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North-South Trade, Openness and Growth

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ABSTRACT

In models of endogenous growth, international trade can impact upon growth by allowing access to the innovative products of other countries. Since developing countries do little if any innovation, it is primarily through trade with developed countries that they profit from higher levels of technological development. In this paper we construct an empirical model to estimate trade flows from the 'North' to the 'South'. Using the results of this model we construct a measure of openness to Northern imports, based on the deviation of actual imports from that predicted by our model. We find that this measure of openness is significantly and robustly related to economic growth, suggesting that trade with advanced countries can facilitate growth through the absorption of advanced technology.

JEL Classification: F14, F43, O40

Keywords: North-South Trade, Openness, Growth

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1 Introduction

It has long been thought that openness to international trade can have a beneficial impact on a country's growth rate. Indeed, the notion that international trade is important for a country's economic performance was a feature of Adam Smith's (1776) *An Inquiry into the Nature and Causes of the Wealth of Nations*. Until recently however this hypothesis was based on models emphasising static gains from trade. In these models, outward orientation shifts a country's internal allocation of resources more in line with its comparative advantage, but while this should raise the level of income per capita it has no obvious impact upon economic growth in the longer term. The recent literature on endogenous growth has shown however that openness can affect a country's growth rate through several channels (see for example, Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991). The new theories emphasise a number of channels through which trade can affect growth, by providing access to foreign markets, technology and resources.

In addition to the theoretical literature, there is a vast empirical literature on openness and growth. A variety of different measures of openness have been employed, with many studies finding a positive relationship between some measure of trade openness and growth (see for example, Dollar, 1992; Sachs and Warner, 1995; Harrison, 1996). Despite these findings there remains considerable controversy, centred on what openness measures are actually capturing, with many potentially capturing a wide variety of macroeconomic phenomena (Rodriguez and Rodrik, 1999). A further source of concern relates to the fact that many measures of openness do not appear to be highly correlated, suggesting that they be capturing different aspects of openness (Pritchett, 1996). Evidence has also emerged questioning the robustness of explanatory variables in growth regressions, including those measuring openness (Levine and Renelt, 1992; Sala-i-Martin, 1997). Various econometric problems, including problems in identifying the direction of causality have also added to the controversy over the empirical literature.

There exists little empirical research examining the role of trade in new growth models, especially for developing countries. Some research has attempted to test for the existence of international knowledge spillovers and their impact on productivity growth. Coe and Helpman (1995) and Coe, Helpman and Hoffmaister (1997) for example, show that there exist knowledge spillovers between countries, with trade being one mechanism through which such spillovers occur. Such spillovers are found to occur between developed countries, but also from developed countries to developing countries. There is however little evidence concerning the role of goods trade, although Lee (1993, 1995) has shown that restrictions on imports of capital goods can reduce growth.

This paper examines the impact of goods trade on a country's growth rate. In particular we emphasise the role of manufactured imports from developed to developing countries. We emphasise North-South trade because it is through trade with developed countries that developing countries should benefit from advanced technology. Historically a large share of North-South trade has consisted of imports of manufactured goods, which are likely to embody advanced technology[1]. This suggests that it is primarily through North-South trade that developing countries can benefit from trade through the importation of advanced technology.

The remainder of this paper is organised as follows. In section 2 we develop an empirical model that predicts trade flows from the 'North' to the 'South'. We show that the model can explain a large proportion of the cross-country variation in imports from the North. Using the predicted values from this model we construct a measure of openness to imports from the North. In section 3 we use this measure to estimate the impact of openness on the growth rates of our sample of Southern countries. We find that those countries that are ranked as more open enjoy significantly higher growth rates than those ranked as closed to Northern imports, a result that appears to be quite robust. Section 4 provides some overall conclusions.

2 Measuring Openness to Northern Imports

2.1 Background

A large number of openness measures have been used in the empirical literature. Often a summary indicator of trade is employed, for example exports, total trade or

[1] Wood (1994) for example, finds that during the period 1955 to 1989 between 73 and 79 percent of the total exports of the North to the South consisted of manufactures.

the trade to GDP ratio. Others use data on tariff rates, while some use data on a number of different indicators to form an index of trade distortions. One shortcoming of many of these measures is that often they do not relate to the theories linking growth to trade. The theory emphasises the role of imports, and in particular the role of imports of capital, intermediates and technology in the growth process. For developing countries we would expect the benefits to growth of such imports to arrive through trade with more advanced countries, where most R&D is undertaken.

What we do is construct a measure of openness to the imports of advanced countries for a sample of developing countries, by estimating an empirical model that predicts such imports using data on various characteristics of both the importer and exporter. The extent of deviation of actual trade from that predicted is taken as an indicator of the extent of trade restrictions on Northern imports. A number of others have attempted to measure openness in a similar manner, although they tend to look at exports rather than imports and tend not to concentrate on North-South trade. Chenery and Syrquin (1989)[2] for example measure openness for a sample of up to 108 countries for 1965 and 1980 according to their observed share of merchandise exports in GDP relative to the predicted share. The predicted share is constructed by adjusting (in an *ad-hoc* fashion) for such things as the level of GDP per capita, size, transport costs and various resource endowments. A high relative export level led to an outward oriented classification, while a low level resulted in an economy being classed as inward oriented. They showed that the ranking of countries corresponded fairly well with that of the World Development Report 1987. Furthermore, they found that GDP growth was higher in the outward oriented group than in the inward oriented group, suggesting that openness was good for growth.

Leamer (1988)[3] conducts a similar exercise, but bases his measure of openness on a modified version of the Hecksher-Ohlin-Vanek model of trade flows. He predicts a country's net exports as a function of the country's endowment of land, labour, capital, oil, coal, minerals, the distance to its markets and the country's trade balance. The model is estimated for 1982 on 182 commodities at the 3-digit SITC level. Two measures of openness are developed, the first is an adjusted trade intensity ratio that

[2] See also Chenery and Syrquin (1975).
[3] This builds upon Leamer (1984).

allows for differences in resource supplies and the second is the ratio of actual to predicted trade. Leamer states that the first of these is analogous to a measure of welfare loss, indicating the percentage of GDP lost as a result of trade barriers, while the second is analogous to a tariff average that suggests how much trade is deterred by barriers. Leamer appears to be sceptical of the results obtained, questioning whether the adjusted trade intensity ratio is actually measuring barriers to trade or is more an indicator of tastes, omitted resources and historical accidents. He does state however that many of the "unusual aspects of patterns of net exports occur mostly from the export side and are related to historical factors or to special resources, and not to trade barriers. It may well be that a separate study of the import side would be productive." (p. 179). Since we are considering imports, many of these problems may be overcome. Furthermore, the fact that we use more aggregated data may remove the influence of tastes, and also of historical accidents and special resources that result in some countries specialising in particular commodities.

2.2 Predicting Trade Flows

To measure openness in our sample we construct a model that explains the extent of trade, and in particular imports of manufactured goods from the North. Leamer (1974) identifies three predictors of imports; resistance, the stage of development and resource supplies. Resistance includes such things as transport costs and the level of tariffs and trade restrictions. Transport costs have for a long time been considered an important determinant of trade. Limao and Venables (1999) have shown that doubling transport costs can reduce trade flows by around 80 percent. Various proxies are often used to capture the impact of resistance on trade; these include distance, the presence of common borders and language and whether countries are landlocked or not. More recently it has been proposed that the internal infrastructure of both the importer and exporter may affect the level of trade through its impact on internal transport costs (for example, Bougheas *et al*, 1999; Limao and Venables, 1999).

Leamer also suggests that stage of development would affect imports; *ceteris paribus* the more developed a country is, the higher are its imports expected to be. A variety of proxies for stage of development have been suggested in the literature, examples include the level of GDP and the per capita income. Finally, resource supplies are also considered to be an important determinant of a country's imports. These include such things as the stock of capital, the labour force, the level of human capital, the presence of natural resources and the level of R&D. These factors determine a country's comparative advantage and the extent of specialisation, which can then affect the level of imports.

To predict imports we use a variant of the gravity model that is augmented with various measures of factor endowments. The use of the gravity model as a means of estimating trade flows has increased a great deal following the development of a theoretical foundation for the model by amongst others Anderson (1979), Bergstrand (1985) and Helpman and Krugman (1985). The model relates a country's imports, exports or total trade to the size of the importer and exporter and to the distance between the two. Trade flows are seen as being the result of supply conditions at the origin, demand conditions at the destination, and trade stimulating and trade restricting forces between the two countries. These determinants are usually proxied respectively by the GDP of the exporter and importer, their per capita incomes and distance from each other. Trade stimulating forces are other factors that can enhance trade between countries; examples include common language, preferential trading arrangements, former colonial ties and direct land borders. Trade restricting forces are factors that drive a wedge between supply and demand and consist of three elements; transport costs, transport time (which represents problems of perishability, adaptability to market conditions and irregularities in supply), and psychic distance (which represents familiarity with laws, institutions and habits).

Many applied papers[4] estimate some variant of the following simple version of the gravity equation

$$\log(EX_{xm}) = \alpha + \beta_1 \log(GDP_x.GDP_m) + \beta_2 \log(GDPC_x.GDPC_m) + \beta_3 \log(Dist_{xm}) + \beta_4(others)$$

where EX_{xm} are exports from the exporter (x) to the importer (m), GDP_x and GDP_m are the gross domestic products of the exporter and importer respectively, $GDPC_x$ and $GDPC_m$ are the per capita GDP's of the exporter and importer respectively and $Dist_{xm}$ is the distance between the importer and exporter. Other variables often included are dummy variables for common languages and common borders, for landlocked countries and for trade bloc participation. The first is included since it is expected that being adjacent to another country increases familiarity with the culture, institutions and preferences of the trade partner, while a common language facilitates communication between trade partners and reduces the search costs of international trade. A common language may also be due to former colonial ties, which for historical reasons may result in greater trade flows[5]. Entering GDP and per capita incomes multiplicatively can be justified by modern trade theory that predicts larger trade volumes between more similar countries in terms of size and their factor endowments (it is not uncommon however to include the GDP of the importer and exporter separately).

We estimate for each of 52 Southern countries, imports from a sample of 21 Northern countries[6] over a 15-year period (1976-1990). To do this we estimate a model of trade that depends upon gravity determinants and factor endowments. We estimate two different models; the first simply uses (logged) total value of manufactured imports from each Northern country as the dependent variable, while the second uses the share of manufactured imports in GDP from each Northern country as the dependent variable. The reason for the distinction is that we may expect that the model using the value of trade will tend to predict trade better for larger than for smaller countries. We expect that the value of imports will be larger for larger countries. Although we include variables such as the level of GDP to take account of the importer's size we may still expect that the econometrics will dictate minimising the residuals from the bigger countries, while ignoring to some degree those of smaller countries. As a result we expect to find larger countries ranked in the middle of the distribution, since the distortion of actual from predicted trade using trade volumes for the larger countries would tend to be small[7].

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[4] Examples include, Wang and Winters (1992), Bayoumi and Eichengreen (1995), Frankel (1997) and Helliwell (1998).
[5] For some evidence of this see Kleiman (1976).
[6] See Appendix A for a list of the exporters (i.e. the 'North') and importers (the 'South').
[7] Similarly when using trade shares, we may expect that OLS will dictate minimising the residuals from countries with large trade shares. It is often observed that smaller countries tend to have higher trade shares than larger countries, since larger countries need not specialise to the same extent as smaller countries. In this case we may expect that smaller countries will be ranked in the middle of the distribution.

For a few country pairs and years, reported trade was zero. Four methods have been proposed to deal with this issue (see Frankel, 1997, chapter 6). Firstly, we could exclude all zeros. This however leads to sample selection bias and doesn't use information about why exports may be low in these cases. Secondly, we could substitute the zero with an arbitrarily small number; this is *ad-hoc* but does allow estimation by conventional means. Thirdly, we could add 1 to all the dependent observations and estimate the log-linear form. Finally, we could use Tobit estimation techniques. This considers that exports are limited dependent variables censored at zero; OLS can therefore lead to a large bias[8]. Given that the number of zero observations relative to the total number of observations is very small, the resulting bias is also going to be small. As a result we didn't feel the extra complexity of using Tobit estimation was justified. We therefore chose the second of the above options and added one to all the zeros[9].

2.3 Results

For each importing country in the South we estimate annual manufactured imports from each of 21 OECD countries (i.e. from the North) between 1976 and 1990. We use panel data techniques, with each cross-section unit representing imports from a particular Northern to a particular Southern country. The panel is quite large with potentially 16380 observations. Because of missing observations the final number is 16245. We estimated using a random-effects model. There are a number of *a-priori* reasons to favour a random effects model. Most importantly, a fixed effects model makes it impossible to identify the impact of time-invariant variables such as common language, distance and landlockedness, which are often found to impact significantly on imports. Moreover, since individual country and time dummy variables may capture differences in trade distortions across countries and time, the use of a fixed effects model is inappropriate since we assume that the residuals from our model capture trade distortions. As a practical justification for the use of random effects models, fixed effects models are considered to be less efficient than random effects models, since the use of dummy variables is costly in terms of the loss of valuable

8 Greene (1981) shows that this bias is inversely related to the sample proportion of non-zero observations.

9 Adding a small number to the zero values leads to a further possibility. OLS in effect gives larger weights to extreme value, whether large or small As a result the zero values may receive too large a

degrees of freedom. Furthermore, for many of the results presented the Hausman test and the Breusch-Pagan test, which are tests of fixed versus random effects support the use of a random effects model. One shortcoming of random effects models is that it assumes that country-specific effects are uncorrelated with independent variables included, and hence it may be subject to omitted variable bias and inconsistency.

We estimate a number of specifications using both data on the value of imports and on the share of imports. The specifications make use of data on factor endowments, gravity determinants and various combinations of the two[10]. Table 1 reports results using the value of imports as the dependent variable, while table 2 reports results for the import shares.

We begin in Table 1 by including just measures of factor endowments (Column 1). These are the capital stock (*Capital*), the labour force (*Labour*), area (*Area*) and the value of primary exports[11] (*PriX*). In other specifications we also include a measure of skilled (*Skilled*) and unskilled (*Unskilled*) labour, using data on the labour force and on the percentage of people over 25 with higher education. We find that a relatively small proportion of the variation in imports is explained (the overall R^2 is 0.26). The coefficients however are all significant. We find that countries with high levels of capital and labour tend to import more from the North, as do countries that are large producers of primary products. These results suggest that bigger countries tend to import more than smaller countries, a result that would be expected. Countries who are land abundant however tend to import less than those that are small in terms of area.

The use of gravity determinants improves the fit (Columns 2 and 3), with the model explaining over 60 percent of the variation in imports[12]. The gravity determinants included are the distance between the importer and exporter (*Dist*), the GDP and per

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weight in the estimation. Removing the zero values was found not to affect the results a great deal however.

[10] In Appendix B we provide details on data sources and construction; a full list of the variable names and their definitions is provided in table 5.

[11] This is included as a measure of the availability of natural resources.

[12] It should be noted that the model explains a large proportion of the between variation (i.e. the variation across countries) but much less of the within variation (i.e. the variation in trade over time). This is not surprising since there is little in the models estimated that would explain the dynamics of imports.

capita GDP of the importer and exporter interacted (*GDPIN* and *GDPPC* respectively) and dummy variables for a common language (*Comlang*) between the importer and exporter, for a landlocked exporter (*LockX*) and for a landlocked importer (*LockM*). As expected distance is found to be negatively related to a country's imports. The level of GDP and per capita incomes of the importer and exporter interacted are also found to be significant and positive, suggesting that the bigger and the wealthier a country in the South is, the more it trades with the North. We find that the presence of a common language encourages imports, which is a common result. We also find that being landlocked reduces its imports, which again is a standard result. Being landlocked for the exporting country tends to encourage exports however, which is not what we would expect[13].

When we include both factor endowments and gravity determinants together (Columns 4 – 6) we find that the coefficients tend to remain significant and of the same sign. This is true for all variables except for the labour force and the per capita income interacted, which changes from a positive to a negative sign. One possible explanation for the result on per capita income interacted is that when included without factor endowments, per capita income may be acting as a proxy for non-labour factor endowments[14], whereas when factor endowments are included in the regression separately, income per capita is acting as a proxy for something else. One possibility would be size; larger countries tend to trade less since they need not specialise to the same extent as smaller countries. Using our approximation for skilled and unskilled labour we find that countries with high levels of skilled and unskilled labour tend to have lower imports (Columns 5 and 6).

[13] The reason for this result is not clear. It is a standard result that landlocked countries tend to trade less, due to higher transport costs for example. The positive and significant coefficients are only found using data on trade volumes and not using trade shares. The result may reflect a scale effect therefore, whereby the volume of trade of the two landlocked exporting countries, Austria and Switzerland, is high relative to other exporters after controlling for various factors, but the share of exports in GDP is not significantly higher than for other exporters.

[14] Dollar (1992) uses per capita income as a measure of factor endowments, arguing that since GDP is the values of the factor services generated by an economy in a year, then GDP per capita is a measure of per capita factor availability.

Table 1: Results Using Import Volumes

Import Volume	*1*	*2*	*3*	*4*	*5*	*6*
Area	-0.18 (-4.26)*			-0.061 (-1.99)**	-0.14 (-4.54)*	-0.14 (-4.4)*
Labour	0.134 (2.73)*			-0.75 (-15.37)*		
Capital	0.168 (7.81)*			-0.01 (-0.47)	0.038 (1.7)***	0.044 (1.99)**
PriX	0.63 (27.92)*			0.56 (26.02)*	0.46 (20.52)*	0.38 (15.57)*
Skilled					-0.043 (-15.84)*	-0.4 (-14.62)*
Unskilled					-0.14 (-2.35)**	-0.12 (-2.04)**
Dist		-1.17 (-14.38)*	-1.19 (-14.98)*	-1.21 (-15.79)*	-1.04 (-13.53)*	-1.04 (-13.57)*
GDPIN		0.727 (35.58)*	0.725 (35.76)*	1.12 (35.61)*	1.13 (36.13)*	1.13 (36.28)*
GDPPC		0.129 (3.65)*	0.11 (3.12)*	-0.57 (-11.74)*	-0.26 (-4.95)*	-0.22 (-4.1)*
LockM			-0.96 (-7.4)*	-0.68 (-4.95)*	-0.75 (-5.51)*	-0.72 (-5.31)*
LockX			0.013 (0.09)	0.51 (3.77)*	0.38 (2.83)*	0.37 (2.71)*
ComLang			0.82 (6.29)*	0.79 (6.31)*	0.69 (5.57)*	0.72 (5.79)*
DTTI						0.003 (8.29)*
Constant	1.23 (0.61)**	-17.67 (-16.31)*	-17.08 (-15.9)*	-17.13 (-16.14)*	-27.82 (-21.9)*	-29.32 (-22.86)*
Wald-Test[15]	930.9*	2214.3*	2472.5*	3778.4*	4059.9*	4140.4*
Breusch-Pagan	79150*	48270*	46120*	45051*	44537*	45117*
Hausman	98.03*	1172.5*	1158.2*	497.3*	372.7*	327.2*
Overall R^2	0.26	0.64	0.65	0.65	0.65	0.66

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

Changes in the terms of trade for the importer (*DTTI*) are also found to positively affect the level of imports (Column 6). This is what we would expect since an

[15] This is a Wald test of the joint significance of all the regressors in the model, and follows a chi-squared distribution.

improvement in the terms of trade allows a country to import a greater amount of goods for a given level of exports.

The results using scaled data (given in Table 2) are broadly similar to those in Table 1, although the model has lower explanatory power. We begin again by including only factor endowments (Column 1). We also scale the various factor endowments of the importer, including in the model capital per worker (*K/Worker*), the ratio of skilled to unskilled labour (*Skill/Unskill*), the ratio of land to workers (*Land/Worker*) and the share of primary exports in GDP (*PriX/GDP*). All of the coefficients are found to be significant. We find that having a high ratio of capital to workers results in a higher share of imports. Again this may reflect the fact that wealthier countries tend to import more. We also find that a high share of primary exports in GDP and a high ratio of land to labour tends to increase the share of imports from the North in GDP. We find that developing countries with high shares of skilled to unskilled labour tend to import less.

When the model of imports is based on gravity determinants (Columns 2 and 3) the R^2 increases substantially. The coefficients all tend to have the expected sign and are significant, although the coefficient on per capita incomes is significant only in specification 2 and then only at the 10 percent level. The coefficient on the variable for a landlocked exporter is never significant.

When both factor endowments and gravity determinant are included (Columns 4 and 5) the R^2 of the model tends to remain at approximately the same level as when just gravity determinants are used. The coefficients on most of the variables remain significant however, although that on capital per worker now becomes negative, but insignificant. The coefficient on per capita incomes remains positive and is found to be highly significant when the two sets of variables are included.

Table 2: Results Using Import Shares

Import Share	*1*	*2*	*3*	*4*	*5*
K/Worker	0.006 (5.82)*			-0.0015 (-1.49)	-0.001 (-1.2)
Skill/Unskill	-0.092 (-5.0)*			-0.29 (-14.89)*	-0.28 (-14.65)*
Land/Worker	0.039 (3.43)*			0.055 (5.24)*	0.048 (4.59)*
Prix/GDP	0.47 (19.56)*			0.4 (17.22)*	0.28 (10.81)*
Dist		-0.05 (-13.49)*	-0.056 (-14.14)*	-0.061 (-15.92)*	-0.59 (-15.58)*
GDPIN		0.02 (20.4)*	0.02 (20.56)*	0.025 (25.03)*	0.027 (26.65)*
GDPPC		0.003 (1.75)***	0.0025 (1.49)	0.007 (3.59)*	0.0078 (4.02)*
LockM			-0.035 (-5.49)*	-0.036 (-5.33)*	-0.033 (-4.95)*
LockX			-0.004 (-0.52)	-0.0035 (-0.52)	-0.003 (-0.4)
ComLang			0.04 (6.35)*	0.046 (7.4)*	0.047 (7.48)*
DTTI					0.0002 (11.22)*
Constant	0.22 (18.65)*	-0.14 (-2.72)*	-0.13 (-2.42)**	-0.47 (-8.88)*	-0.58 (-10.76)*
Wald-Test	610.5*	849.8*	988.8*	1949.5*	2085.8*
Breusch-Pagan	79416*	55608*	53630*	51307*	52329*
Hausman	152.1*	1008.5*	1013.9*	607.1*	486.3*
Overall R^2	0.05	0.47	0.48	0.43	0.46

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

2.4 Measuring Openness

Openness is measured as the deviation of actual imports from that predicted by our model. All of the countries in our sample have some form of trade restrictions in place. The fitted values therefore do not give an estimate of imports in the absence of trade restrictions, but an estimate of imports for a country with certain characteristics (size, resource endowments, distance to markets) and some level of protection. The extent to which a country's actual level of imports from each Northern country differs from that predicted gives an estimate of the extent of trade restrictions relative to the average. The estimates above tend to explain a relatively large proportion of the variation of imports from the North, leaving a relatively small amount of variation to be explained by trade restrictions[16]. The fact that the models estimated explain a much greater portion of the cross-country variation compared to the time series variation however, may indicate that the measure of openness developed will be better at explaining relative levels of openness across countries rather than changes in openness within countries.

The statistic we use to measure openness is:

$$open_{mxt} = \frac{Actual_{mxt}}{Fitted_{mxt}}$$

This is one of the methods used by Leamer (1988) and is suggestive of how much trade is deterred by barriers. A value in excess of one indicates that a Southern country (*m*) imports more from this Northern country (*x*) than would be predicted by the model, a value less than one indicates that it imports less. Higher values of this statistic then are associated with increased levels of openness across countries and time.

We construct our measure of openness using specification 6 in Table 1 for the unscaled data (*open1*) and specification 5 in Table 2 for the scaled model of imports (*open2*). The statistic is calculated for each Southern country's imports from each Northern country, for each of the 15 years in the sample. The overall measure of openness for each Southern country is given by:

$$openi_{mt} = \frac{\sum_{x=1}^{21} open_{xmt}}{21}, \qquad i = 1, 2.$$

i.e. the measure of openness for country *m* at time *t* is given by the sum of the openness index to each Northern country, *x*, divided by the total number of Northern countries (which is 21).

[16] The models developed explain up to 66% of the variation in imports. Moreover the models explain over 80% of the cross-country variation in imports, with much less of the within country variation (i.e. the time-series variation) explained.

Figures 1 and 2 in Appendix C plot average values over the period 1976-1990 of actual against fitted imports using the unscaled (*open1*) and scaled (*open2*) data respectively. It is clear from these figures that both the average level and the average share of trade over this period has differed widely for different countries. The figures also suggest however that the models estimated explain the majority of the variation in trade. If anything the plots suggest that the model using the scaled data (Figure 2) explains less of the variation in trade. This initial view is confirmed by looking at the correlation between the actual and the fitted values, 0.9 for the unscaled model and 0.7 for the scaled model, as well as the R^2 values of the models estimated above.

In Figure 3 we plot the average values of the two openness measures for each country against each other. An OLS regression of *open1* on *open2* and a constant results in a coefficient on *open2* insignificantly different from one and an insignificant constant, suggesting that there is little difference between the two measures of openness. The R^2 of this simple regression is 0.64. There are however one or two outliers that are evident in Figure 3. The one striking outlier is Panama, which is found to have a very high level of openness in comparison to the other countries using both measures[17]. India and Brazil, the two largest countries in the sample are some distance below the 45-degree line, which indicates that they are less open using the share of imports (*open2*) than with the value of imports (*open1*). Alternatively, two of the smaller countries in the sample, Malawi and Malta, are some distance above the line, suggesting that they are more open according to *open2* than *open1*.

In Appendix C a table (Table 6) ranking the countries according to the two averaged measures is also provided. There are some significant differences in the rankings of countries and the correlation between the two rankings is low at 0.15. Figure 4 plots the difference between the two openness measures for each country. The number on the horizontal axis represents the ranking according to *Open1*, such that 1 refers to Panama and so on. The two horizontal lines are one standard deviation away from zero, with the standard deviation being that of *Open1*. It is clear from this figure and Table 6 that for a number of countries, the value of openness differs a great deal

[17] This result is in stark contrast to Leamer who found that although Panama was very trade dependent, her resources would suggest that she should be even more so. One possible explanation for Panama

depending upon the openness measure employed. Indeed, for six of the countries, the value of openness changes by more than one standard deviation from the average value of *open1*[18].

An interesting similarity in the measure of openness is that a number of African countries are ranked quite high in terms of openness, contrary to conventional wisdom. Our results suggest that once various gravity determinants and factor endowments are controlled for, many African countries are indeed relatively open to imports from the North, which supports the results of Rodrik (1988) and Coe and Hoffmaister (1999). The latter finds that if anything the average African country tends to 'overtrade' compared with developing countries in other regions, and suggest that economic size, geographical distance and population can explain the low level of trade in Africa.

3 The Role of North-South Trade on Economic Growth

3.1 Empirical Specification

To test the hypothesis that openness to the North increases growth in the South we specify a regression model with per capita GDP growth as the dependent variable. This is estimated using panel data techniques and once again a random-effects model is employed[19]. A problem arises in selecting the time interval over which to study growth in panel studies due to the presence of cyclical effects. If annual data is used it is necessary to model short-run dynamics. It is common to use five or ten year averages, although this has the problem of removing much of the time series variation. We proceed by using data on five-year averages for all of the variables, with data being collected for 1976-1980, 1981-1985 and 1986-1990.

The model we estimate includes standard variables used in the empirical growth literature (see for example Levine and Renelt, 1992; Durlauf and Quah, 1995) augmented with our measure of openness. The regression model is specified as:

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having such a high level of openness according to our measure is that transhipments are high for Panama.

[18] The six countries are Brazil, India, Mauritius, Malawi, Israel and Malta. The larger countries, such as Brazil and India, tend to be ranked higher according to *open1*, while the smaller countries tend to be ranked higher according to *open2*. This is what we expect, and indeed, this was the justification for scaling the data to begin with.

$$Avgrow_{mt} = \alpha + \beta_j I_{jmt} + \gamma Openi_{mt} + \varepsilon_{mt}$$

Where *Avgrow* is the average growth in per capita GDP, α is a constant, *I* is a vector of additional explanatory variables, *Openi* is one of our two measures of openness and ε is an error term. Included amongst the additional variables are two time dummies (*T1* and *T2*) to take account of differences in growth in the different periods. A large number of explanatory variables have been included in growth regressions and found to be significant. The majority of these however tend not to be robust in the sense that adding additional variables to the regression results in the original variable becoming insignificant (see Levine and Renelt, 1992, and Sala-i-Martin, 1997).

We begin with a small number of explanatory variables, but then include additional variables to test for robustness. Initially we include just two additional variables alongside openness, the initial level of GDP (*InitGDP*) and the average investment rate (*Inv*). The former is included as a catch-up term and we expect its coefficient to be negative. Openness is considered to be one channel through which countries can catch-up; the inclusion of this variable therefore is to account for other forms of catch-up. The investment rate is included as a measure of the growth in the capital stock, which we would expect to be positively related to growth[20].

Another variable included is the rate of population growth (*PopGrow*). *Ceteris Paribus* countries with high population growth would be expected to have lower per capita growth[21]. We also experiment with a number of variables that proxy human capital[22]. Initially we include average years of secondary schooling in the male and female population (*SyrM* and *SyrF* respectively). We also include average number of years of primary schooling in the male and female population (*PyrM, PyrF*) to examine whether different levels of education affect growth differently. To control for a country's attractiveness to investment we include an index of political rights (*Polrit*)

[19] The Hausman and Breusch-Pagan tests in general support the use of a random effects model.

[20] Including the investment rate as an explanatory variable in growth regressions may be problematic since investment is likely to be endogenously determined. The results we obtain however differ very little when investment is excluded.

[21] Kormendi and Meguire (1985), Levine and Renelt (1992) and Mankiw, Romer and Weil (1992) all report negative coefficients for population growth, although Levine and Renelt find the variable not to be robust.

[22] Many authors include measures of human capital; examples include Barro (1991, 1998), Levine and Renelt (1992), Mankiw, Romer and Weil (1992) and Sala-i-Martin (1997).

and civil liberties (*Civlib*)[23]; we would expect that improvements in either of these factors would boost growth. Many analysts control for macroeconomic conditions. Thus we include a measure of government consumption (*Gov't*) and inflation (*Inflation*). Higher levels of government spending would be expected to lower growth due to higher taxes that reduce saving and investment, and also possibly through crowding out[24]. We would expect inflation to be negatively related to growth, since it can negatively affect saving and investment (See Temple, 2000). Inflation may also to some extent proxy for macroeconomic instability, with lower levels of inflation reflecting greater macroeconomic stability, which would be expected to boost growth.

Dummy variables for different regions are often found significant in growth regressions[25]. These are intended to capture a wide variety of political, social and economic conditions that are specific to particular regions, but not captured by other variables. The problem with regional dummy variables is that we don't know what effects they are capturing, which has led some to term such regional dummies, dumb variables[26]. However, regional dummies have been included in growth regressions elsewhere and have been found to be significant. Moreover, Temple (1999) argues that regional dummies can be used in place of fixed effects models in empirical growth models employing panel techniques, since much of the variation in efficiency levels occurs between rather than within continents. Finally therefore, we include dummy variables for Latin America (*DLAT*), East Asia (*DEAS*) and Sub-Saharan Africa (*DSSA*) to see if the coefficients on openness are sensitive to their inclusion.

As mentioned above, in the empirical literature on growth few explanatory variables are robust, in the sense that adding additional variables to a regression makes some of the original variables insignificant. We test the robustness of the relationship between our measure of openness and growth in a number of ways. First we use two different measures of openness. Second we add incrementally quite a large number of variables to examine the impact on the size and significance of existing coefficients to the inclusion of additional variables. Third, we remove potential outliers from our sample.

[23] These variables are included in the models of Barro and Lee (1994b) and Sala-i-Martin (1997). They both find that greater political rights spurs growth, but find differing effects for civil liberties.
[24] See Argimon, Gonzalez Paramo and Roldan (1997) for some evidence of this.
[25] Examples include Barro (1991, 1998), Barro and Lee (1994b) and Sala-i-Martin (1997).
[26] Srinivasan (2000) for example argues that such variables simply quantify our ignorance.

This is done in two ways. Firstly, we drop the observations on Panama from our model. Panama was found to have much higher levels of openness than any other country in our sample[27], removing this observation will allow us to examine whether it is this observation that is driving the results obtained. Secondly, we use an econometric technique developed by Hadi (1992, 1994) to search for potential outliers in our growth model. The results of these tests consistently suggest that for all three periods Kuwait is an outlier, almost certainly reflecting the fact that it is a major oil exporter, with Nicaragua in the period 1986-90 also being an outlier. Finally, therefore we also remove these observations to examine whether these observations are driving any observed relationship between the measures of openness and growth.

3.2 Results

The model is estimated using data on each variable for the three five-year periods for each of the 52 Southern countries giving a total of 156 observations. In Table 3 we report results from the growth regressions using the unscaled openness measure (*open1*), while Table 4 reports the results using the scaled measure (*open2*) (A full list of the variable names and their definitions are described in Table 5 in Appendix B).

If we start with the core variables most coefficients have the expected sign and the majority are significant. The coefficient on initial GDP is negative, as expected, and tends to be significant. The impact of investment on growth is positive and highly significant, a result that is robust across specifications. Population growth is found to affect growth in the manner expected, being both significant and robust across the different specifications.

The results relating to human capital on growth are mixed[28]. We find that male secondary schooling has a positive and significant impact upon growth, but that female secondary schooling has a negative and significant impact, suggesting that investment in female secondary education actually retards growth[29]. The result on the female schooling variable is quite surprising, but not without precedent. Barro and

[27] Using both openness measures and for all three periods, Panama's openness was more than 2.7 standard deviations greater than the average value of openness.

[28] When the average years of secondary schooling in the total population is included in place of the male and female secondary schooling variables, the coefficient is found to be insignificant.

[29] A similar result is found by Barro and Lee (1994b).

Lee (1994b) amongst others have also found a negative and significant coefficient on female schooling and argue that one explanation for this result "is that a high spread between male and female schooling attainment is a good measure of backwardness; hence, less female attainment signifies more backwardness and accordingly higher growth potential through the convergence mechanism" (p. 18). Barro and Lee also show that female schooling has beneficial impacts on infant mortality, fertility and life expectancy.

When we include male and female average years of primary schooling, the coefficients are the opposite to those of the secondary schooling variables. We find that an increase in average years of primary schooling for females is positively related to growth, while the average years of primary schooling for males is negatively related to growth, although neither is significant. The coefficients on the average years of secondary schooling for males and females remain unchanged when the primary school variables are included.

The coefficients on civil liberties and political rights are not found to be significant, (and in the case of political rights the coefficient has the wrong expected sign). The coefficients on both government consumption and inflation have the expected sign, but only that on the government consumption variable is significant[30]. Finally, the coefficients on the regional dummy variables all have the expected sign. The coefficients are only significant for Sub-Saharan Africa and Latin America however, suggesting that East Asia's relatively high growth over the period can be explained by the variables in our model.

[30] The coefficient on inflation becomes significant when the government consumption variable is removed.

Table 3: Regression Results for Growth Model Using *open1*

Avgrow	*1*	*2*	*3*	*4*	*5*	*6*	*7*
InitGDP	-1.35 (-2.98)*	-1.45 (-3.42)*	-0.89 (-1.64)***	-0.93 (-1.6)	-1.11 (-1.94)**	-0.89 (-1.75)***	-0.50 (-0.99)
Inv	1.98 (3.57)*	1.88 (3.58)*	1.78 (3.67)*	1.83 (3.46)*	1.97 (4.03)*	1.49 (3.09)*	1.2 (2.62)*
PopGrow		-0.78 (-2.44)**	-0.94 (-3.15)*	-0.91 (-2.57)*	-0.89 (-2.94)*	-0.96 (-3.42)*	-1.05 (-3.95)*
SyrF			-4.08 (-3.43)*	-4.68 (-3.04)*	-4.57 (-3.71)*	-4.09 (-3.62)*	-2.69 (-2.41)**
SyrM			3.57 (3.94)*	4.06 (3.49)*	3.88 (4.26)*	3.39 (3.97)*	1.54 (1.64)***
PyrF				0.46 (0.62)			
PyrM				-0.51 (-0.74)			
Polrit					0.06 (0.25)		
Civlib					-0.36 (-1.17)		
Gov't						-9.41 (-2.38)**	-12.57 (-3.16)*
Inflation						-3.36 (-1.43)	-2.31 (-0.99)
Open1	6.95 (2.12)**	6.65 (2.11)**	5.42 (1.77)***	5.84 (1.81)***	4.48 (1.69)***	7.24 (2.41)**	8.22 (2.78)*
DEAS							0.06 (0.06)
DLAT							-2.45 (-3.25)*
DSSA							-1.47 (-1.99)**
T1	-2.59 (-5.19)*	-2.7 (-5.34)*	-2.81 (-5.27)*	-2.78 (-5.13)*	-2.73 (-5.02)*	-2.99 (-5.32)*	-2.74 (-4.82)*
T2	-1.16 (-2.28)*	-1.38 (-2.66)*	-1.4 (-2.36)**	-1.34 (-2.19)**	-1.23 (-1.93)**	-1.18 (-2.00)**	-1.03 (-1.77)***
Constant	0.052 (0.01)	3.37 (0.78)	0.39 (0.08)	0.51 (0.09)	3.59 (0.64)	1.31 (0.26)	0.98 (0.2)
Wald-Test	56.87*	64.16*	87.92*	87.16*	91.12*	106.23*	134.73*
Breusch-Pagan	15.97*	9.56*	3.37***	3.26***	3.15***	1.14	0.04
Hausman	0.31	3.28	3.7	3.79	4.55	6.14	7.49
Overall R^2	0.26	0.32	0.40	0.41	0.42	0.45	0.50

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

Table 4: Regression Results for Growth Model Using *open2*

Avgrow	*1*	*2*	*3*	*4*	*5*	*6*	*7*
InitGPP	-1.41 (-3.09)*	-1.50 (-3.49)*	-0.86 (-1.59)	-0.88 (-1.49)	-1.14 (-2.01)**	-0.86 (-1.70)***	-0.51 (-1.04)
Inv	2.15 (3.9)*	2.05 (3.91)*	1.92 (3.97)*	2.03 (3.77)*	1.85 (3.77)*	1.63 (3.48)*	1.33 (2.95)*
PopGrow		-0.75 (-2.33)**	-0.93 (-3.11)*	-0.93 (-2.62)*	-0.90 (-2.97)*	-0.94 (-3.41)*	-1.01 (-3.87)*
SyrF			-4.4 (-3.63)*	-5.09 (-3.25)*	-4.3 (-3.56)*	-4.57 (-4.01)*	-3.23 (-2.89)*
SyrM			3.75 (4.18)*	4.31 (3.73)*	3.72 (4.04)*	3.62 (4.34)*	1.81 (1.99)**
PyrF				0.48 (0.64)			
PyrM				-0.59 (-0.86)			
Polrit					0.07 (0.27)		
Civlib					-0.39 (-1.27)		
Gov't						-10.63 (-2.67)*	-13.47 (-3.41)*
Inflation						-3.23 (-1.38)	-2.22 (-0.56)
Open2	5.39 (1.92)***	4.82 (1.79)***	4.96 (1.91)***	5.66 (2.01)**	5.19 (1.68)***	7.13 (2.78)*	7.7 (3.19)*
DEAS							0.06 (0.07)
DLAT							-2.39 (-3.27)*
DSSA							-1.71 (-2.36)**
T1	-2.58 (-5.18)*	-2.7 (-5.33)*	-2.77 (-5.18)*	-2.71 (-4.96)*	-2.75 (-5.08)*	-2.91 (-5.14)*	-2.66 (-4.68)*
T2	-1.14 (-2.25)**	-1.37 (-2.62)*	-1.32 (-2.2)**	-1.22 (-1.94)**	-1.27 (-2.02)**	-1.05 (-1.76)***	-0.90 (-1.53)
Constant	1.63 (0.41)	5.09 (1.26)	0.24 (0.05)	-0.06 (-0.01)	3.6 (0.64)	0.93 (0.19)	1.33 (0.29)
Wald-Test	55.89*	62.35*	88.68*	88.4*	91.17*	110.33	141.28*
Breusch-Pagan	16.39*	9.94*	3.38*	3.22*	3.16*	0.87	0.14
Hausman	0.67	3.95	3.97	3.85	4.64	6.48	7.75
Overall R^2	0.26	0.31	0.41	0.41	0.42	0.46	0.51

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

Turning now to openness we see that for both measures the coefficient is positive and large, suggesting that growth is positively related to openness to imports from the North. Furthermore, the coefficients are all significant at least at the 10 percent level, and once regional factors have been taken account of, the coefficients are significant at the 1 percent level. The value of the coefficient however is variable, falling when the various measures of human capital are included. The coefficient on *open1* tends to be higher than that on the scaled measure of openness, *open2*. The results suggest that an increase in openness by one standard deviation would increase growth by between 0.39 and 0.72 percent using *open1* as our openness measure and between 0.51 and 0.82 percent using *open2* as our measure of openness.

The results suggest that whichever of the two openness measures is used, a positive and significant relationship between openness and growth is found, suggesting that our measure of openness is quite robust. Moreover, the inclusion of a large number of additional variables into our model doesn't alter the sign or significance of the openness measure. The value of the coefficient does change to some extent, particularly when human capital is included, but the relationship between openness and growth is always significant.

The results of removing the various outliers in the sample are reported in tables 7 to 10 in Appendix D. When removed the one striking outlier according to the measure of openness, Panama, has very little effect on the initial variables in the growth model, although initial GDP becomes insignificant in a number of cases (See Tables 7 and 8). More importantly, the coefficients on the openness measures are still positive and often increase in size. In one case the coefficient on our measure of openness is insignificant, but it is often the case that the coefficients have a higher level of significance after removing Panama. Tables 9 and 10 report the results after removing all three observations on Kuwait and the final observation on Nicaragua. The results are broadly similar to those found for the full sample of countries, with both measures of openness always being positive and significant.

4 Conclusions

For a long time it has been suggested that openness to international trade can have a positive impact on growth. The theory that relates openness to growth however is not conclusive on this hypothesis, openness can be shown to increase or reduce growth depending upon the country in question and upon the goods in which the country specialises in following trade liberalisation.

We examine one particular form of trade, namely North-South trade, and its impact on economic growth. Such a focus is justified by the endogenous growth theories, which suggest that countries benefit from trade through the importation of capital and intermediate goods, and technology. We began by constructing a measure of openness based on the deviation of actual from predicted imports from the North. We modelled imports as being determined by the factor endowments of the importer and by various gravity determinants. The model developed explained well the cross-country variation in the level of imports of the South.

Using this measure we estimated the impact of openness to goods from the North on economic growth. We showed that openness was significantly related to growth, with the positive impact being quite large. We were also able to show that this relationship was robust in the sense that the coefficient was always positive and significant. This was true regardless of the openness measure employed, the additional variables included in the model and the removal of influential outliers. The coefficient on openness did vary however, depending upon the measure used and the variables included in the model.

One important caveat of the measure of openness developed is that it is based on the deviation of actual trade from that expected given a country's factor endowments and geographical characteristics. While this may be a good indicator of government trade restrictions, it may also be measuring other trade limiting forces, such as poor internal infrastructure[31]. An implication of these results then is that lowering impediments to imports from the North can be helpful to growth. One such impediment is trade restrictions, but the removal or reduction of these may not be sufficient to enhance growth. Other impediments not captured in the empirical model may also be important. If imports from the North are low because of poor internal infrastructure for example, reducing trade restrictions may not improve growth. In this case, governments should also look to improve the level of infrastructure within the economy, which can enhance imports by reducing internal transport costs.

[31] A lack of data on measures of internal infrastructure for our sample of countries precluded us from including a variable capturing this in our model of imports.

Appendix A: List of Countries in the Sample

Exporters

1. Canada
2. United States of America
3. Japan
4. Austria
5. Belgium-Luxembourg
6. Denmark
7. Finland
8. France
9. Germany
10. Greece
11. Ireland
12. Italy
13. Holland
14. Norway
15. Portugal
16. Spain
17. Sweden
18. Switzerland
19. United Kingdom
20. Australia
21. New Zealand

Importers

1. Algeria
2. Cameroon
3. Central African Republic
4. Ghana
5. Kenya
6. Malawi
7. Mauritius
8. Niger
9. Senegal
10. Sierra Leone
11. South Africa
12. Sudan
13. Togo
14. Tunisia
15. Zaire
16. Zambia
17. Zimbabwe
18. Costa Rica
19. Dominican Republic
20. El Salvador
21. Guatemala
22. Haiti
23. Honduras
24. Jamaica
25. Mexico
26. Nicaragua
27. Panama
28. Trinidad and Tobago
29. Argentina
30. Bolivia
31. Brazil
32. Chile
33. Colombia
34. Ecuador
35. Guyana
36. Paraguay
37. Peru
38. Uruguay
39. Venezuela
40. Bangladesh
41. Myanmar
42. India
43. Indonesia
44. Israel
45. Korea
46. Kuwait
47. Malaysia
48. Pakistan
49. Philippines
50. Sri Lanka
51. Thailand
52. Malta

Appendix B: Data Sources, Construction and Variable Names

Much of the data used in this paper was taken from the Summers and Heston (1991) database (SH) and the Barro and Lee datasets (1994a, 2000). Data on GDP, growth rates, population, human capital, government consumption, inflation and the terms of trade were all taken from these sources. Data on the labour force and investment were taken from the dataset constructed by Greenaway, Morgan and Wright (1997), denoted as GMW in the table below. Data on distance, common languages and common borders were taken from a web-site maintained by Jon Haveman. Data on area was taken either from the Barro and Lee dataset (1994a) or from the *Central Intelligence Agency (CIA) World Factbook* (1998). Data on total manufacturing imports from the Northern countries are measured as exports from the Northern country to the Southern country and were taken from the publication *International Trade by Commodities Statistics, 1961-1990*. Exports of primary products were taken from *The World Bank Indicators database* (1994). A full list of the variables along with a brief description of each is provided in the table below.

Table 5: Variable Names, Description and Sources

Variable Name	Description	Construction	Source
Area	Total area of importer in square miles (in logs)		Barro and Lee 1994a, CIA World Factbook
Avgrow	Annual growth of per capita GDP		SH
Capital	The value of the capital stock in the importing country (in logs)	Constructed using investment data and assuming a 15-year average life of assets	GMW
Civlib	Measure of civil liberties	Index taking a value between 1 and 7 (1 greatest civil liberties)	Barro and Lee 1994a
Comlang	Dummy variable taking the value 1 if the importer and exporter share a common language		Haveman
DEAS	Dummy variable taking value 1 if the country is in East Asia		Barro and Lee 1994a
DLAT	Dummy variable taking value 1 if the country is in Latin America		Barro and Lee 1994a
DSSA	Dummy variable taking value 1 if the country is in Sub-Saharan Africa		Barro and Lee 1994a
Dist	The Logged distance between the importer and exporter in square	Great circle distance between capital cities in miles	Haveman
DTTI	Terms of trade of the importing country		Barro and Lee 1994a
GDPIN	The logged real value of GDPs of the importer and exporter interacted	GDP of importer multiplied by the GDP of the exporter	SH
GDPPC	The logged real value of the GDP per capita of the importer and exporter interacted	Per capita GDP of importer multiplied by the GDP per capita of the exporter	SH
Gov't	Real Government share of GDP (%) in 1985 international prices		SH
InitGDP	Level of GDP in 1976 in constant dollars		SH
Inflation	Average rate of inflation	Constructed using price level data	SH
Inv	Annual Investment in constant Dollars		GMW
K/Worker	The value of capital per worker (in logs)	*Capital* divided by the *Labour*	Own calculations
Labour	The (logged) number in the workforce of the importing country		GMW
Land/Worker	The ratio of land to the labour force	*Area* divided by *Labour*	Own calculations

LockM	Dummy variable taking the value 1 if the importer is landlocked		Haveman
LockX	Dummy variable taking the value 1 if the exporter is landlocked		Haveman
LogTrade	The (logged) real value of total manufacturing imports from each Northern country		International Trade by Commodities Statistics, 1961-1990, (OECD)
Polrit	Measure of political rights	Index taking a value between 1 and 7 (1 greatest political rights)	Barro and Lee 1994a
PopGrow	Annual rate of population growth		Barro and Lee 1994a
PriX	The logged real value of primary exports of the importing country	Current value of exports deflated by GDP deflator	World Bank Indicators Database
PriX/GDP	The share of primary exports in GDP	*PriX* divided by GDP of the importing country	Own calculations
PyrF	Average years of primary schooling in the female population		Barro and Lee 2000
PyrM	Average years of primary schooling in the male population		Barro and Lee 2000
Skilled	Proxy for the stock of human capital in the importing country (in logs)	Percentage of people over 25 with higher education multiplied by *Labour*	Barro and Lee 1994a, GMW
Skill/Unskill	The ratio of skilled to unskilled workers	*Skilled* divided by *Unskilled*	Own calculations
SyrF	Average years of secondary schooling in the female population		Barro and Lee 2000
SyrM	Average years of secondary schooling in the male population		Barro and Lee 2000
TradeShare	The share of imports from each Northern country in GDP	Real value of imports divided by GDP of importer	OECD and SH
Unskilled	Proxy for unskilled labour (logged value)	*Labour* less *Skilled*	Own calculations

Appendix C: Tables and Figures

Figure 1: Plot of Actual Against Fitted Values (Import Volumes)

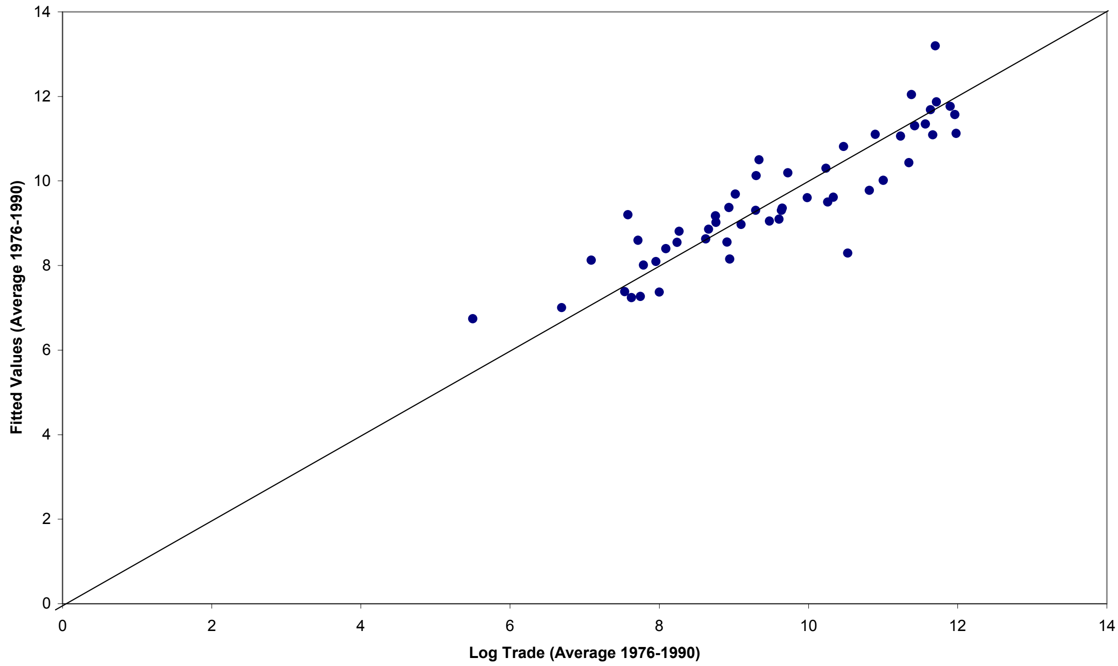


Figure 2: Plot of Actual Against Fitted (Import Shares)

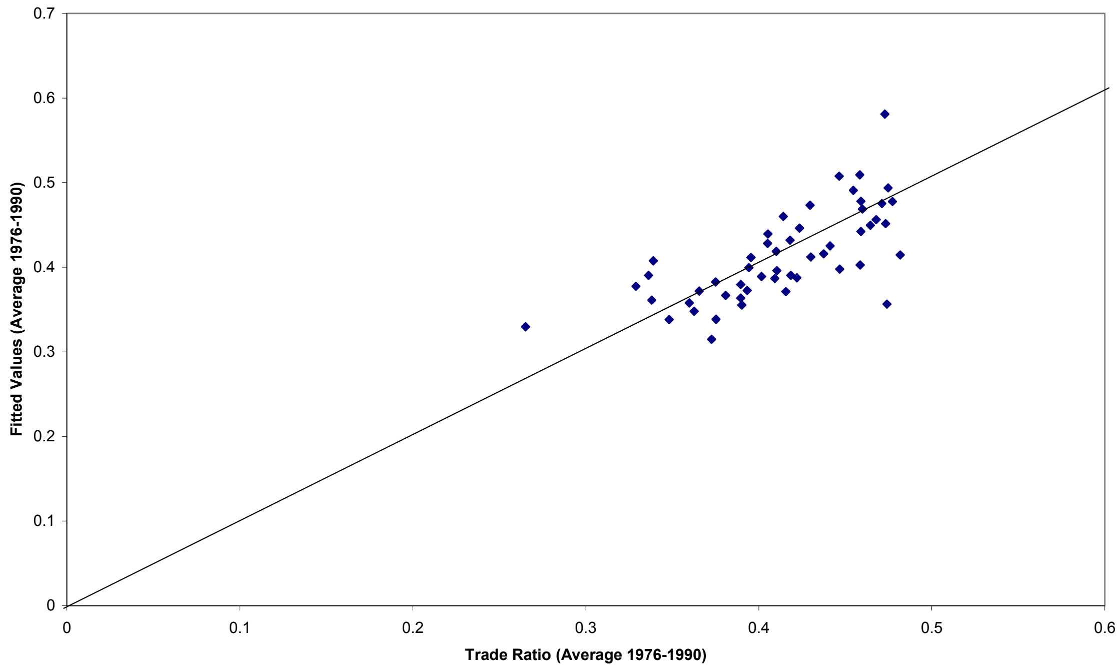


Figure 3: Plot of *open1* Against *open2*

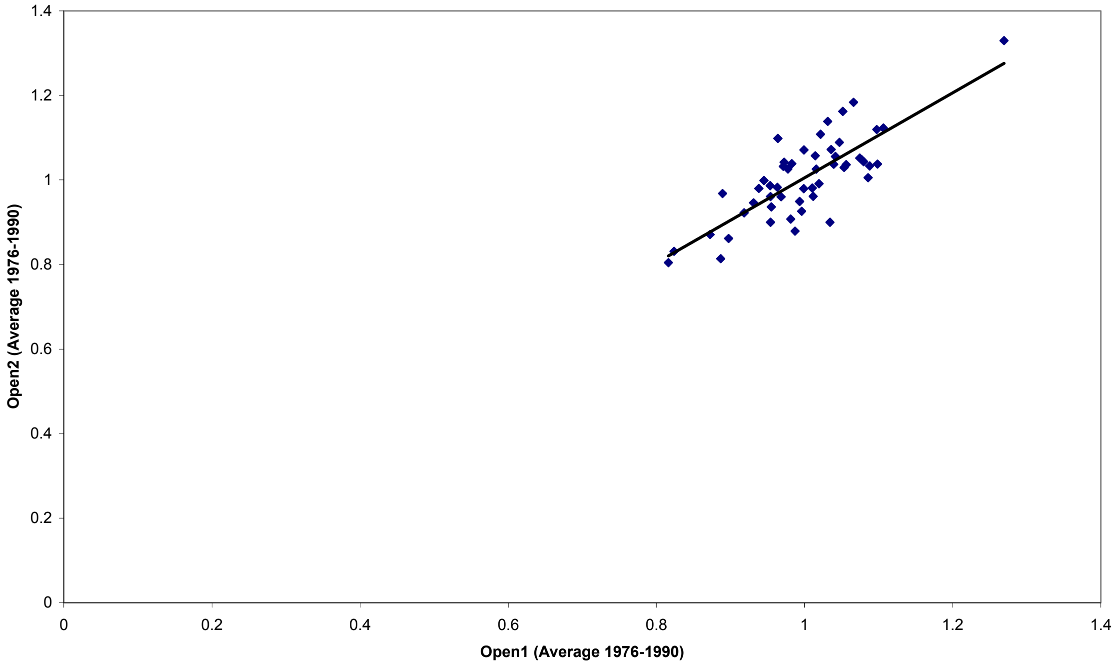
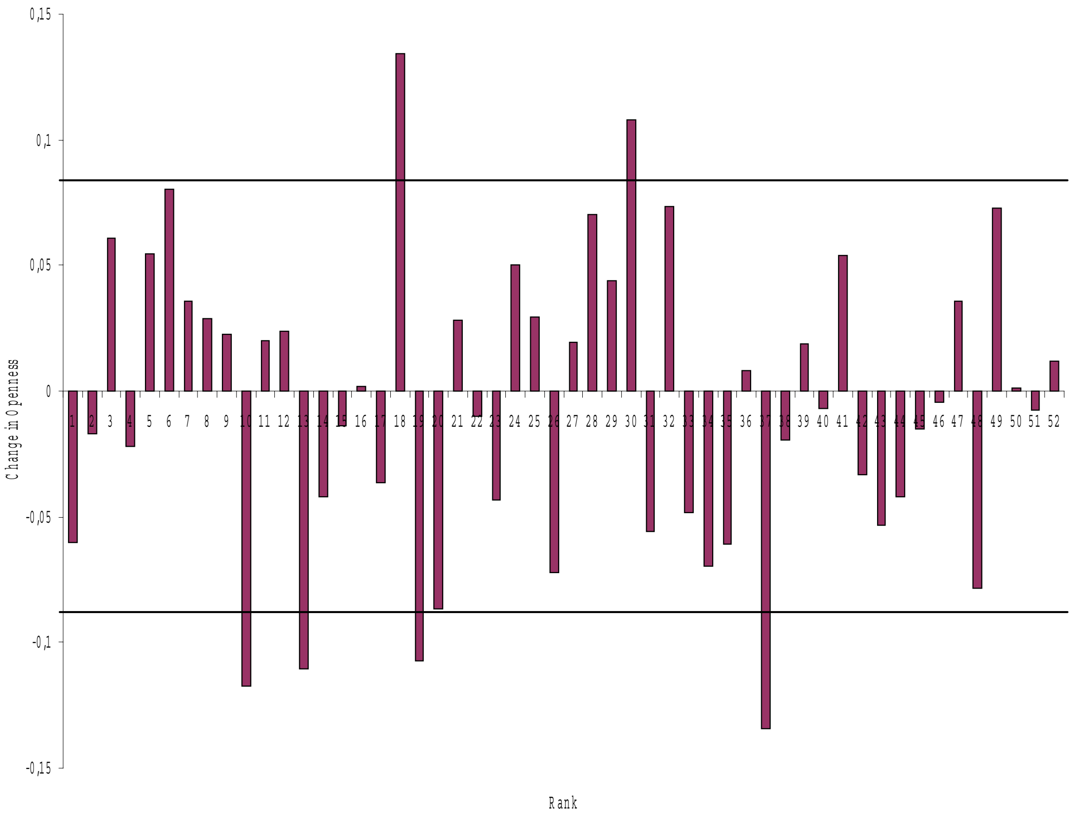


Table 6: Ranking of Countries by Openness Measure

Rank	*open1*	*open2*
1	Panama	Panama
2	Philippines	Malawi
3	Pakistan	Israel
4	Zambia	Malta
5	Thailand	Philippines
6	Bolivia	Zambia
7	Peru	Sierra Leone
8	Korea	Mauritius
9	Chile	Sri Lanka
10	Malawi	Ecuador
11	Bangladesh	Costa Rica
12	Paraguay	Dominican Republic
13	Israel	Uruguay
14	Sri Lanka	Chile
15	Uruguay	Korea
16	Kenya	Peru
17	Ecuador	Haiti
18	India	Togo
19	Malta	Pakistan
20	Sierra Leone	Kenya
21	Venezuela	Bangladesh
22	Malaysia	Thailand
23	Dominican Republic	Jamaica
24	South Africa	Paraguay
25	Indonesia	El Salvador
26	Costa Rica	Malaysia
27	Zaire	Bolivia
28	Mexico	Kuwait
29	Colombia	Venezuela
30	Brazil	Guatemala
31	Togo	Nicaragua
32	Argentina	Indonesia
33	El Salvador	Honduras
34	Haiti	Zaire
35	Jamaica	Trinidad and Tobago
36	Tunisia	South Africa
37	Mauritius	Senegal
38	Nicaragua	Tunisia
39	Guyana	Colombia
40	Senegal	Ghana
41	Sudan	Guyana
42	Guatemala	Mexico
43	Kuwait	Cameroon
44	Honduras	Argentina
45	Ghana	India
46	Cameroon	Sudan
47	Myanmar	Brazil
48	Trinidad and Tobago	Niger
49	Algeria	Myanmar
50	Niger	Zimbabwe
51	Zimbabwe	Algeria
52	Central African Republic	Central African Republic

Figure 4.4: Difference in Openness between *open1* and *open2*



Appendix D: Additional Regression Results

Table 7: Regression Results Omitting Panama Using *open1*

Avgrow	*1*	*2*	*3*	*4*	*5*	*6*	*7*
InitGDP	-1.3 (-2.88)*	-1.41 (-3.32)*	-0.93 (-1.7)***	-0.98 (-1.66)***	-1.21 (-2.09)**	-0.93 (-1.79)***	-0.51 (-1.01)
Inv	1.92 (3.45)*	1.82 (3.46)*	1.74 (3.54)*	1.79 (3.35)*	1.81 (3.65)*	1.46 (3.0)*	1.17 (2.53)**
Popgrow		-0.78 (-2.45)*	-0.92 (-3.07)*	-0.9 (-2.52)*	-0.89 (-2.89)*	-0.95 (-3.35)*	-1.05 (-3.89)*
SyrF			-3.85 (-3.11)*	-4.44 (-2.8)*	-4.12 (-3.28)*	-3.94 (-3.34)*	-2.64 (-2.29)**
SyrM			3.47 (3.69)*	3.95 (3.33)*	3.65 (3.86)*	3.33 (3.77)*	1.53 (1.6)
PyrF				0.46 (0.61)			
PyrM				-0.52 (-0.74)			
Polrit					0.09 (0.39)		
Civlib					-0.44 (-1.44)		
Gov't						-9.28 (-2.32)*	-12.55 (-3.11)*
Inflation						-3.53 (-1.49)	-2.45 (-1.04)
Open1	8.2 (2.32)**	8.03 (2.35)**	5.78 (1.73)***	6.3 (1.78)***	5.29 (1.56)	7.35 (2.25)**	7.81 (2.45)*
DEAS							0.1 (0.11)
DLAT							-2.45 (-3.22)*
DSSA							-1.49 (-2.0)**
T1	-2.58 (-5.12)*	-2.69 (-5.27)*	-2.84 (-5.27)*	-2.81 (-5.13)*	-2.76 (-5.06)*	-3.04 (-5.34)*	-2.78 (-4.85)*
T2	-1.07 (-2.09)**	-1.29 (2.35)**	-1.37 (-2.29)**	-1.31 (-2.13)**	-1.2 (-1.89)**	-1.14 (-1.92)***	-0.98 (-1.67)***
Constant	-1.37 (0.76)	1.85 (0.41)	0.42 (0.08)	0.44 (0.08)	4.09 (0.69)	1.44 (0.28)	1.51 (0.3)
Wald-Test	56.1*	63.71*	84.6*	83.84*	88.31	102.67*	131.01*
Breusch-Pagan	15.58*	9.33*	3.54***	3.4***	3.42***	1.27	0.03
Hausman	0.09	2.8	3.43	3.65	4.36	5.86	7.33
Overall R^2	0.27	0.32	0.40	0.40	0.42	0.45	0.50

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

Table 8: Regression Results Omitting Panama Using *open2*

Avgrow	*1*	*2*	*3*	*4*	*5*	*6*	*7*
InitGDP	-1.38 (-3.01)*	-1.47 (-3.41)*	-0.9 (-1.65)***	-0.92 (-1.54)	-1.17 (-2.02)**	-0.89 (-1.74)***	-0.52 (-1.04)
Inv	2.1 (3.81)*	2.01 (3.82)*	1.89 (3.85)*	2.01 (3.68)*	1.94 (3.91)*	1.61 (3.38)*	1.29 (2.84)*
Popgrow		-0.75 (-2.31)**	-0.91 (-3.03)*	-0.92 (-2.57)*	-0.88 (-2.86)*	-0.93 (-3.33)*	-1.01 (-3.81)*
SyrF			-4.19 (-3.35)*	-4.86 (-3.05)*	-4.39 (-3.47)*	-4.41 (-3.74)*	-3.16 (-2.76)*
SyrM			3.65 (3.97)*	4.21 (3.59)*	3.82 (4.09)*	3.55 (4.15)*	1.78 (1.93)***
PyrF				0.48 (0.63)			
PyrM				-0.62 (-0.87)			
Polrit					0.09 (0.36)		
Civlib					-0.41 (-1.34)		
Gov't						-10.52 (-2.61)*	-13.48 (-3.37)*
Inflation						-3.4 (-1.44)	-2.36 (-1.01)
Open2	6.63 (2.18)**	6.05 (2.07)**	5.34 (1.89)***	6.19 (2.02)**	4.61 (1.6)	7.33 (2.67)*	7.49 (2.91)*
DEAS							0.1 (0.11)
DLAT							-2.41 (-3.24)*
DSSA							-1.72 (-2.65)**
T1	-2.57 (-5.09)*	-2.68 (-5.25)*	-2.79 (-5.18)*	-2.73 (-4.95)*	-2.73 (-5.0)*	-2.95 (-5.16)*	-2.69 (-4.7)*
T2	-1.04 (-2.03)**	-1.26 (-2.39)**	-1.29 (-2.12)**	-1.17 (-1.86)***	-1.15 (-1.79)***	-1.0 (-1.67)***	-0.84 (-1.43)
Constant	0.28 (0.07)	3.72 (0.88)	0.23 (0.04)	-0.24 (-0.04)	4.04 (0.69)	0.97 (0.19)	1.67 (0.36)
Wald-Test	55.36*	61.84*	85.47*	85.27*	88.44*	106.87*	137.61
Breusch-Pagan	16.41*	10.1*	3.57***	3.39***	3.44***	1.0	0.11
Hausman	0.26	3.33	3.78	3.75	4.57	6.25	7.66
Overall R^2	0.26	0.31	0.40	0.52	0.42	0.46	0.51

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

Table 9: Regression Results Using *open1* and Omitting Outliers

Avgrow	*1*	*2*	*3*	*4*	*5*	*6*	*7*
InitGDP	-1.05 (-2.15)**	-1.47 (-2.91)*	-0.92 (-1.62)	-0.79 (-1.25)	-1.12 (-1.87)***	-1.04 (-1.91)***	-0.4 (-0.78)
Inv	2.0 (3.7)*	1.97 (3.77)*	1.82 (3.72)*	1.98 (3.77)*	1.91 (3.86)*	1.52 (3.1)*	1.09 (2.39)**
Popgrow		-0.85 (-2.22)**	-0.91 (-2.4)**	-0.92 (-2.34)**	-0.94 (-2.47)**	-1.03 (-2.8)*	-0.81 (-2.35)**
SyrF			-3.72 (-2.98)*	-3.97 (-2.3)**	-4.08 (-3.17)*	-3.78 (-3.14)*	-1.82 (-1.53)
SyrM			3.38 (3.67)*	3.81 (3.23)*	3.54 (3.76)*	3.26 (3.68)*	1.27 (1.36)
PyrF				0.24 (0.31)			
PyrM				-0.54 (-0.78)			
Polrit					0.13 (0.53)		
Civlib					-0.40 (-1.31)		
Gov't						-9.22 (-2.26)**	-12.36 (-3.12)*
Inflation						-2.64 (-0.75)	-1.24 (-0.35)
Open1	6.88 (2.13)**	7.14 (2.27)**	5.56 (1.77)***	6.27 (1.94)***	5.64 (1.78)***	7.31 (2.31)**	7.1 (2.36)**
DEAS							-0.07 (-0.08)
DLAT							-2.91 (-3.69)*
DSSA							-1.72 (-2.29)**
T1	-2.46 (-4.98)*	-2.54 (-5.11)*	-2.68 (-5.04)*	-2.61 (-4.85)*	-2.58 (-4.76)*	-2.83 (-4.58)*	-2.61 (-4.22)*
T2	-0.92 (-1.8)***	-1.12 (-2.17)**	-1.23 (-2.05)**	-1.11 (-1.82)***	-1.04 (-1.64)***	-1.15 (-1.92)***	-1.09 (-1.86)***
Constant	-2.15 (-0.5)	2.87 (0.61)	0.21 (0.04)	-1.05 (0.86)	2.63 (0.54)	2.22 (0.43)	1.05 (0.22)
Wald-Test	53.56*	59.28*	77.52*	77.9*	79.7*	87.28*	119.1*
Breusch-Pagan	14.27*	10.44*	3.64***	3.46***	3.49***	1.46	0.09
Hausman	2.22	2.72	3.87	4.14	0.84	6.17	8.27
Overall R^2	0.25	0.29	0.37	0.38	0.38	0.41	0.47

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

Table 10: Regression Results Using *open2* and Omitting Outliers

Avgrow	*1*	*2*	*3*	*4*	*5*	*6*	*7*
InitGDP	-1.09 (-2.22)**	-1.46 (-2.87)*	-0.86 (-1.51)	-0.62 (-0.98)	-1.04 (-1.71)***	-0.97 (-1.8)***	-0.36 (-0.72)
Inv	2.16 (4.02)*	2.13 (4.1)*	1.95 (3.98)*	2.22 (4.15)*	2.03 (4.09)*	1.65 (3.45)*	1.17 (2.64)*
Popgrow		-0.78 (-2.01)**	-0.86 (-2.31)**	-0.9 (-2.31)**	-0.89 (-2.36)**	-0.97 (-2.72)*	-0.73 (-2.22)**
SyrF			-4.06 (-3.17)*	-4.34 (-2.5)**	-4.34 (-3.32)*	-4.25 (-3.48)*	-2.29 (-1.93)***
SyrM			3.58 (3.94)*	4.11 (3.51)*	3.74 (4.02)*	3.51 (4.09)*	1.49 (1.66)***
PyrF				0.21 (0.27)			
PyrM				-0.67 (-0.96)			
Polrit					0.13 (0.53)		
Civlib					-0.37 (-1.21)		
Gov't						-10.31 (-2.52)**	-13.33 (-3.45)*
Inflation						-2.44 (-0.69)	-0.76 (-0.22)
Open2	5.64 (2.07)**	5.35 (2.01)**	5.11 (1.95)***	6.4 (2.3)**	4.89 (1.84)***	7.04 (2.66)*	6.91 (2.9)*
DEAS							-0.1 (-0.11)
DLAT							-2.92 (-3.84)*
DSSA							-1.97 (2.73)*
T1	-2.45 (-4.96)*	-2.53 (-5.09)*	-2.65 (-4.96)*	-2.52 (-4.65)*	-2.56 (-4.71)*	-2.74 (-4.43)*	-2.49 (-4.02)*
T2	-0.89 (-1.75)***	-1.09 (-2.1)**	-1.15 (-1.9)***	-0.95 (-1.53)	-0.99 (-1.55)	-1.03 (-1.71)***	-0.96 (-1.64)***
Constant	-1.02 (-0.25)	4.0 (0.86)	-0.26 (-0.05)	-2.79 (-0.48)	2.15 (0.36)	1.68 (0.33)	0.78 (0.17)
Wald-Test	53.23*	57.77*	78.52*	80.31*	79.99*	90.55*	127.51*
Breusch-Pagan	14.37*	10.81*	3.6***	3.36***	3.46***	1.13	0.28
Hausman	2.24	3.04	4.44	4.0	5.25	7.06	9.37
Overall R^2	0.24	0.28	0.38	0.39	0.38	0.42	0.48

Note: values in parentheses are t-values. *, **, *** indicates significance at the 1, 5 and 10 percent level respectively.

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