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THE EDUCATION BIAS OF 'TRADE LIBERALIZATION' AND WAGE INEQUALITY IN DEVELOPING COUNTRIES

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ABSTRACT

The aim of this paper is to examine the impact of increased trade on wage inequality in developing countries, and whether a higher human capital stock moderates this effect. We look at the skilled-unskilled wage differential. High initial endowments of human capital imply a more egalitarian society. When more equal societies open up their economies further, increased trade is likely to induce less inequality on impact because the supply of skills better matches demand. But greater international exposure also brings about technological diffusion, further raising skilled labour demand. This may raise wage inequality, in contrast to the initial egalitarian level effect of human capital. We attempt to measure these two opposing forces. We also employ a broad set of openness indicators to measure trade liberalization policies as well as general openness, which is an outcome, and not a policy variable. We further examine what type of education most reduces inequality. Our findings suggest that countries with a higher level of initial human capital do well on the inequality front, but human capital which accrues through the trade liberalization channel has inegalitarian effects. One explanation could be that governments in developing countries invest more in higher education at the expense of primary education in order to gain immediate benefits from globalization; thus becoming prone to wage inequality after increased international trade. Our results also have implications for the speed at which trade policies are liberalized, the implication being that better educated nations should liberalize faster.

Keywords

trade liberalization, wages, economic disparity, skills development, education, human resources

JEL Classifications: F-15, I-3

THE EDUCATION BIAS OF 'TRADE LIBERALIZATION' AND WAGE INEQUALITY IN DEVELOPING COUNTRIES*

1 INTRODUCTION

The benefits of accelerated globalization since 1980 have been quite unequally distributed among developing nations, disadvantaging sub-Saharan Africa, and even Latin American countries in terms of either negative or indifferent growth rates (Murshed, 2003). This has occurred, despite the fact that most of these nations have become more open in the sense of rising shares of international trade in national income. Associated with this phenomenon of increasing openness is rising within-nation income inequality post-1980. Increased trade, particularly of the inter-industry variety, alters the composition of output in the economy away from non-traded goods towards traded products. This will impact on the functional distribution of income, usually raising the demand for the factor of production employed intensively in the traded sector. In the developed world it is skilled labour, and we have witnessed an increase in the skilled-unskilled labour relative wage premium. In many OECD countries this has meant a more unequal personal distribution of income. As far as developing countries are concerned, especially in those that export unskilled labour intensive manufactured goods, we would expect a fall in the skilled-unskilled labour relative wage premium leading to reduced inequality, since the unskilled are more numerous within the population. But this is generally not true, and inequality in the developing world has also risen, mirroring events in the OECD. What accounts for this paradox? It may be that developing countries have such vast quantities of unskilled labour that the unskilled wage will not respond to increased demand. This is certainly likely in cross-country studies where China and India are included. Alternatively, other less populous developing countries may be exporting relatively more skilled labour intensive products such as semi-conductors, or capital intensive commodities as is the case with fuels and minerals. Finally, an expansion in international trade may raise the demand for, and reward of, skilled labour even when the country in question is exporting unskilled labour intensive products due to skill shortages and other factor complementarities.

Many studies have tried to capture the relationship between trade liberalization and income inequality. A recent paper by Dollar and Kraay (2004) concludes that liberalization does not significantly affect the distribution of income, and at most the relationship is of neutral nature. However their results have been widely challenged, because of their methodology and variable choice (Ravallion, 2003; and Amann et al, 2002). Ravallion (2003) points out that increased openness can lead to a rise in the demand for relatively skilled labour, which tends to be more unequally distributed in poor relative to rich countries. Arbache, Dickerson and Green (2004) find that imported

* We would like to thank Arjun Bedi for valuable comments on an earlier draft.

technology has raised the relative demand for highly skilled labour in Brazil and thus lowered the relative wages of less educated groups. Behrman, Birdsall and Szekely (2001) observe that inequality has increased in 7 out of 18 Latin American countries that initiated market reforms in the mid 1980s. Jayasuriya (2002), accepts that trade liberalization may have reduced consumption poverty in South Asia, but is sceptical about the so-called neutral distributional effects of liberalization. Many suggest that the distribution of the positive effects of liberalization is some what skewed towards urban households rather than rural ones, and to wealthy rather than poor households. See for example, Chen and Ravallion (2003), Cockburn (2001), Friedman (2000), Lofgren (1999). The evidence in this regard comes mainly from the Latin American region primarily because most of the economies there undertook rigorous reform policies in the mid 1980s following the debt crisis in that decade. Legovini, Bouillon and Lustig (2001) find that inequality in Mexico rose sharply between 1984 and 1994, and rising returns to skilled labour accounted for 20 % of the increase in the inequality in household income. Similarly, Hanson and Harrison (1999) find that the reduction in tariffs and the elimination of import licenses accounts for 23 % of the increase in the relative wages of skilled labour during 1986-1990, thus providing evidence for the role liberalization played in rising inequality in Mexico. Other country studies on Brazil, Chile, Colombia and Venezuela, also show that skilled workers received increased premiums after liberalization when compared to their unskilled counterparts (World Bank, 2001b). So the balance of the evidence points to increased globalization inducing greater income inequality.

Irrespective of the exact nature of the cause of trade induced inequality, it is sensible to presume that nations with higher stocks of human capital will experience less of the unequalising spiral consequent upon globalization and trade liberalization. Investment in education may yield a double dividend. It can not only promote growth, but also suppresses inequality by both bequeathing skills as well as moderating rises in skill-premia following an expansion of international trade. More generally, Tinbergen (1975) pointed out that changes in wage inequality are a result of the opposing forces that technological change (skilled labour demand) and education (skilled labour supply/ human capital) exert on relative wages. Eiche and Garcia-Penalosa (2001: 19) suggest that human capital accumulation plays a dual role in development because the stock of educated workers in an economy determines both the degree of income inequality and its rate of growth, making the parameters of the demand for and supply of labour crucial determinants as to whether inequality increases or decreases as an economy accumulates human capital.

The aim of this paper is to examine the impact of increased trade on inequality, and furthermore investigate whether a higher human capital stock moderates this unequalising aspect of international trade. We specifically look at the skilled-unskilled wage differential. High initial endowments of human capital, captured by data on average years of schooling say, imply a more egalitarian society compared to countries with a lower human capital endowment. When more equal societies open up their economies further, increased trade is likely to induce less inequality upon impact because the supply of skills better matches demand. But greater international exposure also

brings about technological diffusion, see Winters (2004), further raising skilled labour demand. This may raise wage inequality, in contrast to the initial egalitarian *level* effect of human capital. We attempt to measure these two opposing forces. An innovation of our paper is to employ a broad set of openness indicators to measure trade liberalization policies as well as general openness, which is an outcome, and not a policy variable. Another purpose of our analysis is to examine what type of education most reduces inequality. In settings of low human capital endowments, as measured by literacy or low primary school enrollment, a policy of relative neglect of primary in favour of expenditure on tertiary education may have a less than benign influence on inequality. Our sample of countries (see appendix 4) excludes developed nations and economies in transition because of higher stocks of human capital in those regions. The rest of the paper is organized as follows: section 2 presents the data and methodology, section 3 contains the empirical results, and finally section 4 concludes with some policy implications.

2 DATA AND METHODOLOGY

We employ the UTIP-UNIDO wage inequality 'THEIL' measure calculated by University of Texas Inequality Project (UTIP) based on UNIDO 2001. This data set is a set of measures of the dispersion of pay across industrial categories in the manufacturing sector, drawn from the Industrial database published annually by United Nations Industrial Development Organisation (UNIDO). The Theil index is decomposable (Conceicao and Galbraith, 2000). If individuals are grouped in a mutually exclusive, completely exhaustive way, overall inequality can be separated into a between group component and a within group component. Thus, there is no interaction between these two components and so one can consider these measures additively decomposable. Moreover, of all entropy based measures, the Theil Index is the one of only two measures for which the weights in the within-groups component add to one. Therefore, overall inequality is the result of adding the two independent components: inequality between groups and inequality within groups.

Here we have decided to employ the Theil index or more specifically a measure of inequality in manufacturing pay between skilled and unskilled labour, instead of taking measures of absolute inequality which would capture the personal income distribution (GINI). This is motivated by several considerations. First, comparable and consistent measures of income inequality, whether on a household level or per head basis are difficult, almost implausible and generally fails to provide adequate or accurate longitudinal and cross-country coverage. By contrast, inequality of manufacturing pay, based on UNIDO Industrial Statistics provides indicators of inequality that are more stable, more reliable and more comparable across countries because UNIDO measures are based on a two or three digit code of International Standard Industrial Classification (ISIC), a single systematic accounting framework. Furthermore, manufacturing pay has been measured with reasonable accuracy as a matter of official routine in most countries around the world for nearly forty years (Galbraith and Kum, 2002).

Secondly, pay is major source of household income. Any change in wage inequality is reflected in income inequality. According to Fields (1980) pay inequalities in the manufacturing sector have been found out to be the driving force behind the evolution of inequality. Furthermore, as discussed above, processes of globalization through technological change raises the concentration of skilled workers in advanced sectors against unskilled worker in the backward sector. Since manufacturing is the sector most affected by modern technological change, income inequality would certainly have an inter-industrial feature that would show up in changing pay differentials between advanced and backward manufacturing industries (Galbraith and Kum, 2002).

Thirdly, our principal reason for using the UTIP-UNIDO wage inequality 'THEIL' measure is because we are more interested in the functional distribution of income. Changes in the functional distribution between skilled and unskilled labour, will in turn predictably impact on the personal income distribution in countries that are unskilled labour abundant. Inequality will rise as the skilled-unskilled labour wage premium increases and vice versa.

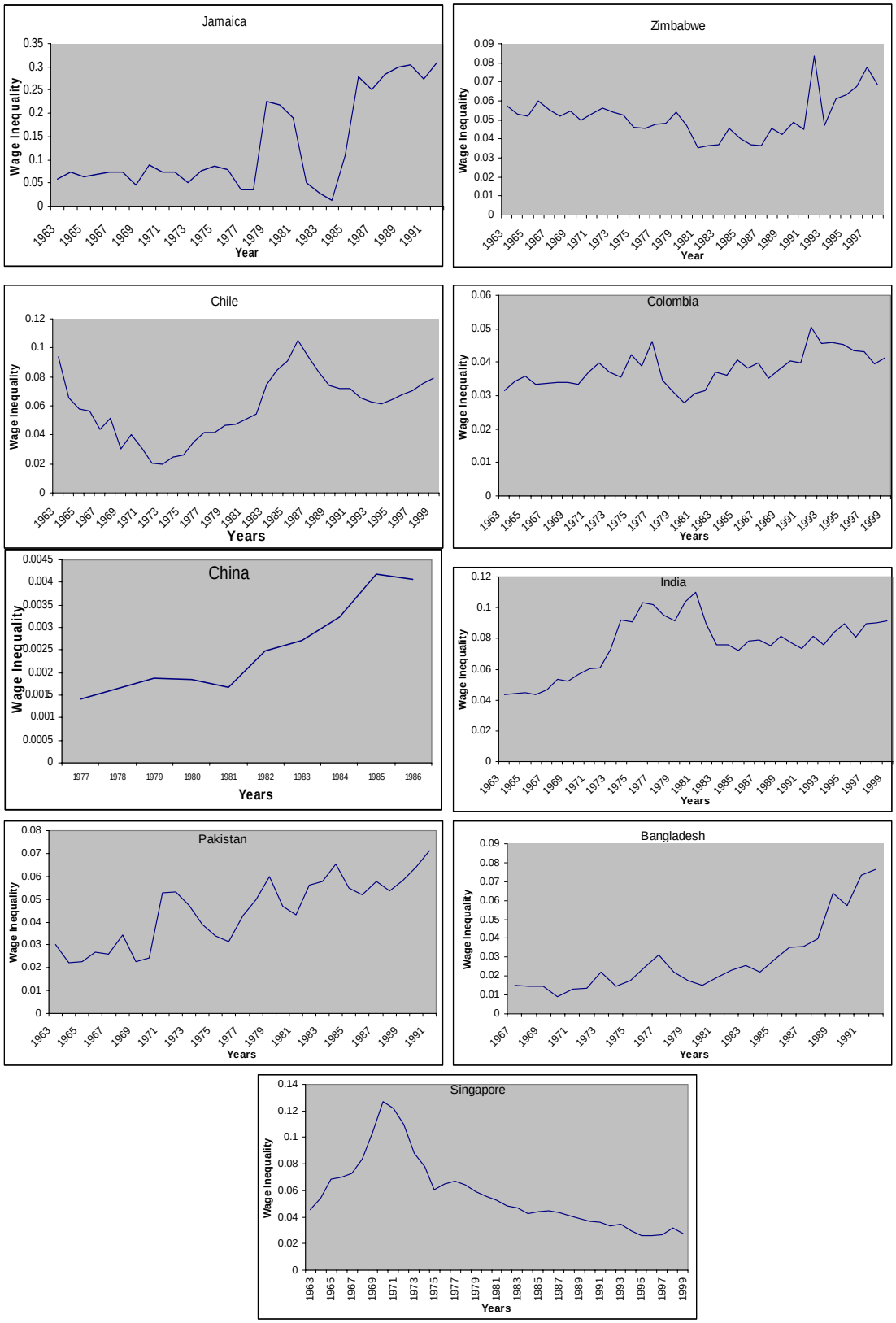
The UTIP- UNIDO wage inequality measure is the between-group component of Theil's T statistic, an entropy measure whose functional form is defined as:

$$T = \sum (\frac{Y_i}{Y}) T_i + \sum \frac{Y_i}{Y} \log(\frac{Y_i / Y}{N_i / N}) = T^W + T^B \qquad (1)$$

Where and indicate within-group and between-group inequality measures respectively. and stand for total employment and total pay respectively, and subscript denotes group identity. As mentioned, UTIP captures as their inequality measure, where groups are defined as categories within the UNIDO industrial classification codes. Like GINI, the Theil index range from 0 to 1. However, strictly speaking the , which only captures a part of inequality, ranges from 0 to less than 1 (0.36 for the current UNIDO data set).

The UTIP data set provides Theil inequality measures for nearly 3200 country/year observations, covering over 150 countries during the period 1963 to 1999. Figure 1 illustrates trends in wage inequality between skilled and unskilled workers over time in selected developing countries and is representative of different regions. All the country graphs, except one, show that wage inequality has been on the rise in 1980s and 1990s. The only exception is Singapore which belongs to a group associated with the "East Asian Miracle" of the 1980s. This miracle, however, was confined to a few countries, and is not representative of the developing world, as is evident from the graphs. Since 1980s and 1990s are associated with 'Structural Adjustment Policies' under which many developing countries embraced trade liberalization, it is safe to suggest that the above trends in wage inequality are related to these market reforms. Appendix 4 lists these countries, and the latest year for which the Theil wage inequality index was available for them.

Figure 1


Jamaica
Wage Inequality
Year
Zimbabwe
Wage Inequality
Year
Chile
Wage Inequality
Years
Colombia
Wage Inequality
Years
China
Wage Inequality
Years
India
Wage Inequality
Years
Pakistan
Wage Inequality
Years
Bangladesh
Wage Inequality
Years
Singapore
Wage Inequality
Years

Our basic model for wage inequality between skilled and unskilled workers based on integration will have 2 equations:

$$Inequality = f[Integration(Openness), Skills_0] \quad (2)$$
$$(+) \qquad (-)$$

$$Inequality = f[Integration(TradePolicy), Skills_0] \quad (3)$$
$$(+) \qquad (-)$$

Here wage inequality is a positive function of integration, which in turn is positively related to the degree of the openness of the economy in equation (2), or trade *policies* that promote greater openness in equation (3). The latter effect is often ignored in the literature, which only employs openness indicators. It should be noted, however, that openness is an outcome of trade and industrial policies and not a policy indicator per se. Wage inequality is also negatively related to the initial stock of skills in the economy as discussed above. A simple Heckscher-Ohlin or Stolper-Samuelson model would suggest that the overall returns to skill would decline, and with it incentives for education, when a skill-scarce developing country opens up (see Wood and Ridao-Cano, 1999). However, in a multi-dimensional Stolper-Samuelson model approximating reality, endogenous growth with increasing returns to R & D, a skill-bias in tradables, skill shortages, or unlimited supplies of unskilled labour, could all lead to an increase in returns to skill following greater integration (Arbache et al., 2004). Integration can also lead to the diffusion of more efficient education technologies which would further augment the level of skills in the economy (Winters, 2004). Thus the expected effect of openness and trade policy on wage inequality is positive in developing countries where majority of the population is unskilled and uneducated.

The econometric form of the wage inequality model based on openness and trade policy is as follows:

$$THEIL_{1i} = \sigma_1 + \kappa_1 OPEN_i + \nu_1 skills65_i + \varepsilon_{1i} \quad (4)$$

$$THEIL_{2i} = \sigma_2 + \kappa_2 TP_i + \nu_2 skills65_i + \varepsilon_{2i} \quad (5)$$

Where is wage inequality in a country i for the decade of 1990s (the latest value available for the Theil index for every country is employed: see appendix 4 for the exact year), is the random error term, captures openness and is the indicator for the trade policy stance in 1980s respectively, and measures initial skill levels proxied by average years of schooling for the population aged 25 in 1965 (see appendix 3 for data details). Note that the skill acquisition parameter refers to a period well before the trade liberalizations episodes post-1980. We will employ a total of 17 measures of openness and 11 measures of trade policy to carry out multiple regression analysis for equations 4 and 5, respectively. The core openness variable is the overall trade share (the ratio of nominal imports plus exports to GDP), which has been extensively used in the literature (see Frankel and Romer, 1999; Acemoglu, Johnson and Robinson,

2001; Alcala and Ciccone, 2002; Dollar and Kraay, 2002; and Rodrik et al, 2004). Two other measures of openness are trade penetration (tars) derived from World Bank's TARS system and overall import penetration (*Impen*) respectively. Following the study by Rose(2002), we have employed 8 different categories of trade penetration and import penetration respectively. However, these variables are an outcome and not policy variables as neither of these measures are direct indicators of trade policy of a country, pointing only towards the level of its participation in international trade. To that end we also employ, unlike in most studies, proxies measuring the trade policy stance. There are indicators of trade restrictiveness acting as measures of trade policy (Edwards, 1998, Greenaway et al, 2001, Rose 2002). Import tariffs as a percentage of imports (*Tariffs*), tariffs on intermediate inputs and capital goods (*Owti*), trade taxes as a ratio of overall trade (*Txtrg*) and total import charges (*Totgvo*), as well as sectoral categories of import charges (manufacturing, agriculture and resources) can all be considered as good proxies of trade restrictiveness and have also been employed in this study. Other measures which capture restrictions in overall trade are non-tariff barriers. We used 4 different categories of non-tariff coverage (*Nontar*), i.e, overall, manufacturing, agriculture and resources respectively, as well as non-tariff barriers on intermediate inputs and capital goods (*Owqi*) as 5 in total broader proxies of non-tariff barriers (see Rose, 2002). Since this data is episodic, our study must of necessity be cross-sectional rather than a panel data analysis.

There could be potential endogenity problems associated with the dependent variable, wage inequality and the explanatory variable, openness/trade policy. First of all, openness when measured by the trade share of national income is not truly exogenous, but an outcome of other factors. Secondly, the degree of wage inequality between skilled and unskilled workers, or the country's relative factor endowments (Tavares, 1998) may determine a country's trade policy choices. Even under the aegis of structural adjustment policies, decisions regarding openness were gradually taken. It may be that more egalitarian labour abundant nations may choose to open up faster than less equal land (or mineral) abundant nations.

We need to instrument for the openness and trade policy variables' potential endogenity with wage inequality. The literature establishes the predicted trade share following Frankel and Romer (FR) (1999) from a gravity equation as an appropriate instrument for openness/trade policy (see, Dollar and Kraay, 2002; Rodrik et al, 2004; Acemolgu, Johnson and Robinson, 2001; Hall and Jones, 1999). Furthermore, following Rodrik et al (2004), the distance from the equator has been chosen as the second instrument for openness/trade policy variables because the level of integration of an economy depends upon its location in the world map. Our Instrumental Variable (IV) regression model is a two stage least squares (2SLS) estimate beginning with:

$$OPEN_{1i} = \varsigma_1 + \tau_1 FR_i + \psi_1 Disteq_i + \varepsilon_{3i} \quad (6)$$

$$TP_{1i} = \varsigma_2 + \tau_2 FR_i + \psi_2 Disteq_i + \varepsilon_{4i} \quad (7)$$

Here stands for predicted trade shares from gravity equations computed by Frankel and Romer (1999), whereas (distance from the equator) is a proxy for geography. In the first stage, equation (6) and equation (7) have been used to generate predicted values of openness and trade policy variables by regressing them on the two instruments. The predicted openness and trade policy variables are then employed in equation (4) and equation (5) respectively, as the second and final stage of the regression analysis.

3 RESULTS

Before we carry out the IV analysis, it is informative to look at simple bivariate relations between integration (predicted trade shares and predicted tariff rates) with the Theil index. The first graph in figure 2 shows that increases in trade shares after liberalization leads to higher inequality, and the second graph also suggests that *decreases* in import tariffs exerts a negative and unequal distributional effect on wages. One of the reasons for the decrease in relative wages of unskilled labour, as tariffs fall, is that the heavily protected sectors in many developing countries tend to be industries that employ a high proportion of unskilled workers (Goldberg and Pavcnik, 2004).

Figure 2

Table 1a and 1b (Appendix 1) gives IV regression results with 58 different specifications. The results confirm the findings of figure 2. All openness and trade policy variables carry expected signs, and nearly all of them are significantly related to wage inequality. It would, therefore, appear that trade liberalization does worsen the distribution of wages between skilled and unskilled labour in developing countries. We have also carried out a robustness test to further check the role of trade in increasing wage inequality by regressing 28 selected proxies of openness and trade policy on the Theil index in equation (4) and equation (5) with 5 more proxies of skilled labour (i.e., $skills60$, $skills70$, $skills75$, $skills80$, $skills85$). We found in all the 145

cases, trade exacerbates inequality; the relationship is significant in 112 cases out of these 145 (table 2, appendix 1).

Furthermore, the results in table 1a and 1b show that initial skill endowments is negatively related to inequality showing that developing countries that are more educated to begin with do well on wage inequality. This is expected, and in line with the theory that countries where the skill endowment is more evenly distributed, are less prone to an adverse wage distributional effect (Fisher, 2001; Tuelings and van Rens, 2002; Eiche, 2001; Bourguignon and Morrisson, 1990; Tilak, 1989).

Figure 3 shows that trade liberalization also augments skills in developing countries. This is true because increased exposure to international trade is followed by technology transfer, which improves the general skill level. This means that part of the human capital stock is endogenous to the processes of openness, as hinted at by many endogenous growth models. Here a *change* in skilled human capital which is endogenous to integration will have its own independent effect on relative wages and inequality. And this effect will be different to that which is attributable to the *level* of human capital endowment/educated population in a country.

Figure 3

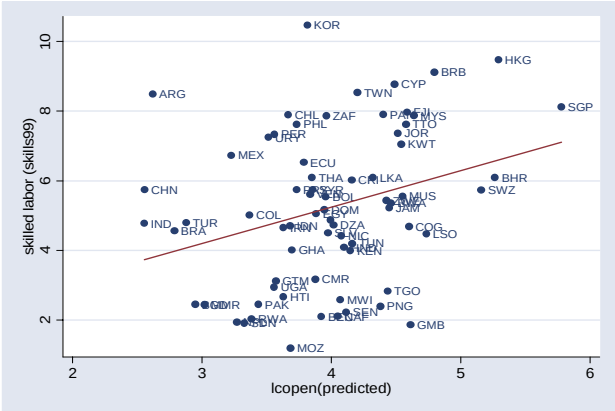
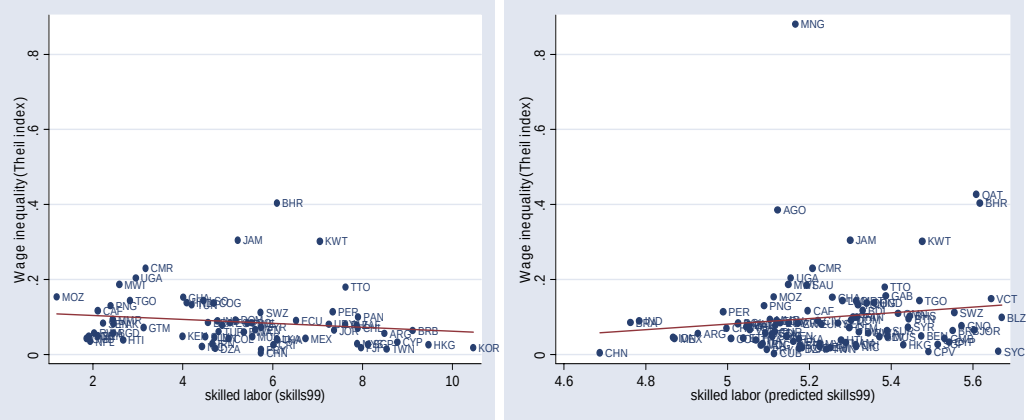


Figure 4 shows two graphs. The first one illustrates a simple relationship between skill levels in 1999 and wage inequality, and suggests that countries with higher stocks of skilled labour will have less inequality. The second graph has a different measure of skills in 1999 (based on predicted values; those skills that are acquired as a consequence of trade), conversely suggests that skill accumulation due to greater global integration raises wage inequality. This suggests that the skills that are directly accrued through the processes of trade, contributes to wage inequality. This is in line with Tinbergen's (1975) arguments, and our earlier discussion regarding the dual role of skilled human capital in the economy.

Figure 4



In order to examine the dual (positive and negative) impact of skilled labour stocks on the skilled-unskilled labour wage differential, we modify our basic 'wage inequality model' by introducing an interaction term between skills and some selected openness and trade policy measures.

Conceptually speaking, our wage inequality framework should contain:

$$Inequality = f[(Skills_i(openness), Skills_0] \qquad (8)$$
$$(+) \qquad (-)$$

$$Inequality = f[(Skills_i(tradepolicy), Skills_0] \qquad (9)$$
$$(+) \qquad (-)$$

Here we already know from our early discussion that the countries which have higher *initial* skill endowments perform well on the inequality front, as suggested by the second argument on the right-hand-side of (8) and (9). However, the skills which are accrued through trade liberalization exacerbate inequality especially in developing countries where a large portion of the population is unskilled and uneducated. To capture the longitudinal effects of skill accumulation in society we have $skills_1$ which contains the effect of greater openness or trade policies aimed at liberalization. In summary, $skills_0$ refers to the skills level for the initial period where it is exogenous to trade, whereas $skills_i$ refers to the skill levels after a period of time when the processes of trade openness or liberalized trade policies alter the stock of human capital.

The econometric form of our modified wage inequality model is:

$$THEIL_{3i} = \lambda_1 + \Omega_1 Interaction(OPEN \times Skills99)_i + \rho_1 Skills65_i + \varepsilon_{5i} \qquad (10)$$

$$THEIL_{4i} = \lambda_2 + \Omega_2 Interaction(OPEN \times Skills99)_{hyr_i} + \rho_2 Skills65_i + \varepsilon_{6i} \quad (11)$$

$$THEIL_{5i} = \lambda_3 + \Omega_3 Interaction(TP \times Skills99)_i + \rho_3 Skills65_i + \varepsilon_{7i} \quad (12)$$

$$THEIL_{6i} = \lambda_4 + \Omega_4 Interaction(TP \times Skills99)_{hyr_i} + \rho_4 Skills65_i + \varepsilon_{8i} \quad (13)$$

Note that $skills65$ represents initial skill endowments in 1965, whereas captures skill accumulation in 1999 - a point in time when earlier trade liberalization has had time to play a role in skill accumulation in developing countries through technology transfer. The interaction terms capture the effect of skills on inequality, while taking into account the extent to which each developing country is integrated with world markets. Average years of schooling is our first proxy for skills. Since there is evidence which suggests unequal investments in higher education are important determinants of increasing inequalities in developing countries (Barro, 1999), we also utilize average years of higher schooling in addition to average years of schooling as the second proxy for skilled labour. This gives us interaction terms based on two categories of skill levels. The interaction term $Interaction(OPEN \times Skills99)$ and $Interaction(TP \times Skills99)$ are based on the first category of skills and represents the general skill level proxied by overall years of schooling in the total population at age 25 for 1999 and the interaction term $Interaction(OPEN \times Skills99)_{hyr}$ and $Interaction(TP \times Skills99)_{hyr}$ are based on average years of higher schooling in the total population at age 25 for the same year. The later category will give us more specific information about the relationship between inequality and higher education. To investigate integeration we employ six definitions of openness: *Lcopen, Impen1o, Impen2o, Tars1o, Tars2o* and *Open80* and 5 different proxies of trade policy namely *Tariffs, Owti, Txtrdg, Owqi,* and *Heritage* [1] (see Appendix 3 for detailed variable definitions).

Before obtaining the interaction terms, we have once again instrumented for openness, trade policy and skills in order to resolve the endogeneity problem which might exist between openness/trade policy and skill levels.[2]

$$OPEN_{2i} = \phi_1 + \theta_1 FR_i + \varepsilon_{9i} \quad (14)$$

$$TP_{2i} = \phi_2 + \theta_2 FR_i + \varepsilon_{10i} \quad (15)$$

$$Skills_i = \eta + \tau TLEX_i + \varphi PTR_i + \varepsilon_{11i} \quad (16)$$

Note here that we are not exactly running a conventional two stage least square analysis where in the first stage the common instruments enter all the first stage equations. In our case there is no common instrument for openness/trade policy and Skills. For openness and trade policy variables we used the standard instrument namely predicted *FR* trade shares in an attempt to gauge how more liberalized trade policies modify the role of skills in

determining wage inequality (equation 14 and equation 15).[3] The two proxies for skills are instrumented by total public spending on education as a percentage of GDP (TLEX) and primary pupil-teacher ratio (PTR) in equation (16).

Table 3 (Appendix 1) shows results for our instrumental variables, shedding light on the robustness of instruments we have chosen. The results show that the FR instrument works well for openness proxies if we consider the t values. However, with the exception of *Lcopen* the coefficients and standard errors for all the openness proxies are large showing that they violate low-power over identification restrictions. In the case of trade policy indicators, though the t values are smaller, they are significant in most cases with smaller standard errors and coefficients, indicating the robustness of the *FR* instrument for trade policy proxies. Average years of schooling (*Skills99*) have a positive association with public spending on education (*TLEX*), and a negative relationship with pupil teacher ratio (*PTR*). Both these instrumental variables carry expected signs when related to basic education (*Skills99*), because on the one hand, governments in developing countries have lately been spending resources on primary education in order to improve literacy rates at the behest of donors, and on the other hand, a high pupil-teacher ratio is one of the main causes of school drop-outs.[4] The result for average years of higher schooling (*Skills99hyr*) when related to *PTR* is similar to that for basic education (*Skills99*). However, the relationship between *Skills99hyr* and *TLEX* is insignificant. This is because governments in developing countries either spend on basic education or on tertiary education, putting less emphasis on secondary education.

Table 4a and 4b (Appendix 1) show $Skills65$ is negatively related to inequality for 15 out of 22 specifications of equations (10), (11), (12) and (13), confirming our earlier results that countries with a better *initial* school attainment do well apropos inequality. The coefficients for Skills65 are, however, insignificant in the presence of post-liberalization skill levels that are interacted with openness/ trade policy proxies.

The results in table 4a demonstrate that $Interaction(OPEN \times Skills99)$ term enters the inequality equation insignificantly, and $Interaction(OPEN \times Skills99)_{hyr}$ enters the inequality equation insignificantly in 4 out of 5 cases, being significant only in the case of lcopen, suggesting limited role played by openness per se in determining wage inequality once we control for openness proxies for skill level. This result supports Dollar and Kraay (2004), who found that openness does not carry any significant effects on inequality. Nevertheless, the significance of *Lcopen* for $Interaction(OPEN \times Skills99)_{hyr}$ implies that greater openness may only benefit those who have a minimum threshold level of skills, such as high school degree/ diploma. Whereas the insignificance of $Interaction(OPEN \times Skills99)$ suggests that basic education in itself as a target is not enough to contain wage dispersion when the economy begins to trade more with the outside world, perhaps there is a need for a balanced education policy in the South. The provision of the necessary higher/technical education should be done in a way so that it does not compromise the achievement of

primary education (see Boeren and Hotland, 2005). Primary education is the first step towards more skilled labour force, and it is a pro-poor policy as the overwhelming majority of the poor remain uneducated (Mamoon, 2005).

Let us now turn to the analysis of the effect of trade policy measures, leaving aside general openness outcomes. As noted earlier, general openness is an outcome of earlier policies, and it either does not significantly effect wage inequality, or it may even reduce wage disparities if openness is a consequence of policies promoting competitive industrialization. Table 4b shows that the interaction terms for trade policy variables. $Interaction(Tp \times Skills99)$ and $Interaction(TP \times Skills99)_{hyr}$ and always enter equation (12) and equation (13) significantly, with a negative sign. The significance of *trade policy* variables in contrast to general *openness* indicators suggests that labour market inequalities are more closely related to trade policies. The negative sign implies that more open trade policies worsen wage inequality. These findings are in line with the results shown in figure 4. The simple interpretation is that skills accrued through processes of liberalization seem to complement trade liberalization in worsening the gap between the haves and have-nots in developing countries. This may be due to a "protection" effect. Generally, developing countries protect unskilled-labour intensive goods prior to liberalization. So after liberalization the producers of unskilled intensive good face increased costs amid more outside competition, and their real wages and living standards decline in the absence of government subsidies.

Another way of looking at the results in table 4b is to consider government revenue effects. Decreasing tariffs may lead to a fall in public revenues, with serious repercussions for development expenditure, especially education spending. In this respect, we could say that there is complementarity between unequal education policies, which result is qualitative and quantitative constraints in the education sector, and a more open trade policy.

The literature suggests that in most developing countries skills are unevenly distributed (Ravallion, 2003). Thomas, Wang and Fan (2000) and Domenech and Castello (2002) find that Gini coefficient of the distribution of human capital in Sub Saharan Africa and South Asia are the highest (most unequal) in the world. Berthelemy (2004) arrives at the same conclusion not only for Sub Saharan Africa and South Asia, but also for Middle East and North Africa (MENA). Another important observation which can be made from table 4b is that the coefficients on $Interaction(TP \times Skills99)_{hyr}$ are higher than the coefficients on $Interaction(TP \times Skills99)$. This may indicate that the stock of highly skilled labour in developing countries is closely linked to free market policies in explaining the degree of wage inequality. In other words, either open-door policies, or a bias in educational expenditure in favour of higher education, exacerbates the skilled labour wage premium.

In the developing world, governments focus more attention on higher education compared to primary education. The distribution of public resources on education is highly unequal, as shown in Table 5 based on Chowdhury (1994). The higher education bias widens disparities in incomes among different skill levels, following greater trade liberalization. In many countries a

considerable proportion of public expenditures for education benefits middle and upper-income families, because richer groups are over-represented at all levels of education, particularly at the university level. From Table 5 we can gauge that in African countries, public expenditure per student on higher education is 28 (Francophone Africa) and 50 (Anglophone Africa) times greater than the level on primary education. For developing countries as a whole, only 7 % of the relevant population enrol in higher education.

Table 5
Public Expenditure per Student as a % of Per Capita GNP by Region (circa 1980)

Region	Primary	Secondary	Higher
Anglophone Africa	18	50	920
Francophone Africa	29	143	804
South Asia	8	18	119
East Asian and Pacific	11	20	118
Latin America	9	26	88
Middle East and North	2	28	150
Africa	14	41	370
Developing Countries	22	24	49

Source: Mingat and Tan (1985) cited in Chowdhury (1994).

As shown in Table 6 (appendix 2), the share of public spending on education in Latin America that is allocated to higher education has tended to be high -- more than 20 % on average, compared to 15 % on average in East Asia. Venezuela and South Korea are extreme examples of this phenomenon. While in the early 1990s Venezuela allocated 35 % of its public education budget to higher education, South Korea allocated just 8 % of its budget to post-secondary schooling. Public expenditure on education as a percentage of GNP was actually higher in Venezuela (5.1) than in Korea (4.5). However, after subtracting the share going to higher education, public expenditure available for basic education as a proportion of GNP was considerably higher in Korea (3.6) than in Venezuela (1.3).

Birdsall (1999) summarises the debate on education and inequality with reference to Latin America and East Asia:

> By giving priority to expanding the quantity of education and improving quality at the base of the educational pyramid, East Asian governments stimulated the demand for higher education, while relying to a large extent on the private sector to satisfy that demand. In Latin America, government subsidies have disproportionately benefited high-income families whose children are much more likely to attend university. At the same time, low public funding of secondary education has resulted in poorly qualified children from low-income backgrounds being forced into private universities or opting out of the education system at higher levels. (p. 11)

4 CONCLUSIONS

In summary, our discussion suggests that the earning inequalities which we witness in developing countries have two important determinants. First there are significant entrenched inequalities in educational attainment. Second, increased international trade transforms these education inequalities into wage inequalities by favouring skilled labour over unskilled labour. In line with previous studies we have found that education may be central to explaining the increasing gap in relative wages between skilled and unskilled workers in developing countries. Though our analysis supports the argument that those countries with a higher initial level of human capital do well on the inequality front, it also suggests that human capital, particularly the part related to higher education, which accrues after trade liberalization has inegalitarian effects. Governments in developing countries tend to invest more in higher education at the cost of primary education in order to seize short-term benefits from globalization.

One reason for this bias in education policies in developing countries towards higher education may lie in the belief that elementary education has a very limited direct role in determining growth rates. According to Barro (1999) the rate of economic growth responds more to secondary or higher education levels rather than elementary schooling. International trade in manufactures and services is considered to be one of the key engines for growth. This often requires college graduates, or those who have at least finished high school. One reason why India and China have become havens for international outsourcing and trade is because they have managed to accumulate relatively educated and skilled human capital by investing in higher education.[5] In the last two years, the United States has lost two million manufacturing jobs to China, India and other third world countries, mainly in the Far East. Consequently, in 2001, the manufacturing sector in the USA had shrunk to just 18% of GNP from 48 % in 1950 and it is expected to recede to just 10 or 11% within the next 10 years.[6] Forrester Research, a market research firm predicts that at least 3.3 million white-collar jobs and $ 136 billion in wages will shift from the US to low cost countries by 2015, whereas, most of them will find their way to Indian or Chinese centres.[7] Countries in the South that are set to benefit most from globalization are those that have transformed at least a *segment* of their labour force into relatively skill intensive by investing in higher education programmes. So it is no surprise that in order to participate in the race to be competitive, many developing countries have a tendency to invest in higher education at the cost of primary education to achieve greater growth. For example, Pakistan's current education policy is skewed towards higher education. In fiscal year 2003, the government increased its higher education budget to Rs 5 billion from Rs 800 million five years ago - an increase of nearly 400%. In 2004, the government doubled the previous year's expenditure on higher education. The budget for primary education, by contrast, increased by a meagre average of 4% per annum for the last few years. This apparent pro-growth higher education policy of Pakistan at the expense of primary education may very well accelerate growth, but it definitely excludes the poor and unskilled, and will subsequently lead to increased wage and income disparities in the country.

As noted earlier, governments in developing countries tend to focus their education policies on higher education in the anticipation that this investment will yield quick dividends in the current international business environment. Though they are right, they need to realize that promoting higher education at the cost of primary education breeds greater income inequality in the absence of countervailing policies, and is not pro-poor. Consequently, governments need to increase the mean level of human capital through a balanced education policy where primary education is given as much importance as higher education. An equitable education policy will decrease the skilled-unskilled wage premium, as the overall supply of low skilled and uneducated workers goes down and the supply of educated workers increases, as well as give rise to general equilibrium effects that reduce wage inequality. Also such policies are consistent with the millennium development goals (MDGs). We agree with the recent World Development Report (2006) which suggests that wider access to education and jobs could "level the economic playing field" and improve livelihoods.

Our results also have implications for the speed at which trade policies are liberalized. Developing countries require time to adjust to an open regime because of their low skill level stocks; the implication being that better educated nations should liberalize faster. If skill levels were homogenously distributed, free trade would lead to a more equal and pro poor growth. In the immediate time frame, it would be wiser for developing economies to first look for regional trade agreements by following the model of European Union. The rationale for regional trade is that developing countries lie in a heterogenic plain where each country is located at different stages of the technical ladder. To climb the ladder, the more efficient way may lie in increased South-South trade rather than North-South trade in a regional framework as in the case of ASEAN (Association of South East Asian Network). Similar trade agreements would enable developing countries to slowly liberalize their economies, while at the same time enabling their work force to ascend the skill ladder (Mamoon, 2004).

REFERENCES

ACEMOGLU, Daron, JOHNSON, Simon and ROBINSON, James A., "The Colonial Origins of Comparative Development: An Empirical Investigation," American Economic Review, Vol. 91, No. 5, 2001, pp. 1369-1401 http://emlab.berkeley.edu/users/chad/e236c_f04/ajr2001.pdf

ALCALA, Francisco and CICCONE, Antonio, "Trade and Productivity", CEPR Discussion Paper No. 3095, 2001

AMANN, Edmund, ASLANINDIS, Nektarios, NIXSON, Fredrick, and WALTERS, Bernard, "Economic Growth and Poverty Alleviation: A Reconsideration of Dollar and Kraay," Development Economic Discussion Papers, No. 0407, 2002. http://les.man.ac.uk/ses/research/devpapers/Povertyconference%5B1%5D.pdf

ARBACHE, Jorge S., DICKERSON, Andy and GREEN, Francis, "Trade Liberalization and Wages in Developing Countries," Economic Journal, Vol. 114, No. 493, 2004, pp. 73-96

BARRO, Robert J., "Does an Income Gap Put a Hex on Growth' Business Week, March 29, 1999

BEHRMAN, Jere R., BIRDSALL, Nancy, and SZEKELY, Miguel, "Pobreza, Desigualdad, y Liberalizacion Comercial y Financiera en America Latina." Inter American Development Bank (IADB), Washington D.C, 2001 http://www.undp.org/rblac/liberalization/docs/capitulo3.pdf

BERTHELEMY, Jean-Claude, "To What Extent are African Education Policies Pro-Poor," Unpublished, 2004 http://www.csae.ox.ac.uk/conferences/2004-GPRaHDiA/papers/5h-Berthelemy-CSAE2004.pdf

BIRDSALL, Nancy, "Education: the People's Asset", CSED Working Paper No. 5, 1999 http://www.brookings.org/dybdocroot/ES/dynamics/papers/education-tpa/education-tpa.htm

BOEREN, Ad and HOTLAND, Gerrit (eds) 'A Changing Landscape - making support to higher education and research in developing countries more effective', NUFFIC, the Netherlands, 2005

BOURGUIGNON, Francois and MORRISON, Christian., "Income Distribution, Development and Foreign Trade: A Cross Section Analysis," European Economic Review, vol. 34, no. 6, 1999, pp. 1113-1132

CASTELLO, Climent, Maria Amparo and DOMENECH, Rafael, "Human Capital Inequality and Economic Growth: Some New Evidence," Economic Journal, Vol. 112, 2002, pp. C187-C200

CHEN, Shaohua and RAVALLION, Martin, "Household Welfare Impacts of China's Accession to the World Trade Organization," World Bank Policy Research Working Paper 3040, 2003 www.econ.worldbank.org/files/26013_wps3040.pdf

CHOWDHURY, Kowsar P., "Literacy and Primary Education", Human Capital Development and Operations Policy Working Paper (HCOWP) 50, 1994. http://www.worldbank.org/html/extdr/hnp/hddflash/workp/wp_00050.html

COCKBURN, John, "Trade Liberalization and Poverty in Nepal: A Computable General Equilibrium Micro Simulation Analysis," The Centre for the Study of African Economies Working Paper Series. Working Paper 170, 2002

http://www.bepress.com/csae/paper170

CONCEICAO, Pedro and GALBRAITH, Jame K., "Constructing Long and Dense Time Series of Inequality using the Theil Index," Eastern Economic Journal, Vol 26, 2001, pp. 61-74

DE GREGORIO, Jose. and LEE, Jong-Wha, "Education and Income Distribution: New Evidence from Cross-Country Data," Development Discussion Paper No. 714, Harvard Institute for International Development (HIID), 1999 http://www.hiid.harvard.edu/pub/pdfs/714.pdf

DOLLAR, David and KRAAY, Aart, "Trade, Growth, and Poverty," *Economic Journal*, Vol. 114, pp. F22-F49, February 2004

DOLLAR, David and KRAAY, Aart, "Institutions, Trade and Growth," *Carnegie Rochester Conference on Public Policy*, 2002 http://www.carnegie-rochester.rochester.edu/April02-pdfs/ITG2.pdf

DUR, Robert A. J. and TEULINGS, Coen N, "Education, Income Distribution and Public Policy," *Unpublished draft*, Tinbergen Institute, 2002 http://www.iza.org/iza/en/papers/transatlantic/1_teulings.pdf

EDWARDS, Sebastian, 'Openness, Productivity and Growth: What Do We Really Know?' *The Economic Journal*, Vol. 108, 1998, pp. 383-398.

EICHE, Theo S. and CECILIA Garcia-Penalosa , "Inequality and Growth: The Dual role of human Capital in Development," *Journal of Development Economics*, vol. 66, issue 1, 2001, pages 173-197

FIELDS, Gary "Poverty, Inequality and Development," New York: Cambridge University Press, 1980

FISCHER, Ronald D., "The Evolution of Inequality after Trade Liberalization," *Journal of Development Economics*, Vol. 66, 2001, p. 555-579.

FRANKEL, Jeffery and ROMER, David, "Does Trade Cause Growth?" *American Economic Review*, vol. 89, no. 3, 1999, pp 379-399.

FRIEDMAN, Jed, "Differential Impacts of Trade Liberalization on Indonesia's Poor and Non-Poor," Conference on International Trade and Poverty, Stockholm, October 20, 2000.

GALBRAITH, Jame K. and KUM, Hyunsub, "Inequality and Economic Growth: Data Comparisons and Econometric Tests," UTIP Working paper Numebr 21, The University of Texas at Austin, 2002

GOLDBERG, Pinelopi, K and PAVCNIK, Nina, "Trade, Inequality and Poverty: What Do We Know? Evidence From Recent Trade Liberalization Episodes in Developing Countries," *Conference Paper Brooking Trade Forum*, 2004 http://www.econ.yale.edu/~pg87/brookings.pdf

GREENAWAY, David, MORGAN, Wyn, and WRIGHT, Peter, 'Trade Liberalisation and Growth in Developing Countries,' *Journal of Development Economics*, vol.67, 2001, pp. 229-224.

HALL, Robert E., and CHARLES Jones, "Why do Some Countries Produce So Much More Output per Worker than others?" *Quarterly Journal of Economics*, Volume 114, 1999, pp. 83-116

HANSON, Gordon, and HARISSON, Ann, "Trade and Wage Inequality in Mexico," *Industrial and Labour Relations Review*, Vol. 52, no. 2, 1999, pp. 271-288.

JAYASURIYA, Sisira, "Globalization, Equity and Poverty: The South Asian Experience," *Annual Global Conference of GDN*, Cairo, Egypt, 2002.

LEGOVINI, Avianna, BOUILLON, Cesar and LUSTIG, Nora, "Can Education Explain Income Inequality Changes in Mexico?" *Inter-American development Bank (IADB)*, Washington D.C., 2001

LOFGREN, Hans, "Trade Reform and the poor in Morocco: A Rural-Urban General Equilibrium Analysis of Reduced Protection," *TMD Discussion paper*, IFPRI, Washington DC, No. 38, 1999

LONDONO, Juan Liuis and SZEKELY, Miguel, "Distributional Surprises After a Decade of Reforms: Latin America in the Nineties." In Hausman R. and Lora E. (eds.), *Latin America After a Decade of Reforms: What Comes Next?* (Washington, DC: Inter-American Development Bank), 1997.

LORA, Eduardo and BARRERA, Felipe "A Decade of Structural Reforms in Latin America: Growth, Productivity and Investments are Not What They Used to Be." In Hausman R. and Lora E. (eds.), *Latin America After a Decade of Reforms: What Comes Next*? (Washington, DC: Inter-American Development Bank), 1997.

MAMOON, Dawood '*Education for all is central to Higher Education Reforms in Developing Countries*' in Boeren, Ad and Gerrit Holtland (eds) 'A Changing Landscape - making support to higher education and research in developing countries more effective', NUFFIC, the Netherlands, 2005 http://www.nuffic.net/common.asp?id=1704

MAMOON, Dawood, "What Matters Most Apropos Neo Classical Free Market Paradigm: 'Poverty or Inequality'?" Conference paper, 2nd Development Dialogue on 'Globalization, Poverty and Inequality', Institute of Social Studies, The Hague, the Netherlands, May 2004.

MINGAT, Alain and TAN, J. P., "Subsidization of Higher Education versus Expansion of Primary Enrollments: What Can a Shift of Resources Achieve in Sub-Saharan Africa?" International Journal of Education Development, Vol.5, 1985, pp. 259-268.

MURSHED, S. Mansoob, "Globalization is not always good: An Economists Perspective," in Paul van Seters, Bas de Gaay Fortman and Arie de Ruijter (eds), Globalization and its New Divides: Malcontents, Recipes and Reform, Dutch University Press, 35-48.

RAVALLION, Martin, "The Debate on Globalization, Poverty, and Inequality: Why Measurement Matters" World Bank Policy Research Working Paper 3038, Washington DC, 2003 http://econ.worldbank.org/files/26010_wps3038.pdf

RODRIGUEZ, Francisco and RODRIK, Dani, 'Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence,' Macroeconomics Annual, Ben Bernanke and Kenneth Rogoff, eds., MIT Press for NBER, 2000

RODRIK, Dani, SUBRAMANIAN, Arvind, and TREBBI, Francesco, "Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development," Journal of Economic Growth, Vol. 9, no. 2, June 2004, pp. 131-165

ROSE, Andrew K., "Do WTO Members Have a More Liberal Trade Policy?" NBER Working Paper 9347, 2002.

SACHS, Jeffrey D., 'Investing in Development – A Practical Plan to Achieve the Millennium Development Goals', UN Millennium Project, 2005

SACHS, Jeffrey D. and WARNER, Andrew, 'Economic Reform and Process of Global Integration,' Brookings Papers on Economic Activity, (1), 1-118, 1995

TAVARES, José, 'Trade Openness, Factor Proportions and Politics,' mimeo, Harvard university, 1998.

THOMAS, Vinod, WANG, Yan, and FAN, Xibo, "Measuring Education Inequality: Gini Coefficients of Education," Mimeo, Banque Mondiale, 2000 http://econ.worldbank.org/files/1341_wps2525.pdf

TINBERGEN, Jan, Income Distribution: Analysis and Policies, Amsterdam: American Elsevier, 1975

TILAK, Jandhyala B. G., Education and its Relation to Economic Growth, Poverty and Income Distribution, World Bank: Washington D. C., 1989

TEULINGS, Coen N. and RENS, Thijs van, "Education, Growth and Income Inequality," CESifo Working Paper Series No. 653; Tinbergen Institute Working Paper No. 2002-001/3, 2002

WINTERS, L. Alan., "Trade Liberalization and Economic Performance: An Overview," The Economic Journal, Vol. 114, 2004, pp. 4-21

WINTERS, L. Alan., "Trade Liberalization and Poverty", Discussion Paper No. 7, Poverty Research Unit, University of Sussex, UK, 2000

World Bank, A globalized Market – Opportunities and Risks for the Poor, Global Poverty Report, Washington D.C., 2001a.

World Development Report 2000/1, Attacking Poverty, 2001b

World Development Report 2006, Equity and Development, 2006

WOOD, Adrian, and RIDAO-CANO, Cristobal, "Skill, Trade and International Inequality," Oxford Economic Papers, Vol. 5, No. 1, 1999, pp. 89-119 http://www.ids.ac.uk/ids/bookshop/wp/wp47.pdf

NOTES

[1] The Heritage Foundation has created an index of overall "economic freedom", and the index runs from one (a score signifying institutions and policies most conducive to economic freedom) through five (least conducive).

[2] Since we are using skills for year 1999, there is high probability that there are endogeniety problems between skill levels and selected openness/ trade policy variables.

[3] It is useful to note that we also predicted Openness and Trade policy variables by regressing them on both *FR* and *Disteq*. The results did not change for most, but for *Owti* the interaction terms became insignificant; *Owti* represents tariffs on intermediate and capital goods, from the Sachs and Warner (1995) composite measure of openness. The Sachs-Warner criteria defines a country as open if (i) non-tariff barriers cover less than 40 percent of trade, (ii) average tariff rates are less than 40 percent, (iii) the black market premium was less than 20 percent during the 1980s, (iv) the economy is not socialist, and (v) the government does not control major exports through marketing boards. Rodriguez and Rodrik (2000) argue that in many cases the Sachs-Warner measures can be replaced by an Africa dummy. In which case, *Disteq* is not a good instrument for owti as well as *Open80*.

[4]See:.http://www.heros-inc.org/star-press-release.pdf and http://www.ecs.co.sz/cca/cca_5.html.

[5] In other export areas such as textiles which use unskilled labour intensively, these countries vast populations dictate that the skilled-unskilled premia will not narrow even if the absolute real wages of the unskilled increases.

[6] http://www.freenewport.com/us/useconomy.asp

[7] http://www.tribuneindia.com/2004/20040223/login/main1.htm

APPENDIX 1

Table 1a
IV Regression Results With Different Specifications^

	1	2		1	2		1	2
lcopen	0.0297	0.039	impen2m	0.0028	0.0024	tars1r	0.0039	0.0033
	(1.19)	(2.19)**		2.32**	(2.07)**		(3.02)*	(2.48)**
skills65		-0.015	skills65		-0.015	skills65		-0.0112
		(-2.32)**			(-1.75)***			(-1.60)
F-test	1.42	4.14**	F-test	5.38**	2.94**	F-test	9.11*	4.19**
n	97	63	n	71	51	n	72	51
R^2	0.03	0.08	R^2			R^2		0.21
impen1o	0.0021	0.0016	impen2a	0.0109	0.009	tars2o	0.00047	0.0008
	(2.4)**	(2.08)**		(2.23)**	(2.01)**		(1.62)	(2.07)**
skills65		-0.0157	skills65		-0.012	skills65		-0.015
		(-1.82)***			(-1.44)			(1.79)***
F-test	5.74**	3.02***	F-test	4.97**	2.99***	F-test	2.62	2.98***
n	72	51	n	71	51	n	69	50
R^2			R^2			R^2		
impen1m	0.0035	0.002	impen2r	0.0059	0.0038	tars2m	0.0012	0.0017
	(2.46)**	(2.15)**		(2.28)**	(2.28)**		(1.67)***	(1.94)***
skills65		-0.016	skills65		-0.012	skills65		-0.017
		(-1.90)***			(-1.66)***			(-1.79)***
F-test	6.05**	3.14***	F-test	5.19**	3.55**	F-test	2.8***	2.57***
n	72	51	n	71	51	n	69	50
R^2			R^2			R^2		
impen1a	0.0011	0.0095	tars1o	0.0012	0.0009	tars2a	0.0080	0.0039
	(2.35)**	(2.09)**		(2.60)*	(2.15)**		(1.76)***	(1.53)
skills65		-0.012	skills65		-0.016	skills65		-0.014
		(-1.44)			(-1.92)***			(-1.53)
F-test	5.51**	2.99***	F-test	6.77*	3.17***	F-test	3.10***	1.88
N	72	51	n	72	51	n	69	50
R^2			R^2			R^2		
impen1r	0.0107	0.0090	tars1m	0.0026	0.0018	tars2r	0.0009	0.0024
	(1.98)**	(1.77)***		(2.23)**	(1.98)***		(1.34)	(2.32)**
skills65		-0.017	skills65		-0.0189	skills65		-0.012
		(-1.65)***			(-1.95)***			(-1.61)
F-test	3.94**	2.14	F-test	4.96**	2.7***	F-test	1.80	3.67**
n	72	51	n	72	51	n	69	50
R^2			R^2			R^2		0.09
impen2o	0.0016	0.0012	tars1a	0.0051	0.0045	tariffs	-0.024	-0.0072
	(2.37)**	(2.17)**		(2.09)**	(1.54)		(0.66)	(-1.36)
skills65		-0.014	skills65		-0.0133	skills65		-0.025
		(-1.73)***			(-1.54)			(-2.09)**
F-test	5.61**	3.23**	F-test	4.37**	1.95	F-test	0.44	2.20
n	71	51	n	72	51	n	64	48
R^2			R^2			R^2		

* , **and *** denote significance at 1%, 5% and 10% level.

^ For variable descriptions please refer to appendix 3.

Table 1 b
IV Regression Results With Different Specifications^

	1	2		1	2
owti	-0.298	-0.254	owqi	-0.4228	-0.02975
	(-2.03)**	(-1.87)***		(-1.29)	(-1.00)
skills65		-0.0132	skills65		-0.016
		(-1.48)			(-1.29)
F-test	4.11**	2.42	F-test	4.59**	0.93
n	70	51	n	69	51
R^2			R^2		
totgvo	-0.0028	-0.0017	nontaro	-0.0022	-0.0018
	(-2.66)*	(-2.02)**		(-2.20)**	(-1.77)***
skills65		-0.0111	skills65		-0.0210
		(-1.28)			(-1.76)***
F-test	7.06*	2.51***	F-test	4.85**	1.96
n	69	49	n	69	49
R^2			R^2		
totgvm	-0.0026	-0.0015	nontarm	-0.0022	-0.0019
	(-2.65)*	(2.01)**		(-2.10)**	(-1.70)***
skills65		-0.0118	skills65		-0.022
		(-1.34)			(-1.73)***
F-test	7.02*	2.50***	F-test	4.85**	1.80
n	69	49	n	69	49
R^2			R^2		
totgva	-0.0027	-0.0018	nontara	-0.0026	-0.0027
	(-2.75)*	(-2.10)**		(-1.97)**	(-1.52)
skills65		-0.071	skills65		-0.0329
		(-1.29)			(-1.66)***
F-test	7.58*	2.70***	F-test	3.87**	1.49
n	69	49	n	69	49
R^2			R^2		
totgvr	-0.0049	-0.0026	nontarr	-0.0016	-0.0009
	(2.14)**	(-1.78)***		(-2.42)**	(-1.81)***
skills65		-0.0045	skills65		-0.009
		(-0.46)			(-1.13)
F-test	4.59**	1.97	F-test	5.87**	2.11
n	69	49	n	69	49
R^2	–	–	R^2		

* , **and *** denote significance at 1%, 5% and 10% level.

^ For variable descriptions please refer to appendix 3.

Table 2
Inequality Trade Nexus

Openness/ Trade Policy	(dependent variable) Theil Index (T)					
	$T_{skills60}$	$T_{skills65}$	$T_{skills70}$	$T_{skills75}$	$T_{skills80}$	$T_{skills85}$
lcopen	Significant	Significant	Significant	Significant	Significant	Significant
impen1o	Significant	Significant	Significant	Significant	Significant	Significant
impen1m	Significant	Significant	Significant	Significant	Significant	Significant
impen1a	Significant	Significant	Significant	Significant	Significant	Significant
impen1r	Significant	Significant	×	Significant	Significant	Significant
impen2o	Significant	Significant	Significant	Significant	Significant	Significant
impen2m	Significant	Significant	Significant	Significant	Significant	Significant
impen2a	Significant	Significant	Significant	Significant	Significant	Significant
impen2r	Significant	Significant	Significant	Significant	Significant	Significant
tars1o	Significant	Significant	Significant	Significant	Significant	Significant
tars1m	Significant	Significant	Significant	Significant	Significant	Significant
tars1a	×	×	×	×	×	Significant
tars1r	Significant	Significant	Significant	Significant	Significant	Significant
tars2o	Significant	Significant	Significant	Significant	Significant	Significant
tars2m	Significant	Significant	Significant	Significant	Significant	Significant
tars2a	×	×	×	×	×	×
tars2r	Significant	Significant	Significant	Significant	Significant	Significant
tariffs	×	×	×	×	×	×
owti	Significant	Significant	Significant	Significant	Significant	Significant
txtrg	×	×	×	×	×	×
totgvo	Significant	Significant	Significant	Significant	Significant	Significant
totgvm	Significant	Significant	Significant	Significant	Significant	Significant
totgva	Significant	Significant	Significant	Significant	Significant	Significant
totgvr	Significant	Significant	Significant	Significant	Significant	Significant
owqi	×	×	×	×	×	×
nontaro	Significant	Significant	×	Significant	Significant	Significant
nontarm	Significant	Significant	×	Significant	Significant	×
nontara	×	×	×	×	×	×
nontarr	Significant	Significant	Significant	Significant	Significant	Significant

- significant at 1%, 5% and 10% level.

Note: The skills, which range from 1960 to 1985, represent the base line skills or initial factor endowments and thus are assumed to be exogenous in our wage inequality equation (eq.3). Here, the openness and trade policy variables are the only ones which are instrumented for on FR trade shares and Disteq.

Table 3
Regression Results for Instrumental Variables

	Independent Variables												
Instruments	lcopen	lmpen1o	lmpen2o	Tars1o	Tars2o	Open80	Tariffs	Owti	Txtrdg	Owqi	Heritage	Skills99	Skills99(HYR)[a]
Logfrankrom	0.524	16.70	19.38	28.65	41.58	0.213	-1.025	-0.068	0.0037	-0.056	-0.363		
	(13.41)*	(7.85)*	(7.73)*	(7.53)*	(3.90)*	(2.97)*	(-0.90)	(-3.47)*	0.63	(-1.77)***	(-2.15)**		
TLEX												0.22	-0.0001
												(1.59)***	(-0.01)
PTR												-0.140	-0.012
												(-8.32)*	(-6.34)*
N	147	95	94	95	92	60	97	97	54	95	94	64	64
F	179.1*	61.5*	59.6*	56.7*	15.2*	8.80*	0.81	12.04*	0.40	3.13***	4.64*	51.8*	24.9
R^2	0.55	0.40	0.40	0.37	0.14	0.13	0.0084	0.11	0.0077	0.03	0.04	0.63	0.44

*, **and *** denote significance at 1%, 5% and 10% level.

[a] Higher Education

Table 4a
Interaction Terms for Openness Variables

	Dependent Variable: Theil Index											
Independent Varibles	Specifications for ($Skills_{99}$)						Specifications for ($HigherEducationSkills_{99}$)					
	1	2	3	4	5	6	1	2	3	4	5	6
Interaction(Lcopen × Skill99)	-0.0023											
	(-1.53)											
Interaction(Lcopen × Higher EducationSkill99)							-0.041					
							(-2.14)**					
Interaction(Impen1o × Skill99)		0.00002										
		(0.17)										
Interaction(Impen1o × Higher EducationSkill99)								-0.0007				
								(-0.40)				
Interaction(Impen2o × Skill99)			0.00003									
			(0.31)									
Interaction(Impen2o× Higher EducationSkill99)									-0.0004			
									(-0.23)			
Interaction(Tars1o× Skill99)				0.0006								
				(0.09)								
Interaction(Tars1o × Higher EducationSkill99)										-0.0005		
										(-0.56)		
Interaction(Tars2o × Skill99)					0.00002							
					(0.34)							
Interaction(Tars2o × Higher EducationSkill99)											-0.0001	
											(-0.17)	
Interaction(Open80 × Skill99)						0.001						
						(0.12)						
Interaction(Open80× Higher EducationSkill99)												-0.07
												(-0.42)
Skills65	-0.0009	-0.0092	-0.0088	-0.009	-0.0096	-0.0091	0.001	-0.0071	-0.007	-0.0006	-0.008	-0.006
	(-0.12)	(-1.21)	(-1.21)	(-1.17)	(-1.29)	(-1.19)	(0.23)	(-0.90)	(-0.92)	(-0.84)	(-1.04)	(-0.86)
N	38	38	38	38	38	38	38	38	38	38	38	38
F	2.01*	0.80	0.47	0.79	0.84	0.79	3.18**	0.87	0.02	0.92	0.80	0.90
R^2	0.10	0.04	0.04	0.04	0.04	0.04	0.15	0.04	0.04	0.04	0.04	0.04

*, **and *** denote significance at 1%, 5% and 10% level.

Table 4b
Interaction Terms for Trade Policy Variables

Independent Variables	Dependent Variable: Theil Index									
	Specifications for ($Skills_{99}$)					Specifications for ($HigherEducationSkills_{99}$)				
	1	2	3	4	5	1	2	3	4	5
Interaction(Tariffs × Skill99)	-0.0013 (-2.66)*									
Interaction(Tariffs × Higher EducationSkill99)						-0.017 (-2.87)*				
Interaction(Owti × Skill99)		-0.0619 (-2.65)*								
Interaction(Owti × Higher EducationSkill99)							-0.9076 (-2.89)*			
Interaction(Txtrdg × Skill99)			-0.306 (-1.66)***							
Interaction(Txtrdg× Higher EducationSkill99)								-5.105 (-2.24)**		
Interaction(Owqi× Skill99)				-0.006 (-2.76)*						
Interaction(Owqi × Higher EducationSkill99)									-0.952 (-2.96)*	
Interaction(Heritage × Skill99)					-0.004 (-2.70)*					
Interaction(Heritage × Higher EducationSkill99)										-0.056 (2.90)*
Skills65	0.0034 (0.007)	-0.0016 (-0.25)	-0.002 (-0.03)	-0.0001 (-0.02)	0.003 (0.44)	0.0037 (0.50)	-0.0001 (-0.02)	0.002 (0.29)	0.0011 (0.16)	0.0037 (0.49)
N	38	38	38	38	38	38	38	38	38	38
F	4.49*	4.46*	2.23**	4.76*	4.59*	5.10*	5.15*	3.40*	5.36*	5.16*
R^2	0.20	0.20	0.11	0.21	0.21	0.22	0.22	0.16	0.23	0.22

*, **and *** denote significance at 1%, 5% and 10% level.

APPENDIX 2

Table 6
Budget Allocated to Higher Education, 1990-94

EAST ASIA	%age of Overall Education Budget
Malaysia	17
Thailand	17
Indonesia	18
Korea, Rep.	8
Average (simple)	**15**
LATIN AMERICA	
Argentina	17
Brazil	26
Chile	20
Colombia	17
Costa Rica	31
Dominican Republic	11
Ecuador	23
Honduras	20
Mexico	14
Uruguay	25
Venezuela	35
Average (simple)	**22**

Source: UNDP (1997) citing BIRDSALL, Nancy, "Education: the People's Asset", CSED Working Paper No. 5, 1999

APPENDIX 3

Data and sources

Black: Black Market Premium, Year: 1985. Source: Rose (2002).

Disteq: Distance from Equator of capital city measured as abs (Latitude)/90. Source: Rodrik, Subramanian & Trebbi (2002)

Heritage: Heritage Foundation Index, Source: Rose (2002).

Skills60: Average Schooling Years in the total population at 25,Year: 1960. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills65: Average Schooling Years in the total population at 25,Year: 1965. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills70: Average Schooling Years in the total population at 25,Year: 1970. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills75: Average Schooling Years in the total population at 25,Year: 1975. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills80: Average Schooling Years in the total population at 25,Year: 1980. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills85: Average Schooling Years in the total population at 25,Year: 1985. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills90: Average Schooling Years in the total population at 25,Year: 1990. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills95: Average Schooling Years in the total population at 25,Year: 1995. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills99: Average Schooling Years in the total population at 25,Year: 1999. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Skills99hyr: Average Years of Higher Schooling in the Total Population at 25, Year: 1999. Source: Barro R & J. W. Lee data set, http://post.economics.harvard.edu/faculty/barro/data.html

Impen1o: Import Penetration: overall, 1985. Source: Rose (2002).

Impen1m: Import penetration: Manufacturing, 1985. Source: Rose (2002).

Impen1a: Import Penetration: Agriculture, 1985. Source: Rose (2002).

Impen1r: Import Penetration: Resources, 1985. Source: Rose (2002).

Impen2o: Import Penetration: overall, 1982. Source: Rose (2002).

Impen2m: Import penetration: Manufacturing, 1982. Source: Rose (2002).

Impen2a: Import Penetration: Agriculture, 1982. Source: Rose (2002).

Impen2r: Import Penetration: Resources, 1982. Source: Rose (2002).

Lcopen: Natural logarithm of openness. Openness is given by the ratio of (nomnal) imports plus exports to GDP (in nominal US dollars), Year: 1985. Source: Penn World Tables, Mark 6.

Logfrankrom: Natural logarithm of predicted trade shares computed following Frankel and Romer (1999) from a bilateral trade equation with 'pure geography' variables. Source: Frankel and Romer (1999).

Nontaro: Non- Taiff Barriers Coverage: Overall, 1987. Source: Rose (2002).

Nontarm: Non- Taiff Barriers Coverage: manufacturing, 1987. Source: Rose (2002).

Nontara: Non- Taiff Barriers Coverage: agriculture, 1987. Source: Rose (2002).

Nontarr: Non- Taiff Barriers Coverage: resources, 1987. Source: Rose (2002).

Open80: Sachs and Warners (1995) composite openness index. Source: Rose (2002).

Owqi: Non Trade barriers Frequency on intermediate inputs, Capital goods, 1985. Source: Rose (2002).

Owti: Tariffs on Intermediate and Capital Goods, 1985. Source: Rose (2002)

Ptr: Pupil Teacher Ratio, Primary, Year: 1999, Source: WDI (2002)

Tars1o: TARS Trade Penetration: overall, 1985. Source: Rose (2002).

Tars1m: TARS Trade Penetration: manufacturing, 1985. Source: Rose (2002).

Tars1a: TARS Trade Penetration: agriculture, 1985. Source: Rose (2002).

Tars1r: TARS Trade Penetration: resources, 1985. Source: Rose (2002).

Tars2o: TARS Trade Penetration: overall, 1982. Source: Rose (2002).

Tars2m: TARS Trade Penetration: manufacturing, 1982. Source: Rose (2002).

Tars2a: TARS Trade Penetration: agriculture, 1982. Rose (2002).

Tars2r: TARS Trade Penetration: resourses, 1982. Rose (2002).

Tariffs: Import Duties as %age imports, Year:1985. Source: World Development Indicators (WDI), 2002.

Theil97: UTIP-UNIDO Wage Inequality THEIL Measure - calculated based on UNIDO2001 by UTIP, Year: 1997. Source: University of Texas Inequality Project (UTIP) http://utip.gov.utexas.edu.

Tlex: Public Spending on Education, Total (as a percentage of GDP), Year: 1999, Source: WDI (2002)

Totgvo: Weighted Average of Total Import Charges: overall, 1985. Source: Rose (2002)

Totgvm: Weighted Average of Total Import Charges: manufacturing, 1985. Source: Rose (2002)

Totgva: Weighted Average of Total Import Charges: agriculture, 1985. Source: Rose (200**2)**

Totgvr: Weighted Average of Total Import Charges: resourses, 1985. Source: Rose (2002)

Txtrg: Trade taxes / trade, 1982. Source: rose (2002)

APPENDIX 4

List of Countries for Theil Index

Afghanistan (1988)
Algeria (1997)
Angola (1993)
Argentina (1996)
Bahamas, The (1990)
Bahrain (1992)
Bangladesh (1990)
Barbados (1997)
Belize (1992)
Benin (1981)
Bhutan (1989)
Bolivia (1997)
Botswana (1997)
Brazil (1994)
Burkina Faso (1981)
Burundi (1990)
Cameroon (1997)
Cape Verde (1993)
Central African Republic (1993)
Chile (1997)
China (1985) Colombia (1997)
Congo, Rep. (1988) Costa Rica (1997) Cote d'Ivoire (1997) Cuba (1988) Cyprus (1997)
Dominican Republic (1985)
Ecuador (1997)
Egypt (1997)
El Salvador (1997)
Equatorial Guinea (1990)
Eritrea (1988)
Ethiopia (1997)
Fiji (1997)
Gabon (1994)
Gambia, The (1981)
Ghana (1995)
Guatemala (1997)
Haiti (1988)
Honduras (1994)
Hong Kong, China (1997)
India (1997)
Indonesia (1997)
Iran, Islamic Rep (1993)
Iraq (1985)
Jamaica (1990)
Jordan (1997)
Kenya (1997)
Korea, Rep. (1997)
Kuwait (1997)
Lesotho (1994)
Liberia (1985)
Libya (1980)
Macao, China (1997)
Madagascar (1988)
Malawi (1997)
Malaysia (1997)
Mauritania (1978)
Mauritius (1997)
Mexico (1997)
Moldova (1994)
Mongolia (1994)
Morocco (1997)
Mozambique (1994)
Myanmar (1997)
Namibia (1994)
Nepal (1996)
Nicaragua (1985)
Nigeria (1994)
Oman (1997)
Pakistan (1996)
Panama (1997)
Papua New Guinea (1989)
Paraguay (1991)
Peru (1994)
Philippines (1997)
Puerto Rico (1997)
Qatar (1994)
Rwanda (1985)
Saudi Arabia (1989)
Senegal (1997)
Seychelles (1988)
Singapore (1997)
Somalia (1986)
South Africa (1997)
Sri Lanka (1994)
St. Vincent and the Grenadines (1994)
Sudan (1972)
Suriname (1993)
Swaziland ((1994)
Syria (1997)
Togo (1981)
Thailand (1994)
Tonga (1994)
Trinidad and Tobago (1994)
Tunisia (1997)
Turkey (1997)
Taiwan (1997)
Tanzania (1990)
Uganda(1988)
United Arab Emirates (1985)
Uruguay (1997)
Venezuela (1994)
Western Samoa (1972)
Yemen (1986)
Zambia (1994)
Zimbabwe (1997)