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Trade Liberalisation is Good for You if You are Rich

by

Charles Ackah and Oliver Morrissey

Abstract

This paper investigates the relationship between trade policy and growth using a dynamic panel regression model with GMM estimates for data on 44 developing countries over 1980-1999. Trade policy is captured by measures of tariffs, import and export taxes. Typically, the average effects of changes in such policy variables have been investigated. However, from a policy perspective, the differential effects on high- or low-income countries may be of more interest. Our preferred specification for growth thus includes as an explanatory variable an interaction term between trade barriers and initial income levels to capture the non-linearity in the relationship. This specification reveals a significant interaction effect under which the marginal impact of tariffs on growth is declining in initial income. In particular, for low-income countries tariffs appear to be associated with *higher* growth, whereas only for middle-income and richer countries is there a negative impact of tariffs on growth. The impact of a marginal change in protection on growth changes from positive to negative as income increases beyond a threshold level of GDP per capita (below which, in rough terms, a country would be classed as low-income). Put differently, trade liberalisation seems to offer the possibility of achieving faster growth only in relatively richer countries.

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Outline

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1. INTRODUCTION

For many years, particularly following World War II, economists and policy makers have discussed the impact of trade barriers on economic performance. There are compelling theoretical reasons to believe that trade liberalisation would stimulate economic growth (see Srinivasan and Bhagwati (2001), Grossman and Helpman (1991) and Lucas (1988)). However, there are also some endogenous growth models in which protection of the domestic market is growth-promoting (see Lucas (1988); Young (1991); Grossman and Helpman (1991); Matsuyama (1992); Srinivasan (2001)). As Harrison (1996) points out, the endogenous growth theorists do not predict that free trade will unambiguously raise economic growth - increased competition could, for example, discourage innovation by lowering expected profits. The foregoing discussion suggests that it is impossible to sign the effect of trade liberalisation on growth unambiguously based on theoretical considerations alone. The impact of trade policy on economic growth remains a matter of empirical testing.

Empirically, the evidence is mixed; some studies have found that a country's rate of economic growth is positively correlated with its openness to international trade, while others have failed to demonstrate any role for trade liberalisation in spurring economic growth. In the last decade, in particular, considerable attempts have been made to measure the effects of both trade and trade policy on per capita income and income growth. Most of the cross-country empirical literature seems to support the view that trade liberalisation (or openness) leads to more rapid growth and that economic growth results in poverty reduction, as exemplified in the influential papers by Sachs and Warner (1995) and Dollar and Kraay (2000 and 2001).[1] However, these studies specifically, or the general empirical approach, have come under severe criticism following the seminal work by Rodríguez and Rodrik (2001). In a serious critical review of the cross-country growth literature, Rodríguez and Rodrik (2001) contend that the cross-country growth regressions are fraught with various methodological shortcomings and hence the findings are less robust than claimed. The main criticisms concern the unsatisfactory measures of openness commonly used in the cross-country studies, the problem of disentangling the effects of trade liberalisation due to the

[1] Other examples of such studies include Dollar (1992), Ben-David (1993), Lee (1993), Edwards (1993,

collinearity of trade policies with a myriad of other simultaneous factors and policies, and other econometric difficulties including the statistically sensitive specifications frequently adopted in the cross-country growth literature.

While several studies may have identified a positive correlation between trade policy openness and growth, the direction of causation remains unclear. As Rodrik (1999) argues, it may well be the case that faster growing economies become more open rather than economies that become more open grow faster. Harrison (1996) concludes that previous studies on the direction of causality between openness and growth have generated mixed results, with causality being bi-directional. Rodríguez and Rodrik (2001) hold the view that there has been a tendency to overstate the growth effect of trade liberalisation. Rodrik (1999) further points to the existence of potential contingency between trade policy openness and economic growth. He argues that the benefits from openness are not *unconditional* but rather depend upon the availability of complementary policies and institutions - rule of law, good macroeconomic policies, adequate financial markets and functioning government institutions, implying a contingent or nonlinear relationship between openness and growth. Along these lines, Panagariya (2003) contends that openness is necessary but not sufficient for sustained rapid growth.

Another criticism of many of the empirical studies is that they use measures of trade or indices of openness, rather than using measures of trade policy. Measuring the extent of trade policy openness has become one of the major challenges for studies involved in the analysis of the growth effects of trade policy (Winters, 2004; Rodríguez and Rodrik 2001; Pritchett 1996; Edwards 1993, 1998; Greenaway *et al*. 1998, 2002; Milner and Morrissey 1999; Rodrik 1992, 1998, 1999). Research must confront the fact that it is very difficult to obtain reliable direct measures of trade policy openness across countries over time. Several approaches have been employed to circumvent the problem, especially the use of indices of trade orientation that are constructed using quantitative and qualitative judgments, e.g. Dollar (1992), Sachs and Warner (1995), Harrison (1996), Edwards (1998), and Frankel and Romer (1999). Some studies confuse trade outcome measures (trade volume or its components) with policy

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1998), Harrison (1996), Frankel and Romer (1999) and Mbabazi *et al*. (2002).

indicators, e.g. those that interpret the trade volume measure of openness, (exports + imports)/GDP, as a policy indicator. “In the context of policy advice, trade policy ‘openness’ is most directly associated with a liberal trade regime (low tariffs, very few non-tariff barriers etc.) but in fact that is rarely the concept used in empirical work” (Winters, 2004: 4). Rodríguez and Rodrik (2001) argue that the indicators of openness used by researchers have crucial shortcomings in measuring the trade orientation of countries and are therefore problematic as measures of trade policy.[2]

Because of the disagreements that these previous studies have created about the association between trade policy and growth, further research on this important subject is warranted. Accordingly, this study investigates the impact of trade policy on economic growth in developing countries during the period 1980-1999, based on a dynamic panel regression model. We address the measurement concern by using three alternative policy measures: average unweighted scheduled tariffs, import taxes (as a percentage of imports, a measure of the average implicit tariff) and export taxes (as a percentage of exports).[3] Furthermore, to allow for the differential effects on high- or low-income countries, our preferred specification for growth includes an interaction term between trade barriers and initial income levels to capture the non-linearity in the relationship between trade barriers and growth. We address endogeneity concerns by employing the GMM estimator. The focus of this study is to attempt to answer the following empirical questions: Does trade policy openness cause economies which liberalize to grow more rapidly than those which do not? Is the effect of trade liberalisation felt equally across countries (rich and poor), or are there systematic differences conditioned on income?

The quantitative results provide evidence of a robust, positive link between trade policy and real per capita GDP growth. The relationship between tariffs and growth is positive and significant across all alternative policy measures, but is not uniform across countries at different stages of development. The results suggest the existence of a contingent relationship under which the marginal impact of protection on growth is declining in income. The richer the country, the more likely it is that protection

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[2] Indeed, while most economists would intuitively agree on the positive relationship between trade flows and growth, the same cannot be said about the effects of trade barriers on growth.

[3] These indicators have limitations as measures of trade policy (see Milner and Morrissey, 1999; Rodrik,

reduces growth (tariffs are negatively associated with growth), whereas for poor countries the more likely it is that trade protection will enhance growth (tariffs are positively associated with growth). Thus, for two economies that belong to different income groups (low and high), similar trade policies will have different effects on economic growth. The results indicate that failure to recognise the contingency in the relationship between trade policy and growth is partly responsible for the ambiguity in the literature. The remainder of this paper is organized as follows. In Section 2 we describe a standard dynamic growth equation and present some preliminary statistics from the data. The section further describes the econometric methodology we employ for our estimations. In Section 3, we present evidence from cross-section, fixed effects and from a dynamic panel data model based on the GMM estimator of trade barriers and growth, and discuss the estimation results for various measures of trade restrictions. In Section 4, we carry out some sensitivity analysis to test for the robustness of our results. Section 5 presents concluding remarks.

2. SPECIFICATION AND DATA

2.1. Modelling Issues and Approach

Consider the following standard growth equation

$$\Delta y_{it} = \alpha\, y_{it-1} + \beta' \mathbf{x}_{it} + \eta_i + \lambda_t + \varepsilon_{it} \tag{1}$$

where y_{it} is per capita real GDP for country i in period t, Δy_{it} reflects the average growth rate of per capita GDP, y_{it-1} is the initial per capita GDP, $\mathbf{x}$ is a vector of determinants of economic growth, η_i represents the unobserved country-specific factors, λ_t is a period-specific effect, ε_{it} is the time-varying regression residual, and α and β are parameters to be estimated. The subscripts i and t represent country and time period, respectively. Clearly, equation (1) is a dynamic model with a lagged dependent variable. Several approaches have been used to estimate (1) in the empirical growth literature. As many economists have pointed out, the estimation of equation (1) presents at least two main important econometric difficulties that may lead to

1999), but should capture the broad pattern of trade policy across countries and over time.

inconsistent and biased estimates: omitted variable bias and endogeneity bias. In what follows, we discuss how these problems arise and how the empirical literature has sought to correct for both of the biases.

2.1.1. Cross-section OLS Estimation

The term η_i is a permanent but unobservable country-specific effect and captures the existence of other growth determinants that are not already controlled for by the vector $\mathbf{x}$ (i.e. omitted variables). It is time invariant and generally captures such cross sectional heterogeneity as differences in tastes or technology between countries. If the country-specific parameter were not included in (1), random country-specific fluctuations would be grouped into the regression residual ε_{it}. This would bias the common error term. In the presence of any correlation between the right-hand side variables and the country specific effect (η_i), estimation methods such as OLS will not be consistent.[4] This is evident from the fact that

$$E\left(\eta_i y_{iy-1}\right) = E\left[\eta_i\left(\alpha y_{it-2} + \beta'\mathbf{x}_{it-1} + \eta_i + \lambda_{t-1} + \varepsilon_{it-1}\right)\right] \neq 0 \quad (2)$$

Aside from omitted variable bias, cross-section growth regressions may suffer from endogeneity problems. Note that the determinants of growth in the vector $\mathbf{x}$ can be classified according to whether they are strictly exogenous, predetermined or endogenous.[5] The vector $\mathbf{x}$ is strictly exogenous if it is uncorrelated with all past, present and future realisations of ε_{it}. However, this assumption is rather too restrictive and often times very difficult to justify. For example, an unanticipated shock to the growth rate of an economy could have a contemporaneous effect on the rate of investment or the level of openness, thus compromising the strict exogeneity of these variables. Alternatively, it is reasonable to infer that a positive shock to economic

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[4] In a pure cross-sectional regression, the unobserved country-specific effect is part of the error term. However, in a dynamic growth regression the lagged dependent variable y_{it-1}, will necessarily correlate with η_i and thereby result in biased coefficient estimates.

[5] For a variable z_{it} that belongs to the vector $\mathbf{x}$, z_{it} is said to be endogenous if it is correlated with ε_{it} and earlier shocks but uncorrelated with ε_{it+1} and subsequent shocks. By predeterminacy, we mean that $\mathbf{x}$ and ε_{it} are uncorrelated, but $\mathbf{x}$ may still be correlated with ε_{it-1} and earlier shocks.

growth in period $t-1$ will result in a higher level of openness or positively affect gross domestic investment in period t. Endogeneity is a particular problem in studies that relate growth to openness using trade outcome measures such as trade share of GDP. Such openness measures could clearly be endogenous since both the export and the import share seem likely to vary with income levels. Even direct trade policy measures, such as average tariffs, are susceptible to potential endogeneity. O'Rourke (2000) discusses a potential mechanism of reverse causation between direct trade barrier measures and GDP growth. In his narrative, prices go up in booms, eroding the share of import duties in total import values during a period when such duties were collected as specific tariffs. Growth subsequently slows down in the slump following the boom and prices fall, so that low tariffs are associated, spuriously, with poor growth. Thus, trade barriers may present issues of reverse causality, especially because protection may depend on economic growth. If reverse causality is not taken into account, it can lead to bias in the estimated coefficients and incorrect inferences.

2.1.2. Within-Group (Fixed Effects) Estimation

The possibility of endogeneity together with the presence of country specific effects correlated with some of the explanatory variables implies that estimation methods such as OLS will not be consistent. A first step in obtaining consistent estimates is to eliminate the country-specific heterogeneity. One approach is to employ the within-group estimator by taking deviations with respect to individual country means. However, when the model includes a lagged dependent variable the dynamic fixed-effects model produces estimates that are inconsistent if *N* (number of 'individuals', or cross section) is large relative to *T* (number of time periods), hence the fixed effects estimator is biased (see Nickell (1981); Wooldridge (2002); and Baltagi, (1995)). Specifically, the within-group estimator is biased downwards of the order $1/T$ and this bias declines as T increases. As we will discuss later, in this study the number of time periods is small ($T=5$) and thus the bias could be severe.

2.1.3. Generalized Method of Moments

The growth equation (1) can be rewritten equivalently as

$$y_{it} = \alpha\, y_{it-1} + \beta' \mathbf{x}_{it} + \eta_i + \lambda_t + \varepsilon_{it} \tag{3}$$

The Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1991) relies on first-differencing to eliminate unobserved individual-specific effects (η_i), and then uses lagged values of endogenous or predetermined variables as instruments for subsequent first-differences. Thus, the GMM estimation procedure simultaneously addresses the problems of correlation and endogeneity.

First-differencing equation (3) yields

$$y_{it} - y_{it-1} = \alpha\left(y_{it-1} - y_{it-2}\right) + \beta'\left(\mathbf{x}_{it} - \mathbf{x}_{it-1}\right) + \left(\varepsilon_{it} - \varepsilon_{it-1}\right) \qquad (4)$$

However, eliminating the country-specific effect introduces a correlation between the lagged dependent variable and the new error term. Due to the correlation between y_{it-1} and ε_{it-1}, it can be shown that

$$E\left(y_{it-1} - y_{it-2}\right)\left(\varepsilon_{it} - \varepsilon_{it-1}\right) \neq 0 \qquad (5)$$

Also, as discussed above, the contemporaneous effects of growth shocks on the determinants of growth will result in the presence of endogeneity arising mainly due to the correlation between $\mathbf{x}$ and ε_{it}. This correlation arises since

$$E\left(\mathbf{x}_{it} - \mathbf{x}_{it-1}\right)\left(\varepsilon_{it} - \varepsilon_{it-1}\right) \neq 0 \qquad (6)$$

To address the endogeneity problem, Arellano and Bond (1991) recommend using the lagged values of the explanatory variables in levels as instruments under the assumptions that there is no serial correlation in the error term ε_{it} and the right-hand side variables. We follow Easterly and Levine (2001) and DeJong and Ripoll (2004) in addressing the issue of endogeneity by imposing the identifying restriction that the determinants of growth (variables in the $\mathbf{x}$ vector) are predetermined.[6] The assumption is that shocks to economic growth in period *t*-1 could affect, for example, physical

[6] This is a testable hypothesis for which the Sargan test of overidentifying restrictions is reported with

investment, human capital investment, population growth, our trade policy measures or their interaction terms in period t. Given this assumption, an appropriate instrument for the difference is the lagged value.

Given the shortcomings of the differenced estimator (Easterly and Levine, 2001), we use the alternative systems estimator that estimates jointly the regression in differences with the regression in levels, as proposed by Arellano and Bover (1995) and Blundell and Bond (1998).[7] The consistency of the GMM estimator depends on the validity of the assumption that the error term does not exhibit serial correlation and on the validity of the instruments. By construction, the test for the null hypothesis of no first-order serial correlation should be rejected under the identifying assumption that the error is not serially correlated; but the test for the null hypothesis of no second-order serial correlation, should not be rejected. We use two diagnostics tests proposed by Arellano and Bond (1991) and Blundell and Bond (1998), the Sargan test of over-identifying restrictions, and whether the differenced residuals are second-order serially correlated. Failure to reject the null hypotheses of both tests gives support to our model.

2.2. The Model

Our estimating equation in standard form is:

$$\begin{aligned}\ln Y_{it} - \ln Y_{it-1} &= \delta_0 + \delta_1 \ln Y_{it-1} + \delta_2 \ln POP_{it} + \delta_3 INV_{it} + \delta_4 SEC_{it} \\ &+ \delta_5 TPOLICY_{it} + \eta_i + \lambda_t + \varepsilon_{it}\end{aligned} \tag{7}$$

where Y_{it} is per capita GDP for country i during period t, and Y_{it-1} is the level of real per capita GDP in country i at the start of period t. In addition to estimating (7) by the system GMM estimator, we also report results obtained using two alternative estimators: cross-sectional OLS and the panel within-group estimator. Equation (7) imposes a uniform and linear restriction on the parameter δ_5; the *average* effect of trade policy on growth. However, some theoretical models have indicated that the growth effect of trade barriers may be contingent on the level of development (see Lucas (1988), Young (1991) and Matsuyama (1992)). In other words, it is unnecessary

all regression results.

[7] Blundell and Bond (1998) suggest that when the lagged levels of the series are weakly correlated with

to assume that all countries would derive the same benefits from trade liberalisation. Equation (7) may thus suffer from an un-modelled contingency in the relationship between trade barriers and growth (DeJong and Ripoll, 2004).

Hence, we extend the basic regression specification (7) to capture potential contingencies in the relationship between trade barriers and growth. We use two approaches in this regard.

$$\begin{aligned}\ln Y_{it} - \ln Y_{it-1} &= \delta_0 + \delta_1 \ln Y_{it-1} + \delta_2 \ln POP_{it} + \delta_3 INV_{it} + \delta_4 SEC_{it} \\ &+ \delta_5 TPOLICY_{it} + \delta_6 \ln Y_{it-1} * TPOLICY_{it} + \eta_i + \lambda_t + \varepsilon_{it}\end{aligned} \tag{8}$$

First, in equation (8), we allow the growth effect of trade policy to differ for countries at different stages of development by including in our baseline specification (7) an additional explanatory variable constructed as the product of initial income and our individual trade policy variables. The interaction term is meant to capture the dependence of the growth effect of trade barriers on income, where income is used here to proxy for overall level of development.[8] Evidence of a contingent relationship is provided by a significant coefficient on the interaction term. In addition, we employ an alternative technique to explore the potential contingency by specifying a regression model under which we interact *TPOLICY* with a dummy variable for rich countries (*THERICH*) constructed from the World Bank's (July 2005) income-rank index.[9] This specification is analogous to (8) except that we replace $\ln Y_{it-1} * TPOLICY$ with the new interaction term $THERICH * TPOLICY$. We then consider the differential impact of trade policy for rich and poor countries.

2.3. Data Description and Variable Selection

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the subsequent first-differences, the differenced GMM estimator can provide biased results.

[8] DeJong and Ripoll (2004) and Chang *et al*. (2005) are examples of empirical growth regressions where initial income is interacted with some measure of openness for similar reasons. Sachs and Warner (1997b) and Baliamoune (2002) interact openness with initial income to test the hypothesis that a greater degree of openness is associated with a faster rate of convergence to the steady state.

[9] The World Bank index categorized all countries into four income groups – low, lower-middle, upper-middle and high income countries (see appendix for exact cut-off values corresponding to the indexes). *THERICH* takes the value of one for middle and high income countries and zero otherwise.

Annual data for 44 developing countries covering the period 1980-99 is used.[10] This is the data used for the single cross-section analysis. For the panel estimations, we construct an unbalanced panel by averaging the data over five non-overlapping four-year time periods: from 1980-83 through 1996-99. Each country thus has a potential maximum of five observations. Not all countries have data for all five time periods, but the use of unbalanced panels may attenuate the effect of self-selection in the sample. The final sample consists of 19 Sub-Saharan African countries, 11 Latin American countries, 7 from East Asia, 4 from South Asia and 3 from the Middle East and North Africa. The data comprise a heterogeneous group of countries in terms of size, level of income, degree of openness, population, resource endowments and so on. The countries covered and detailed variable definitions and sources are presented in Tables A1 and A2 respectively in Appendix A.

The variables included in the model are widely accepted in the empirical growth literature as core determinants of growth. The log of real GDP per capita at the beginning of each 4-year period ($\ln Y_{t-1}$) is included to capture initial country-specific effects or convergence effects.[11] If initial income captures convergence the expected sign is negative (see Barro and Sala-i-Martin (1995)). However, in a cross-country regression it may capture country-specific initial conditions, and the sign could be positive (Mbabazi *et al*. 2001). The coefficient on population growth (*POP*) is expected to carry a negative sign. The coefficients on investment share of GDP (*INV*) and human capital (*SEC*) are expected to be positive. In addition to this conditioning set, we employ three alternative measures of trade policy (*TPOLICY*) – average (unweighted) scheduled tariffs (*TARIFF*), and then for robustness checks we use import taxes as a percentage of imports (*MTAX*) and export taxes as a percentage of exports (*XTAX*).[12]

Our dependent variable is the (period) growth of real per capita GDP. However, in the single pure cross-sectional regressions, the dependent variable is the annual average

[10] Our sample and time series are primarily determined by the availability of data on average tariff, our main measure of trade policy.

[11] In the case of the single cross-sectional regression, the logarithm of GDP per capita in 1980 is used as initial income.

[12] Undoubtedly, one could consider large list of potential of growth determinants, but degrees of freedom considerations and data constraints require us to be modest with the number of right-hand variables.

growth rate for the entire period 1980-99. There are at least two ways of measuring economic growth in the empirical growth literature. Most commonly, cross-section growth studies tend to use as dependent variable the growth rate of real GDP per capita from the World Bank's World Development Indicators data base (WDI). In the empirical dynamic growth literature, however, the growth rate of GDP per capita is often approximated by the logarithmic difference in GDP per capita.[13] Recall from equation (7) that when the dependent variable is measured this way the logarithm of initial GDP per capita (Y_{it-1}) proxies for the lagged dependent variable; resulting in a dynamic specification. However, when the growth series in the WDI is used as the dependent variable, the dynamic model as in equation (3) requires that we include the lagged dependent variable lagged growth ($Growth_{t-1}$) in the right-hand side variables. As is standard in the growth literature, the initial GDP per capita still appears in the regression specification as an additional regressor. For comparison, we use both approaches to measure the growth rate of per capita output in both the cross-section and panel estimations.

2.2.1. Descriptive Statistics

Figure A1 in Appendix A plots the series for the two alternative measures of per capita GDP growth used in the empirical literature. Similarly, Figure A2 also in Appendix A is a graphical representation for a selected number of countries of the average within-country growth rate over the entire period of the study. Clearly, in both cases, there are obvious differences in the way growth is measured. Economic growth, as measured by the World Bank (WDI 2003), is higher both within (except in a few countries, for e.g. Congo Democratic Republic and Madagascar) and across countries. It would be interesting to find out whether cross-country growth results are sensitive to the choice of measurement of growth, the dependent variable. While we follow the largest strand of the empirical dynamic growth literature by approximating growth by the log difference of GDP per capita, we also report results in Appendix C for estimates obtained using as our dependent variable the average annual growth rate as reported by the WDI.

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[13] Hoeffler (2002), Tsangarides (2002) and DeJong and Ripoll (2004) and Chang *et al*. (2005) are recent examples of studies where the logarithmic difference in GDP per capita is used as the dependent

It is useful to examine simple descriptive statistics for the relevant policy measures over the period under consideration (Tables 1 and 2). Table 1 displays correlations between per capita GDP growth, trade share and the trade barrier measures. The simple correlations suggest that while we can expect to find a positive and statistically significant association between trade volumes (measured by the ratio of trade to GDP) and growth, the unconditional relationship between trade barriers and growth is less clear. There is evidence of a negative and statistically significant correlation in two cases (export tax and import tax); for average tariff the correlation appears positive but is not significantly different from zero. All three trade barrier indicators are positively and significantly correlated with one another. However, all the trade barrier indicators are negatively and significantly correlated with trade flows, suggesting that trade barriers do limit trade. Given the positive relationship between trade share and growth, the negative correlation between trade barriers and trade share suggests that trade barriers are likely to be detrimental to growth. However, as the econometric estimates that follow indicate, the relationship between trade barriers and growth is more complex than these statistics imply.

Table 1: Correlation Matrix between Policy Measures

VARIABLE	*GROWTH*	*TRADE (% GDP)*	*TARIFF*	*EXPORT TAX*
GROWTH	1.000			
TRADE (%GDP)	0.232	1.000		
	(0.001)			
TARIFF	0.047	-0.372	1.000	
	(0.521)	(0.000)		
EXPORT TAX	-0.181	-0.200	0.145	1.000
	(0.012)	(0.005)	(0.061)	
IMPORT TAX	-0.177	-0.328	0.511	0.182
	(0.013)	(0.000)	(0.000)	(0.011)

Source: Authors' calculations. Note: *p*-values in parentheses

Table 2 provides information about the means and standard deviations of the main variables for the entire sample and for the low-income and high-income sub-samples, two aspects being of particular interest for our analysis. First, the statistics suggest that structural and institutional weaknesses (as measured by low levels of human capital

variable.

investment) are characteristics of poor countries. Human capital investment (as proxied by secondary school enrolment) is relatively low in low-income countries. If indeed, the gains from openness are conditional on the availability of other policy complementarities or structural characteristics (such as the level of human capital) it is not difficult to infer why openness can be detrimental to low-income countries. We investigate this claim econometrically in Section 5. The second, message from Table 2 is the apparent high trade restrictions (low openness) in low-income countries. All the (three) alternative trade policy measures and the conventional openness measure indicate that trade restrictions are still substantially higher in low income countries.

Table 2: Summary Statistics for the Main Variables (1980-99), by income group

Variable	Obs	Mean	Std. Dev.	Min	Max
Per capita GDP growth (annual %)	220	1.26	3.59	-9.91	12.93
Income per capita [in logs]	220	6.83	1.24	4.57	10.14
Human capital investment (secondary enrolment)	190	43.06	23.15	2.93	102.00
Population growth	220	2.25	0.84	-2.75	6.53
Gross domestic investment	220	21.82	7.92	4.33	47.10
Average tariff	189	24.82	16.15	0.20	99.90
Import tax (% Imports)	194	14.10	8.05	0.27	46.77
Export tax (% Exports)	194	3.09	6.07	0.00	34.58
Trade volume (% GDP)	219	64.05	51.85	11.39	407.35
Low-income countries (32 observations)					
Per capita GDP growth (annual %)	160	0.79	3.62	-9.91	12.93
Human capital investment (secondary enrolment)	133	35.37	20.54	2.93	77.25
Average tariff	137	27.71	17.00	6.00	99.90
Import tax (% Imports)	137	16.05	8.07	1.85	46.77
Export tax (% Exports)	137	3.72	6.89	0.00	34.58
Trade volume (% GDP)	160	54.51	25.50	11.39	147.70
High-income countries (12 observations)					
Per capita GDP growth (annual %)	60	2.49	3.23	-5.30	8.10
Human capital investment (secondary enrolment)	57	60.99	18.61	20.35	102.00
Average tariff	52	17.21	10.45	0.20	47.00
Import tax (% Imports)	57	9.41	5.81	0.27	22.95
Export tax (% Exports)	57	1.55	2.86	0.00	10.90
Trade volume (% GDP)	59	89.92	85.97	14.11	407.35

Source: Authors' calculations based on all 44 countries in our sample and then for low and high – income countries respectively. Averages are taken of annual values for 1980-1999.

Table 3 replicates the information in Table 2 from a regional perspective. The two main observations contained in Table 2 are equally valid for Table 3: Sub-Saharan Africa, the poorest region, is the most protected. It is also the region with the lowest growth and weakest institutional development. The opposite is true for East Asia. Perhaps not surprisingly, the low income countries, in general, and SSA in particular, recorded the lowest average growth rate (0.79% per year) between 1980 and 1999. In fact, SSA (excluding Mauritius, Botswana and South Africa) actually registered a negative average growth rate over the period (-0.62% per year), compared with an average growth rate of 4.49% in East Asia.

Table 3: Summary Statistics for the Main Variables (1980-99), by region

Variable	Obs	Mean	Std. Dev.	Min	Max
Sub-Saharan Africa					
Per capita GDP growth (annual %)	80	-0.62	3.60	-9.91	12.93
Average tariff	62	24.36	10.62	6.00	60.80
Import tax (% Imports)	63	18.44	6.49	4.64	36.28
Export tax (% Exports)	63	6.66	8.91	0.00	34.57
Trade volume (% GDP)	80	50.46	23.59	11.39	147.70
Human capital investment (secondary enrolment)	63	22.05	16.31	2.93	75.90
East Asia					
Per capita GDP growth (annual %)	35	4.49	3.43	-4.06	11.41
Average tariff	35	20.83	13.38	0.20	49.50
Import tax (% Imports)	33	6.63	4.52	0.27	15.59
Export tax (% Exports	33	0.77	1.56	0.00	7.31
Trade volume (% GDP)	34	107.43	106.09	14.71	407.35
Human capital investment (secondary enrolment)	33	59.85	19.38	29.75	102.00
Latin America					
Per capita GDP growth (annual %)	55	0.62	2.78	-5.92	7.15
Average tariff	46	17.64	8.78	8.00	47.00
Import tax (% Imports)	49	9.95	4.41	2.04	18.39
Export tax (% Exports)	49	1.35	2.62	0.00	10.90
Trade volume (% GDP)	55	59.31	27.55	14.11	131.50
Human capital investment (secondary enrolment)	49	53.29	16.06	21.18	85.10

Source: Authors' calculations.
Note: Averages are taken of annual values for 1980-1999. Sub-Saharan Africa excludes the three middle-income countries –Mauritius, Botswana and South Africa.

These statistics reveal an unconditional negative effect of trade barriers and low human capital on economic performance. There appears to be a complementarity between human capital investment or lack thereof and trade policy reforms. It is clear from these statistics that the growth effect of openness is heterogeneous, and may depend on the structural and institutional characteristics of countries. We note also that the availability and the degree of these institutions may be contingent on the level of development of a country. High income countries are more likely to possess these structural and institutional characteristics than low income countries. For example, high-income countries have almost twice the enrolments in secondary schools (61%) compared to low-income countries (35%). The richest countries had higher education levels and also had the lowest tariff barriers in the sample. On this basis, it is reasonable to expect that the growth response to trade liberalization may be contingent on whether a country is rich or poor. We test this hypothesis econometrically in the next section of this paper.

3. RESULTS AND DISCUSSION

In this section we discuss the cross-country econometric results, based on estimates of equations (7) and (8). Tables 4, 5 and 6 report coefficient estimates obtained from the growth regressions where we measure trade policy (*TPOLICY*) by average tariff (*TARIFF*), import tax (*MTAX*) and export tax (*XTAX*) respectively. In each of the three tables, we present estimates from the baseline specification (7) in columns 1-3 under which we model the relationship between trade barriers and growth as linear (i.e., without interaction between trade policy and initial income) in all the regressors. In this basic specification only linear effects are allowed – the average growth effect of trade policy. For this simple linear specification, we report comparative results from estimates obtained from cross-section (column 1), within-group (column 2) and system GMM (column 3) estimators. Column 4 in Tables 4-6 presents estimates from a non-linear specification (8) intended to establish whether the relationship between trade policy and growth is contingent on the level of income by introducing an interaction term between the respective policy measures and initial income. This specification relies on the more efficient system GMM estimator. Various diagnostic tests are reported alongside the coefficient estimates in all tables.

While the estimated coefficients of other explanatory variables may be of interest, we restrict our attention to the discussion of the estimated effects of trade policy on growth.[14] We are interested in whether changes in trade policy have significant and homogeneous effects on income growth. We summarize our main results below. As shown in Tables 4 to 6, we only find statistically significant effects for our trade policy measures when using the GMM estimator. In the main, our results from the three linear specifications (columns 1 through 3) are not inconsistent with the state of the

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[14] Aside the trade policy measures, the most robust variables in our regressions are investment, the growth rate of population and human capital. Human capital investment (*SEC*) has the intuitive sign and statistically significant most of the time. As found by Levine and Renelt (1992), investment is a fundamental determinant of cross-country growth. As predicted by the Solow growth model, the growth rate of population is negatively correlated with per capita GDP growth.

literature on trade restrictions and growth. Regardless of the estimator used, it is difficult to find a consistent effect of trade barriers on growth in a 'global' cross-country regression.

Table 4

Trade Policy -*TARIFF* - and Growth in Developing Countries (1980-1999): Dependent Variable is $\ln Y_{it} - \ln Y_{t-1}$

	SIMPLE LINEAR SPECIFICATIONS			INTERACTION
	[1] CROSS SECTION	[2] WITHIN GROUP	[3] SYS-GMM	[4] SYS-GMM
$\ln Y_{t-1}$	-0.2536**	-2.1279***	-0.0290***	0.0095
	(0.1230)	(0.6316)	(0.0071)	(0.0074)
POP	-0.4914**	-0.2033	-0.0474***	-0.0368***
	(0.1907)	(0.3665)	(0.0068)	(0.0112)
INV	0.0936***	0.1459***	0.0088***	0.0093***
	(0.0149)	(0.0307)	(0.0004)	(0.0005)
SEC	0.0034	0.0234	0.0019***	0.0020***
	(0.0069)	(0.0213)	(0.0005)	(0.0005)
TARIFF	0.0038	-0.0168	-0.0000	0.0134***
	(0.0086)	(0.0127)	(0.0003)	(0.0018)
TARIFF* $\ln Y_{t-1}$				-0.0021***
				(0.0003)
Constant	0.9065	11.5958***	0.0903*	-0.2099**
	(1.1204)	(3.9702)	(0.0462)	(0.0786)
Period Dummies:				
1984-87		0.3941	-0.0147***	-0.0027
		(0.2809)	(0.0047)	(0.0122)
1988-91		0.3549	0.0092***	0.0141*
		(0.3070)	(0.0033)	(0.0073)
1992-95		0.2556	-0.0324***	-0.0193***
		(0.3750)	(0.0048)	(0.0051)
1996-99		0.3286		
		(0.5376)		
R^2 Adjusted	0.64	0.20		
Sargan Test			[0.475]	[0.901]
1st-order serial correlation			[0.084]	[0.090]
2nd-order serial correlation			[0.538]	[0.653]
Observations	44	165	136	136

Notes:

1. Standard errors in parentheses while *p*-values in brackets, *; **; and *** denote significant at 10%; 5%; and 1% respectively.
2. The Sargan test is for the validity of the set of instruments.
3. The tests for 1st (m1) and 2nd (m2) - order serial correlation are asymptotically distributed as standard normal variables (see Arellano and Bond, 1991). The p-values report the probability of rejecting the null hypothesis of serial correlation, where the first differencing will induce (MA1) serial correlation if the time-varying component of the error term in levels is a serially uncorrelated disturbance.

Table 5

Trade Policy -*MTAX* - and Growth in Developing Countries (1980-1999): Dependent Variable is $\ln Y_{it} - \ln Y_{t-1}$

	SIMPLE LINEAR SPECIFICATIONS			INTERACTION
	[1] CROSS-SECTION	[2] WITHIN-GROUP	[3] SYS-GMM	[4] SYS-GMM
$\ln Y_{t-1}$	-0.2488**	-2.8285***	-0.0025**	0.0222***
	(0.1118)	(0.6940)	(0.0012)	(0.0043)
POP	-0.5446***	-0.2721	-0.0437***	-0.0299***
	(0.1747)	(0.4167)	(0.0065)	(0.0050)
INV	0.0981***	0.1656***	0.0097***	0.0096***
	(0.0152)	(0.0316)	(0.0005)	(0.0007)
SEC	0.0030	0.0306	0.0005***	0.0012***
	(0.0068)	(0.0195)	(0.0002)	(0.0002)
MTAX	0.0160	-0.0287	-0.0009**	0.0177***
	(0.0143)	(0.0299)	(0.0004)	(0.0023)
MTAX* $\ln Y_{t-1}$				-0.0026***
				(0.0004)
Constant	0.7784	15.8223***	-0.0529**	-0.3101***
	(0.9128)	(4.4945)	(0.0208)	(0.0392)
Period Dummies:				
1984-87		0.4150	-0.0098	
		(0.2773)	(0.0101)	
1988-91		0.3478	0.0118*	0.0162***
		(0.2907)	(0.0066)	(0.0060)
1992-95		0.3153	-0.0263***	-0.0151**
		(0.3456)	(0.0023)	(0.0060)
1996-99		0.6030		0.0118*
		(0.5433)		(0.0060)
R^2 Adjusted	0.65	0.25		
Sargan Test			[0.722]	[0.769]
1st-order serial correlation			[0.068]	[0.085]
2nd-order serial correlation			[0.581]	[0.751]
Observations	44	171	132	132

Notes: Same as for Table 4.

Table 6

Trade Policy -*XTAX* - and Growth in Developing Countries (1980-1999): Dependent Variable is $\ln Y_{it} - \ln Y_{t-1}$

	SIMPLE LINEAR SPECIFICATIONS			INTERACTION
	[1] CROSS-SECTION	[2] WITHIN-GROUP	[3] SYS-GMM	[4] SYS-GMM
$\ln Y_{t-1}$	-0.2649**	-2.8368***	0.0013	0.0119***
	(0.1100)	(0.6924)	(0.0019)	(0.0025)
POP	-0.5101***	-0.2036	-0.0360***	-0.0313***
	(0.1749)	(0.4159)	(0.0054)	(0.0034)
INV	0.0983***	0.1660***	0.0086***	0.0102***
	(0.0155)	(0.0315)	(0.0004)	(0.0007)
SEC	0.0043	0.0345*	0.0011***	0.0002*
	(0.0069)	(0.0196)	(0.0003)	(0.0001)
XTAX	0.0193	-0.0426	0.0022**	0.0113***
	(0.0199)	(0.0350)	(0.0008)	(0.0020)
XTAX* $\ln Y_{t-1}$				-0.0016***
				(0.0004)
Constant	0.9104	15.3185***	-0.1143***	-0.1852***
	(0.8853)	(4.4312)	(0.0389)	(0.0097)
Period Dummies:				
1984-87		0.3769	-0.0158***	-0.0197**
		(0.2739)	(0.0054)	(0.0075)
1988-91		0.1994	0.0073	-0.0005
		(0.3035)	(0.0060)	(0.0067)
1992-95		0.2310	-0.0279***	-0.0356***
		(0.3577)	(0.0042)	(0.0028)
1996-99		0.6037		
		(0.5342)		
R^2 Adjusted	0.64	0.25		
Sargan Test			[0.473]	[0.910]
1st-order serial correlation			[0.071]	[0.057]
2nd-order serial correlation			[0.503]	[0.579]
Observations	44	171	132	132

Notes: Same as for Table 4.

Using OLS, we find a positive but insignificant effect for all our trade policy measures. In contrast, the within group estimator provides negative estimates for all three measures, which are likewise not significantly different from zero. Generally, the coefficients provided by the system GMM are estimated more precisely than the OLS and within-group estimates and in most cases the estimated coefficients are statistically significant. Thus, the remainder of the discussions in this paper refers to the parameter estimates obtained using the GMM.

We proceed by discussing the global relationship observed between trade barriers and growth given the exclusion of the interaction term from our baseline specification (7). In Table 4 (column 3) *TARIFF* enters negatively but the estimated coefficient is not significantly different from zero. *MTAX* however, enters Table 5 negatively and is statistically significant while *XTAX* has a positive and statistically significant coefficient in Table 6. The results provide evidence of a globally ambiguous relationship between trade barriers and growth. When *TPOLICY* alone is introduced into the growth regression it has inconsistent signs, suggesting that it is sensitive to how trade policy is measured. This result is obviously worrying, but it is the kind of result that dominates the previous empirical cross-country growth literature. It would be appropriate to recognise that countries are heterogeneous in many respects, not least that some are poor while others are rich. It is reasonable to expect the growth effect of trade policy to differ for rich and poor countries. Anecdotal evidence and our descriptive analysis do not lend support to the notion that all countries derive similar benefits from international trade. This evidence precludes the use of simple linear models to investigate the openness-growth relationship in a cross-country framework. It would be interesting and proper to explicitly allow the impact of trade policy to differ across countries in different income groups and at different stages of development.

We now discuss the relationship observed between trade policy and growth, given the inclusion of the interaction term in our baseline specification (column 4 of Tables 4 to 6). An interesting story emerges. *TPOLICY* (regardless of how it is measured) now enters consistently with a positive and statistically significant coefficient, but the interaction term is significantly negative in all cases. This specification reveals a significant interaction effect under which the marginal impact of trade barriers on growth is decreasing in initial income. These results imply that the impact of trade barriers on growth is a function both of the level of restriction and of the level of income. From equation (8), the derivative of growth with respect to trade policy is calculated as

$$\frac{\partial GROWTH_{it}}{\partial TPOLICY_{it}} = \delta_5 + \delta_6 \left(\ln Y_{it-1} \right) \tag{9}$$

implying that the effect of a change in *TPOLICY* on *GROWTH* depends on the value of the conditioning variable, the logarithm of initial GDP per capita ($\ln Y_{it-1}$).We know from the fact that the coefficient on the interaction term is negative that the positive effect of trade barriers declines as the level of income increases. These results suggest potential threshold effects and non-linearity in the relationship between trade protection (and by implication liberalization) and growth. We illustrate this with Figure A3 in Appendix A, which plots the impact of a marginal change in protection on growth for each of the three trade policy measures against real GDP per capita for our sample. The results are quite revealing. For all the alternative trade policy measures, the marginal effect of protection changes from positive to negative as income increases beyond the threshold level of GDP per capita. Focusing on *TARIFF*, the top panel of Figure A3 reveals a threshold at the level of income equivalent to approximately $590 per capita (in constant international prices, base year 1985), above which the relationship between protection and growth is negative and below is positive.[15] Therefore, in principle, trade protection retards growth and liberalization is growth-promoting once a country has reached the threshold level of GDP per capita. Put differently, the results suggest that trade protection appears to assist (even protect) growth in low-income countries. A corollary is that trade liberalization will not, in general, have an unambiguous effect on growth. Trade liberalisation seems to offer the possibility of achieving faster growth only in relatively richer countries.

Sachs and Warner (1997b) offer other explanations for the sign and significance of the coefficient on the interaction term. Based on a static cross-sectional model with interaction between openness and initial income, the authors conclude that higher openness facilitates convergence; such that more open economies grow faster than closed economies. This conclusion is based on the estimated positive coefficients on both openness and the openness-initial income interaction term. In contrast, while our estimated 'average' coefficient on initial income is largely negative and significant (confirming the conditional convergence hypothesis), in the specifications where initial

[15] All the SSA countries in our sample (except South Africa, Botswana, Mauritius, Zimbabwe, Cote d'Ivoire and Congo Republic), Bangladesh, Nepal, India and Nicaragua were below this threshold level during the period 1996-99. When *MTAX* is used as our preferred measure of protection (see middle panel of Figure A3) the threshold level of per capita income increases to $905. When *XTAX* is used instead (see bottom panel of Figure A3) the threshold level of per capita income increases further to $1,167. In both cases, all the SSA countries in our sample (except South Africa, Botswana and

income is interacted with trade policy the estimated coefficient on initial income turns positive and significant, implying divergence. This has an interesting interpretation in light of the fact that the interaction term is always negative: the process of convergence seems to be determined, in part, by the trade regime - closed economies diverge more slowly than open economies.

This finding together with the results in Table 7 (below) contradicts the claim by Sachs and Warner (1997b) that open economies converge faster than closed economies.[16] Our results are, however, consistent with the findings by Baliamoune (2002) who suggests the possibility of a threshold effect in the impact of openness on growth. Applying panel fixed effects estimation methods to a sample of African countries covering the period 1980-99 (the same period as in our case); Baliamoune estimates a negative and statistically significant coefficient on openness (as measured by the share of trade in GDP). In a separate specification that includes an interaction between openness and initial income, she estimates a negative coefficient on the interaction term, concluding that 'globalization may be good but only for those countries that are not among the poorest group' (Baliamoune, 2002:7).

Table 7 reports results for the case where we experiment by using the conventional openness measure, *OPEN* (the ratio of trade volume [exports + imports] to GDP) in equation (8). As with Tables 4-6, we interact *OPEN* with the log of initial income to test (1) the hypothesis that open economies grow faster and (2) the robustness of our finding that openness is beneficial only when incomes are low. Perhaps surprisingly, the results reported in columns 3 and 4 of Table 7 contradict the commonly held view that openness is good for growth. Moreover, the findings do not support the idea that more open low-income countries converge faster than closed countries. Our results are, however, completely consistent with the previous results in Tables 4 to 6 – where we use actual trade policy measures. Our findings also corroborate the work by Baliamoune (2002). We consider the result in Table 7 as a further robustness check for our results.

Mauritius) fell below the relevant threshold level during the period 1996-99.

[16] The inconsistency in our results may be due to differences in the samples, time period, estimation techniques and how trade policy openness is measured. The Sachs and Warner (1997b) study covers a pooled sample of 83 developed and developing countries for the period 1965-1990. Single cross-section OLS estimation techniques are used and trade openness is measured by the Sachs and Warner (1995) index.

Table 7

Trade *Openness* and Growth in Developing Countries (1980-1999): Dependent Variable is $\ln Y_{it} - \ln Y_{t-1}$

	SIMPLE LINEAR SPECIFICATIONS			INTERACTION
	[1] CROSS-SECTION	[2] WITHIN-GROUP	[3] SYS-GMM	[4] SYS-GMM
$\ln Y_{t-1}$	-0.2603**	-2.5311***	0.0061	-0.0190*
	(0.1240)	(0.6112)	(0.0048)	(0.0102)
POP	-0.5106***	-0.0515	-0.0208***	-0.0472***
	(0.1813)	(0.3711)	(0.0064)	(0.0104)
INV	0.0970***	0.1659***	0.0097***	0.0106***
	(0.0182)	(0.0298)	(0.0005)	(0.0005)
SEC	0.0027	0.0237	0.0010***	0.0006
	(0.0070)	(0.0183)	(0.0002)	(0.0004)
OPEN	-0.0007	-0.0018	-0.0005***	-0.0050***
	(0.0023)	(0.0085)	(0.0001)	(0.0002)
OPEN* $\ln Y_{t-1}$				0.0005***
				(0.0000)
Constant	1.0886	13.0909***	-0.1576***	0.0969
	(0.9631)	(3.8959)	(0.0396)	(0.0601)
Period Dummies:				
1984-87		0.3753	-0.0196***	
		(0.2619)	(0.0034)	
1988-91		0.4821*	0.0073	0.0240***
		(0.2843)	(0.0055)	(0.0047)
1992-95		0.5202	-0.0269***	-0.0032
		(0.3406)	(0.0047)	(0.0056)
1996-99		0.8437		0.0238***
		(0.5316)		(0.0041)
R^2 Adjusted	0.64	0.26		
Sargan Test			[0.258]	[0.705]
1st-order serial correlation			[0.062]	[0.079]
2nd-order serial correlation			[0.887]	[0.802]
Observations	44	188	147	147

Notes: Same as for Table 4.

4. FURTHER ROBUSTNESS CHECKS

This section examines the robustness of our results with respect to several further modifications of our model. First, both the Sargan and serial-correlation tests indicate that the null hypothesis of correct specification cannot be rejected, lending support to our estimation results. Recall that we assumed that the right-hand side variables in equation (8) (including the trade policy measures and their interaction terms) are not strictly exogenous. The Sargan test of the null hypothesis for over-identifying restrictions (that all regressors are predetermined) is not rejected at the 0.05 level of significance for all regressions. This suggests that the over-identifying restrictions are valid. The *p*-values in the test for second order serial correlation indicates that we cannot reject (at 0.05 level) the null hypothesis that there is no second order serial correlation in the differenced residuals, suggesting consistency of our estimates.

Further, we explore whether the dependency of the growth effects of protection on income also extends to other policy variables. The relevant question is: What does initial income ($\ln Y_{it-1}$) capture? Some commentators have argued that trade policy reforms require other complementary policy reforms such as investment in human capital or institutions (see Rodrik, 2000; Chang *et al.* 2005). The concern is that initial income may be a proxy for such critical institutions and thus it is the availability of such institutions that matter and not whether a country is rich or poor. Indeed, our descriptive analysis of the data in Section 2.3.1 (see Table 2) suggests a high correlation between being a low-income country and having low levels of human capital, one of the most important country characteristics in our regressions. Being sceptical about the role of initial income, we perform two exercises to explore the robustness of the contingency established with initial income.

In the first exercise, we hypothesize that initial income may be a proxy for a country's overall level of development and is thus strongly related to the country-specific characteristics critical for growth and development. We arbitrarily select one such country characteristic - human capital investment - and interact it with our trade policy measures, the results of which we report in Table B2 in Appendix B. The coefficient on the interaction between all alternative policy measures and human capital (*SEC*) is negative and significant. This indicates that the growth effect of higher protection (in low-income countries) is diminished when investment in human capital is higher. Alternatively, trade liberalization is more likely to be beneficial when human capital investment is high. This result could be viewed as an indictment of the contingency result established with initial income. Hence, we now test empirically whether the results in Tables 4-6 remain robust to the introduction of the interaction between our alternative trade policy measures and human capital into the regression specification (8).

Our goal here is to verify the robustness of the *TPOLICY***SEC* interactions in Table B2 once we account for the $TPOLICY * \ln Y_{t-1}$ dependence. In essence, we are interested in checking whether the growth effect of protection is dependent on country characteristics independent of dependence on the overall level of development. In all cases (Table B2 column 2) the inclusion of the income interaction term displaces the statistical significance of the coefficients of the interaction between trade policy and human capital. Interestingly, the income interaction remains significantly negative, indicating that whether a country is rich or poor determines the growth impact of trade policy openness. This is a plausible result since the overall level of development or the income rank of a country is a good indicator of (and may be capturing) the level of development in several important dimensions, such as the availability of public infrastructure, financial depth and governance. Whilst obviously important, human capital alone could not be the determinant of the effect of trade protection on growth. It is the overall level of development, whether a country is rich or poor, that matters.

In the second exercise on the robustness of the income interaction, we employ an alternative technique to explore the potential contingency already established by our results in Tables 4-7 and Table B2.[17] To test for the robustness of the existence of contingency, we follow DeJong and Ripoll (2004) (but with an updated version of the World Bank income classification table) by specifying a regression model under which we interact trade policy with the World Bank's (July 2005) income-rank index with low-income countries ranked as 1, lower-middle income countries ranked as 2, upper-middle income ranked 3 and high-income ranked as 4 (see Appendix A for exact cut-off values corresponding to the indexes). We then consider the differential impact of trade policy for high and low–income countries. The results reported in Table B1 suggest that the impact of trade restriction (or openness) on growth, given the level of protection (or volume of trade), will be different for countries classified as relatively rich compared to those classified as poor. For all alternative measures the results are broadly consistent with the finding of a contingent relationship under which the marginal impact of trade policy (openness) is decreasing (increasing) in initial income.

[17] While the choice of initial income as a proxy for 'overall level of development' generates interesting results, it is not unique. One could think of other initial conditions that could as well describe the development (or income) status of a country.

The sign and significance of this interaction term confirms our earlier finding of the importance of a country's rank on the income ladder in determining the effect of trade policy on growth. We consider this as a robustness check for our results. The results suggest that an important missing link in the previous literature is the failure to account for this apparent contingency.

Finally, we performed diagnostic tests for influential observations to confirm that the parameter estimates are not unduly influenced by a small subset of observations. Our examination of the data for the presence of outliers, high-leverage points or influential observations using the DFFITS statistic (Besley *et al.*, 1980) identified Singapore, Nicaragua, Congo Democratic Republic and Congo Republic as high-leverage and influential.[18] However, the omission of all four observations does not affect the fit and hence the estimated coefficients in Tables 4 to 6. We present the parameter estimates from the regression without the four outliers in Table B3 in Appendix B. Both the signs and orders of magnitude of the coefficients are preserved in most cases. Thus the model parameters are robust in that they show little sensitivity to changes in the model specification and to the inclusion or exclusion of outliers. We still find convincing evidence of a positive and statistically significant relationship between trade barriers and economic growth which is contingent on income.

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[18] Suppose X denotes the matrix of explanatory variables in our model and x_i the ith element of X, containing observations on household i. Letting $P = X\left(X'X\right)^{-1}X'$ denote the associated *hat* matrix, the leverage statistic for observation i, which is the ith diagonal element of P, is $p_{ii} = x_i'\left(X'X\right)^{-1}x_i$, $i = 1, 2, ..., N$. This measures the distance of x_i from the centre of mass from the other rows of P. If r_i denotes the studentized residual of observation i, the $DFFITS_i$ statistic would be $DFFITS_i = r_i\sqrt{\frac{p_{ii}}{1-p_{ii}}}$. In our empirical application, we identified potential outliers as observations with associated $DFFITS$ statistic $-1 < p_{ii} > 1$. This identification procedure was consistent with two other alternative diagnostic measures used – Cook's Distance (Cook, 1977) and Welsch's Distance (Welsch, 1982).

5. CONCLUSION

Our primary result concerned the effect of trade liberalisation on economic growth for the poorer countries. In this regard, we examined the relationship between a variety of trade policy measures and growth. We find that trade protection has, on average, a robust positive effect on economic performance for low-income countries in general. Trade liberalisation thus seems to offer the possibility of achieving faster growth only in relatively richer countries. The richer the country, the chances are that trade liberalisation will be growth-enhancing and the poorer the country the more likely that trade protection will affect growth positively. Thus, for two economies that belong to two different income groups (low and high), similar trade policies will have different effects on growth. The results suggest that richer countries with lower tariffs tend to grow faster than countries with only one of these attributes. The corollary that poorer countries with lower tariffs grow slower is equally supported.

Our findings suggest that studies that have sought to explain the openness-growth relationship in terms of conventional linear models may be misleading. The conventional *average* effect of trade liberalisation tends to mask interesting heterogeneity in the individual responses of countries to trade liberalisation. In our sample of 44 developing countries pooled over 20 years, we find overwhelming evidence of such nonlinearity. In particular, we find that the growth effects of trade barriers may vary with the level of income from positive to negative, a possibility ignored in many previous studies. This finding seems consistent with the intuitive notion that low-income countries could increase growth by using tariffs based on the infant industry argument. On the basis of the weight of evidence in this paper, we suggest that it would be too simplistic to think that trade liberalisation *per se* is the key to prosperity for all countries - liberalisation is not a ‘magic wand’. Despite being an important determinant of growth, the potential benefits from trade liberalisation are not automatic and poorer countries may actually be made worse off by it. Policy makers in low income countries, SSA especially, should recognise that trade liberalisation alone without accompanying complementary policies would be a sub-optimal policy option.

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Appendix A: Data and Extensions

Table A1: List of Countries

Argentina*	Ethiopia	Paraguay
Bangladesh	Ghana	Philippines
Botswana*	India	Rwanda
Burkina Faso	Indonesia	Sierra Leone
Burundi	Jamaica	Singapore*
Cameroon	Kenya	South Africa*
Chile*	Korea Rep.*	Sri Lanka
China	Madagascar	Thailand
Congo Dem. Rep.	Malawi	Tunisia
Congo Republic	Malaysia*	Uganda
Costa Rica*	Mauritius*	Uruguay*
Cote d'Ivoire	Mexico*	Venezuela*
Dominican Rep.	Morocco	Zambia
Ecuador	Nepal	Zimbabwe
Egypt	Nicaragua	

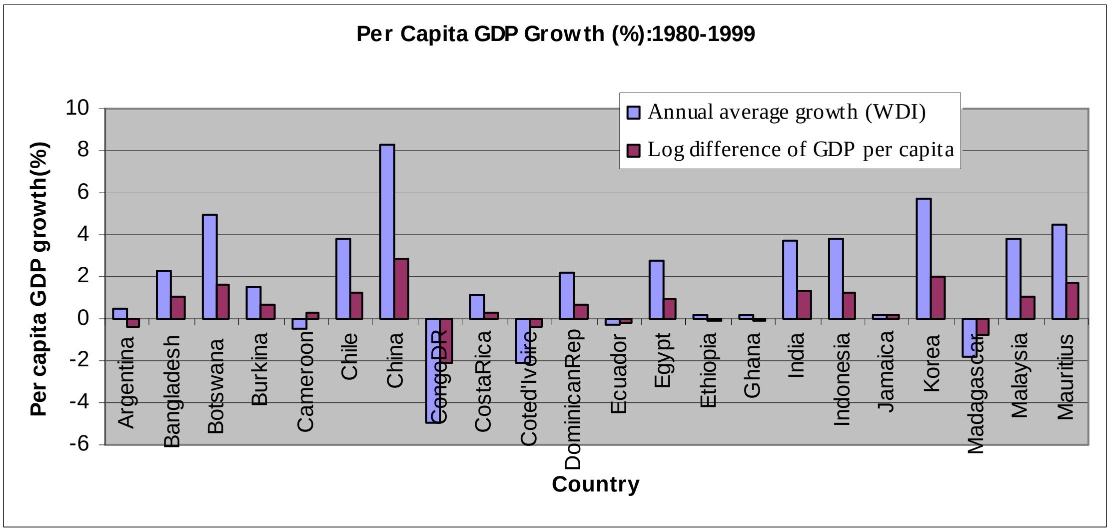
Countries marked with asterisk are classified by the World Bank as high-income (i.e. including 'Upper middle income') countries (with gross GNI per capita of at least $3,256 in 2004. There are 12 'rich' countries (upper-middle and high), 32 'poor' countries (lower-middle and low) and 19 SSA countries (of which all except 3 are 'poor' countries).

Table A2: Definitions and Sources of Data

Variable:	Definition	Source
GROWTH	Real per capita GDP growth rate	World Development Indicators (2003) and Easterly (2001).
$\ln Y_{t-1}$	Real per capita GDP at beginning of each 4-year period (in logs).	World Development Indicators (2003) and Easterly (2001).
OPEN	Ratio of total trade (exports + imports) to GDP.	World Development Indicators (2003) and Easterly (2001).
POP	Population growth rate	World Development Indicators (2003) and Easterly (2001).
INV	Gross domestic investment	World Development Indicators (2003) and Easterly (2001).
SEC	Human capital investment (measured by gross secondary school enrolment).	World Development Indicators (2003) and Easterly (2001).
TARIFF	Average scheduled tariff (unweighted)	Data drawn from World bank.
MTAX	Import duties as percentage of total imports.	World Development Indicators (1999).
XTAX	Export duties as percentage of total exports.	World Development Indicators (1999).
THERICH	Dummy variable with the value of unity for upper-middle and high income countries and zero for all others.	Author's construction using data from World Bank (July 2005).

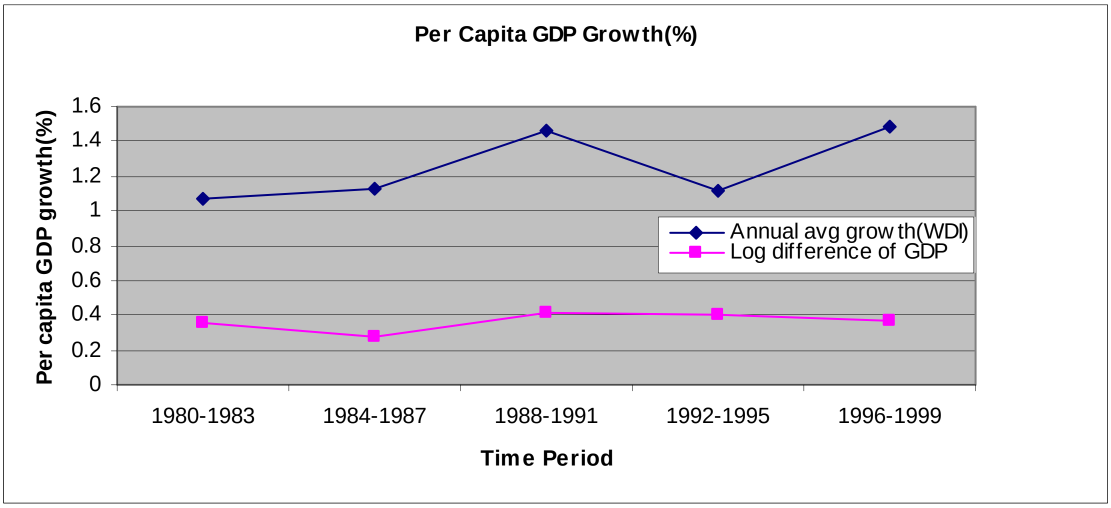
Unless stated otherwise, all data series are drawn from the World Development Indicators (WDI, CD-ROM 2003 and 1999) and Easterly (2001) data series available as the Global Development Network Growth Database at the web site www.worldbank.org/research/growth. TARIFF data are from Ng Francis (2001) available at http://publications.worldbank.org/catalog/content-download?revision_id=1526199. Last accessed 20th October 2004.

Figure A1: Selected cross-country growth for the period 1980-99.



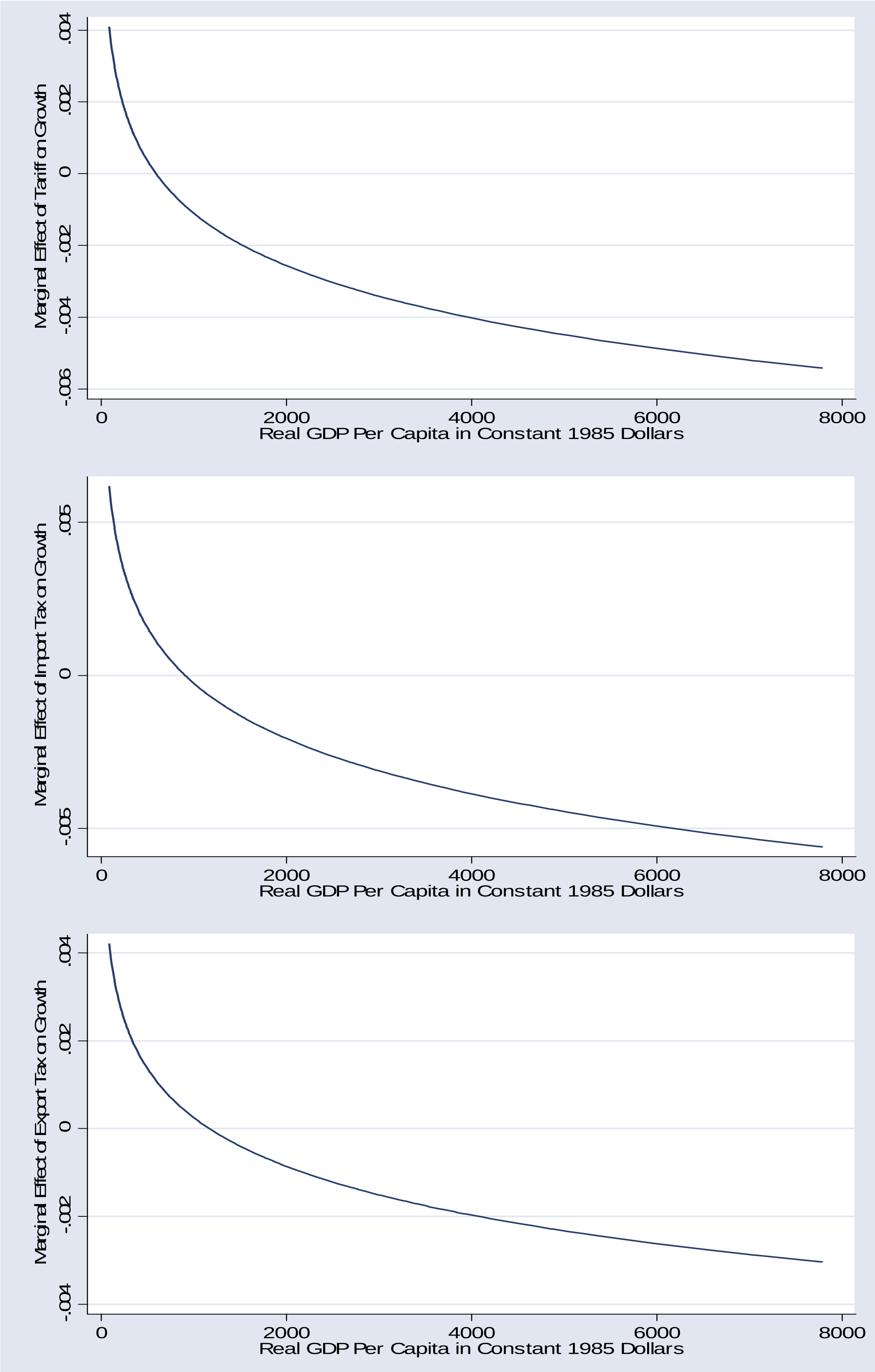
Source: Author's with data from WDI 2003.

Figure A2: Cross-country growth series, 1980-99



Source: Author's with data from WDI 2003.

Figure A3: Marginal Effect of Protection on Growth as a Function of GDP per Capita



Taking a Closer Look within Countries

Table A3: Contribution of Tariff to Income in Rich and Poor Countries, 1980-1999

12 Richest Countries	**Actual Income (log)**	**Predicted Income (log)**	**Unexplained Income**	**Contribution of *TARIFF* to Income (%)**
Singapore	9.749	9.870	0.123	-0.23
Korea Republic	8.903	9.090	0.051	-8.25
Argentina	8.868	8.871	0.006	-10.29
Uruguay	8.548	8.548	0.016	-10.35
South Africa	8.330	8.370	0.066	-6.42
Venezuela	8.173	8.083	0.075	-8.82
Chile	8.134	8.167	0.041	-5.93
Mexico	8.093	8.126	0.058	-6.01
Malaysia	8.077	8.138	0.008	-5.07
Costa Rica	8.030	8.070	0.005	-5.33
Mauritius	7.887	7.906	0.073	-10.70
Botswana	7.866	8.055	0.052	-8.29
Simple Average	**8.388**	**8.441**	**0.048**	**-7.14**
12 Poorest Countries				
Ethiopia	4.654	4.596	0.012	7.21
Malawi	5.019	4.961	0.029	3.84
Burundi	5.205	5.211	0.066	4.03
Nepal	5.233	5.208	0.025	3.08
Congo Dem. Rep.	5.262	5.419	0.088	2.78
Burkina Faso	5.334	5.284	0.041	5.37
Uganda	5.567	5.390	0.135	1.75
Madagascar	5.581	5.597	0.011	0.51
Sierra Leone	5.601	5.753	0.017	1.30
Rwanda	5.606	5.667	0.051	1.88
Bangladesh	5.641	5.547	0.040	5.61
India	5.747	5.802	0.013	5.05
Simple Average	**5.371**	**5.370**	**0.044**	**3.53**

Note: Predictions are based on estimates from equation (8) using *TARIFF* as the preferred measure of trade policy. The remaining 20 semi-poor countries are not reported for succinctness and clarity.

Despite the attempt to introduce heterogeneity in the effect of trade policy on growth, it is reasonable to believe that average estimates do not provide enough information about the within-country variance in the impact of trade policy on per capita income growth. For most practical purposes, however, it may be useful to have some information on individual country experiences. In Table A3 we show the 12 richest and 12 poorest countries in our regression sample, along with their actual average per capita GDP and their predicted average income from the regressions. In addition, we estimate how much of the variations in within-country income is explained by trade policy. The evidence suggests that trade policy plays an important role in explaining within-country variations in income. Overall, the model explains reasonably well the experience of all countries irrespective of the income group. The unexplained income (residual) is negligible in absolute terms. The main message from this table is that, whereas for all the rich countries the contribution of tariffs is negative (-7.1% on average), for the poorest countries tariffs (protection) are positively associated with income (3.5% on average). Tariff reductions would by implication be beneficial (harmful) to only the richest (poorest) countries, *ceteris paribus*.

Table A4: Contribution of Tariff to Income within Sub-Saharan Africa, 1980-1999

19 SSA Countries	Actual Income (log)	Predicted Income (log)	Unexplained Income	Contribution of *TARIFF* to Income (%)
Ethiopia	4.654	4.596	0.012	7.21
Malawi	5.019	4.961	0.029	3.84
Burundi	5.205	5.211	0.066	4.03
Congo Dem. Rep	5.262	5.419	0.088	2.78
Burkina Faso	5.334	5.284	0.041	5.37
Uganda	5.567	5.390	0.135	1.75
Madagascar	5.581	5.597	0.011	0.51
Sierra Leone	5.601	5.753	0.017	1.30
Rwanda	5.606	5.667	0.051	1.88
Kenya	5.823	5.766	0.060	1.13
Ghana	5.878	5.760	0.065	0.50
Zambia	6.159	6.158	0.018	-1.05
Zimbabwe	6.454	6.459	0.008	-1.28
Cameroon	6.633	6.627	0.031	-3.53
Cote d'Ivoire	6.714	6.563	0.101	-3.52
Congo Rep.	6.809	6.972	0.129	-3.79
Simple Average	**5.769**	**5.761**	**0.054**	**1.07**
Botswana	7.866	8.055	0.052	-8.29
Mauritius	7.887	7.906	0.073	-10.70
South Africa	8.330	8.370	0.066	-6.42
Simple Average (All)	**6.125**	**6.132**	**0.056**	**-0.44**

Table A4 replicates the same exercise for the 19 SSA sub-sample. Even within SSA the effects of tariff is heterogeneous. The countries are arranged from the very poorest to the least poor. What is interesting is that some SSA countries really appear as rich countries in terms of the tariff effects. The three richest countries in SSA, South Africa, Mauritius and Botswana all have strong negative tariff effects. Without these three countries, tariffs contribute, on average, a percentage point to income. However, once we include them in the SSA sample the contribution of tariffs turns negative, albeit marginally (-0.4%). The results in Tables A3 and A4 provide evidence for the view that the effects of trade policy on income, income growth and poverty are heterogeneous, underscoring the need to avoid the search for *average* effects.

Appendix B: Results for Robustness Checks

Table B1: Trade Policy and Growth in Developing Countries (1980-1999): Dependent Variable is $\ln Y_{it} - \ln Y_{t-1}$

INTERACTIONS WITH WORLD BANK INCOME CLASSIFICATION

	[TARIFF]	[MTAX]	[XTAX]	[OPEN]
$\ln Y_{t-1}$	-0.0875***	-0.0043	-0.0196*	-0.0363***
	(0.0122)	(0.0033)	(0.0114)	(0.0094)
POP	-0.0181	-0.0556***	-0.0402***	-0.0236**
	(0.0134)	(0.0080)	(0.0069)	(0.0103)
INV	0.0120***	0.0085***	0.0094***	0.0099***
	(0.0006)	(0.0005)	(0.0007)	(0.0010)
SEC	0.0029***	0.0006***	0.0012***	0.0027***
	(0.0004)	(0.0002)	(0.0004)	(0.0005)
THERICH	0.2328***	0.1132***	0.0501***	0.0377
	(0.0252)	(0.0233)	(0.0141)	(0.0297)
TARIFF	0.0021***			
	(0.0004)			
TARIFF*THERICH	-0.0037**			
	(0.0016)			
MTAX		0.0011*		
		(0.0006)		
MTAX*THERICH		-0.0132***		
			(0.0017)	
XTAX			0.0039**	
			(0.0017)	
XTAX*THERICH			-0.0110***	
			(0.0019)	
OPEN				-0.0009**
				(0.0004)
OPEN*THERICH				0.0010**
				(0.0004)
Constant	0.1914***	-0.0279	0.0103	0.0370
	(0.0482)	(0.0271)	(0.0569)	(0.0522)
Period Dummies:				
1984-87		0.0013	-0.0147	
		(0.0122)	(0.0114)	
1988-91	0.0156***	0.0181**	0.0070	0.0224***
	(0.0050)	(0.0073)	(0.0080)	(0.0061)
1992-95	-0.0056	-0.0288***	-0.0344***	-0.0144**
	(0.0112)	(0.0064)	(0.0049)	(0.0066)
1996-99	0.0405***			0.0102
	(0.0136)			(0.0085)
Sargan Test	[0.800]	[0.823]	[0.869]	[0.819]
1st-order serial corr.	[0.074]	[0.059]	[0.054]	[0.060]
2nd-order serial corr.	[0.627]	[0.728]	[0.624]	[0.895]
Observations	136	132	132	147

Notes: Same as for Table 4.

Table B2: Trade Policy and Growth in Developing Countries (1980-1999): Dependent Variable is $\ln Y_{it} - \ln Y_{t-1}$

	[1]	[2]	[1]	[2]	[1]	[2]
	TARIFF	TARIFF	MTAX	MTAX	XTAX	XTAX
$\ln Y_{t-1}$	-0.0273***	0.0105	-0.0113	0.0290***	0.0058**	0.0046
	(0.0052)	(0.0093)	(0.0096)	(0.0095)	(0.0023)	(0.0031)
POP	-0.0575***	-0.0429***	-0.0585***	-0.0393***	-0.0165***	-0.0326***
	(0.0103)	(0.0119)	(0.0097)	(0.0071)	(0.0040)	(0.0053)
INV	0.0094***	0.0100***	0.0103***	0.0101***	0.0099***	0.0091***
	(0.0003)	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0005)
SEC	0.0026***	0.0009**	0.0028***	0.0012**	0.0012***	0.0006**
	(0.0003)	(0.0004)	(0.0004)	(0.0006)	(0.0002)	(0.0002)
TARIFF	0.0027***	0.0093***				
	(0.0006)	(0.0013)				
TARIFF*SEC	-0.0001***	-0.0000				
	(0.0000)	(0.0000)				
MTAX			0.0092***	0.0169***		
			(0.0008)	(0.0026)		
MTAX*SEC			-0.0002***	-0.0001		
			(0.0000)	(0.0000)		
XTAX					0.0053***	0.0130***
					(0.0007)	(0.0025)
XTAX*SEC					-0.0001***	0.0000
					(0.0000)	(0.0001)
TARIFF* $\ln Y_{t-1}$		-0.0012***				
		(0.0002)				
MTAX* $\ln Y_{t-1}$				-0.0019***		
				(0.0005)		
XTAX* $\ln Y_{t-1}$						-0.0023***
						(0.0007)
Constant	0.0475	-0.1864**	-0.1200*	-0.3644***	-0.2204***	-0.1385***
	(0.0557)	(0.0858)	(0.0641)	(0.0479)	(0.0140)	(0.0451)
Sargan Test	[0.716]	[0.927]	[0.836]	[0.807]	[0.919]	[0.958]
1^{st}-order serial correlation	[0.086]	[0.096]	[0.087]	[0.097]	[0.062]	[0.080]
2^{nd}-order serial correlation	[0.532]	[0.625]	[0.365]	[0.668]	[0.813]	[0.522]
Observations	136	136	132	132	132	132

Notes: Same as for Table 4. Period dummies (not reported for succinctness) are included to capture the effects of cyclical impacts on growth.

Table B3: Trade Policy and Growth in Developing Countries (1980-1999) – Outliers Dropped: Dependent Variable is $\ln Y_{it} - \ln Y_{t-1}$

INTERACTIONS WITH WORLD BANK INCOME CLASSIFICATION

	[TARIFF]	[MTAX]	[XTAX]
$\ln Y_{t-1}$	0.0063	-0.0000	-0.0096
	(0.0088)	(0.0091)	(0.0058)
POP	-0.0676***	-0.0420***	-0.0418***
	(0.0145)	(0.0058)	(0.0077)
INV	0.0099***	0.0098***	0.0113***
	(0.0005)	(0.0006)	(0.0007)
SEC	0.0009**	0.0008***	0.0001
	(0.0004)	(0.0003)	(0.0002)
TARIFF	0.0126***		
	(0.0015)		
TARIFF* $\ln Y_{t-1}$	-0.0021***		
	(0.0003)		
MTAX		0.0080**	
		(0.0034)	
MTAX* $\ln Y_{t-1}$		-0.0012**	
		(0.0005)	
XTAX			0.0098***
			(0.0032)
XTAX* $\ln Y_{t-1}$			-0.0021***
			(0.0006)
Constant	-0.0612	-0.0990	-0.0198
	(0.1010)	(0.0698)	(0.0388)
Period Dummies:			
1984-87	0.0101	-0.0088	0.0043
	(0.0104)	(0.0088)	(0.0137)
1988-91	0.0305***	0.0151*	0.0170*
	(0.0100)	(0.0089)	(0.0090)
1992-95	-0.0105***	-0.0216***	-0.0223***
	(0.0038)	(0.0029)	(0.0058)
Sargan Test	[0.881]	[0.956]	[0.976]
1st-order serial corr.	[0.012]	[0.018]	[0.013]
2nd-order serial corr.	[0.566]	[0.728]	[0.774]
Observations	125	122	122

Notes: Same as for Table 4.

Appendix C: Alternative Estimation

Before estimating the main model, we considered two prior experimentations with our specifications, (7) and (8). Our first experiment involved estimating variants of (7) and (8) under which we measure the dependent variable by the WDI annual growth series. These specifications also included foreign direct investment (*FDI*) as an additional explanatory variable but excluded human capital investment (*SEC*).[19] The sample in this case involves 48 countries. The results obtained using the systems GMM estimator, are reported in Tables C1 to C3 below. The baseline specification as in column (1) and its variant as in column (2) are dynamically specified (with lags of per capita GDP growth) and estimated using the GMM systems estimator. We find that our trade policy measures enter consistently with a negative and statistically significant coefficient, but the interaction term is significantly positive in all cases, which, according to the theory, suggests a contingent relationship. The results suggest that trade protection has, on average, a robust negative effect on economic performance for low-income countries. Openness to trade seems to offer the possibility of achieving faster growth with differing impacts on countries belonging to different income groups.

It is possible that the results contained in Tables C1 to C2 are biased. Biases may result from at least two sources –under and/or over specification and the choice of measurement of the dependent variable. One issue is that *FDI* may not belong to the model as it is incorporated in physical investment (*INV*), at least in principle.[20] The second point is that it is quite difficult to justify the omission of human capital investment (*SEC*) from the growth model, notwithstanding that the measure is not very good.[21] The critical importance of human capital accumulation in the augmented Solow model has been discussed by Lucas, (1988), Romer (1990) and Mankiw *et al*., (1992). It is also standard for recent cross-country empirical work based on the neoclassical and endogenous growth models to include human capital as a determinant

[19] There is evidence that FDI contributes to growth (Borensztein *et al*., 1998). Over the two decades under study FDI has become the single largest capital flow to developing countries, far surpassing portfolio equity investment, private loans, and official development assistance. The World Bank (2002) reported that in 1997 developing countries received 36 percent of total FDI flows. However, for low-income countries FDI tends to be low (aid is typically a much larger share of capital inflows)

[20] If this is truly the case, the problem of collinearity can bias the results in Tables C1 to C3.

[21] If SEC is really fundamental, excluding it from the model can cause omitted variable bias. The use of GMM however permits us to deal with this potential problem.

of growth. Levine and Renelt (1992) for example include investment in human capital in their set of **I**-variables (i.e. the set of variables always included in growth regressions). Indeed, virtually all the empirical growth papers cited in this paper include in their models some measure of education, and human capital formation in general. On the issue of how to measure growth, the concern is that using the WDI growth rates as the dependent variable, and therefore (in GMM) including the lag of growth as an explanatory variable, in a regression which already includes lagged GDP per capita as a regressor may not be appropriate due to the high correlation between lagged growth and lagged GDP per capita.

To examine if the growth effect of trade policy is sensitive to these concerns, our second experiment involved re-estimating all the regressions but this time including a measure of human capital investment, the rate of gross secondary school enrolment (*SEC*), in our model.[22] We also take seriously the suggestion that *FDI* could in principle be incorporated in *INV* by dropping the former from the model. Our sample now reduces to 44 countries – Brazil, Guniea, Pakistan and St. Lucia are excluded from the regressions for lack of data on *SEC*. For this experiment, we retain WDI growth as our dependent variable. The results based on the system GMM are presented in Tables C4 to C6. Surprisingly, the effect of trade barriers gets reversed controlling for human capital and excluding *FDI*. Trade policy now enters consistently with a positive and statistically significant coefficient, but the interaction term is significantly negative in all specifications. This suggests that the omission of human capital from the model and the 'double-counting' of physical investment (*FDI* and *INV*) were possibly responsible for the negative tariff effect in the previous regressions. These results are illuminating in light of the non-robustness of the previous literature. In part, these results may help explain the ambiguity in the cross-country literature which has sought to find the growth-effect of trade policy. Results can be extremely sensitive to the control variables used in the models. Failure to control for important determinants (which rightly belong to the model) and/or including irrelevant variables can be dangerous as they can lead to biased results.

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[22] Barro (1991), Mankiw *et al*. (1992), Easterly (2001), Tsangarides (2002) and Chang *et al*. (2005) used this variable as a proxy for human capital.

Assuming that we wanted to follow the mainstream of the empirical dynamic growth literature, we now turn to check whether this latter result is sensitive to how we measure growth. Thus, in keeping with standard practice, the rest of the analysis and discussions in this paper refer to the regressions with controls for human capital and in which growth is approximated by the logarithmic difference of GDP per capita.[23]. Tables 4 to 6 report the estimates for the GMM and the other two estimation methods used for comparison. The first column of each table shows the results when using OLS, while the last three columns show the panel results. Column 2 in each table shows the results when using the within group estimator, while columns 3 and 4 present results obtained using the system GMM. Results in column 3, like columns 1 and 2, are based on the linear specification (7), whereas column 4 reports results based on the non-linear model (8) – the model with the interaction term. On the whole, the results obtained from the system GMM (columns 3 and 4) are qualitatively consistent with the results reported in Tables C4 to C6. The arrangements of signs and significance of the estimated coefficients remain largely unchanged. The results suggest that how growth is measured does not really matter, at least in qualitative terms. Quantitatively, however, compared with Tables C4 to C6 the parameter estimates in Tables 4 to 6 are quite small in absolute terms. For example, while the estimated coefficients on $TARIFF$ and $TARIFF * \ln Y_{it-1}$ in column 2 of Table C4 are 0.202(0.045) and -0.031(0.007) respectively, the corresponding estimates in column 4 of Table 4 are respectively 0.0134(0.0018) and -0.0021(0.0003). The extreme differences in the parameter estimates raise concerns about the appropriateness of using the WDI growth rates as the dependent variable in a dynamic growth model.

[23] All the accessible dynamic growth literature using GMM (including the ones cited in this paper) measures growth as the logarithmic difference of GDP per capita. With the exception of Hoeffler (2002), all the studies include some measure of human capital investment and none (including Hoeffler) include FDI as explanatory variables. The study by Hoeffler was a direct reaction to Sachs and Warner (1997a, b). The objective was to show that cross-sectional regressions which fail to deal with the problems of endogeneity and correlation can provide misleading results. The strategy is to replicate Sachs and Warner's regressions in a dynamic framework using GMM. Since Sachs and Warner did not explicitly control for c human capital, Hoeffler did not include human capital as well in her study.

Table C1

Trade Policy-*TARIFF*-and Growth in Developing Countries (1980-1999): Dependent variable is Per Capita GDP Growth (WDI)

EXPLANATORY VARIABLES:	[1] SIMPLE LINEAR	[2] INTERACTION
Lagged Growth	0.295	0.319
	(9.39)**	(9.92)**
$\ln Y_{t-1}$	0.144	-0.728
	(1.38)	(2.68)*
POP	0.284	-0.236
	(1.58)	(0.82)
INV	0.205	0.163
	(8.09)**	(7.97)**
FDI	0.137	0.274
	(2.24)*	(2.43)*
TARIFF	0.025	-0.229
	(3.73)**	(3.73)**
TARIFF* $\ln Y_{t-1}$		0.044
		(4.41)**
Constant	-5.66	1.081
	(5.23)**	(0.51)
Sargan Test	[0.583]	[0.756]
1st Order Serial Correlation	[0.021]	[0.010]
2nd Order Serial Correlation	[0.711]	[0.694]
Observations	170	170
Number of Countries	48	48

Notes: Absolute *t*-statistics in parentheses while *p*-values in brackets, * denotes significant at 10%; ** denotes significant at 5%.

1. Time dummies (not reported) are included to capture the effects of cyclical impacts on growth.
2. The Sargan test is for the validity of the set of instruments.
3. The tests for 1st and 2nd - order serial correlation are asymptotically distributed as standard normal variables (see Arellano and Bond, 1991). The p-values report the probability of rejecting the null hypothesis of serial correlation, where the first differencing will induce (MA1) serial correlation if the time-varying component of the error term in levels is a serially uncorrelated disturbance.

Table C2

Trade Policy-*MTAX*-and Growth in Developing Countries (1980-1999): Dependent variable is Per Capita GDP Growth (WDI)

Explanatory variables:	[1] SIMPLE LINEAR	[2] INTERACTION
Lagged Growth	0.218	0.244
	(11.69)**	(7.82)**
$\ln Y_{t-1}$	0.108	-1.126
	(1.02)	(4.51)**
POP	-0.743	-0.73
	(4.63)**	(3.77)**
INV	0.165	0.147
	(9.57)**	(6.80)**
FDI	0.065	0.279
	(0.74)	(2.69)**
MTAX	-0.02	-0.624
	(2.37)*	(5.40)**
MTAX* $\ln Y_{t-1}$		0.10
		(5.32)**
Constant	-0.679	6.165
	(0.81)	(3.70)**
Sargan Test	[0.782]	[0.843]
1st Order serial correlation	[0.002]	[0.003]
2nd Order serial correlation	[0.244]	[0.380]
Observations	163	163
Number of Countries	48	48

Notes: Same as for Table C1.

Table C3
Trade Policy-*XTAX*-and Growth in Developing Countries (1980-1999): Dependent variable is Per Capita GDP Growth (WDI)

Explanatory variables:	[1]	[2]

	SIMPLE LINEAR	INTERACTION
Lagged Growth	0.174	0.245
	(7.65)**	(8.10)**
$\ln Y_{t-1}$	-0.014	0.057
	(0.20)	(0.62)
POP	-1.013	-0.733
	(8.32)**	(6.37)**
INV	0.174	0.148
	(8.80)**	(5.51)**
FDI	0.258	0.084
	(3.82)**	(1.16)
XTAX	0.018	-0.191
	(3.71)**	(2.41)*
XTAX* $\ln Y_{t-1}$		0.03
		(2.09)*
Constant	-0.062	-0.403
	(0.11)	(0.82)
Sargan Test	[0.697]	[0.813]
1st Order serial correlation	[0.003]	[0.003]
2nd Order serial correlation	[0.284]	[0.240]
Observations	163	163
Number of Countries	48	48

Notes: Same as for Table C1.

Table C4

Trade Policy-*TARIFF*-and Growth in Developing Countries (1980-1999): Dependent Variable is Per Capita GDP Growth (WDI)

	SIMPLE LINEAR	INTERACTION

	[1] SYS-GMM	[2] SYS-GMM
Lagged Growth	0.180***	0.092*
	(0.038)	(0.048)
$\ln Y_{t-1}$	-0.926***	-0.190
	(0.269)	(0.280)
POP	-1.916***	-1.661***
	(0.407)	(0.195)
INV	0.095***	0.223***
	(0.020)	(0.024)
SEC	0.076***	0.042***
	(0.010)	(0.011)
TARIFF	-0.018**	0.202***
	(0.007)	(0.045)
TARIFF * $\ln Y_{t-1}$		-0.031***
		(0.007)
Constant	5.724**	-1.365
	(2.339)	(1.315)
Period Dummies:		
1984-87	1.903***	1.631***
	(0.246)	(0.237)
1988-91	1.713***	1.111***
	(0.255)	(0.159)
1992-95	0.621***	0.449***
	(0.131)	(0.117)
Sargan Test	[0.852]	[0.989]
1st-order serial correlation	[0.029]	[0.034]
2nd-order serial correlation	[0.856]	[0.806]
Observations	136	136

Notes: Same as for Table 4.

Table C5

Trade Policy -*MTAX* - and Growth in Developing Countries (1980-1999): Dependent Variable is Per Capita GDP Growth (WDI)

	SIMPLE LINEAR	INTERACTION

	[1] SYS-GMM	[2] SYS-GMM
Lagged Growth	0.142***	0.138***
	(0.020)	(0.022)
$\ln Y_{t-1}$	-0.812***	-0.231
	(0.128)	(0.232)
POP	-1.496***	-2.582***
	(0.280)	(0.447)
INV	0.132***	0.092**
	(0.022)	(0.035)
SEC	0.064***	0.043***
	(0.009)	(0.011)
MTAX	-0.087***	0.198**
	(0.008)	(0.096)
MTAX * $\ln Y_{t-1}$		-0.036**
		(0.015)
Constant	4.525***	5.726***
	(1.012)	(2.063)
Period Dummies:		
1984-87	1.792***	
	(0.240)	
1988-91	1.726***	-0.126
	(0.178)	(0.174)
1992-95	0.513***	-1.493***
	(0.110)	(0.252)
1996-99		-1.925***
		(0.319)
Sargan Test	[0.955]	[0.996]
1st-order serial correlation	[0.018]	[0.019]
2nd-order serial correlation	[0.550]	[0.495]
Observations	132	132

Notes: Same as for Table 4.

Table C6

Trade Policy -*XTAX* - and Growth in Developing Countries (1980-1999): Dependent Variable is Per Capita GDP Growth (WDI)

	SIMPLE LINEAR	INTERACTION

	[1] SYS-GMM	[2] SYS-GMM
Lagged Growth	0.213***	0.172***
	(0.025)	(0.033)
$\ln Y_{t-1}$	-0.389**	-0.341**
	(0.150)	(0.164)
POP	-1.465***	-1.881***
	(0.251)	(0.294)
INV	0.094***	0.139***
	(0.019)	(0.030)
SEC	0.066***	0.025***
	(0.009)	(0.007)
XTAX	-0.022	0.002
	(0.043)	(0.088)
XTAX * $\ln Y_{t-1}$		-0.009
		(0.017)
Constant	2.817	2.729
	(1.680)	(1.664)
Period Dummies:		
1984-87		1.543***
		(0.201)
1988-91	0.199	1.388***
	(0.158)	(0.148)
1992-95	-1.411***	0.399***
	(0.146)	(0.110)
1996-99	-2.062***	
	(0.183)	
Sargan Test	[0.641]	[0.985]
1^{st}-order serial correlation	[0.012]	[0.014]
2^{nd}-order serial correlation	[0.564]	[0.573]
Observations	132	132

Notes: Same as for Table 4.