

International Integration and Growth: A Survey and Empirical Investigation

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Abstract

The authors attempt a comprehensive assessment of different forms of international integration on growth. In particular, the paper considers the impact of trade flows, of inward foreign direct investment, of preferential treatment of less-developed countries, and of membership in trade blocs. Results confirm that general openness and foreign direct investment into a country do lead to increased growth; that membership in a trade bloc facilitates growth; and that the variation in income in the trade bloc also encourages more rapid growth among member countries.

1. Introduction

In recent years there has been a renewed interest in studying the determinants of growth given the divergence in per capita incomes across the nations of the world. Neoclassical growth theory predicts that all countries will converge to the same steady-state growth rate. Given that this prediction does not square with the observed divergence in growth rates, others have developed theories explaining growth without the troubling convergence prediction. While endogenous growth theories consider a variety of mechanisms by which growth can be sustained, we concentrate on how international interactions—including trade, foreign direct investment, and the formation of trade blocs—contribute to growth.¹

We begin by briefly describing the theoretical work and surveying the empirical work that directly relates international integration to growth. We then empirically analyze the effects of different types of international interactions on growth. Our paper contributes to the literature by discriminating between the different channels through which growth is affected by international integration as well as by integrating the channels through which international interactions may influence growth. Most, if not all, empirical work focuses on one international interaction at a time. Because measures of international interactions are highly and statistically significantly correlated, omitting any of them will lead to a biased estimate of the influence of those that are included in the regression.

In general, we find that increased international integration does lead to faster growth. In particular, increases in inward FDI, increases in the trade share of GDP, increases in exports to richer countries, being a member of a trade bloc, and increases in the dispersion of income of trade bloc members lead to increased growth.

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2. Theoretical Predictions

Trade theory shows that countries gain from trade, in the sense of achieving a higher *level* of income, by reallocating scarce resources to those sectors in which a country has a comparative advantage. Endogenous growth theory attempts to explain growth while endogenizing technological change. When integrated, the two theories shed light on how trade, trade policy, and investment affect growth. We highlight endogenous growth models of open economies. The papers incorporate the insights of both bodies of literature: growth may be sustained by dynamic comparative advantage, technology diffusion, learning-by-doing, spillovers, and economies of scale. Several survey papers focusing on theoretical work on growth that incorporates international interactions have been written. Therefore, we limit the discussion to several papers that provide examples of the ways in which international interactions may influence growth, rather than surveying the vast literature on the topic.

Grossman and Helpman (1991a) discuss three channels, in addition to dynamic comparative advantage, through which international integration might affect a country's growth rate. First, international integration increases the opportunities for communication and thus facilitates the transmission of technology. Second, increasing international competition can encourage entrepreneurs to engage in more R&D activities, while at the same time reducing duplication of research effort. Finally, the size of the market is expanded with freer trade, potentially increasing investment activity. Grossman and Helpman (1991b) develop a dynamic general equilibrium model to discuss the knowledge spillovers through which trade improves a country's growth performance. A homogeneous, traded final good is produced by perfectly competitive firms using labor and nontraded, horizontally differentiated intermediate goods that require R&D to produce new varieties. Productivity of R&D is linked to the stock of knowledge capital, which depends not only upon domestic efforts on product development, but also upon the number of contacts that local firms have with the international research and business communities. The number of contacts is assumed to be positively related to the extent of international trade in commercial commodities. Thus, trade, and trade policies, can affect a country's growth.²

In their model, the effect of trade policy on the long-run growth rate depends on parameters in the production function. For example, in the case where the relative importance of spillover effects from international trade declines over time, trade policy can influence the rate of knowledge accumulation and growth only in the transition period. A policy such as a tariff, imposed by either the home or the foreign government, can reduce the chance of interacting with foreign firms, so that during the transition period growth will slow towards the steady state. However, in the long run, the volume of trade (and hence trade policy) has no effect on the steady-state growth rate. On the other hand, in the case where the volume of trade grows at the same rate as the number of varieties of the differentiated industrial products, Grossman and Helpman prove that a reduction in the size of trade barriers will increase the ratio of the cumulative volume of trade relative to the number of varieties in the long run; this accelerates technological progress and therefore leads to a higher growth rate in the steady state. Thus, where trade and trade barriers do have an effect on growth, more international interactions (higher trade volumes, lower trade barriers) increase growth.

Ben-David and Loewy (1997, 1998) also suggest that trade may lead to economic growth by facilitating the diffusion of knowledge and knowledge accumulation among countries. They assume that the extent of knowledge spillovers between two countries is an increasing function of the volume of trade between them. As predicted by Grossman and Helpman, Ben-David and Loewy show that a unilateral tariff reduction by a single country would cause all trading countries to grow faster in the steady state. In addition, Ben-David and Loewy show that removing or reducing tariffs improves growth by directly changing market clearing prices and thus consumption. Consequently, trade policy has an indirect effect on the extent of knowledge spillovers and accumulation.

Another mechanism through which international integration can contribute to growth, other than the knowledge spillover effect, is illustrated by Rivera-Batiz and Romer (1991). They emphasize the pure scale effect through which integration by two similar countries affects long-run growth.³ They distinguish two types of R&D in which innovation occurs to differentiated capital inputs: a knowledge-driven specification and a lab equipment specification. The first type of R&D is characterized by the assumption that the R&D sector uses human capital and the existing stock of knowledge as inputs. Unskilled labor and physical capital, which also enter the production function of the manufacturing sector, have no impact on the accumulation of knowledge. In the lab equipment specification, R&D is assumed to use the same inputs as the manufacturing product and knowledge *per se* has no value.

Complete integration can raise the growth rate and improve welfare in both countries, regardless of whether R&D *per se* has production value. However, for partial integration, Rivera-Batiz and Romer show that trade in goods alone without exchanging ideas has no effect on the long-run growth rate for both countries in the knowledge-driven R&D model. The intuition behind this finding is straightforward. Without exchanging ideas, the stock of knowledge in both countries remains the same, and there will be no technological progress in either of these countries. Therefore, international trade can only have a level effect on the steady state without affecting the growth performance of a country. On the other hand, since trade in goods has already provided an incentive for researchers in different countries to specialize in different designs, allowing trade in ideas can take advantage of the fact that the worldwide stock of knowledge is twice as large as the stock in each individual country, and hence the productivity of human capital in the research sector and the growth rate of output can be increased.

Rivera-Batiz and Romer conclude that it is not knowledge spillovers that cause long-run growth, but rather it is increasing returns to scale, arising from the enlarged market size, in the production of new designs that result in a higher growth rate for two identical, integrated countries. Given that the production function of new designs exhibits increasing returns to scale, trade in goods can therefore provide the incentive to avoid redundant effort from operating two research sectors in isolation. Additionally, trade in ideas along communications networks in the knowledge-driven model and trade in capital goods in the lab equipment model can serve the function that ideas discovered in one country can be available for use in research in both countries.

Although Rivera-Batiz and Romer show that trading commodities alone between two similar countries can have no growth effect in the knowledge-driven model, it can also be shown that this equilibrium is not stable in the case where two countries slightly differ in the initial stock of knowledge. Devereux and Lapham (1994) adopt the same

type of model and prove that the symmetric balanced growth path can never be attained as long as the initial stocks of knowledge are not identical across two countries.⁴ Specifically, trading goods alone without exchanging ideas will eventually cause a country with a relatively small share in the initial world stock of designs to specialize in producing manufacturing goods and a country with a larger share to diversify between manufacturing and R&D. These findings reinforce the importance of trade in commodities and the role played by comparative advantage in the process of income growth when two countries integrate with each other.

We thus see a variety of ways in which international interactions can affect growth. What hypotheses can we take from these stylized models to the “real” world? Since one role international interactions play is to diffuse technology, increased trade and increased foreign direct investment should increase growth. Rivera-Batiz and Romer’s model also suggests that the establishment of a trade bloc, and the degree of integration attained within the trade bloc, could, in addition to contributing to technology diffusion, cause rationalization to occur in the R&D sectors, also leading to higher growth.

3. Empirical Literature

We now survey the empirical literature relating international integration to growth. The modern empirical literature has stepped away from developing countries to examine linkages between international interactions and growth. As discussed above, there are many avenues through which international interactions can affect growth in a country or set of countries. Unfortunately, the majority of empirical work has been narrow in focus, addressing only a single issue rather than all of the possible interactions that may lead to growth. Accordingly, we divide this section into three subsections: trade and openness, foreign direct investment, and preferential trading arrangements.

Trade and Openness

Perhaps the most empirically studied issue relating to growth and international interactions is trade and openness. The most commonly used variables have been the share of exports in GDP (or growth of exports) or the share of exports and imports in GDP.⁵ Openness is a catchall for the transmission of growth facilitators into a country. That is, the more a country trades, relative to its size, the more likely it is to experience the benefits of international interactions.⁶ To the extent that this raw measure is capable of capturing the complicated issues raised by the new growth theories, this is a reasonable approach. These studies typically find a positive relationship between the trade share and growth. Criticisms of these studies include the robustness of the results, the identical treatment of imports and exports, and the endogeneity of trade flows or their correlation with other pro-growth policies.

Because export and trade shares may not capture the degree to which a country is “open,” given that trade volume is determined by a number of characteristics beyond trade policy, many studies have examined more exact measures of the degree to which a country is open. In one of the most comprehensive treatments of the issue of openness, Harrison (1996) considers a number of measures of openness over a sample of developing countries, including: an annual index of trade liberalization based on exchange rate and commercial policies; another based on tariffs and nontar-

iff barriers; the black-market premium; the share of trade in GDP (the usual openness measure); movements toward international prices; a modified version of the price distortion index used in Dollar (1992); the indirect bias against agriculture from industrial sector protection; and the overvaluation of the exchange rate. The results generally show that movements toward openness positively affect growth, while greater distortions reduce economic growth. Edwards (1992) adopts indices of openness and intervention in trade based on Leamer's (1988) approach to predicting trade. In essence, the openness and intervention indices are based on deviations of observed trade flows and trade intensities from their predicted value.⁷ He too finds broad support that more openness leads to higher growth rates on a sample of developing countries.

Frankel and Romer (1996) focus on the potential endogeneity of the trade share and other more direct measures of openness, such as trade barriers. They note that countries with liberal international trade policies are likely to be those with domestic policies that are also conducive to growth. In this case, measures of the policy stance and trade volumes may reflect variables omitted from the income equation rather than the effects of international trade. Their approach is to instrument for trade using the geographic component of a country's trade from a common gravity equation; they rightly point out that geographic isolation is unlikely to influence a country's income other than by reducing its interactions with other countries. They continue to find a significant impact of trade on growth, and suggest that studies that do not account for endogeneity understate the magnitude of the effect.⁸ Van den Berg (1996) tackles the simultaneity issue by adopting a time-series approach to simultaneously estimating growth, export share, import share, and investment share for a variety of Latin American countries. When significant, the effect of export and import share is positive; when both are significant for a country, the effect of exports is generally of larger magnitude than the effect of imports.

Levine and Renelt (1992) find that the common favorable relationship between trade and growth is not robust to changes in the broader model specification. They consider the robustness of export share, import share, Leamer's indices of openness and of distortions, the black market premium, and Dollar's index of real-exchange rate distortion. Under an extreme bounds test for robustness, they reject robustness for all measures. Levine and Renelt's robustness criterion is severe, prompting Sala-i-Martin (1997) to consider a more relaxed definition of robustness. He finds that trade share is not robust, but also finds that an alternative measure of openness, "Number of Years an Economy Has Been Open Between 1950 and 1990," is robustly positive and significant. In addition, Roubini and Sala-i-Martin (1991) note that Levine and Renelt allow the sample to change as different variables are included in the model due to different missing values for different regressors. Hence, while the coefficient on an openness variable may become insignificant when another variable is added to the specification, it is unclear whether the insignificance arises from the new specification or the new estimating sample. We limit our analysis to the same set of observations for all model specifications in order to avoid this problem.

Foreign Direct Investment

The role of FDI in the growth process has long been a topic of intense debate. Until relatively recently, however, there has been very little empirical analysis of the issue. The recent developments in the growth theory, discussed above, have provided a

convenient framework in which to pursue empirical work. Accordingly, the evidence of the impact of FDI on growth is expanding rapidly. To date, however, the evidence is not clear; there is evidence of both a positive and a negative impact of FDI on growth in developing and developed countries.

Borensztein et al. (1995) present compelling results of the impact of FDI from industrial countries to 69 developing countries. They find that FDI contributes to growth in less-developed countries primarily through technology transfer. Foreign investment is found to contribute relatively more to growth than domestic investment, presumably by implementing technologies with higher productivity. They suggest an important caveat, however, that a host country will benefit in this way only once it obtains a minimum threshold stock of human capital. In essence, without the resources necessary to exploit the new technology on a wide scale, these productivity improvements will not be realized. A secondary finding is that foreign investment and domestic investment are complements.

Balasubramanyam et al. (1996) test the hypothesis that trade and inward FDI are complements for 46 developing countries. This is accomplished by dividing the sample into countries pursuing an outward-oriented trade regime and those pursuing import substitution policies. They find that FDI is more likely to be a contributor to growth in countries pursuing outward-oriented (export promoting) policies, and that in fact there is evidence that FDI is negatively related to growth in countries pursuing import substitution policies. A shortcoming of the conclusion centers on the distinct possibility that the nature of the foreign direct investment may differ significantly in each case. In the case of outward-oriented countries, the investment may well represent the appropriate specialization and utilization of abundant resources in the host country. FDI into countries pursuing import-substituting strategies, on the other hand, may represent efforts to jump trade barriers. As such, this investment may embody technologies that are inappropriate for the host country, resulting in an inefficient use of domestic resources. In addition, the model does not include a measure of imports. If FDI is an effort to hurdle trade barriers, then FDI and imports will be negatively correlated, and the included FDI measure will pick up both the effect of FDI as well as the effect of imports. This too may explain the observed negative coefficient, since high FDI may also proxy for low imports, negatively affecting growth.⁹ Saltz (1992) finds a negative relationship between FDI and growth in third world countries, pointing to overly capital-intensive technologies, monopolization, and transfer pricing distortions resulting in the underutilization of labor. He also suggests that direct investment may well cause more outflow of capital over time than portfolio investment.¹⁰

Much of the work on the effect of FDI on growth has concentrated on FDI from developed countries into developing countries, and the results have been mixed. If Saltz is correct that investment by developed countries embodies technology that is inappropriate for developing countries, it suggests that FDI by similar countries may increase growth. We therefore include FDI from all countries.

Preferential Trading Arrangements

An aspect of trade regimes that remains under-studied is that of preferential trading arrangements: preferential market access or formal bilateral agreements. In particular, the Generalized System of Preferences (GSP) is often defended by the notion that granting less-developed countries preferential access to markets in developed

countries will facilitate growth among developing countries;¹¹ similar arguments were made by France when insisting that former colonies receive preferential access to the EEC under the Yaoundé and Lomé conferences. The theory underlying the growth effects of this type of arrangement or other preferential arrangements is scant but growing, perhaps explaining the dearth of empirical work. Of the small amount of empirical work that has been carried out, the European Union has received the most attention.

Henrekson et al. (1997) study the growth effect of European integration. They find that membership in the European Union or the European Free Trade Area does significantly promote growth, and suggest that technology transfer is the main mechanism through which EU and EFTA membership affect growth. Landau (1995), on the other hand, finds that membership in the EU does *not* contribute to growth of member countries. Landau limits his sample to 17 wealthy OECD countries over 1950 to 1990; however, even when limiting the analysis to the 22 OECD countries, Henrekson et al. still find a statistically significant positive effect of membership in the EU or EFTA. The difference in results is perhaps explained by the fact that Henrekson et al., control for membership in the EU or EFTA, while Landau only considers membership in the EU. Thus, Landau's control group will include members of EFTA, which may explain why the coefficient on EU membership is not statistically significantly different from the control group.¹²

Little has been done on regional integration in general. De Melo et al. (1992) estimate a growth equation including dummy variables for each trade bloc; the only significant dummy is for the Southern African Customs Union in the 1960–72 subperiod. Henrekson et al. discuss why it is surprising that the influence of trade blocs is insignificant as well as discussing possible explanations for the insignificant result. When we adopt the De Melo et al. approach, we too find generally insignificant results. However, alternative measures of regional integration, as discussed below, suggest that regional integration does increase growth rates.

4. Empirical Framework

From the discussion above, we find that there are a number of disjointed pieces of evidence that more international interactions lead to more trade. It seems clear that different types of international interactions are related. For example, foreign direct investment is thought to provide an alternative form of supplying a foreign country if tariffs are high, and empirical evidence suggests that trade and FDI are complementary. In Table 1, we report statistically significant correlation coefficients for correlations between the international variables we include in our study and between the international variables and the other included regressors (table A1). Indeed, most of the correlations are significant. Following in the same vein as Frankel and Romer (1996) and Levine and Renelt (1992), we note that omission of some international variables may therefore bias the results on other international variables. We therefore turn to a more comprehensive investigation into the effects of foreign direct investment, trade in general, and preferential trade arrangements. By controlling for all forms of international interactions we can avoid the omitted variable bias that results from a fragmented approach.

We adopt a panel data approach.¹³ We borrow and extend Islam's approach, arriving at the following estimating equation:

Table 1. Correlations Among International Variables, and Between International and Control Variables

	FDI shr	Trade shr	Rich X	Same X	Poor X	Rich M	Same M	Poor M	Any bloc	TPA	FIA	CU	Bloc std	Initial GDP	Govt shr	Initial sec ed	Pop. growth	Invest shr
FDI shr.*	-0.19	—	—	—	—	—	—	—	—	—	—	—	—	0.67	-0.41	0.50	-0.40	0.54
Trade shr*	-0.52	0.40	—	—	—	—	—	—	—	—	—	—	—	—	0.25	—	—	—
Rich X*	0.47	0.32	-0.55	—	—	—	—	—	—	—	—	—	—	-0.63	0.27	-0.56	0.44	-0.32
Same X*	0.40	0.41	-0.36	0.71	—	—	—	—	—	—	—	—	—	0.74	-0.19	0.57	-0.62	0.48
Poor X*	-0.55	0.44	0.93	-0.57	-0.32	—	—	—	—	—	—	—	—	0.69	-0.29	0.56	-0.48	0.46
Rich M*	0.42	0.40	-0.51	0.91	0.75	-0.47	—	—	—	—	—	—	—	-0.66	0.31	-0.55	0.45	-0.35
Same M*	0.45	0.44	-0.37	0.69	0.88	-0.34	0.77	—	—	—	—	—	—	0.77	-0.19	0.61	-0.63	0.42
Poor M*	-0.56	0.23	0.38	-0.29	-0.19	0.37	-0.27	-0.23	—	—	—	—	—	0.72	-0.30	0.58	-0.52	0.47
Lomé	—	—	—	—	-0.15	—	—	-0.15	0.18	—	—	—	—	-0.52	0.44	-0.38	0.24	-0.54
Any bloc	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.13	—	—	-0.30
TPA	-0.19	—	0.29	-0.24	—	0.18	-0.30	—	0.35	—	—	—	—	-0.19	—	—	0.23	—
FTA	0.14	—	—	—	—	—	—	-0.19	0.59	-0.24	—	—	—	-0.14	0.18	—	—	-0.29
CU	0.36	—	—	0.28	—	-0.14	0.27	0.17	0.27	-0.26	—	—	—	0.22	—	—	-0.45	—
Bloc std	0.41	—	-0.20	0.34	0.17	-0.19	0.31	0.23	0.56	0.16	0.18	0.53	—	0.35	—	0.22	-0.44	0.19
Bloc size	—	—	—	0.41	0.16	-0.23	0.37	0.25	0.26	—	0.66	0.78	—	0.38	—	0.17	-0.53	0.21

* In logs. A blank entry indicates that the correlation was not significant at the 5% level.

$$dy_{it} = \alpha + \beta y_{it-5} + \gamma C_{it} + \tau T_{it} + v_i + \varepsilon_{it}, \quad (1)$$

where dy_{it} is the growth rate of GDP per capita from period $t - 5$ to period t ; y_{it-5} is country i 's per capita income in period $t - 5$; C_{it} is a set of control variables; T_{it} is a set of international interaction variables; v_i is a country-specific error term; and ε_{it} is the residual.¹⁴ We assume that continuous variables affect growth nonlinearly, so they are entered as logs.

As controls, C_{it} , we use the log of investment and government spending shares of GDP, the log of the population growth rate, and a measure of the initial stock of human capital, all of which are common control variables in empirical growth studies.¹⁵ We expect that the coefficient on investment will be positive. The standard neoclassical explanation is that increased investment raises the steady-state level of output per effective worker and therefore raises the growth rate for a given starting value of GDP. The endogenous growth explanation would rely on economies of scale and/or spillovers to explain the manner in which increased investment leads to increased growth. The expectation of the sign of the coefficient on government share is ambiguous, as it depends on what government is purchasing. For example, Barro (1997) considers government expenditures to proxy for outlays that do not improve productivity. The larger the share of GDP spent on nonproductive government spending, the lower is expenditure on more productive endeavors and hence the lower is the growth rate. On the other hand, if the government is investing in education and infrastructure or some other form of productive capital, the coefficient should be positive. We expect a negative coefficient on the population growth rate. In a neoclassical model, if the population is growing, more of the economy's investment is used to provide capital for new workers rather than to raise capital per worker. Thus, a higher rate of population growth has a negative effect on the steady-state level of output per effective worker. In addition, a higher fertility rate means that increased resources must be devoted to child-rearing rather than to production of goods, also reducing the growth rate. The measure of human capital is the average number of years of secondary schooling of males aged 25 and over in the total population.¹⁶ Based on the assumption that more human capital helps a country absorb advanced knowledge from other countries, we expect that a higher initial stock of human capital will cause a country to grow more quickly towards its long-run GDP per capita.

A variety of measures of international interactions are included in the vector T_{it} . They can be broadly classified as measuring foreign direct investment (FDI), general openness/trade, the existence of trade preferences, and membership in and characteristics of trade blocs. FDI differs qualitatively from domestic investment in that it is often thought of as an important channel through which advanced technology can be transferred from the source country to the host country. Thus, we would expect a positive relationship between foreign direct investment and growth. We measure FDI as the flow of all inward FDI as a share of the recipient country's GDP.

To measure the extent to which a country is open, we measure the volume of international trade in two ways. First, we include the log of the trade share of GDP. Using total trade share makes two implicit assumptions. First, it assumes that imports and exports affect growth identically. Second, it assumes that the source and destination countries are irrelevant. Both assumptions seem unlikely. For example, endogenous growth theories that incorporate trade often model trade as facilitating growth via technology transfer. Then we might expect imports to have a larger impact on growth

than exports, as imports will embody technology in the product as well as the transaction. In addition, Devereux and Lee (1998) and Baldwin (1992) discuss the impact of increased domestic competition due to imports on growth rates. Obviously this result is absent for exports. Similarly, to stimulate growth the traded good must embody some appropriate technology. Thus, we divide trade flows according to direction and according to their sources/destinations. We divide source and destination countries into three categories, richer, same, and poorer countries, where the categories are defined as countries with higher-, similar-, or lower-per capita GDP.¹⁷ This division of trade according to the relative income of the trade partner assumes that income is positively correlated with technology embodied in goods and transactions. If trade primarily affects growth by transmitting technology, interactions with higher-income countries may have a more beneficial impact than interactions with similar- or lower-income countries. On the other hand, technology from countries that are richer or poorer may not be appropriate to the country, so that technology adoption from countries that are more different may be below that adopted from more similar countries. Thus, we expect all trade flows to positively influence growth or to have no impact, but form no expectations regarding the relationship between magnitudes.

We empirically analyze the effect of trade preferences on growth in several different ways. First, consider nonreciprocal trade blocs. The former colonies of European Union member countries and some Caribbean countries have been granted preferential, nonreciprocal access to the European Union under the Lomé and Yaoundé conventions, and to the US through the Caribbean Basin Economic Recovery Act, respectively. These countries are identified with a dummy variable labeled "Non-Reciprocal Bloc Member." Preferential, nonreciprocal access was granted in order to benefit these countries, so we expect a positive coefficient on this variable. We also control for membership in reciprocal trade blocs. First, we identify countries which are members of any type of formal trade bloc with a dummy variable.¹⁸ In addition, we control for the type of trade blocs: trade preference associations, free trade areas, and customs unions.¹⁹ The results of Rivera-Batiz and Romer suggest that we should find a positive coefficient on these variables.

We also control for some characteristics of trade blocs. First we consider a measure of the size of the trade bloc. We expect that membership in a small trade bloc would have a smaller impact on growth than membership in a larger trade bloc. We measure the size of the trade bloc excluding the country's size by the total GDP of the bloc less the GDP of the country itself. The idea is to measure the extent to which joining the bloc increases the effective market for an individual country, as a larger market can facilitate the exploitation of economies to scale and increase the return to R&D, in turn leading to faster growth. Finally, we attempt to control for the likelihood of trade creation versus trade diversion. To do so, we include the standard deviation of per capita incomes within a trade bloc. Intuitively, a more diverse trade bloc increases the likelihood that the trade bloc will result in trade creation rather than trade diversion, which should lead to increased technology diffusion. Thus, we expect to find a positive coefficient on this variable.

In order to take advantage of the cross-sectional and time-series variation in the data, we would ideally use a GLS, random-effects estimation technique which optimally utilizes the cross-sectional and time-series variation in the data. However, this approach requires that the country-specific error, v_i , be independent of the regressors; otherwise the coefficient estimates are biased and inconsistent. Hausman specifi-

cation tests soundly reject this assumption. Therefore, we employ the fixed-effects (within) estimator, which does not require this independence assumption.

5. The Data

The core data are from the *Penn World Table 5.6* dataset, the most commonly used dataset for empirical work on growth.²⁰ Human capital stock data are from Barro and Lee (1996). Data on foreign direct investment are obtained from the IMF's *International Financial Statistics*. Data on trade flows are from the World Bank's *Direction of Trade Statistics* for 1970–90. The *Penn World Table* data are based on annual observations from 1950 to 1992, while the data in the Barro–Lee dataset are presented quinquennially from 1960 to 1990. Thus, we use five-year time intervals since the human capital data are available only every five years.²¹ Finally, the data cover 1970 to 1989; the sample is chosen as the longest time period for which all variables are available for the widest selection of countries. Because we are interested in comparing growth equations with different international integration variables, we limit the analysis to the same set of observations on the 74 countries for which data are available from all sources. This leaves us with a sample of 228 observations.

Information on trade blocs is derived from a variety of sources. A list of preferential trade areas is included in the Appendix. This reveals a pattern of trade agreements formed between countries that are similar in location and development, with the exception of the Yaoundé and Lomé conventions and the Caribbean Basin Economic Recovery Act. These latter trade arrangements occurred between developed and developing countries, and were negotiated primarily to aid the developing countries, granting them preferential, nonreciprocal access to the EU and the United States, respectively. While the Appendix lists all trade blocs that have been attempted, there is wide consensus that several have been quite unsuccessful. In particular, the Central American Common Market in its later days, the Latin American Free Trade Area, the Economic Community of Western African States, ASEAN, the Customs and Economic Union of Central Africa, the Andean Pact, the Preferential Trade Area for Eastern and Southern African States, the Southern African Development Coordination Conference, and the Communauté Economique de l'Afrique de l'Oest, are commonly mentioned as failed attempts at integration. Because the results when eliminating these trade blocs from the analysis are largely unchanged, we report only the results including all trade blocs, given that the term “failure” is applied in an arbitrary manner.

6. Results

Our results are presented in Table 2. The fit is reasonably good, and the fixed effects are always jointly significant.²² The baseline regression, which does not include any controls for international integration, is given in column (1). Column (2) includes a control for inward FDI; columns (3)–(4) incorporate aspects of trade and openness. Columns (5)–(9) present regressions controlling for aspects of trade blocs, and column (10) gives the results obtained when all three aspects of international integration are included. We present the results in piecemeal fashion as well as comprehensively to illustrate the biases that may result when other aspects of international interactions are omitted from the growth regression.

Table 2. Fixed-Effects Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln (Initial GDP)	-0.455*** (0.056)	-0.455*** (0.056)	-0.465*** (0.055)	-0.503*** (0.061)	-0.466*** (0.056)	-0.470*** (0.056)	-0.459*** (0.056)	-0.474*** (0.055)	-0.482*** (0.055)	-0.534*** (0.062)
Ln (Govt share)	-0.192*** (0.071)	-0.167** (0.074)	-0.183** (0.070)	-0.094 (0.077)	-0.204*** (0.072)	-0.203*** (0.070)	-0.196*** (0.071)	-0.195** (0.070)	-0.190*** (0.070)	-0.089 (0.078)
Initial Male sec. ed.	0.021 (0.027)	0.005 (0.029)	0.006 (0.028)	0.026 (0.027)	0.016 (0.027)	0.029 (0.027)	0.018 (0.027)	0.014 (0.027)	0.013 (0.027)	0.004 (0.028)
Ln (Pop. growth)	-0.022 (0.018)	-0.019 (0.018)	-0.017 (0.018)	-0.014 (0.018)	-0.019 (0.018)	-0.010 (0.019)	-0.019 (0.018)	-0.015 (0.018)	-0.014 (0.018)	-0.007 (0.018)
Ln (Dom. invest. share)	0.099*** (0.040)	0.077* (0.041)	0.063 (0.042)	0.128*** (0.042)	0.113*** (0.040)	0.072* (0.040)	0.107*** (0.040)	0.107*** (0.039)	0.100** (0.039)	0.106** (0.043)
Ln (Inward FDI share)		0.035** (0.015)								0.025* (0.015)
Ln (Trade share)			0.116** (0.049)							
Ln (X to rich share)				0.113*** (0.044)						0.098** (0.045)
Ln (X to same share)				-0.107 (0.032)						0.005 (0.032)
Ln (X to poor share)				-0.015 (0.031)						-0.015 (0.032)
Ln (M to rich share)				-0.099** (0.044)						-0.084* (0.045)
Ln (M to same share)				0.074** (0.034)						0.065* (0.035)
Ln (M to poor share)				0.031 (0.034)						0.034 (0.036)

Std dev. member inc.				0.012*** (0.004)	0.022** (0.008)	0.019*** (0.009)
Rest bloc size			0.014 (0.010)		-0.025 (0.018)	-0.023 (0.020)
Trade bloc member		0.053** (0.026)				
TPA member			-0.016 (0.038)			
FTA member			0.076** (0.034)			
CU member			0.107** (0.050)			
Nonreciprocal bloc member		0.009 (0.033)	-0.001 (0.033)			
Observations	228	228	228	228	228	228
R ² within	0.38	0.40	0.44	0.41	0.42	0.48
F-test	3.45***	3.37***	2.99***	3.42***	3.73***	3.12***
Hausman spec. test	73.20***	74.33***	66.01***	80.47***	84.16***	81.86***
		82.00***	120.12***	76.03***	86.41***	

***, **, *: Significant at 1%, 5%, and 10% level, respectively. Standard errors in parentheses. Country-fixed effects coefficients omitted for brevity.

We find evidence of convergence across the 74 countries in the sample, given that the coefficient on lagged income is significantly negative in all models. This suggests that countries with low initial income levels grow more quickly than countries with higher initial income levels. We also consistently find that the investment share contributes positively to growth, while the share of government expenditures contributes negatively to growth. The average number of years of secondary and higher schooling generally positively affects growth, but is never significant.²³ Finally, population growth is negative in all specifications, but is also never significant.²⁴

Inclusion of the first measure of international integration, the log of inward foreign direct investment, significantly increases the growth rate, as expected. Inclusion of FDI significantly reduces the estimated coefficient on domestic investment (by 22%). We expect that the larger estimated coefficient on domestic investment when FDI is omitted is due to the correlation between the two variables.²⁵ The two forms of investment will both be motivated, at least in part, by the same factors (e.g., the return on investment). Thus, when FDI is omitted, the estimated coefficient on domestic investment will pick up not only its direct effect on growth, but also will reflect the influence of FDI on growth rates.

We next consider the effect of trade and openness on growth. The effect of trade share, often used as a measure of openness, reported in column (3), indicates that more openness (less closedness) leads to higher growth.²⁶ Next, we consider the source of imports and exports; that is, we disaggregate the trade share variable into exports and imports to/from countries with higher incomes, similar incomes, and lower incomes. Exports to rich countries and imports from similar countries both positively contribute to growth, while imports from richer countries are estimated to reduce growth. The first two results are consistent with a variety of endogenous growth models. Interactions with other countries are expected to lead to a diffusion of technology. That imports from rich countries reduce and imports from similar countries increase growth may be related to the types of technology in rich and similar countries. Endogenous growth theories that incorporate international trade suggest that imports should lead to diffusion of technology and hence growth. Implicitly they assume that the technology diffused is useful to the recipient countries. However, that may not be true. That is, the goods that are imported from richer countries may not embody the technology that is appropriate for poorer countries in the sense of using inputs that the poorer country has in abundance. For example, comparative advantage and casual empiricism suggest that imports from richer countries will embody technology that relies heavily on capital (physical or human), while poorer countries are relatively well endowed with unskilled labor. If recipient countries adopt the inappropriate technology, their growth rates may fall. Alternatively, imports from richer countries may be processed in the recipient country and then re-exported. The effect of imports on growth will be embodied not only in the coefficient on imports, but also in part by the coefficient on exports. That is, though the partial derivative of growth with respect to imports from rich countries is negative, the total derivative may be positive.²⁷ Unfortunately we do not have sufficient data on processing and re-exporting to verify this hypothesis.

Consider now the variables relating to trade blocs. Columns (5) and (6) consider how simple membership in a trade bloc may affect growth. We find evidence that belonging to a reciprocal trade bloc significantly increases growth. Having preferential, nonreciprocal access to the EU through the Yaoundé and Lomé conventions or

to the US through the Caribbean Basin Economic Recovery Act positively affects growth, though the effect is statistically insignificant.²⁸ Column (6) separates membership by type of trade bloc. We find that membership in a free trade area or a customs union significantly increases growth, though membership in a trade preferences association, the least integrated, least formal type of trade bloc, has no significant impact on growth. The relative magnitudes on the different types of trade blocs suggest that the more integrated the trade bloc, the larger the impact on growth.

We then consider how characteristics of the trade bloc may affect growth. We consider two aspects of a trade bloc: (log of) the sum of GDP of the bloc members not including the member country, and the standard deviation of member incomes. The former is expected to measure the possibility of returns to scale in R&D (given a larger market) and the latter to measure the likelihood of trade creation rather than diversion. When each is included separately, we find a positive effect which is statistically significant only for variation in members' incomes. This is true even when both variables are included. In other words, the diversion of a trade bloc matters in determining a country's growth performance, but not the size of it.

Finally, consider the results in column (10), which include controls for FDI, for trade flows from richer, similar, and poorer countries, the standard deviation of trade bloc members income, and rest of bloc size. All of the international variables remain robust in terms of sign and significance (except that the coefficient on bloc size becomes statistically insignificant), though the magnitude of the coefficients shrinks somewhat. The latter effect is due to the fact that the variables are correlated, so that omitting them in the initial regressions caused the included variables to pick up the effect of the omitted variables. The overall fit is improved. We conclude that controlling for all forms of international integration is important. While omitting some forms will not lead to wrong inferences with regard to sign and significance, magnitudes will be overstated, as estimated coefficients pick up the effects of omitted variables as well as the direct effect of the regressor.

7. Conclusions

In this paper, we have provided examples of theoretical propositions regarding the influence of international interactions on growth, a summary of the empirical evidence of these interactions, and evidence of the importance not only of international transactions for growth, but the importance of measuring these interactions comprehensively. What we found in the empirical literature is a piecemeal approach to addressing the issue of international interactions and growth. There are a variety of mechanisms through which active engagement with the rest of the world can facilitate growth. Our evidence reveals that indicators of openness, integration, FDI, and preferential treatment are sufficiently correlated that an analysis of one in the absence of the others is not meaningful. To date, the literature lacks a single study incorporating these various influences and hence fails to provide an adequate picture of how international interactions contribute to growth, especially with respect to magnitude.

We have also identified areas of the literature that remain underexplored. In particular, the influence of preferential trading arrangements of one sort or another on growth is currently an open question. Theory gives ambiguous predictions: depending on the model, regional integration may increase or decrease growth or have no influence at all. The empirical evidence, what little exists, is also ambiguous. The importance

of this question is clear when one attempts to understand the motivation for arrangements such as the Yaoundé and Lomé conventions, the Generalized System of Preferences, and the Caribbean Basin Initiative of the United States. These programs are rationalized as promoting growth in less developed regions by granting liberal access to developed markets. While there is evidence that trade preferences do facilitate trade between participating countries, the consequences for growth are neither well understood nor well explored.

Finally, our empirical work employs a single dataset and econometric technique in an effort to consistently examine the several potential contributors of international engagement to growth. We find broad support for the notion that trade, FDI, and regional integration generally contribute to growth in per capita incomes in the 1970s and 1980s. We present results for each mechanism separately and together in order to illustrate the robustness of the results to omitted variable bias. Our results can be broadly characterized as follows: trading more, but with the right countries, foreign direct investment, and trade preferences between countries with disparate incomes lead to enhanced growth of per capita incomes. In addition, a comprehensive regression reveals that these results continue to hold, but with somewhat reduced strength. The estimated magnitudes of the effect of the statistically significant variables fall by 15–30% when all forms of international interactions are included. This result highlights the importance of a comprehensive analysis of international interactions and growth.

Appendix: Preferential Trading Arrangements to 1989^a

^a Year agreement went into effect. Typically the agreement is signed a year or two prior.

^b There were two Yaoundé conventions and three Lomé conventions up to 1989, indicated by YI, YII, LI, and LIII. The conventions granted nonreciprocal access to the EU market.

^c Grants nonreciprocal access to the US.

^d Became a trade preferences association in 1991.

†, *, **, ***: Trade preferences association, free trade area, customs union, and common market, respectively.

Sources: Adapted from de la Torre and Kelly (1992), El-Agraa (1994), Lawrence (1996), Nadal de Simone (1995), Whalley (1991), Whalley and Hamilton (1997), WTO (1995).

*Southern African Customs Union** (SACU)*

1910	South Africa, Botswana, Lesotho, Swaziland
1990	Namibia

*European Union** (EEC, EC, EU)*

1958	Belgium, Luxembourg, France, the Netherlands, W. Germany, Italy
1973	EU and EFTA implement free trade between areas*
1973	Britain, Ireland, Denmark
1981	Greece
1986	Portugal and Spain

European Free Trade Association (EFTA)*

1960	Austria, Denmark, Norway, Portugal, Sweden, Switzerland, Britain
1970	Iceland
1973	Denmark and Britain withdraw
1973	EU and EFTA implement free trade between areas*
1986	Portugal withdraws
1986	Finland

- Latin American Free Trade Association**† (LAFTA)
 1961 Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, Venezuela
 1970s Effectively fails
 1981 Reformulated as Latin American Integration Association, a trade preferences association, with original members
- Central American Common Market** (CACM)
 1961 El Salvador, Guatemala, Nicaragua
 1962 Honduras
 1963 Costa Rica
- African Common Market*** (ACM)
 1962 Algeria, United Arab Republic, Ghana, Guinea, Mali, Morocco
- Yaoundé and Lomé Conventions*^b
 1964 (YI) Between EEC and former French, Belgian, and Italian colonies in Africa: Burundi, Cameroon, Central African Republic, Chad, Congo, Côte de Ivoir, Benin, Burkina Faso, Gabon, Madagascar, Mali, Mauritania, Niger, Rwanda, Senegal, Somalia, Togo
 1971 (YII) Convention extended
 1973 (YII) Mauritius
 1976 (LI) Lomé supercedes Yaoundé. Extended to Britain's former colonies in Africa and all former colonies in the Caribbean and Pacific: Bahamas, Barbados, Botswana, Equatorial Guinea, Ethiopia, Fiji, The Gambia, Ghana, Guinea, Guinea-Bissau, Grenada, Guyana, Jamaica, Kenya, Lesotho, Liberia, Malawi, Nigeria, Sierra Leone, Sudan, Swaziland, Tanzania, Tonga, Trinidad and Tobago, Uganda, Upper Volta, Western Samoa, Zaire, Zambia
 1976 (LI) Suriname, Seychelles, Comoros
 1977 (LI) Sao Tome and Principe, Cape Verde, Papua New Guinea
 1978 (LI) Djibouti, Solomon Islands
 1979 (LI) Tuvalu, Dominica, St Lucia, Kiribati
 1980 (LI) St Vincent and the Grenadines
 1981 (LII) Convention extended
 1981 (LII) Vanuatu
 1982 (LII) Antigua and Barbuda, Belize, and Zimbabwe
 1986 (LIII) Convention extended
 1986 (LIII) Mozambique
- Australia/New Zealand Free Trade Area** (ANZERTA)
 1966 Australia–New Zealand Free Trade Area
 1983 Becomes Australia–New Zealand Closer Economic Relations Trade
- Arab Common Market** (ARABCM)
 1965 Egypt, Iraq, Jordan, Lebanon, Libya, Mauritania, Syria
- Automobile Products Trade Agreement (Auto Pact)*
 1965 Canada, United States
- UK–Ireland Free Trade Area**
 1966 United Kingdom, Ireland
- Communauté Economique de l'Afrique de l'Oest* (CEAO)
 1959 Customs Unions of Western African States predecessor
 1966 Burkina Faso, Côte d'Ivoire, Mali, Mauritania, Niger, Senegal

- 1984 Benin
*Customs and Economic Union of Central Africa** (UDEAC)
 1962 Equatorial Customs Union predecessor
 1966 Cameroon, Central African Republic, Chad, Congo, Gabon
 1985 Equatorial Guinea
- East African Community* (EAC)
 1967 Kenya, Tanzania, Uganda
 1977 Collapsed
- Association of Southeast Asian Nations*[†] (ASEAN)
 1967 Indonesia, Malaysia, Philippines, Singapore, Thailand
 1977 Becomes a trade preferences association
 1984 Brunei
- Andean Pact** (ANDEAN)
 1969 Bolivia, Chile, Colombia, Ecuador, Peru, Venezuela
 1976 Chile exits
 1988 Andean Group** formed with all original members
- Caribbean Community and Common Market*** (CARICOM)
 1968 Caribbean Free Trade Association (CARIFTA) predecessor;
 Antigua and Barbuda, Barbados, Guyana, Trinidad and Tobago
 1973 Barbados, Guyana, Jamaica, Trinidad and Tobago
 1974 Antigua and Barbuda, Belize, Dominica, Grenada, Montserrat, St
 Kitts-Nevis, St Lucia, St Vincent and the Grenadines
 1983 Bahamas
- Mano River Union**** (MRU)
 1973 Liberia, Sierra Leone
 1980 Guinea
- Economic Community of Western African States** (ECOWAS)
 1975 Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, The Gambia,
 Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger,
 Nigeria, Senegal, Sierra Leone, Togo
- Economic Community of the Countries of the Great Lakes** (CEPGL)
 1976 Burundi, Rwanda, Zaïre
- Bangkok Agreement[†]
 1976 Bangladesh, India, Laos, Philippines, South Korea, Sri Lanka,
 Thailand
- Southern African Development Co-ordination Conference* (SADCC)
 1980 Angola, Botswana, Mozambique, Tanzania, Zambia, Zimbabwe,
 Lesotho, Malawi, Swaziland
 1990 Namibia
- Communauté Economique des Etats de l'Afrique Centrales*** (CEEAC)
 1981 Burundi, Cameroon, Central African Republic, Chad, Congo, Equatorial
 Guinea, Gabon, Rwanda, Sao Tome and Principe, Zaïre
- Organization of Eastern Caribbean States**** (OECS)
 1981 Antigua and Barbuda, Dominica, Grenada, Montserrat, St
 Kitts-Nevis, St Lucia, St Vincent and Grenadines, British Virgin
 Islands
- Gulf Cooperation Council*[†] (GCC)
 1983 Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates

- Preferential Trade Area for Eastern and Southern African States*[†] (PTA)
 1984 Angola, Burundi, Comoros, Djibouti, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Mauritius, Rwanda, Somalia, Sudan, Swaziland, Uganda, Tanzania, Zambia, Zimbabwe
- Caribbean Basin Economic Recovery Act*^f
 1984 Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Montserrat, Netherlands Antilles, Nicaragua, Panama, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Trinidad and Tobago, British Virgin Islands
- United States–Israel Free Trade Area Agreement*^{*}
 1985 United States, Israel
- South Asian Association for Regional Cooperation*^d (SAARC)
 1985 Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka
- Canada–US Free Trade Agreement*^{*} (CUSFTA)
 1989 Canada, United States
- Arab Maghreb Union*^{**} (AMU)
 1989 Algeria, Libya, Mauritania, Morocco, Tunisia

References

- Balasubramanyam, V. N., M. Salisu, and D. Sapsford, "Foreign Direct Investment and Growth in EP and IS Countries," *Economic Journal* 106 (1996):92–105.
- Baldwin, Richard E., "On the Growth Effects of Import Competition," NBER Working Paper 4045 (1992).
- Baldwin, Robert E. and Tracy Murray, "MFN Tariff Reductions and Developing Country Trade Benefits under the GSP," *Economic Journal* 87 (1977):30–46.
- Baldwin, Richard E. and E. Seghezza, "Growth and European Integration: Towards an Empirical Assessment," manuscript, Graduate Institute of International Studies, Geneva (1996).
- Barro, Robert, *Determinants of Economic Growth*, Cambridge, MA: MIT Press (1997).
- Barro, Robert and Jong-Wha Lee, "International Measures of Schooling Years and Schooling Quality," *American Economic Review Papers and Proceedings* 86 (1996):218–23.
- Ben-David, Dani and Michael B. Loewy, "Free Trade, Growth, and Convergence," NBER Working Paper 6095 (1997).
- , "Knowledge Dissemination, Capital Accumulation, Trade, and Endogenous Growth," manuscript (1998).
- Borensztein, Eduardo, José De Gregorio, and Jong-Wha Lee, "How Does Foreign Direct Investment Affect Economic Growth?," NBER Working Paper 5057 (1995).
- Brown, D. K., "General Equilibrium Effects of the US Generalized System of Preferences," *Southern Economic Journal* 54 (1987):27–47.
- Coe, David T. and Elhanan Helpman, "International R&D Spillovers," *European Economic Review* 39 (1995):859–87.
- Coe, David T. and Reza Moghadam, "Capital and Trade as Engines of Growth in France: An Application of Johansen's Cointegration Methodology," IMF Working Paper (1993).
- De la Torre, Augusto and Margaret R. Kelly, "Regional Trade Arrangements," International Monetary Fund Occasional Paper 93 (1992).
- De Mello, Luiz R., "Foreign Direct Investment in Developing Countries and Growth: A Selective Survey," *Journal of Development Studies* 34 (1997):1–34.

- De Melo, J., C. Montenegro, and A. Panagariya, "Regional Integration Old and New: Issues and Evidence," manuscript, World Bank (1992).
- Devereux, Michael B. and Beverly J. Lapham, "The Stability of Economic Integration and Endogenous Growth," *Quarterly Journal of Economics* 109 (1994):299–305.
- Devereux, Michael B. and Khang Min Lee, "Dynamic Gains from Trade, Revisited," manuscript (1998).
- Dollar, D., "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976–85," *Economic Development and Cultural Change* 40 (1992):523–44.
- Edwards, Sebastian, "Trade Orientation, Distortions, and Growth in Developing Countries," *Journal of Development Economics* 39 (1992):31–57.
- El-Agraa, Ali M., "Economic Integration," in Enzo Grilli and Dominick Salvatore (eds.), *Economic Development*, Westport, CT: Greenwood Press (1994).
- Feder, Gershon, "On Exports and Economic Growth," *Journal of Development Economics* 12 (1983):59–73.
- Fieleke, Norman S., "One Trading World, or Many: The Issue of Regional Trading Blocs," *New England Economic Review* (1992):3–20.
- Frankel, Jeffrey A. and David Romer, "Trade and Growth: An Empirical Estimation," NBER Working Paper 5476 (1996).
- Grossman, Gene and Elhanan Helpman, *Innovation and Growth in the Global Economy*, Boston: MIT Press (1991a).
- , "Trade, Knowledge Spillovers, and Growth," *European Economic Review* 35 (1991b): 517–26.
- Harrison, Ann, "Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries," *Journal of Development Economics* 48 (1996):419–47.
- Henrekson, Magnus, Johan Torstensson, and Rasha Torstensson, "Growth Effects of European Integration," *European Economic Review* 41 (1997):1537–57.
- Islam, Nazrul, "Growth Empirics: A Panel Data Approach," *Quarterly Journal of Economics* 110 (1995):1127–70.
- Italianer, Alexander, "Whither the Gains from European Economic Integration," *Revue Economique* 45 (1994):689–702.
- Kokko, A., "Sweden, EU Membership, Investment, and Growth," *World Economy* 17 (1994):667–78.
- Kormendi, Roger C. and Philip G. Mequire, "Macroeconomic Determinants of Growth: Cross-Country Evidence," *Journal of Monetary Economics* 16 (1985):141–63.
- Landau, D., "The Contribution of the European Common Market to the Growth of its Member Countries: An Empirical Test," *Weltwirtschaftliches Archiv* 131 (1995):774–82.
- Lawrence, Robert Z., *Regionalism, Multilateralism, and Deeper Integration*, Washington, DC: Brookings Institution (1996).
- Leamer, Edward E., "Measure of Openness," in R. Baldwin (ed.), *Trade Policy and Empirical Analysis*, Chicago: University of Chicago Press (1988).
- Lee, Feng Yao and William E. Cole, "Simultaneity in the Study of Exports and Economic Growth," *International Economic Journal* 8 (1994):33–41.
- Levine, Ross and David Renelt, "A Sensitivity Analysis of Cross-Country Growth Regressions," *American Economic Review* 82 (1992):942–63.
- MacPhee, C. R. and V. I. Oguledo, "The Trade Effects of the US Generalized System of Preferences," *Atlantic Economic Journal* 19 (1991):19–26.
- MacPhee, C. R. and D. I. Ronsenbaum, "Has the European Community GSP Increased LDC Exports?" *Atlantic Economic Journal* 21 (1989):823–41.
- Nadal de Simone, Francisco D. A., "A Macroeconomic Perspective of AFTA's Problems and Prospects," *Contemporary Economic Policy* 13 (1995):49–62.
- Pritchett, Lant, "Measuring Outward Orientation in Developing Countries: Can it be Done?" *Journal of Development Economics* 49 (1991):307–35.

- Rivera-Batiz, Luis A. and Paul M. Romer, "Economic Integration and Endogenous Growth," *Quarterly Journal of Economics* 106 (1991):531-56.
- Roubini, Nouriel and Xavier Sala-i-Martin, "Financial Development, the Trade Regime, and Economic Growth," NBER Working Paper 3876 (1991).
- Sala-i-Martin, Xavier X., "I Just Ran Two Million Regressions," *American Economic Review Papers and Proceedings* 87 (1997):178-83.
- Saltz, Ira S., "The Negative Correlation between Foreign Direct Investment and Economic Growth in the Third World: Theory and Evidence," *Rivista Internazionale di Scienze Economiche e Commerciali* 39 (1992):617-33.
- Sinha, Tapen and Dipendra Sinha, "An Empirical Investigation into the Relationship between Openness and Economic Growth: Evidence from Asia," *Rivista Internazionale di Scienze Economiche e Commerciali* 43 (1996):359-70.
- Summers, Robert and Alan Heston, "Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1985," *Quarterly Journal of Economics* 106 (1991):327-68.
- Truett, D. B. and L. J. Truett, "Trade Preferences and Exports of Manufactures: A Case Study of Bolivia and Brazil," *Weltwirtschaftsliches Archiv* 129 (1993):573-90.
- Tsanacas, D. P., "Market Share Effects of the Lomé Convention and the GSP," in *The Modern International Environment*, Greenwich, CN: JAI Press (1989).
- Van den Berg, Nedrik, "Does Simultaneity Exaggerate Empirical Tests of the Trade-Growth Relationship?" *Applied Economics Letters* 3 (1996):225-31.
- Walz, Uwe, "Innovation, Foreign Direct Investment, and Growth," *Economica* 64 (1997):63-79.
- , "Does an Enlargement of a Common Market Stimulate Growth and Convergence?" *Journal of International Economics* 45 (1998):297-321.
- Whalley, John, *Trade Liberalization among Major World Trading Areas*, Cambridge, MA: MIT Press (1985).
- Whalley, John and Colleen Hamilton, *The Trading System After the Uruguay Round*, Washington, DC: Institute for International Economics (1997).
- World Trade Organization, *Regionalism and the World Trading System*, Geneva (1995).

Notes

1. We use the term "international integration" to refer to any type of international interaction. In particular, we are *not* limiting the discussion to the formation of trade blocs.
2. Walz (1997) develops a model based on Grossman and Helpman (1991) but incorporating foreign direct investment as the means by which technology is diffused. He shows that countries more open to FDI have higher growth rates.
3. Rivera-Batiz and Romer focus on similar countries in order to isolate the effect of economies of scale from the effect of gains arising from comparative advantage.
4. Walz (1998) considers the effect of an enlargement of a common market to a third, technologically lagging, country, and finds that enlargement leads to increased growth for all members. Growth in the original members is spurred because they can reallocate resources towards their dynamic sector.
5. For example, Feder (1983) and Kormendi and Mequire (1985) use measures of exports, while Sinha and Sinha (1996), and Harrison (1996) use measures of total trade share. Levine and Renelt (1992) note that similar results obtain with both measures.
6. Recall that several models suggest that the higher the number of transactions with foreigners, the more transmission of technology, and hence the more growth, occurs. Coe and Helpman (1995) present a model of R&D spillovers in which a country benefits from foreign R&D activity the more open is the country.
7. Harrison (1996) and Pritchett (1991) note that Leamer's openness measure is inversely related to other measures of openness, a troubling result. Levine and Renelt note that Leamer's

openness index is *positively* related to his distortions index. It is thus not clear what Leamer's indices are measuring.

8. Several studies in the development literature consider the issue of endogeneity of exports. See, for example, Lee and Cole (1994), who also find that the effect of trade is understated when endogeneity is present.

9. It is this type of bias that we hope to eliminate by adopting a comprehensive approach to measuring the effects of international interactions on growth.

10. Saltz also does not control for the influence of trade on growth.

11. The trade and static welfare effects of the GSP have been studied by Baldwin and Murray (1977), Truett and Truett (1993), MacPhee and Oguledo (1991), Tsanacas (1989), MacPhee and Rosenbaum (1989), Brown (1987), and others.

12. Other studies of European integration also find support for the hypothesis that integration led to growth; see, for example, Baldwin and Seghezza (1996), Coe and Moghadam (1993), Italianer (1994), and Kokko (1994).

13. Islam (1995) offers important caveats against a cross-sectional approach. One drawback is that it does not allow for any differences in the production function across countries. Thus, we too adopt a panel data approach to allow for differences in production functions captured via the country-specific effect.

14. As explained below, we use five-year periods as observations; thus, dy_{it} is country i 's growth rate over the five-year period prior to year t , and y_{it-5} is the per capita income at the beginning of each five-year period.

15. The investment and government spending shares are averages over the five-year period; population growth rate is measured over the five-year period; and human capital is measured at the beginning of each five-year period.

16. We also considered the average number of years of secondary schooling of females and males and the proportion of the population (males alone or females and males) that achieved secondary schooling. The results were largely unchanged.

17. A country with a similar level of per capita income is defined as those 20 countries with per capita incomes closest to the country in question. This form of measurement may introduce some bias. Consider trade with rich countries by poor countries and vice versa. For those countries that are at the bottom or top of the per capita income ranking, trade with poorer or richer countries, respectively, will be zero, since there are no poorer or richer countries, and trade with richer or poorer countries, respectively, will be high since there are a large number of richer and poorer countries, respectively. If countries with low per capita incomes grow more slowly than countries with high per capita incomes (as shown by a correlation of 0.20, significant at the 5% level), then the bias described above suggests that we should find a negative coefficient on imports and exports from rich countries and a positive coefficient on imports and exports from poor countries. While we do find the predicted signs for imports from richer and from poorer countries, we find the opposite sign for exports to richer and to poorer countries. This suggests that we are picking up more than the relationship induced by our measurement approach.

18. We also attempted to use separate dummy variables indicating membership in each individual trade bloc. In general the estimated coefficients were insignificant.

19. As defined by Fieleke (1992), a trade preferences association is a rather casual trade bloc which establishes lower barriers against imports from members than from nonmembers. A free trade area eliminates barriers imposed against other members, while a customs union also establishes a common tariff imposed against imports from nonmembers.

20. See Summers and Heston (1991) for a description.

21. Islam (1995) discusses other reasons why yearly time spans are too short for investigating growth.

22. In the interests of brevity, we omit the fixed-effect results. We also report the results from a Hausman specification test which indicate that, for all models and at extreme significance, the

variables are correlated with the country-specific error term, so that random effects are inappropriate.

23. De Mello (1997) notes that using standard measures of human capital accumulation may not be good at explaining the externalities and spillover effects of human capital stocks. This may explain the statistical insignificance of our result.

24. This lack of significance may be largely driven by outliers. When Guyana, Austria, Belgium–Luxemburg, Denmark, Finland, Germany, and the UK are omitted (all of which have abnormally low population growth), population growth remains negative and becomes significant.

25. FDI and domestic investment are statistically significantly correlated, with a correlation coefficient of 0.54.

26. In addition, studies which have considered alternative measures of openness, such as Harrison (1996), also show that more openness leads to higher growth.

27. Henry Wan suggested this explanation in private communication.

28. Many of the recipient countries are omitted from the sample because information on other variables, especially foreign direct investment, is missing. This may explain the insignificance.