factors explain why after so many years such a fundamental policy issue as the relationship between trade policy and growth is still far from being resolved. First, for a long time, it was argued that the theoretical underpinnings of the proposition that freer trade enhances growth were weak. While the theory was clear regarding the static gains from free trade, the generalization of these results to a dynamic equilibrium growth setting presented some problems. Only recently with the new interest on growth theory, and the resulting "endogenous" growth models, important developments in this direction have been made. Second, the empirical work on the subject has suffered from some important limitations. The most important of these stems from the fact that until now it has been exceedingly difficult to construct satisfactory and convincing measurements of trade orientation that can be used in time series analyses and, especially, in cross-country comparisons.[6]

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[4] See Cooper (1987) for a summary of the debate on trade policy in developing nations.

[5] At the empirical level, however, the overriding concern of this literature has to do with whether after controlling by other variables cross-country rates of growth exhibit a tendency towards convergence. See, for example, Lucas (1988) and Barro (1989). See Edwards (1989) for a survey of the empirical literature on trade regimes and economic performance.

[6] Any attempt to relate trade regimes and growth requires data on either how the trade regime evolves through time in a particular country, or group of countries, or data that can be compared across countries. This, of course, is not an easy task. For example, in the classical and monumental NBER Krueger-Bhagwati project, researchers faced enormous difficulties in

Researchers have developed two types of strategies to deal with the measurement problem of trade orientation: Some, as the Krueger-Bhagwati study, the World Bank in the 1987 World Development Report and Choksi et al. (1991), have resorted to the construction of subjective indexes of trade orientation, which are not truely comparable across countries. Another group of researchers have chosen to decompose the question of the effects of trade orientation on economic performance into two stages. The first stage basically amounts to assuming (without testing) that a more liberalized regime will encourage exports via a reduction of the anti-export bias. At the second stage, then, the researcher usually tests whether higher exports (or a more rapid growth in exports) have indeed been associated with a higher rate of output growth (Michaely 1977, Balassa 1978, 1982). Neither of these approaches, however, have proven to be entirely satisfactory, since they have tended to generate a number of mutually contradictory results. Perhaps the clearest indication of the problems generated by these measurement difficulties is given by the fact that South Korea is now considered an example of the validity of different (almost opposing) views regarding the role of commercial policy in development and growth. For some (i.e., World Bank 1987) Korea is the best example of an outward oriented liberalized economy, while for others (Collins and Park 1988, Sachs 1987) Korea is a prime example that in order for a small developing economy to grow (very) fast it should avoid an abrupt liberalization. To a large extent the results of cross-country studies on trade orientation and growth that are based on subjective indexes depend on whether Korea and a few other

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constructing a series of a trade bias. Likewise, the recently completed World Bank study by Choksi et al. (1991) had great difficulties in performing cross-country comparisons.

countries are classified as "liberalized" or "unliberalized" economies.

The purpose of this paper is to use a set of new indicators on trade intervention and trade distortions to investigate empirically the role of commercial policy in explaining cross-country growth differentials. In Section II, I derive a simple model of endogenous technological progress that focuses on a small developing country's capacity to absorb new technologies developed in the advanced nations. The model assumes that more open economies are more efficient in absorbing exogenously generated innovations. In Section III, I use a set of trade intervention indexes recently constructed by Leamer (1988) to study whether trade policy can explain cross country growth differentials. These indicators are free of many of the limitations of the trade policy indexes used in previous work. More specifically, Leamer indices are objective, continuous and comparable across countries. Additionally, these indicators provide broad measures of trade restrictions that include the effect of non-tariff barriers. In this section I also investigate the role of human capital accumulation and political instability on growth. In Section IV, I investigate the robustness of the results obtained from the analysis based on Leamer indicators. I do this by estimating a number of regressions using alternative -- and, in principle less desirable -- indices of trade distortions. The overall finding is that there is very strong evidence supporting the hypothesis that, with other things given, more open countries will tend to grow faster. These findings are robust to the choice of trade policy indicator, estimation method, sample selection, measurement error correction, equation specification and time period used. Section V contains the conclusions and a discussion on directions for future research.

II. Trade, Endogenous Technological Progress and Growth: An Analytical Framework

In this section I sketch a minimal analytical framework for analyzing the relationship between trade orientation and growth. This model, which provides the basis for the cross-country empirical results reported below, considers the case of a small economy inserted in a world where (most) technological innovations take place in the advanced nations. A key question addressed by the model is how fast and how efficiently this technological progress, that spills over from the industrial countries, is absorbed by the poor nation.

The model is partially motivated by an important insight developed by W. Arthur Lewis in his monumental work Theory of Economic Growth. In this study Lewis argues that those developing countries that are more integrated to the rest of the world will have an advantage in absorbing technological innovations generated in the advanced nations. In Lewis' words: "New ideas will be accepted more rapidly in those societies where people are accustomed to ... change ... [A] country which is isolated is ... by contrast unlikely to absorb new ideas quickly ..." (1955, p. 178).

There are a number of ways in which Lewis' insight can be formalized at the microeconomic level. One possibility is to postulate a "learning-by-looking" type of process where the mere contact with newer commodities and technologies increases the efficiency with which innovations are absorbed.[7] This type of mechanism has recently been proposed by Edwards (1989) in an aggregate analysis of the determinants of growth, and by Grossman and Helpman (1990) in a micro model of technological innovation. More specifically,

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[7] A 1987 study by Dalham, Ross-Larson and Westphal provide microeconomic empirical support to this general view.

Grossman and Helpman (1990) suggest that foreign contributions to the stock of domestic knowledge increase with the number of commercial interactions between domestic and foreign agents and, thus, with the country's degree of openness.

In order to simplify the discussion, and to focus on the question at hand, in this section I focus on the aggregate level. The small country's aggregate production function is given by:[8]

$$Y_t = F(K_t, L_t)A_t \qquad (1)$$

where Y is total output, K is the capital stock, L is the labor force, and A represents the stock of accumulated knowledge, or the level of technological know-how, in the country. Changes in this parameter, then, can be interpreted as "technological progress". Within this standard framework a country's source of growth includes capital (including human) accumulation, labor growth and technological progress. Most recent work on the "new" theories of growth have focused on function $F(\ )$, investigating the role of increasing returns and learning-by-doing.[9] In this model, however, the emphasis is rather different, focusing on how a country's trade policy can affect the speed at which technological improvements take place. The discussion that follows, then, focuses almost exclusively on the determinants of A through time, and shows that under certain configuration of the model's parameters it is possible that trade orientation will affect

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[8] This framework can be easily expanded to a multisector setup, where different sectors (say tradables and nontradables) will be subject to different technical innovations processes. However, in order to make the basic point in this paper it is sufficient to look at aggregae production. Alternatively it is possible to consider this in a partial equilibrium context, and to think that (1) refers to the tradable goods sector only.

[9] On endogenous theories of growth see Romer (1986, 1988, 1989, 1990), Lucas (1988), Jones and Manuelli (1988), King and Rebelo (1988), Rebelo (1990), Helpman (1989).

long run equilibrium growth.

I assume that there are two sources of knowledge accumulation: (1) a purely domestic source stemming from local technological improvements; and (2) a foreign source of knowledge related to the absorption of inventions generated in the advanced nations. Although the first source of knowledge accumulation is related to local innovations, I assume that it is still influenced by external events. In particular, I consider the case where the rate of local technical progress is positively affected by the gap between the stocks of world and domestic knowledge. With respect to the foreign source of technological improvements, I assume that the country's ability to appropriate world technical innovations depends positively on the degree of openness of the economy. This is the Lewis channel discussed above: more open countries have an advantage in absorbing new ideas generated in the rest of the world. In this context "more open" should be interpreted as referring to a less distorted foreign trade sector. The overall rate of knowledge accumulation in this small country can, then, be written in the following way:

$$\frac{\dot{A}}{A} = (\alpha + \delta(\frac{W-A}{A})) + \beta\omega \qquad (2)$$

where α and δ are exogenously given parameters, W is the stock of world's (appropriable) knowledge, ω is the rate of growth of the world stock of knowledge (that is $W_t = W_0 e^{\omega t}$), and β is a parameter between zero and one that measures the country's ability to absorb inventions generated in the rest of the world. In Lewis's spirit β is assumed to be a negative function of the level of trade distortions in the economy (τ).

$$\beta = \beta(\tau); \quad \beta' < 0, \qquad (3)$$

where τ is an index of trade intervention that takes a higher value with a higher level of distortions.

The term $(\alpha + \delta(W-A)/A)$ in equation (2) captures the local source of technological progress. Here α is the basic rate of innovation, which for simplicity is assumed to be exogenous; $\delta(W-A)/A$ is, on the other hand, a "catch-up" term that says that technological improvements will be faster in nations whose stock of knowledge lags further behind the world's accumulated stock of appropriable knowledge.[10] The term $\beta\omega$ captures the proportion of world's technological progress that is absorbed by the small country.

Under the assumption that the stock of world knowledge W grows at rate ω, the trajectory of A through time will be given by:

$$A_t = \left[A_0 - \left(\frac{\delta}{\delta+\omega(1-\beta)-\alpha}\right)W_0\right]e^{-(\delta-\alpha-\beta\omega)t} + \left(\frac{\delta}{\delta+\omega(1-\beta)-\alpha}\right)W_0e^{\omega t} \quad . \quad (4)$$

In long run equilibrium the behavior of the stock of domestic knowledge (A) will depend on whether $(\delta-\alpha-\beta\omega) \gtrless 0$. Consider first the case where $(\delta-\alpha-\beta\omega) > 0$. Under these circumstances in the steady state there will be an equilibrium "knowledge gap": $G = (W-\tilde{A})/\tilde{A}$, where $\tilde{A}_t$ is the steady-state stock of domestic knowledge and is equal to:

$$\tilde{A}_t = \left(\frac{\delta}{\delta+\omega(1-\beta)-\alpha}\right)W_t \quad (5)$$

In this case the stock of domestic knowledge will grow, in the steady-state, at the rate of the world's technical progress ω, and, thus, will be independent of trade orientation. However, the level of domestic output (Y_t) will be a function of the degree of trade intervention, with higher

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[10] I assume that not all inventions generated in the advanced nations can be freely appropriated by the LDCs. In that sense, W should be interpreted as the accumulated stock of innovations in the industrialized countries that have spilled over to the rest of the world.

trade distortions resulting in a lower level of real income. The reason for this is that the steady state stock of A depends negatively on the degree of trade distortions.[11] An important implication of this result is that trade liberalization episodes will be characterized, during the transition between two steady states, by higher rates of knowledge accumulation and thus, by faster rates of growth. That is, if $(\delta-\alpha-\beta\omega) > 0$, countries that liberalize their foreign trade will experience, for some period of time, higher rates of growth than an otherwise identical nation that has not liberalized its foreign sector. Once the new steady state is reached, knowledge, once again begins to accumulate at rate ω.

Consider now the case where $(\delta-\alpha-\beta\omega) < 0$. Now, the long run rate of knowledge accumulation $(\dot{A}/A)$ will depend on whether $\omega \gtrless (\alpha-\delta)/(1-\beta)$. If $\omega > (\alpha-\delta)/(1-\beta)$, then the exponent of the second RHS term in equation (4) will be larger than the exponent of the first RHS term, and the stock of domestic knowledge will grow in the steady state at the world rate ω. As in the first case, then, the long run steady state equilibrium rate of capital accumulation will be given by ω, and will be independent of trade policy. Also, as in the previous case, countries that go through a trade liberalization episode will experience higher growth during the transition to the new steady state equilibrium.

Finally, if $(\delta-\alpha-\beta\omega) < 0$, and $\omega < (\alpha-\delta)/(1-\beta)$, the long run equilibrium rate of knowledge accumulation will be equal to $(\alpha+\beta\omega-\delta)$,[12] and will depend <u>positively</u> on β, the country's capacity to absorb new spillovers of world technology. Since β is itself a negative function of

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[11] From equation (5) it is easy to see that $\partial\tilde{A}/\partial\tau < 0$.

[12] Of course, in this case, $(\alpha+\beta\omega-\delta) > \omega$.

the degree of trade intervention τ, in this case liberalized countries will not only exhibit a higher level of income than countries with trade distortions, but they will also have a higher long run steady state rate of growth.[13] The reason behind this is simple: in this case the domestic source of technological inventions is strong enough as to drive, even in the steady state, the aggregate rate of technological innovations. This result, of course, contrasts with the "traditional" models of growth, in that national policies can now affect long run equilibrium growth.[14]

Summarizing, then, the model given by equations (1) through (5) implies that the rate of growth of aggregate output in a small country will depend positively on capital accumulation, positively on labor force growth, positively on the knowledge (or technological) gap between the country in question and the advanced nations, and negatively on the degree of trade distortions.[15] Under some circumstances discussed above the negative effect of trade distortion will be a characteristic of long run equilibrium. Under other configurations of parameters, however, this negative relationship between trade orientation and growth will only be present out of steady state situations.[16]

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[13]This statement, of course, assumes that the two countries under comparison are otherwise identical.

[14]In Grossman and Helpman's (1990) micro model of technological progress it is also possible that, under some circumstances, more open economies will exhibit higher long-run growth.

[15]By differentiating (1) and using the results from our technological progress analysis we can generate a growth equation that captures these implications. However, in order for capital accumulation to affect long run growth, it is necessary to incorporate some source of increasing returns.

[16]Determining empirically which of these situations is more appropriate is not an easy task. It would require an analysis at the microeconomic level of the innovation process. As I point out in Section V, I believe that this is indeed the direction that new research should take.

III. Trade Orientation and Growth: Empirical Results

In this section I use a data set of developing countries to analyze whether, after controlling for other variables, there is an important relationship between trade orientation and growth. The theoretical framework used in this analysis is the one developed in the preceding section. In order to facilitate the estimation, in this section I mainly (but not exclusively) focus on a linear relationship between growth and its determinants. From the model in Section II, the basic regression equation used in the empirical analysis is the following:

$$GROWTHj = a_0 + a_1\ INVGDP_j + a_2\ GAP_j + a_3\ \tau_j + u_j \qquad (6)$$

Where, GROWTH is the average rate of growth of real GDP per capita in country j, $INVGDP_j$ is country j's ratio of aggregate investment to GDP; GAP is a measure of the gap between the world's and country j's stock of knowledge $(W-A)/A$; τ_j is an index of trade intervention in country j; and u_j is an error term. It is expected that INVGDP and GAP will have a positive impact on growth, while trade intervention τ will negatively affect growth.[17] The role of other possible determinants of growth, such as human capital and political instability, is investigated below.

III.1 The Data

Our basic data set consists of a cross section of 30 developing countries; the list of countries is in the Appendix. Data on growth and most other variables correspond to a 1970-82 average. Alternative data sets, including one comprised of 51 developed and developing nations and

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[17] Since GROWTH refers to GDP per capita, we have excluded the growth of the labor force as a determinant of growth. However, when this variable is included the results obtained are not affected in any way. The labor force growth variable was obtained from the World Development Report 1984.

data sets for different time periods, were also used, as is reported in Section IV. The variables were defined as follows:

a) Growth: This variable was defined as the rate of growth of real GDP per capita. These data were taken from Summers and Heston (1989) and are, for most cases, 1970-1982 averages. In Section IV below I also report results for 1960-1982 averages.

b) Investment Ratio: Defined as the ratio of gross investment to GDP. These data were also taken from Summers and Heston (1989).

c) Knowledge Gap: Since it is not possible to directly measure the technological gap two basic proxies were used. The first is the initial level of real GDP per capita, which is denoted by RGDP70. The idea is that those countries with lower initial income per capita have a larger gap and thus will tend to "catch up" with the more advanced nations. It is expected, then, that in those regressions where RGDP70 is included its coefficient will be negative.[18] Data on this variable were also obtained from Summers and Heston (1989).

The second proxy for technological gap is the number of engineers engaged in R&D per one thousand inhabitants. (This variable was denoted as RD.) Data for 26 of our 30 countries could be collected for this indicator. For each country the closest available year to 1970 was selected. This series were taken from UNESCO's Statistical Yearbook (several issues, 1971-89). As in the case of RGDP70, it is expected that the coefficient of RD will be negative: countries with a lower initial value of RD will have a larger knowledge gap and, thus, with

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[18] Notice that this implication of the model is consistent to the "convergence" hypothesis recently investigated by a number of authors. See, for example, Barro (1989).

other things given, will tend to grow faster.

d) Openness and Intervention Indexes: As pointed out in the introduction, one of the most difficult aspects of empirically analyzing the relationship between trade orientation and growth is to find appropriate indexes of openness and trade intervention. One of the reasons why these indexes are so difficult to define has to do with the fact that in many countries, and especially in the less developed ones, a tariff is only one form of protection -- and not even the most important one. In fact, it has now been documented by a number of authors that the poorest countries rely very heavily on an array of nontariff barriers.[19] Data on NTBs coverage are sometimes used as indexes of the severity of nontariff controls. A problem with this, however, is that these ratios are not good indicators of how restrictive these barriers actually are. In fact, it is perfectly possible to find cases where the coverage of import licenses is broad, but their restrictiveness is almost nonexistent.[20] The approach taken in this section is not to look at directly recorded data on trade impediments. Instead, I have used a set of broad indexes of openness recently constructed by Leamer (1988), which implicitly measure the overall restrictiveness of trade policy.[21] Leamer uses an empirical Heckscher-Ohlin model with nine factors -- capital, three types of labor, four types of land and oil -- to estimate net trade flows and trade intensity ratios for 183 commodities at the 3

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[19] See, for example, Nogue's, Olechowski and Winters (1986) and Balassa and Balassa (1984).

[20] See Leamer (1988).

[21] Edwards (1988) first used the Leamer indexes in a study on trade policy and growth.

digit SITC level for 53 countries (30 of which are LDCs).[22] He then takes "[t]he differences between the 'predicted' and actual trade intensity ratios... as an indicator of trade barriers". Leamer uses this approach to construct two basic sets of trade policy indicators: the first refers to openness, and measures the way in which trade policy (both tariffs and nontariff barriers) restricts imports, while the second group of indicators measures trade intervention and captures the extent to which commercial policy distorts trade, either positively or negatively. The main difference between these two group of indicators is that while the openness indexes measure the role of trade restrictions only, the intervention indexes also captured the role of export subsidies. In this section I use six indexes computed by Leamer:

INTERV1: Overall intervention index obtained when a homoskedastic, or unscaled model is used to predict trade flows for the 183 commodities in the sample.[23]

INTERV2: Overall intervention index obtained when a scaled, or heteroskedastic model with residuals proportional to GNP is used to estimate trade flows.

OPEN1: Overall openness index obtained from the unscaled trade model.

OPEN2: Overall openness index computed from the residuals of the scaled trade model.

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[22] In addition to these nine factors, Leamer uses distance and net trade balance in his regressions.

[23] See Leamer's article for a discussion on the use of the scaled or unscaled trade model.

OPENM1: Openness index for the manufacturing sector obtained from the unscaled trade model.[24]

OPENM2: Manufacturing sector openness index calculated from the scaled heteroskedastic trade model.

It is expected then, that the coefficients of the intervention indexes will be negative in the growth regressions: countries that distort their trade more heavily will tend to grow slower. On the other hand, it is expected that the coefficients of the openness indicators will be positive, indicating that as suggested by the model, countries with a more open trade regime will tend to grow faster than those with a close regime.

Leamer's trade policy indicators have a number of desirable properties. First, they are derived from an empirical trade model that captures each country's comparative advantage and that is as sophisticated as one can possibly expect. Second, they are objective indexes, where no attempt whatsoever has been made to a priori classify countries as open or closed. Third, it is a continuous index that allows for different degrees of openness, and fourth it is comparable across countries. In that regard, the use of these indexes should provide some persuasive evidence that will help towards the resolution of the long standing controversy on the relationship between trade policy and growth.

These indexes, however, also have some limitations.[25] First, in order to interpret the residuals from the trade model as trade barriers, two

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[24]The reason for using this manufacturing index, in addition to the overall indicators, is that it is likely that a large proportion of technological improvement coming from the rest of the world will refer to manufactured goods. I am grateful to Rudi Dornbusch for suggesting the use of the manufacturing index.

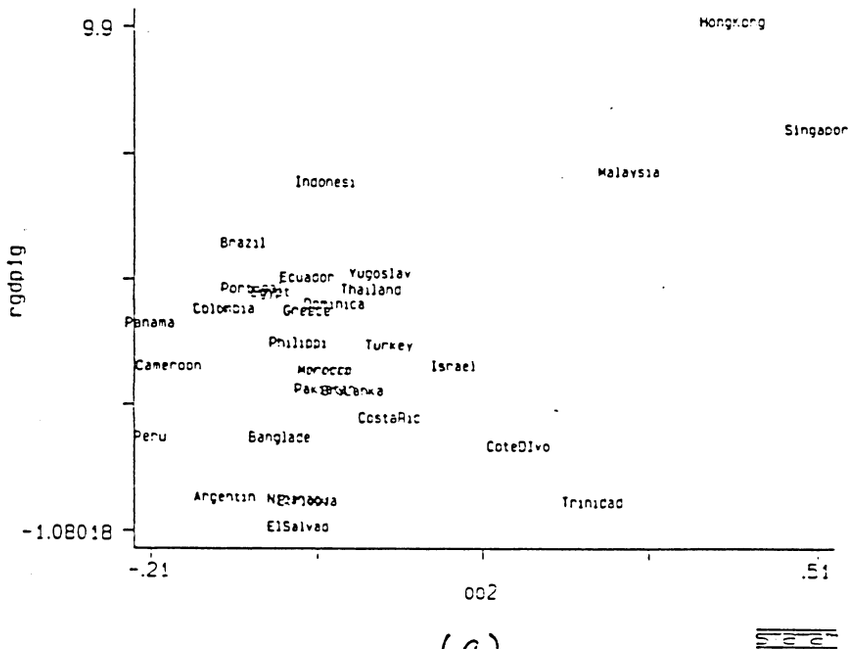
[25]See Leamer's original article for a detailed discussion on these index limitations.

important assumptions have to be made: trade impediments constitute the only excluded variable in the estimation of trade flows, and trade barriers are uncorrelated with the included variables. Since these assumptions are with all likelihood violated, it is necessary to treat the results obtained from the growth equations with some degree of skepticism. A second limitation of Leamer's indicators is that they were computed using trade data for one year only (1982).[26] For these reasons in this paper I take the view that the Leamer indexes are imperfect proxies (although I think the best available ones) of the theoretical trade intervention and trade distortion indices. Consequently I subject the results to a strict battery of robustness tests, including an analysis on how the results vary when alternative, and less desirable, indicators are used. Figure 1 provides a first glimpse at the data. Panel A plots real growth of GDP (RGDP1G) against the intervention INTV1 index; Panel B plots growth against the openness index OPEN1. The complete data set is in the Appendix.

III.2 Basic Results

Tables 1 and 2 summarize the basic regression results obtained from the estimation of several versions of equation (6). While the regressions on Table 1 were obtained when the four openness indexes were used as indicators of commercial policy, those on Table 2 refer to regressions with the intervention indicators. As can be seen from these tables, the results are highly satisfactory. In all but one regression the trade orientation indicators have the expected signs and the vast majority of them are highly significant at conventional levels. Additionally, in every one of these

[26] This problem is not an easy to overcome. As Leamer (1984) reports, obtaining data for the required variables to fit the disaggregated trade model is a major task, virtually impossible to attain for a time series of any reasonable length.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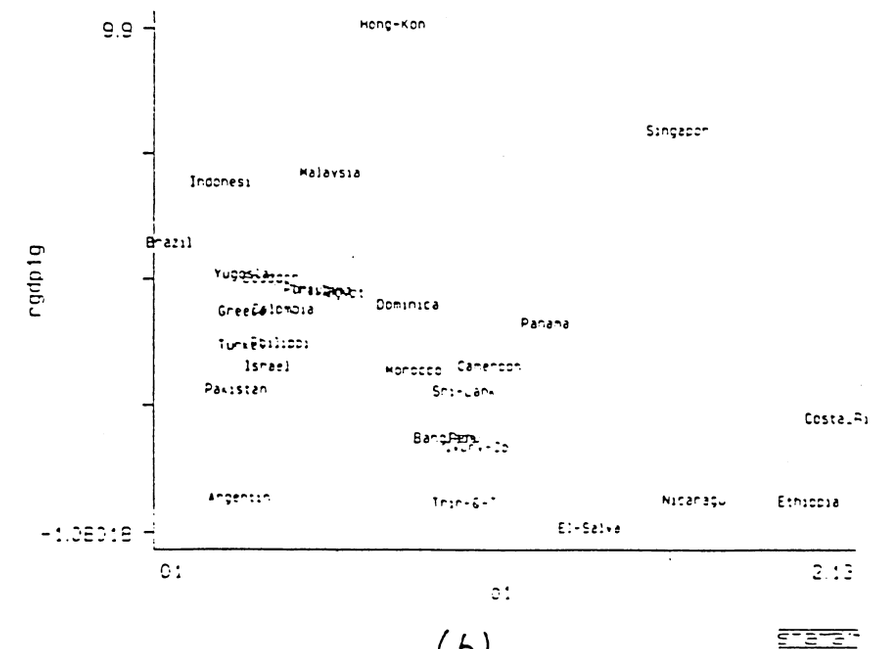
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El-Salva

(b)

Figure 1

regressions the R^2 is very high (especially in the context of cross sections) indicating that the empirical model is capable of explaining up to three quarters of the cross country variability in average growth.

Table 1, which contains results for six OLS regressions when the openness indexes were used, shows that the coefficients of the investment ratio are, as expected, always positive and significant. Also, the coefficients of both proxies for the knowledge gap are negative and significant suggesting that, as predicted by the model, with other things given countries with a larger technological gap -- captured in this setting by a lower level of RGDP70 or RD -- will tend to "catch-up" faster. An interesting feature of this result is that it provides support to the "convergence" hypothesis of the new growth theories.[27] In terms of this paper, the most important result in Table 1 is that the coefficient of the openness indicators is, in every regression positive and significant at conventional levels, providing strong support to the hypothesis that countries with a more open trade regime have, with other things given, tended to grow faster.

Table 2 contains regression results obtained when Leamer's intervention indexes are used as indicators for trade orientation. Since an analysis of the residuals from some of the growth regressions indicate the presence of heteroscedasticity, I also report weighted least squares regressions.[28] Overall, Table 2 tells much of the same story as Table 1: in terms of this

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[27] It is interesting to notice that, as in convergence studies, when other variables are excluded the coefficient of RGDP70 becomes very small and insignificant. On the convergence hypothesis, and some cross country results, see Barro (1989).

[28] Population was used as the weight. It should be noticed that heteroskedasticity was also detected in the regressions based on the openness indices. When WLS were used the results were not affected and, thus, due to space considerations, are not reported here.

TABLE 1

Openness and Growth in Developing Countries OLS: (1970-1982)

	EQ(6.1)	EQ(6.2)	EQ(6.3)	EQ(6.4)	EQ(6.5)	EQ(6.7)
CONSTANT	-0.141 (-0.128)	-1.999 (-1.753)	-0.160 (-0.152)	-1.510 (-1.483)	0.376 (0.264)	0.056 (0.039)
INVGDP	0.282 (5.614)	0.336 (5.729)	0.289 (6.073)	0.307 (5.767)	0.187 (2.955)	0.206 (3.285)
RGDP70	-0.120 (-6.066)	-0.128 (-5.389)	-0.125 (-6.512)	-0.127 (-5.935)	-	-
RD	-	-	-	-	-4.310 (-2.547)	-4.674 (-2.681)
OPEN1	2.004 (3.785)	-	-	-	2.305 (3.975)	-
OPEN2	-	2.910 (1.523)	-	-	-	-
OPENM1	-	-	3.730 (4.069)	-	-	4.352 (2.672)
OPENM2	-	-	-	9.148 (2.859)	-	-
$\bar{R}^2$	0.760	0.693	0.772	0.717	0.501	0.472
N	30	30	30	30	26	26

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t-statistics in parentheses; $\bar{R}^2$ is the adjusted coefficient of correlation; N is the number of observations.

TABLE 2: Trade Intervention and Growth in Developing Countries (1970-82 Averages)

EQN 0	EQ(6.9)	EQ(6.10)	EQ(6.11)	EQ(6.12)	EQ(6.13)	EQ(6.14)	EQ(6.15)	EQ(6.16)
Method	OLS	WLS	OLS	WLS	OLS	WLS	OLS	WLS
CONSTANT	-1.572	1.314	-0.839	1.209	-2.837	-0.717	-2.117	-0.081
	(-1.484)	(1.333)	(0.644)	(0.771)	(-2.737)	(-0.765)	(-1.606)	(-0.067)
INVGDP	0.360	0.262	0.264	0.194	0.367	0.363	0.364	0.342
	(7.340)	(5.294)	(4.345)	(2.568)	(5.627)	(5.942)	(4.190)	(4.487)
RGDP70	-0.126	-0.153	-	-	-0.128	-0.156	-	-
	(-5.719)	(-4.908)	-	-	(-5.210)	(-4.178)	-	-
RD	-	-	-4.972	-4.619	-	-	-6.003	-7.178
	-	-	(-2.822)	(-1.609)	-	-	(-2.925)	(-2.563)
INTERV1	-1.191	-2.016	-1.619	-2.058	-	-	-	-
	(-2.518)	(-3.541)	(-2.621)	(-1.851)	-	-	-	-
INTERV2	-	-	-	-	0.742	-3.450	-6.008	-9.237
	-	-	-	-	(0.315)	(-0.902)	(-1.854)	(-1.845)
R^2	0.700	0.698	0.467	0.414	0.629	0.566	0.395	0.414
N	30	30	26	26	30	30	26	26

*t-statistics in parentheses

paper's main interest, the coefficients of the intervention indexes, are in all but one of the regressions significantly negative as expected. In the one equation where INTV2 is not negative its coefficient is very small and highly insignificant.[29] Overall, then, the results in these two tables provide strong preliminary support for the hypothesis that countries with a more distorted trade regime (that is a higher value of the intervention indexes) will tend to grow slower.

The fact that the coefficients of the intervention and openness indices are significant does not necessarily imply that these variables play a quantitatively important role in explaining cross countries variability in growth rates. This issue is tackled in Table 3 which presents estimated beta standardized coefficients for four of the growth regressions in Tables 2 and 3. These coefficients tell us how the dependent variable would react to typical (one standard deviation) shocks to each of the independent variables. As can be seen from this Table trade orientation indexes do not have the highest betas, their magnitudes in absolute terms are still quite large, indicating that changes in trade policy will have nontrivial effects on growth.

III.3 Measurement Error and Outliers

Measurement Error

The openness and trade intervention indices are, at best, rough proxies for the theoretical concept of trade orientation. A natural way to address this problem is to treat these indicators as being subject to measurement errors. The standard way of tackling this errors in variables problem is by

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[29] As is discussed in greater detail below the positive coefficient of INT2 in eq. (6.13) is driven by one outlier observation. When this outlier is removed the coefficient of INT2 becomes negative and highly significant.

TABLE 3

Beta Coefficients from Growth Equations

	EQ(6.1)	EQ(6.2)	EQ(6.9)	EQ(6.14)
INVGDP	0.71	0.83	0.90	1.00
RGDP70	-0.66	-0.70	-0.70	-
RD	-	-	-	-0.58
INTERV1	-	-	-0.26	-
INTERV2	-	-	-	-0.39
OPEN1	0.41	-	-	-
OPEN2	-	0.20	-	-
N	30	30	30	26

using an instrumental variables technique. Although the instruments do not have to be free of error, they have to be correlated with the independent variable they are instrumenting for, and have to be uncorrelated with regression's error term. Two variables that classify for this role are the average and coefficient of variation of the black market premium in the foreign exchange market. Countries with a higher level of trade (and other) restrictions have traditionally had more generalized black markets for foreign exchange with larger and more variable premia. An advantage of using an instrumental variables approach to deal with measurement error is that it also allows us to tackle the potential reversed causality problem.

Table 4 contains instrumental variables estimates for three representative growth regressions.[30] As can be seen the results obtained strongly support the main implications of the model: All coefficients have the expected signs and are significant at conventional levels.

An alternative, and sometimes more informative approach to measurement error is to use a set of reversed regressions to compute bounds for the coefficient of those variables measured with error. Klepper and Leamer (1984) have shown that if there are no changes in the pattern of coefficient signs when computing the reversed regressions, the "true" value of each coefficient will be bounded by the minimum and maximum estimates from the set of reversed and direct regressions. However, if there are changes in the signs pattern, it is only possible to bound the estimated coefficients if additional restrictions are brought into the model. One such restriction refers to the relation between the "true" (unobservable) variable and the (imperfectly) measured variable. More specifically, Klepper and Leamer show

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[30] The results from other variants of the regressions are similar, and strongly support the most important implications of our model.

TABLE 4

Instrumental Variables Estimates of Growth Equations

	EQ(6,17)	EQ(6,18)	EQ(6,20)
CONST	0.714	-0.557	-2.431
	(0.451)	(-0.410)	(-1.505)
INVGDP	0.252	0.345	0.553
	(3.877)	(6.411)	(3.692)
RGDP70	-0.118	-0.125	-
	(-5.712)	(-5.243)	-
RD	-	-	-8.811
	-	-	(-2.983)
INTERV1	-	-2.139	-
	-	(-2.496)	-
INTERV2	-	-	-16.579
	-	-	(-2.328)
OPEN1	2.636	-	-
	(2.678)		
N	30	30	26
$\bar{R}^2$	0.747	0.654	0.219

*t-statistics in parentheses. Instruments are INVGDP, GLF, RGDP70 (or RD), the average premium in the black market for foreign exchange, the coefficient of variation of the black market premium and population.

that the set of estimated coefficients will be bounded if the R^2 between the dependent and true (error free) explanatory variables does not exceed $R_m^2 = R^2 + (1-R^2)(\max_{i,j}(1-\beta_{ij}/b_{ij}))^{-1}$ where R^2 is the direct regression coefficient of correlation, β_{ij} is the reversed regression estimate of variable j and b_{ij} is the direct regression estimate. A particularly attractive feature of this reversed regressions approach is that it allows the researcher to handle cases where more than one variable -- and even all of them -- are measured with error.

When the reversed growth regressions were estimated, the signs of the trade orientation indicators and of RGDP70 and RD were never altered. This means that if we assume that these are the only variables measured with error, the results reported above are resilient to measurement error difficulties. (That is, these coefficients are bounded within the expected orthant.) Table 5 contains examples of reversed regressions for three equations. As can be seen in Panels A and B, there are no changes in any of the coefficient signs. The coefficients of intervention INTV1 (Panel A) are then bounded by -0.935 and -6.061, while those of the openness index OP1 (Panel B) are bounded within 0.763 and 5.65. Panel C, however, shows that the coefficient of INVGDP changes in one of the reversed regressions. This would present no problem, however, if we are willing to assume that INVGDP is not subject to measurement error. In this case the coefficient of the openness index will be bounded by 2.575 and 3.571.[31]. However, under the assumption that INVGDP is also subject to error, we need to impose a (plausible) restriction to the error variances in order to restrict the estimated sign of the openness coefficient to be positive. It is informa-

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[31] If it is assumed the INVGDP is error free, the INVGDP column and row are eliminated from the coefficients matrix in Panel C.

TABLE 5

Direct and Reversed Growth Regressions

	Direct	INVGDP	RGDP70	Trade Orientation Index
	A. Trade Policy Index: INT1			
INVGDP	0.360	0.534	0.482	0.279
RGDP70	-0.126	-0.169	-0.226	-0.115
INTERV1	-1.191	-0.935	-2.393	-6.061
	B. Trade Policy Index: OP1			
INVGDP	0.282	0.515	0.395	0.107
RGDP70	-0.120	-0.169	-0.206	-0.109
OPEN1	2.004	0.763	1.765	5.650
	C. Trade Policy Index: OP2			
INVGDP	0.336	0.603	0.478	-0.143
RGDP70	-0.127	-0.180	-0.241	-0.107
OPEN2	2.910	-1.184	2.575	3.571

tive to express this restriction as the gap, in percentage terms, between R^2 (the direct regression coefficient of correlation) and 1 that can be attributed to measurement error (see Klepper and Leamer, 1984). For the equation in Panel C of Table 5, the value of this gap is 0.71. This is a reasonable number, since it implies that if all measurement errors were eliminated the regressions R^2 would improve significantly, as one would expect.

All in all, the results obtained from this reversed regression analysis are encouraging, in the sense that they suggest the growth equations estimates have an important degree of resistance to measurement errors. More specifically, if it is assumed that RGDP70 and the trade orientation indicators are the only variables measured with error, the coefficients of openness and trade intervention can be bounded within the expected signs, without any need for incorporating additional restrictions.

Outliers

In order to analyze the possible role of outliers in the results reported above, an influence analysis based on Cook's distance measure was undertaken. This shows the presence of two outliers: Hong-Kong and Singapore. When the observations corresponding to these countries were deleted the results reported above were, in fact, strengthened. For instance, the coefficient of INTV2 in the OLS equation became negative with a t-statistic with an absolute value greater than one. Table 6 contains three sample regressions for the smaller data set that excludes the two outliers.

TABLE 6

Growth and Trade Orientation:

Influence Analysis*

	EQ(6.21)	EQ(6.22)	EQ(6.23)
CONSTANT	0.373 (0.345)	-1.728 (-1.532)	1.914 (1.588)
INVGDP	0.252 (4.929)	0.343 (5.635)	0.126 (2.428)
RGDP70	-0.101 (-5.319)	-0.107 (-4.494)	-0.053 (-3.801)
INTERV1	-1.645 (-3.855)	-	-
INTERV2	-	-3.189 (-1.531)	-
OPEN1	-	-	2.234 (3.908)
$\bar{R}^2$	0.704	0.546	0.554
N	28	28	28

*These regressions exclude the two outliers detected by the computation of Cook's distance measure: Hong Kong and Singapore.

III.4 Other Determinants of Growth: Human Capital Accumulation and Political Instability

An important question is whether the openness and intervention indices are capturing the effect of some other possible determinant of growth that have been omitted from the analysis. In this subsection I consider the roles of human capital and political instability.

Human Capital

Some recent empirical work on cross country differentials in long term growth has focused on the role of human capital accumulation (Barro 1989, Romer 1989). Although our model does not refer explicitly to human capital, it is possible -- even necessary some may argue -- to interpret the term "capital" in equation (1) as referring to a broad concept that includes both physical and human capital. In order to analyze the role of human capital accumulation, a number of regressions including education attainment were estimated. Two basic formulations were used. In the first one, the level of secondary educational attainment, measured as secondary schooling enrollment as percentage of population of the corresponding age group in 1981 was added to the growth regressions. This variable was denoted by ED. In the second formulation the increase in secondary school enrollment over the 1960-81 period (denoted by GED) was used.[32] Both variables were obtained from the World Bank World Development Report, 1984 (Table 25). To the extent that human capital accumulation has indeed played an important role in the poorer countries long term growth experiences we would expect that once included the coefficient of these variables would be positive. Table 7 contains regression results once the human capital variables were

[32] This second variable is available for 28 of our countries only; Ethiopia and Portugal have missing observations for the 1960 educational level.

added to the analysis. As can be seen from these results the coefficients of the human capital variables in every regression were as expected, with t-statistics in the 1.3-2.4 range. Moreover, when these human capital variables are included in the analysis the results regarding trade orientation are not altered.

Political Instability

It has long been suggested that the political and institutional environment may play an important role in explaining cross country differentials in growth. Barro (1989), has recently included a series of politically related variables in his cross country growth regressions. Since Barro's variables refer mostly to political violence, they do not directly capture the country's degree of instability, understood as the perceived probability of government change.[33] Arguably, however, it is indeed the degree of political volatility that mostly affect growth via actual or potential changes in laws, regulations and property rights. The approach I follow in this paper is to use as a regressor a political instability index that measures the perceived probability of government change. This index, which is taken from Cukierman, Edwards and Tabellini (CET) (1989), was constructed as the estimated probability of government change computed from a pooled time series cross section probit analysis for 79 countries over the period 1948-82.[34]

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[33] Barro includes revolutions, political assassinations and coups.

[34] The dependent variable in this probit estimate took a value of 0 for the years in which there was no government change (regular or irregular), and a value of 1 otherwise. In turn, the explanatory variables in the probit model included three groups of variables: (1) economic variables designed to measure the recent economic performance of the government; (2) political variables, which accounted for significant political events that signal the imminence of a crisis; and (3) structural variables, that accounted for institutional differences and country-specific factors that do

TABLE 7

Growth, Trade Orientation

And Human Capital

(OLS)

	EQ( )	EQ( )	EQ( )
CONSTANT	-2.171 (-1.952)	-0.118 (-0.108)	-1.838 (-1.521)
INVGDP	0.329 (6.109)	0.247 (4.082)	0.258 (3.971)
RGDP70	-0.134 (-5.972)	-0.129 (-6.019)	-0.137 (-6.031)
INTERV1	-1.203 (-2.325)	-	-
OPEN1	-	1.984 (3.750)	-
OPEN2	-	-	4.068 (2.128)
ED	-	0.020 (1.370)	-
GED	0.051 (1.792)	-	0.064 (2.165)
$\bar{R}^2$	0.704	0.760	0.694
N	28	30	28

When this estimated index of political instability was added to the growth regressions, its coefficient was always negative, indicating that, as expected, higher political volatility has tended to reduce aggregate growth. The following is an example of the type of result obtained when WLS are used:

$$\begin{aligned} GROWTH = {} & 2.612 + 0.183\ INVGDP \\ & (1.814)\quad (2.711) \\ & - 0.119\ RGDP70 + 2.390\ OP1 - 1.803\ POL \\ & (-3.124)\qquad (3.516)\qquad (-1.518) \end{aligned} \qquad \bar{R}^2 = 0.691,\ N = 30$$

An interesting feature of the results reported in this subsection is that with the addition of these additional possible determinants of growth (human capital and political instability), the coefficients of the trade orientation indexes maintain their expected signs and their relatively high level of significance.

IV. How Robust Are These Results? Alternative Trade Orientation Indicators and Alternative Samples

The results reported above suggest quite strongly that trade policy plays an important role in explaining cross country growth performance in this sample. Countries with more open and less distorted external sectors have tended to outperform nations with more interventionist trade regimes. Moreover, the discussion presented in the preceding section showed that these results are very robust to the estimation method, to the inclusion or exclusion of other determinants of growth, to error-in-variables corrections, and to the removal of outlier observations. However, the fact that

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no change, or that change only slowly over time. Using the pooled time series-cross country probit estimates, Cukierman et al., compute an estimated frequency of government change in each country during the period 1971-82. The index on political instability was then constructed by averaging the estimated probabilities of government change over that time period.

this investigation has been based exclusively on the use of Leamer's estimated trade orientation indicators may stand in the way of it becoming a truly persuasive story. In this section I address this problem by investigating the way in which the regression results are affected if alternative, and in my opinion less desirable, indexes of trade orientation are used. Also, I report results for a larger data set that includes both developed and developing countries, and that include data for alternative periods.

IV.1 Alternative Indicators of Trade Orientation and Trade Distortions

The following alternative indicators of trade orientation were used in this robustness analysis:

(1) Average Black Market Premium (BMP): Averages on black market premium were computed for the period 1970-82 from raw data obtained from various issues of Pick's Currency Yearbook. An attractive feature of this indicator is that, in principle, it not only captures the effect of distortions to trade, but also to capital flows and other markets. This indicator is available for all thirty of the countries in the basic sample.

(2) Coefficient of Variation of the Black Market Premium (BMCV): This indicator provides a proxy on how variable exchange, trade and other controls, have been during the period in question. It is also available for all 30 countries. As with the previous index the source is Pick's Currency Yearbook.

(3) Index of Relative Price Distortions (RPDIST): This indicator, computed by Dollar (1990) measures the extent to which the relative prices of tradables to nontradables are distorted. This index is available for 25 of our countries.

(4) Average Import Tariffs (IMPO and IMPM): This indicator provides average nominal tariffs computed from country pages in UNCTADs Handbook of Trade Control Measures of Developing Countries. Averages for all line items (IMPO) and for the manufacturing sector only were used (IMPM) in our growth regressions. A limitation of this indicator is that it refers to 1987 tariffs only; also tariff averages miss the distortive effects of nontariff barriers. The raw data are reported in Pritchett (1990).

(5) Average Nontariff Barriers Coverage (NTB): This index measures what percentage of each country's tariff line items are covered by NTBs. A limitation of this index is that it is completely silent with respect to how restrictive these NTBs actually are. Certainly, high NTB coverage does not necessarily imply a high degree of trade restrictions. The original data were obtained by Pritchett (1990) from UNCTAD. This index is available for 25 of our countries.

(6) World Development Report's Index of Trade Distortions (WDR): This index was originally computed by Agarwala (1983) and published by the World Bank in World Development Report 1983. Unfortunately, however, this index is only available for 13 of our 30 countries.

(7) Index of Effective Rates of Protection (ERP): An index measuring the level of effective rates of protection for 16 of our countries were obtained from deLong and Summers (1990). These data, which are originally taken from Jones are binary, have a value equal to 1 if the ERP is greater than 40% and zero otherwise. A positive feature of this index is that it incorporates the role of distortions on intermediate inputs. On the negative side, this indicator does not include in any way the effect of nontariff barriers. Additionally, the

fact that this index is discontinuous reduces its usefulness.

(8) World Bank Index on Outward Orientation (OUTW): This index was published by the World Bank in the 1987 World Development Report, and classifies countries according to their degree of outward orientation. A serious limitation of this indicator is that it is subjective, in the sense that the researchers that constructed it used their judgment to classify different countries in the alternative openness categories. The index is supposed to capture the average extent of outward orientation for the period 1973-85. This index is available for 17 of the 30 countries in our basic sample.

Indexes (1) through (7) are measures of the degree to which governments distort international trade. It is expected, then, that in growth regressions their coefficients will be significantly negative. Indicator (8) on outward orientation, however, measures openness and its coefficient is expected to be positive.

Table 8, which contains a summary of the results obtained from a series of growth regressions using these alternative trade orientation indicators presents a very interesting picture. First, the results concerning the coefficients of the investment ratio and technological gap are not affected when alternative indicators of trade orientation are used. Second, and more important for the purpose of this paper, in virtually every regression the coefficient of the trade orientation variable has the expected sign. Moreover, in all but one of these regressions, these coefficients were estimated with a fairly high degree of precision with the t-statistics exceeding (in absolute value) one and in some cases, exceeding two.

The only indicator of trade orientation that does not have the expected sign is the index of nontariff barriers (NTBs). This is the case even when

TABLE 8: Growth and Trade Orientation: Alternative Indicators

EQN 0	(18)[a]	(19)[a]	(20)[b]	(21)[a]	(22)[a]	(23)[a]	(24)[a]	(25)[b]	(26)
INVGDP	0.249**	0.353**	0.348**	0.239**	0.236**	0.321**	0.248*	0.516**	0.255**
RGDP70	-0.140**	-0.163**	-0.170**	-	-	-0.147**	-	-0.154**	-0.118**
RD	-	-	-	-7.996**	-8.125**	-	-10.629*	-	-
BMP	-2.193*	-	-	-	-	-	-	-	-
BMCV	-	-0.214*	-	-	-	-	-	-	-
RPDIST	-	-	-0.012*	-	-	-	-	-	-
IMPO	-	-	-	-0.030*	-	-	-	-	-
IMPM	-	-	-	-	-0.029*	-	-	-	-
NTB	-	-	-	-	-	0.016*	-	-	-
WDR	-	-	-	-	-		-2.305*	-	-
ERP	-	-	-	-	-	-		-0.424	-
OUTW	-	-	-	-	-	-	-	-	1.414**
N	30	30	25	20	20	22	12	14	17
R^2	0.586	0.592	0.578	0.391	0.392	0.592	0.100	0.699	0.751

All equations, except (25), were estimated with WLS. An asterisk indicates that that coefficients t-statistic exceeds one in absolute value; two asterisks indicate that the to-statistic exceeds two.

it is included jointly with tariff averages. In a way, this is not too surprising since NTB is likely to be one of the poorest indicator of trade orientation.[35]

Alternative Data Sets

An important question is whether the results presented in the preceding tables are only valid for this particular sample of developing countries, or whether they still stand in a wider sample of developed and developing countries. This issue is addressed in Table 9 where a set of regressions for a 51 countries data set that incudes 51 developed and developing countries are presented.[36] These regressions were performed both for 1970-82 growth averages, as well as for 1960-82 averages. As can be seen, the results are highly satisfactory, providing broad support to our endogenous approach to growth and trade policy; they clearly suggest that the previous findings are not an artifact of the sample selection or the time period chosen.[37]

V. Concluding Remarks

This paper has presented suggestive -- even persuasive, I would hope -- evidence on the existence of a strong and robust relationship between trade

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[35]The reason for this is that, as pointed out above, the fact that NTBs have a broad coverage does not necessarily mean that they are very restrictive. Indeed there are many countries where in spite of the fact that import licenses have a broad coverage, they are granted as a matter of course, without generating significant disruptions to trade. This has been, for example, the case of Colombia in years where the price of coffee is high. See Thomas (1985).

[36]These 21 countries are: U.S., U.K., Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Finland, Iceland, Ireland, Portugal, Spain, Australia, and New Zealand.

[37]I think, however, that the endogenous technological progress story of Section II is appropriate for LDCs and not for industrial nations. In that case the internal process of innovation would have to be modelled in greater detail.

TABLE 9

Growth and Trade Orientation:

Developed and Developing Countries*

	EQ( )	EQ( )	EQ( )	EQ( )
PERIOD	1970-82	1960-82	1970-82	1960-82
CONSTANT	0.575 (0.925)	1.303 (2.903)	0.665 (0.640)	1.434 (2.129)
INVGDP	0.159 (5.147)	0.143 (6.173)	0.226 (4.807)	0.240 (5.918)
RGDP70 or RGDP60	-0.044 (-4.651)	-0.0005 (-5.514)	-0.083 (-3.352)	-0.002 (-5.641)
INTERV1	-	-	-0.793 (-1.368)	-0.830 (-1.981)
OPEN2	2.888 (2.027)	2.801 (2.732)	-	-
$\bar{R}^2$	0.433	0.521	0.513	0.776
N	51	51	51	51

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*t-statistics in parentheses. The last equation was estimated using weighted least squares.

orientation and economic performance. The results reported clearly indicate that countries with more open and less distortive trade policies have tended to grow faster than those countries with more restrictive commercial policies. The results also support the existence of a catch-up effect, in the sense that countries with a lower initial level of income per capita will tend to grow faster than other countries. The results also indicate that in this sample physical capital accumulation measured by the ratio of investment to GDP, has been an important determinant of growth, as has been human capital accumulation. Another interesting result reported in this paper refers to the role of political instability in determining growth. Instead of using raw proxies for instability such as assassinations and riots, I used an index of the perceived probability of government change in a set of growth regressions. The results obtained provide support to the hypothesis that there is a negative relationship between instability and growth.

The empirical work presented here centers around a set of indicators on trade orientation constructed by Leamer from a disaggregated model of directions of trade for 58 countries and 183 commodities. Although these indicators are not free of problems, and are at best rough proxies of trade orientation, I believe that they are the best indicators that one could possibly obtain in a cross-country setting. They are objective, comparable across countries, and continuous. Additionally, these indicators collapse into one index the effects of tariff and nontariff barriers. However, I am aware that results on such a controversial issue as the role of trade policy on growth may not be fully persuasive if based on simple regressions that use a single trade indicator. More often than not, people whose priors are not confirmed by empirical work tend to question the appropriateness of the data, the validity of the estimation methods and the relevance of the time

period selected. In an effort to provide a persuasive story, in this paper I have made a serious attempt at checking the robustness of the basic results. The first step of this sensitivity analysis consisted of basically taking apart the regressions based on the Leamer indexes in an effort to understand what was driving the results. Two alternative methods for dealing with measurement error were implemented; heteroscedasticity correction was performed; an influence analysis was used to detect whether outliers were driving the estimates; alternative specifications were used; larger data sets that also included developed countries were considered; different time periods were tried; and the role of interactive terms was explored. This battery of procedures showed that the fundamental findings were extraordinarily robust. Again and again the regression estimates suggest that more open countries have tended to grow faster.

The second step in the robustness analysis consisted of replacing the Leamer indexes by alternative, and in my opinion less desirable, indicators of trade orientation and openness. Nine proxies for trade intervention and openness were used in those alternative formulations. In all, but of the cases, the coefficients of trade policy had the expected sign and were estimated with relative precision. All in all, these alternative indicators for trade orientation tend to confirm the main thrust of our results.

Where to go from here? First, I believe that one of the important next steps in the research on endogenous growth should go in the direction of analyzing some of the microeconomic aspects of the problem. The reason for this is that, although aggregate studies of the type presented here are informative and interesting, they are unable to sharply discriminate between different hypotheses regarding the channels through which growth is actually working its way through. A second important dimensions of future research

refers to broadening the analysis to a time series dimension. A problem with this, however, refers to the trade orientation indicators. The construction of broad and careful trade distortion indexes, such as Leamer's indicators, is a costly and laborious task. It seems, however, that if we are to broaden further our understanding of the growth process, there is no alternative to constructing these types of indicators for several points in time.

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DATA APPENDIX

	country	inter1	inter2	open1	open2
1.	Greece	.24	.26	.24	.26
2.	Portugal	.47	.47	.47	.47
3.	Turkey	.24	.17	.24	.17
4.	Yugoslavia	.25	.21	.25	.21
5.	Argentina	.23	.27	.23	.27
6.	Brazil	.01	.19	.01	.19
7.	Colombia	.37	.25	.37	.25
8.	CostaRica	2.13	.55	2.13	.55
9.	DominicanRep	.77	.19	.77	.19
10.	Ecuador	.33	.19	.33	.19
11.	ElSalvador	1.35	.28	1.35	.28
12.	Nicaragua	1.68	.24	1.68	.24
13.	Panama	1.21	.39	1.21	.39
14.	Peru	.95	.31	.95	.31
15.	TrinidadTobago	.95	.49	.95	.49
16.	Israel	.32	.25	.32	.25
17.	Egypt	.57	.25	.57	.25
18.	Bangladesh	.89	.11	.89	.11
19.	SriLanka	.95	.29	.95	.29
20.	HongKong	.72	.67	.72	.67
21.	Indonesia	.17	.21	.17	.21
22.	Malaysia	.52	.45	.52	.45
23.	Pakistan	.22	.23	.22	.23
24.	Philippines	.36	.21	.36	.21
25.	Singapore	1.63	.8	1.63	.8
26.	Thailand	.49	.27	.49	.27
27.	Cameroon	1.03	.27	1.03	.27
28.	Ethiopia	2.04	.13	2.04	.13
29.	CoteDIvoire	.99	.43	.99	.43
30.	Morocco	.79	.34	.79	.34

	country	rgdp1g	rgdp70	invgdp	rd
1.	Greece	3.616813	2952	23.69675	.116808
2.	Portugal	4.107667	2575	27.25495	.256709
3.	Turkey	2.87085	1702	19.80089	.179027
4.	Yugoslavia	4.434443	2885	33.28975	.742169
5.	Argentina	-.428469	4002	24.3854	.273684
6.	Brazil	5.108412	1782	22.03155	.072719
7.	Colombia	3.664589	1711	17.85121	.052317
8.	CostaRica	1.283247	2300	22.68738	.145918
9.	DominicanRep	3.767774	1232	20.95509	.
10.	Ecuador	4.34645	1403	21.49347	.097653
11.	ElSalvador	-1.08018	1358	16.82034	.201507
12.	Nicaragua	-.472911	2292	17.92116	.293428
13.	Panama	3.356877	2093	26.90743	.125076
14.	Peru	.8689871	2285	15.51923	.063153
15.	TrinidadTobago	-.541995	6957	27.94423	.368932
16.	Israel	2.417474	4861	28.2	1.017182
17.	Egypt	4.02591	671	20.90291	.205871
18.	Bangladesh	.860155	458	5.3	.022524
19.	SriLanka	1.871546	1018	19.26624	.159287
20.	HongKong	9.9	1300	29	.
21.	Indonesia	6.431859	559	20.31124	.09
22.	Malaysia	6.637047	1525	26.63026	.181457
23.	Pakistan	1.912324	797	15.30154	.009425
24.	Philippines	2.924142	1094	21.60891	.176266
25.	Singapore	7.560045	2869	37.52717	.175355
26.	Thailand	4.077312	1063	23.95508	.014393
27.	Cameroon	2.420509	703	18.10264	.056374
28.	Ethiopia	-.513206	341	10.35792	.
29.	CoteDIvoire	.66742	1028	15.2	.074013
30.	Morocco	2.331048	876	21.16364	.