Trade and Income Distribution in Developing Countries

Carol Litwin

Working Papers in Economics no 9
October 1998
Department of Economics
Göteborg University

Abstract

This study examines the relationship between trade policy and income distribution on a cross-section of developing countries. The evidence suggests that the impact of openness on income distribution depends on the endowments of human capital. Basic education was found to be the key human capital variable determining export composition. Countries relatively well endowed with basic education tend to have higher shares of manufacturing exports and experience lower income inequality than countries with high shares of primary exports. These findings suggest that trade policies promoting manufactures should be based on expanding basic education to have the necessary poverty and inequality reducing effects.

Keywords; Trade, Income Distribution, Inequality, Human Capital
JEL-Codes: F10

Department of Economics
Göteborg University
Box 640
SE 405 30 Göteborg
Phone +46 31 773 1327
E-mail Carol.Litwin@economics.gu.se

1. Introduction

Numerous multi-country studies, using various measures of trade openness, report that relatively open economies experience substantially higher rates of per capita growth rates than closed economies (Balassa 1978; Krueger 1980; Heitger 1987; World Bank 1987; De Long and Summers 1991; Michaely et al. 1991; Dollar 1992; Roubini and Sala-i-Martin 1992; Sheehey, 1995). However, relatively little attention has been given to the effects on personal income distribution and the way human resource endowments interacts with the trade regime. This study attempts to examine the role of human resources in enhancing incomes through trade and provide insights into why trade liberalization has sometimes increased and sometimes decreased income inequality. Empirical evidence for developing countries makes clear that changes in poverty and income distribution depend on more than the rate of economic growth[1]. A high rate of growth is neither necessary nor sufficient for inequality or poverty to decline (Fields, 1984). But Fields (1989) reviews evidence of that poverty tends to decline with economic growth. In line with this evidence the findings in Deininger and Squire (1996), although unable to support a significant correlation between growth and inequality, suggest that growth was associated with an increase in the incomes of the poorest quintile.

This study explores the importance of endowments of resources, trade orientation and trade composition on personal income distribution. The hypothesis of this study is that changes in the sectoral composition of trade, which is one of the most prominent features of structural transformation, is an important determinant of income distribution. Throughout this study, the term "income distribution" refers to the dispersion of personal incomes. Moreover, income distribution and inequality will be used interchangeably.

[1] See for instance Ravallion (1995).

2. Theoretical Framework

2.1. Traditional Trade Theory

The Stolper-Samuelson theorem predicts that liberalizing the trade regime would increase demand for the abundant factor and reduce demand for the scarce factor as import-competing sectors contract. In the textbook Heckscher-Ohlin case where labor and capital are the two factors of production, trade liberalization reduces inequality since labor is assumed to be relatively abundant in developing countries. However, the Stolper-Samuelson theorem refers to the functional income distribution and it is not obvious that the effects of greater trade openness can be directly linked to the personal income distribution.

Capital

Traditional trade theory assumes that capital is a specific factor of production and is therefore a determinant of comparative advantage. However, capital is internationally mobile and can therefore not be a source of comparative advantage. However, infrastructure is not internationally mobile. One of the most obvious economic differences between developed and developing countries is the extent and quality of infrastructure. This gap in the availability of infrastructure constitutes a basic element of truth in the traditional Heckscher-Ohlin proposition giving developed countries, which are relatively well-endowed with capital, a comparative advantage in infrastructure-intensive goods, and developing countries, which are poorly endowed, a comparative disadvantage in infrastructure- intensive goods (Wood, 1994a).

Labor

Labor, on the other hand, is far less internationally mobile than capital and can therefore be a source of comparative advantage. However, labor is not a homogenous factor of production as postulated by traditional trade theory: As the quantity of labor is important so is the quality. Education makes labor more productive. Notwithstanding arguments about credentialism, screening and low quality, there can be no doubt that genuine human capital formation takes place in schools in developing countries. To describe human capital endowments embodied in labor a distinction has to be made between various levels of skills.

In the framework of the Stolper-Samuelsson theorem the effect of opening up a low-income country with a relative abundance of unskilled labor to trade reduces inequality. However, for middle-income countries the effects are less clear. Wood (1997) argues that recent trade liberalization amongst Latin American countries has increased wage differentials within the industrial sector. Before liberalization these countries produced a wide range of industrial goods which varied in the proportions in which they used human resources. Following liberalization those import-competing sectors which used unskilled labor most intensively contracted under competition from lower income exporters (mainly in Asia) and those import-competing sectors which used skilled labor most intensively contracted under competition from producers in the developed countries. The net effect of this could narrow or widen wage differentials, but Wood argues that the data for these Latin American countries is consistent with wage differentials widening, implying that the negative impact of trade liberalization on import-competing sectors was greater on those sectors which use unskilled labor most intensively than it was in those sectors which use skilled labor most intensively[2].

This study implicitly suggests that income differentials between sectors can be explained by skill differentials. Wood (1994a) argued that wage differences between sectors for a particular skill category are less likely to have an impact on the overall income distribution than wage differences across categories. This is because supply elasticities are likely to differ between the two dimensions and that mobility of labor tends to eliminate inter-sectoral differences. Moreover, trade-induced changes in relative wages are likely both to be smaller and to provoke less concern and resistance since few unions are cross-sectoral than that of changes between skilled and unskilled labor. In the following analysis income differentials across skill levels are assumed to be the source of income inequality and that these differentials are reflected in the sectoral wage differentials.

[2] World Bank, *World Development Report, 1995,* found evidence of widening wage differentials in Chile after trade liberalisation both between sectors and between skill levels. Similarly, although differentials initially fell, following trade liberalisation in Mexico subsequently they increased.

2.2. The Model

Following the neoclassical framework outlined by Bourguignon and Morrisson (1989, 1990) for a small open economy with n individuals, m factors of production and N sectors the income distribution $Y=(y_1, y_1,...y_n)$ is determined by the following set of equations:

$$(2.1) \qquad y_i = \sum_{j=i}^{m} \sigma_{ij} w_j, \qquad i = 1,2,...,n \quad j = 1,2,...,m$$

$$(2.2) \qquad \frac{\partial F_j^k}{\partial L_j^k} p^k = w_j \qquad k = 1,2,...,N$$

$$(2.3) \qquad E_j = \sum_{k=1}^{N} L_j^k$$

where the income of individual i y_i is determined by quantity of factor j owned by individual i, σ_{ij}, and the return to that factor, w_j. Assuming perfect competition in the factor and product markets, the return to factor j is determined by the domestic producer price p^k and by the marginal product of factor j in sector k. E_j represents the total endowment of factor j in the economy.

If all commodities are tradable the domestic producer price is determined by the exogenous world market price p* and the effect of trade distortion t^k:

$$(2.4) \qquad p^k = p^* \ (1 + t^k)$$

Using equations (2.2), (2.3) and (2.4) factor returns are determined by total factor endowments, foreign prices and the influence of the trade distortion:

$$(2.5) \qquad w_j = g_j(E_j; p^*; t)$$

A change in trade policy aiming at promoting exports or reducing imports affects income distribution through altering the structure of factor incomes. Thus, the relationship between foreign trade and personal incomes can now be described in the following way:

$$(2.6) \qquad \sum_j \sigma_{ij} w_j(E; p^*; t, \Omega) = y_i(E; p^*; t, \Omega)$$

where $\Omega=(\sigma_{ij}/E_j)$ is the matrix of individual shares of total factor endowments.

Thus, income distribution is assumed to be determined by (a) factor endowments (E), (b) the distribution of factor endowments (Ω), and (c) trade distortion (t). A change in the producer price p^k alters the quantity of factors used in sector k, and in a static framework, where the supply of factors are given, this generates a restructuring of factor allocation between sectors which in turn affects income distribution. In a dynamic context where endowments are allowed to vary, an increase in the supply of factor j, affects the returns to this factor and changes the output structure in the economy ultimately affecting the income distribution.

For the purpose of this study we assume two tradable sectors: a manufacturing and primary sector that differ in the intensity of infrastructure, natural resources and human capital in their production. Following Wood (1994a, 1994b) and Wood and Ridao-Cano (1996) labor is divided into three categories. The first category consists of workers with no (or almost no) education that are unemployable in the manufacturing sector. These workers, termed NOEDs, are thus assumed to be specific to the primary sector. The second and third categories include workers with basic education (BASEDs) and those with post-basic levels of education (PBs). BASEDs are employable in both the manufacturing and primary sector. In the primary sector workers with no education can increase their productivity, and thus their incomes, by investing in basic education. Once these workers have invested in basic education they can either stay in the primary sector or move to the manufacturing sector.

Assuming that the returns to post-basic education are lower in the primary sector than in the manufacturing sector there are low (or no) incentives to invest in post-basic education and remain in the primary sector. Therefore PBs are assumed to be specific to the manufacturing sector. Thus, while there is substitutability between NOEDs and BASEDs in primary production and between BASEDs and PBs in manufacturing production there are no substitution

possibilities between NOEDs and PBs in this framework. This can be explained by the unwillingness of PBs to perform tasks assigned to NOEDs and that NOEDs are unable to perform the tasks of PBs.

The key implication of these assumptions is that countries with high proportions of NOEDs in the working population will have a comparative advantage in primary products. Thus, as the proportions of BASEDs and PBs rise relative to the proportion of NOEDs in an economy we would expect the expansion of primary production to slow down or even cease so that manufactures production will rise relative to primary production as a proportion of total output and exports. We would expect small countries, where natural resources tend to be relatively scarce, to develop a manufacturing export at an earlier stage than resource-rich countries, where specialization in primary products persists to a much later stage of development. Syrquin (1988) points out that large countries have shifted away from the specialization in primary products through a trade policy of import-substitution. Leamer (1984) noted that countries scarce in land may become involved in manufacturing at much lower endowment levels of human capital than countries more abundant in land.

Thus, primary export production X_p can be described by the following function:

$$(2.7a) \qquad X^p = f(L^p_{NOED}, L^p_{BASED}, NR^p, I^P)$$

where L^p_{NOED} is the proportion of NOEDs in the economy and L^p_{BASED} is the proportion of BASEDS in the primary sector. NR^P denotes natural resources and I^P represents infrastructure used in primary sector production.

The fact that basic education increases the marginal product of labor in the primary sector is reflected by:

$$(2.7b) \qquad F^p_{NOED}(L^p_{NOED}) < F^p_{BASED}(L^p_{BASED})$$

The manufactures exports production X^m is determined by the following function:

$$(2.8a) \qquad X^m = f(L^m_{BASED}, L^m_{PB}, NR^m, I^m)$$

where L^m_{BASED} is the proportion of BASEDs in the manufacturing sector and L^m_{PB} is the proportion of PBs in the economy. NR^m and I^m represent natural resources and infrastructure, respectively, used by the manufacturing sector. Increased human capital endowments beyond basic education is reflected by an increase in the marginal product of labor so that:

$$(2.8b) \quad F^m_{BASED}(L^m_{BASED}) < F^m_{PB}(L^m_{PB})$$

The marginal product of BASEDs and the relative price between manufactures and primary products determines the incentives for BASEDs to move from the primary sector to the manufacturing sector. BASEDs will move to the manufacturing sector until

$$\frac{\partial f^m_{BASED}}{\partial L^m_{BASED}} p^m = \frac{\partial f^p_{BASED}}{\partial L^p_{BASED}} p^p$$

so that the returns to BASEDs will be equalized across sectors.

Total endowments in the economy are given by:

$$(2.9) \quad \bar{L} = L^p_{NOED} + L^p_{BASED} + L^m_{BASED} + L^m_{PB}$$

$$(2.10) \quad \bar{NR} = NR^p + NR^m$$

$$(2.11) \quad \bar{I} = I^p + I^m$$

so that all resources in the economy are fully utilized.

The distinction between manufactures and primary products boils down to the difference in the proportions in which these two goods use infrastructure, human capital and natural resources. Whilst manufactures and primary products both use infrastructure, natural resources and human capital in their production, manufactures use human capital more intensively than primary products.

In a static framework, where human capital endowments are fixed in the economy, any change affecting the relative producer price of manufactures to primary products affects the sectoral allocation of BASEDs by restructuring the composition of production and trade. Consider the case where the price of manufacturing products is reduced by appropriate trade policies (for instance import tariffs). This policy will have an impact on the specific factor in the sector from which protection is used, PBs, and the income of this factor will be reduced. Since the primary sector makes intensive use of the specific factor, NOEDs alongside BASEDs, it will increase its production, raising the return to NOEDs. The effect on the sectoral allocation of BASEDs will depend on the sectoral difference in the value of the return to this factor that arises as a result of the change of relative prices. It is not possible to determine *a priori* the effect on overall inequality. The effect will depend on the relative sizes of the different categories, their relative mean incomes, their relative income dispersions and the difference in income dispersions for BASEDs between the two sectors.

In a dynamic context accumulation of human capital endowments takes place in response to differentials in factor returns between skill categories. This response will lead to a change in the composition of output and exports towards manufactures. At higher endowment levels, when the proportion of PBs is rising countries will develop a comparative advantage in more advanced manufactures. The change in the educational composition of the labor force has an effect on income distribution. This was the basis of the Kuznets' hypothesis: the transfer of labor between sectors at different income levels initially raises income inequality as more people acquire higher incomes, but eventually lowers it as fewer low-income people remain; if the expanding sector has more inequality, the peaking of overall inequality is delayed. Therefore it is not possible to determine *a priori* the net effect on overall inequality of educational expansion[3]. If complete factor price equalization operated, i.e. in an economy where t^k is equal to zero, so that domestic producer prices are equal to world market prices, factor prices would be entirely exogenous. However, complete factor price equalization is a strong assumption that is difficult to sustain empirically (Leamer and Levinsohn, 1995)[4]. Dropping the assumption of complete factor price equalization allows for wage differentials between factors to change. An expansion of the

[3] Knight and Sabot (1983) measured the contributions of educational expansion in Tanzania and Kenya to urban wage inequality using two components; the effect of educational expansion on the educational composition of the labor force holding the educational structure of wages constant, and the resultant wage compression of that structure holding the composition constant. They found that the compression effect, which reduced inequality, outweighed the composition effect, which increased inequality, so that overall urban wage inequality was reduced as a result of educational expansion. Mohan and Sabot (1988) found similar effects for Colombia.

[4] Leamer (1993) found large disparities in wages between developed and developing countries.

proportion of BASEDs widens the income gap between BASEDs and PBs whereas it compresses the gap between BASEDs and NOEDs. This would also cause more concentration in the middle of the distribution. Similar, an expansion of the proportion of PBs compresses the wage gap both between PBs and BASEDs and between PBs and NOEDs but causes less concentration in the middle of the distribution. The effects of a change in the composition of the different educational categories on relative incomes would be expected to be more pronounced in closed economies because factor returns in open economies are subject to factor price convergence.

3. Empirical Evidence

The above theory makes empirical claims about both the sources of countries' comparative advantage and the effects of this on incomes. However, even if the theory provides an accurate account of the sources of comparative advantage and their impact on incomes these claims may not hold if factor market imperfections prevent them from being fully realized. The impacts on income distribution are examined on a cross-section sample of 56 developing countries in three different regions: Africa, Latin America and Asia.

3.1 Data and Methodological Issues

In the framework presented above changes in income distribution occur as a result of changes in commodity prices and by changes in the composition of human capital endowments. In the following empirical analysis the underlying hypothesis is that human capital endowments have both a direct and, through trade composition, an indirect impact on income distribution. Endowments of infrastructure and natural resources are assumed to have only an indirect effect on income distribution. The distribution of natural resources (land) is ignored since data on land ownership is hard to get. Although Bourguignon and Morrisson (1990) provided data reflecting the distribution of land for a number of countries but these did not cover a sufficient number of the same countries used in this study.

Deininger and Squire (1996) have compiled an extensive income distribution data on inequality including, in most cases, information on the distribution of income or consumption by quintiles.

Although this data allows for analysis on longitudinal relationships for a number of countries the time dimension for several developing countries, especially for African economies, were limited. Furthermore, Li et al. (1998) found that about 90% of the total variance in the Gini coefficients could be explained by variations between countries, while only a small percentage (0.85%) of the total variation was due to variation over time. Their findings suggest that overall inequality, as measured by the Gini coefficient, is determined by factors which differ between countries but tend to be relatively stable within countries. Another explanation for the lack of variation over time could also be due to that redistribution of income (or consumption) could be taking place without this being recorded by an overall inequality measure. For instance, increased income differentials between educational groups or between sectors may not necessarily be recorded by a change in the Gini coefficient

Cross-sectional studies have commonly been criticized on the basis that underlying structural factors may differ substantially across countries and that inferences based on cross-sectional studies are limited. However, Deininger and Squire (1996) point out that a mere focus on income distribution that neglects cross-country differences may lead to flawed conclusions since changes recorded by the Gini coefficient over time tend to be relatively modest. Syrquin (1988) noted that although the cross-section approach was originally intended as a response to the limited availability of data in developing countries comparisons of economic structure across countries are now regarded as useful in their own right. Our study is concerned with analyzing the effect of human capital formation and since these factor endowments change slowly over time it seems more reasonable to analyze the effects on income distribution based on a cross-section of countries.

Following the analysis in Deininger and Squire (1996) we add 6.6 points to the Gini coefficients estimated using expenditure data to bring them into line with the majority estimated from income data. All the observations used satisfy the three criteria proposed by Fields (1989): (a) the Gini coefficient are based on household surveys, (b) the surveys have national coverage, and (c) include all sources of income or expenditure. The last requirement is important for our empirical analysis because we want to examine the entire distribution of income and not just the wage component.

The human capital variables refer to the population over 15; data are from Barro and Lee (1993). We have no absolute grounds for dividing BASEDs from NOEDs and choose here to interpret it

as the percentage of the population who have completed primary education. Thus, NOEDs include those with no education and those who have attained some primary education but not completed a primary education degree. PBs are defined as the percentage of the population which have attained education beyond secondary education.

Following Wood (1994b), it is assumed that natural resource endowments relate to the land size of each country. This variable is measured by the land/population ratio calculated from World Development Reports. Although this may not be an ideal measure of natural resources in terms of soil fertility, water resources, minerals etc. Wood (1994a) finds evidence that this measure is highly significant in determining trade patterns.

The infrastructure data, as measured by the ratio (total kilometers of road/population), is taken from the World Infrastructure Data (Canning,1998).

Underlying the Kuznets proposition, i.e. that inequality increases in the early stages of development with a reversal of this tendency in later stages, is the assumption that the distribution is more egalitarian in the rural than in the urban areas. In line with this assumption we control for the degree of urbanization, measured by the percentage of the population residing in urban areas. The data is taken from World Development Reports.

In the tradition of the Kuznets' hypothesis, GDP per capita and its square has been introduced as additional regressors. The data, as measured by the PPP adjusted GDP per capita, is taken from Penn World Tables (Heston and Summers, 1991).

Even though the definition of openness is theoretically simple, there is controversy about how to empirically measure it properly. No measure is perfect because the true rate of protection reflects a complicated combination of trade policy tools including a large range of administrative barriers. In the literature, two types of measures of openness have been used: incidence and outcome-based measures[5]. Incidence-based measures are direct indicators of trade policy, such as the level or dispersion of tariffs. Although these measures are about the closest one can get to inferring the trade policy of a country they still have two shortcomings: first, they do not account for non-tariff barriers (NTBs); and second, consistent data on tariffs are not available for many

[5] Pritchett (1996) and Edwards (1997) discuss the variuos measures and offer a cautionary note about their usage.

countries. Lee and Swagel (1997) noted that NTBs have become increasingly important as tariff levels have fallen and remained bound by General Agreement on Tariffs and Trade (GATT) strictures. Outcome-based measures, which may have little to do with the distortion of trade[6], are more commonly used because they cover all the sources of distortion and are based on data that are more readily available. For the purpose of this paper we use the most common measure of trade openness as measured by the (exports+imports)/GDP share. The data is taken from Penn World Tables. In sub-section 3.3 we distinguish between open and closed economies using the Sachs and Warner measure[7].

The outcome measure, (export+imports)/GDP, tends to suffer from endogeneity problems. The trade shares reflect many factor besides the trade regime including the size of country and policies in other countries (De Long and Summers, 1991; Sheehey, 1995). GDP growth may cause an increase in the output share of exports rather than the other way round, and such an increase is more likely to happen in small countries than in large countries (Gundlach, 1997). The principal determinant of the share of trade in income across countries is the size of the economy (Syrquin, 1988). Small countries have relatively high trade shares and small domestic markets. Therefore, the production structure in geographically small countries tends to be more specialized than in large countries. Large countries have been more prone to adopt inward-oriented trade policies so these countries have shifted away from specialization in primary production through import-substitution. Splimbergo et al. (1997) develop an index of trade openness that is based on deviations of actual trade from predicted using structural variables based on factor endowments. However, since these variables change only little over time they are supposedly correlated with the error term in the income inequality function and thus the endogeneity problem would persist. In this study we test for the existence of endogeneity where openness is specified as a function of factor endowments and the size of the economy. The test results, presented in appendix B, report that endogeneity with respect to openness can be rejected.

The data on trade composition are from UNCTAD using the conventional division between primary (SITC 0-4) and manufactured exports (SITC 5-8 minus 68). Thus, primary exports exclude minerals, ores and fuels.

[6] In fact, a country could be simultaneously more open but more distorted than another country with completely liberal trade policies.

The correlation statistics, reported in table A3, show that there are some quite strong multi-collinearities, for example between GDP per capita and the human capital variables, human capital and urbanization, and also between natural resources and infrastructure. The latter presumably because geographically large countries, with more km^2 of land area, tend to have more km of roads. The rather high correlation between human capital and urbanization is likely to reflect a concentration of education around urban areas.

Table 3.1 presents the list of independent variables used in the empirical specifications. Table A1 in appendix A list the countries included in the sample.

Table 3.1: Variables

Variable	Definition
GDPPC	GDP per capita
$GDPC^2$	GDP per capita squared
S	Average years of schooling/population above the age of 15
HK1	BASEDs/NOEDs
HK2	PBs/NOEDs
URB	Percentage of the population residing in urban areas
LW	Km^2 land/population above 15 years of age
INFRSTR	Km roads/population above 15 years of age
OPEN	Trade openness: (exports+imports)/GDP
X^m/X^p	Manufacturing exports/Agricultural primary exports
min	Mineral, ores and oil exports/GDP
sw	Sachs and Warner trade index=1 if the country is open =0 else
LA	Regional dummy variable =1 for Latin American countries =0 else
AFRICA	Regional dummy variable =1 for African countries =0 else

[7] Sachs and Warner (1995) constructed a binary trade openness measure based on the level of tariffs and quotas, the existence of marketing boards and black market premiums for a number of countries.

3.2 Evidence on Endowments, Income distribution and Openness

In this sub-section equation 2.6 is estimated under the hypothesis that international trade and factor endowments enter into the determination of factor prices. The specifications estimated include intercept dummy variables to account for regional differences. These specifications where tested against both the specifications where all coefficients were allowed to vary and against a specification without the intercept dummies.

Several authors have already pointed out that the Kuznets-curve estimates are seldom significant when the sample is restricted to developing countries and that these estimates are sensitive to the specification of the model (Ram, 1988; Bourguignon and Morrisson, 1989; Fields and Jacubson, 1994). The results of table 3.2 shows that there is no systematic relationship, as postulated by the Kuznets' hypothesis, between GDP per capita and Income distribution (see figure C1 in appendix C). Both the signs and the significance levels of the coefficients are robust to the inclusion of additional variables (regression (2)). However, the signs are not robust to the different specifications (regression (4)) whereas the signs of all other coefficients are robust to the exclusion of GDP per capita and its square. Moreover, the explanatory power of the model does not change significantly when GDP per capita and the square are excluded suggesting that GDP per capita levels have little to do with income distribution. Thus, the presence of rather high correlations between the human capital variables and GDP per capita does not appear to affect the results (see table A3 in appendix A for correlation statistics).

The coefficient on HK1 is negative and significant; an increase in the ratio BASEDs / NOEDs, given the PB/NOED ratio (and consequently the PB/BASED ratio decreases), improves income distribution. The coefficient on HK2 is positive but not statistically significant. Thus, an expansion of the proportion of BASEDs improves income distribution whereas an expansion of the proportion of PBs does not significantly affect overall income distribution. There are several explanations for the former result. First, the narrowing of the income gap between NOEDs and BASEDs has outweighed the widening of the gap between PBs and BASEDs so that overall inequality declines as a result of the expansion of BASEDs. Second, the composition effect has caused more people to be concentrated in the middle of the distribution. Third, the expansion of BASEDs has shifted the production away from primary activities into manufacturing, a sector within which income are more equally distributed than in primary production (due to a more

equal ownership of factors of production, and in particular due to the lesser importance of unequally distributed land).

On the other hand, the coefficient on urbanization is positive and statistically significant. This result points to the relevance of rural-urban differences in mean incomes and in the dispersion of incomes *ceteris paribus*. Exclusion of GDP per capita variables does not affect this result; both the significance level and the size of the coefficient are robust to the exclusion of GDP per capita.

The coefficient on infrastructure is positive and statistically significant. This is presumably due to concentrated infrastructure in and around urban areas which is reflected by a positive correlation between urbanization and the infrastructure variable (see table A3).

The impact of trade openness is positive and statistically significant. Trade openness affects the relative incomes of the three categories by altering both the relative prices of factor endowments and the relative demand for these factors. Including the intersection terms, HK1*OPEN and HK2*OPEN, (regression (3) and (4)) shows that increasing trade openness reduces the impact of HK1 on income distribution. Thus, increased trade openness tends to counteract the favorable impact of BASEDs on income distribution. This is because the effect of factor price convergence tends to be greater in more open economies than in closed economies so that factor prices, and therefore incomes, are less influenced by resource endowments within the economy. However, increased trade openness could increase the unfavorable impact of PBs but this effect is very small since the coefficients are close to and not significantly different from zero. An expansion of BASEDs reduces the unfavorable impact of openness on income distribution. At sufficiently high ratios of BASEDs to NOEDs inequality declines as a result of increased trade openness[8]. This is due the shift of export composition towards manufacturing where factors of production tend to be more equally distributed[9].

Finally, the regional dummy variables for Latin America and Africa (Asia is accounted for by the intercept) indicate that African economies tend to be the most unequal, followed by Latin American economies. This is likely to be due to the following two factors: (1) Land distribution

[8] The threshold level is 0.69: Panama, China, Hong Kong, Korea and Sri Lanka are above this threshold.

tends to be more equally distributed in Asian economies and, (2) Labor markets in Asian economies tend to be less subject to institutional regulation[10]

[9] In an unreported regression the coefficient on the intersection term WL*OPEN was positive suggesting that the more open a natural resource abundant country is the more concentrated will its structure of export be on primary products.

[10] Fields (1984) found that when government pay policy is allowed to set the pattern of wages for the rest of the economy inequality is worsened. Ahuja *et al*. (1997) suggest that the recent trend of increasing inequality in East Asia is due to that the rate of demand for skilled labor has outstripped the supply.

Table 3.2: Endowments, Inequality and Openness

Dependent variable: Gini							
Variable	(1) Coefficients	(2) Coefficients	(3) Coefficients	(4) Coefficients	Elasticities[1]	(5) Coefficients	Elasticities[1]
Constant	3.131*	1.380	3.142*	4.112*		3.551*	
	(2.474)	(1.123)	(12.920)	(2.522)		(9.259)	
GDPPC	0.209	0.410		-0.161			
	(0.645)	(1.363)		(-0.434)			
$GDPPC^2$	-0.014	-0.024		0.014			
	(-0.704)	(-1.248)		(0.571)			
HK1		-0.111*	-0.085*	0.268	-0.133	0.134	-0.117
		(-4.326)	(-3.178)	(1.247)		(0.749)	
HK2		0.020	0.029	0.007	0.032	0.066	0.036
		(0.824)	(1.190)	(0.558)		(0.525)	
URB		0.097*	0.096**	0.073**		0.097*	
		(2.030)	(1.918)	(1.676)		(2.236)	
LW		0.077	0.009	0.005		0.002	
		(0.467)	(0.498)	(0.394)		(0.118)	
INFRSTR		0.041**	0.050**	0.042**		0.042**	
		(1.768)	(1.977)	(1.831)		(1.769)	
OPEN		0.051**	0.057**	-0.065	0.038	-0.045	0.050
		(1.889)	(1.976)	(-0.930)		(-0.621)	
HK1*OPEN				-0.094**		-0.059	
				(-1.780)		(-1.315)	
HK2*OPEN				0.006		-0.007	
				(0.202)		(-0.231)	
LA		0.103*	0.101*	0.095*		0.090**	
		(2.410)	(2.163)	(2.045)		(1.991)	
AFRICA		0.187*	0.170*	0.187*		0.176*	
		(2.632)	(2.437)	(2.830)		(2.547)	
n	56	56	56	56		56	
R^2	0.010	0.544	0.519	0.583		0.566	
Adj.R^2	-0.027	0.442	0.437	0.467		0.470	

All variables are in logs except the regional dummy variables LA and AFRICA.
T-statistics, reported in parentheses, are corrected for heteroscedasticity.
* Indicates statistical significance at the 95% level
* * Indicates statistical significance at the 90% level
[1] Elasticities are evaluated at the mean.

3.3 Open versus Closed Economies

This sub-section analyzes the impact of human capital endowment on income distribution using the Sachs and Warner (1995) binary classification for trade openness. The underlying presumption is that variations in resource endowments have less effect on factor prices and income distribution in open economies than in closed economies.

The classification of open versus closed economies depends on five criteria chosen to cover major types of trade restriction; (a) black market premium as a proxy for foreign exchange rationing which reflects a form of import control, (b) socialist classification to cover countries which rely on central planning (as opposed to tariffs) to maintain a closed economy, (c) export controls which are symmetrical to import controls in their effects on closing an economy, (d) tariffs and, (e) non-tariff barriers (mainly quotas).

Since Lesotho, Sudan and Panama (included in our original sample) were not rated the sample is reduced to 24 closed economies and 29 open. 12 African countries are rated as closed (consequently 8 are open), 5 Latin American countries are rated as closed (13 open) and in Asia 7 are closed (and 8 open).

The results for closed and open economies are reported in table 3.3. The results show that the coefficient on GDP per capita is positive and significant for closed economies whereas the sign is reversed and the coefficient is not significant for open economies. Thus, closed economies with higher GDP per capita levels experiences higher income inequality than closed economies with lower GDP per capital levels.

The coefficients on HK1 were negative and statistically significant for both closed and open economies but the effect for open economies is smaller than the effect for closed economies. This is in line with the results of table 3.2 where increased openness tends to counteract the impact of BASEDs on income distribution. The effect of HK2 is only significant for closed economies when GDP per capita is included in the specification.

The coefficient on infrastructure is only significant for closed economies. As a developing country liberalizes the trade regime this impact declines because primary production tends to be relatively intense in its use of infrastructure. However, the results show that

endowments of natural resources are more important determinants of income distribution in open than in closed economies. This could be a result of economies that are abundant of natural resources, and tend to be more self-sufficient, experience higher income inequality because of concentrated ownership structures in primary production[11].

Another interesting result is that the effect of urbanization is statistically significant for closed economies whereas this coefficient is close to zero and not statistically significant for open economies. Thus, trade liberalization diminishes the unfavorable impact of urbanization on income inequality and points to trade liberalization acts to reduce rural-urban income differentials.

Table 3.3: Endowments and Inequality: Closed Economies versus Open Economies

	Open Economies		Closed Economies	
Variable	(1)	(2)	(3)	(4)
	Coefficients	Coefficients	Coefficients	Coefficients
Constant	4.450*	3.749*	-4.020**	2.473*
	(3.777)	(11.912)	(-1.760)	(7.793)
GDPPC	-0.236		1.588*	
	(-0.773)		(2.891)	
$GDPPC^2$	0.209		-0.095*	
	(1.074)		(-2.893)	
HK1	-0.090*	-0.070*	-0.095*	-0.089**
	(-2.507)	(-2.223)	(-2.328)	(-1.873)
HK2	0.030	0.034	-0.123*	-0.030
	(1.281)	(1.326)	(-2.150)	(-0.559)
URB	0.010	0.049	0.195*	0.235*
	(0.157)	(0.713)	(3.171)	(3.759)
LW	0.045*	0.029*	-0.051	-0.035
	(3.589)	(2.144)	(-1.278)	(-0.887)
INFRSTR	0.011	-0.003	0.064**	0.060**
	(0.308)	(-0.114)	(1.670)	(1.600)
LA	0.108**	0.100**	0.163	0.040
	(1.923)	(1.771)	(1.468)	(0.341)
AFRICA	0.133**	0.121	0.225*	0.173**
	(1.930)	(1.409)	(2.708)	(1.782)
n	29	29	24	24
R^2	0.605	0.482	0.754	0.664
Adj.R^2	0.418	0.310	0.596	0.517

All variables are in logs except the regional dummy variables LA and AFRICA.
T-statistics, reported in parentheses, are corrected for heteroscedasticity.
* indicates statistical significance at the 95% level
* * indicates statistical significance at the 90% level
[1] elasticities are evaluated at the means.

[11] Leamer (1984) noted that countries very abundant of land may never produce manufactures at all.

3.4 Inequality Decomposition

In this sub-section we analyze the determinants of inequality by income shares using a reduced sample of 50 countries to examine where the changes take place[12]. The first quintile is the share of national income that accrues to the poorest 20% of a country's population. The second quintile is the share of national income that accrues to the second poorest 20% and so forth.

The results for the Gini coefficient showed that an expansion of BASEDs relative to NOEDs decreases inequality whereas the effect of greater proportions of PBs to BASEDs was not significant. Trade openness increased inequality but the interaction terms of the ratio of BASEDs to NOEDs and trade openness showed that high levels of trade openness reduced the favorable impact of HK1 on income distribution whereas high ratios of BASEDs to NOEDs reduced the unfavorable impact of trade openness on inequality.

The results for the income shares are reported in table 3.4. The coefficient on GDPPC is negative but not significant indicating that the poorest 20% in countries with higher GDP per capita are unable to capture an increasing income share. It is the richest 20% that clearly gain from increased GDP per capita but at a diminishing rate. All other income groups either loose or are not significantly affected.

The results for the poorest 20% of the population indicate that their income share tend to increase as the proportion of BASEDs increase. However, this effect is only statistically significant when GDP per capita is included. This could be due to the rather high correlation between GDPPC and HK1.

For the second quintile the only significant slope coefficient is that of HK1, indicating that the income share of this quintile increases as the proportion of BASEDs increase. Similar effects are found for the third and fourth quintiles. It is the richest 20% of the population who loose relative to the other income groups as the proportion of BASEDs increase. All other income groups are effected positively from basic education. Moreover, the size of the impact diminishes with higher income groups: The poorest 40% gain substantially more

[12] Income shares by quintiles were missing for Cameroon, Central African Republic, Gambia, Malawi, Mali and Iran.

than quintiles 3 and 4. The coefficient on HK2 indicates that it is the richest 20% that gain by increasing the proportion of PBs. For all other income groups the sign was negative but statistically insignificant. The negative impact of trade openness on income distribution occurs since it is the richest 20% that gain from increasing trade whereas all other quintiles are negatively but not significantly affected.

The coefficients on URB indicate that none of the income groups are significantly affected by the degree of urbanization despite that earlier results showed that urbanization increased overall inequality. In line with the overall inequality results, decomposition by quintiles show the effect of natural resource endowments does not affect any of the income groups significantly.

The intercept dummies indicate that the poorest 40% (quintile 1 and 2) have a lower share of national income in Latin American than in African and Asian economies. The difference between African and Latin American countries increases when GDP per capita is excluded from the specification. The two middle income groups (quintiles 3 and 4) in African economies tend to have a smaller share of national income than their counterparts in Asian and Latin American economies. The richest 20% in African economies have the largest share of national income compared to Asian and Latin American economies.

Table 3.4: Decomposition by Income shares

Dependent variable	**Poorest 20%**		**Quintile 2**		**Quintile 3**		**Quintile 4**		**Richest 20%**	
Variables	(1) Coefficients	(2) Coefficients	(3) Coefficients	(4) Coefficients	(5) Coefficients	(6) Coefficients	(7) Coefficients	(8) Coefficients	(9) Coefficients	(10) Coefficients
Constant	2.546	-1.789*	1.634	-0.689	2.506	-0.439	1.667**	-0.267	-2.849*	-1.207*
	(0.890)	(-2.311)	(0.716)	(-0.968)	(1.612)	(-0.987)	(1.474)	(-1.069)	(-3.331)	(-5.490)
GDPPC	-0.955		-0.514		-0.668**		-0.439**		0.375**	
	(-1.365)		(-0.856)		(-1.661)		(-1.806)		(1.721)	
GDPPC2	0.046		0.025		0.036		0.024		-0.021	
	(1.108)		(0.722)		(1.477)		(1.565)		(-1.497)	
HK1	0.186*	0.100	0.183*	0.139*	0.148*	0.102*	0.102*	0.073*	-0.100*	-0.076*
	(2.569)	(1.216)	(3.341)	(2.054)	(3.911)	(2.199)	(4.232)	(2.579)	(-4.616)	(-3.022)
HK2	-0.038	-0.080	-0.018	-0.039	-0.023	-0.046	-0.025	-0.041	0.030**	0.043**
	(-0.515)	(-0.998)	(-0.302)	(-0.600)	(-0.538)	(-1.028)	(-0.959)	(-1.497)	(1.755)	(1.762)
URB	-0.031	-0.084	-0.143	-0.169	-0.097	-0.115	-0.055	0.066	0.059	0.067
	(-0.181)	(-0.517)	(-0.884)	(-1.134)	(-0.958)	(-1.193)	(-1.009)	(-1.200)	(1.271)	(1.427)
LW	0.027	0.033	0.011	-0.014	0.013	-0.012	-0.000	-0.001	0.003	0.004
	(0.758)	(0.780)	(0.394)	(-0.431)	(0.596)	(-0.474)	(-0.018)	(-0.051)	(0.252)	(0.286)
INFRSTR	-0.073	-0.085	-0.051	-0.057	-0.045	-0.053	0.025	-0.030	0.024	0.028
	(-1.347)	(-1.299)	(-1.173)	(-1.149)	(-1.365)	(-1.346)	(-1.115)	(-1.174)	(1.128)	(1.210)
OPEN	-0.086	-0.123	-0.042	-0.074	-0.021	-0.049	-0.015	-0.033	0.047*	0.052*
	(-1.093)	(-1.384)	(-0.650)	(-1.078)	(-0.434)	(-0.898)	(-0.484)	(-0.947)	(1.999)	(2.117)
LA	-0.463*	-0.469*	-0.251*	-0.255*	-0.161*	-0.163*	-0.092**	-0.094**	0.094*	0.096*
	(-3.110)	(-3.022)	(-2.338)	(2.323)	(-2.146)	(-2.108)	(-1.861)	(-1.820)	(2.069)	(2.025)
AFRICA	-0.401**	-0.350**	-0.262**	-0.235	-0.206**	-0.177	-0.140**	-0.121	0.128**	0.113**
	(-1.957)	(-1.728)	(-1.693)	(-1.473)	(-1.720)	(-1.525)	(-1.811)	(-1.604)	(1.796)	(1.711)
n	50	50	50	50	50	50	50	50	50	50
R^2	0.474	0.406	0.406	0.376	0.436	0.378	0.431	0.376	0.504	0.448
Adj.R^2	0.340	0.290	0.254	0.255	0.291	0.257	0.286	0.254	0.378	0.359

All variables are in logs except the regional dummy variables LA and AFRICA.
T-statistics, reported in parentheses, are corrected for heteroscedasticity.
* indicates statistical significance at the 95% level
* * indicates statistical significance at the 90% level

3.5 Evidence on Endowments, Income Distribution and Trade Composition

So far we have assumed that factor endowments directly affect income distribution. However, the hypothesis of this study is that it is the structure of the economy, or more specifically the composition of trade, that matters for income distribution. Primary production is more intensive in its use of natural resources and less intensive in its use of human resource endowments than manufacturing (Wood and Berge, 1994; Owens and Wood, 1995). Thus, opening up to trade in a country which is relatively well endowed with natural resources will shift the structure of output away from manufacturing towards primary production in which the country has a comparative advantage. In the theoretical framework presented in this paper a shift in structure of the economy caused by trade policy will affect income distribution by altering the relative returns to human capital endowments.

For the model to work empirically we need to show that human capital endowments explains *both* patterns of trade *and* inequality. In the following empirical analysis income distribution is estimated as a function of GDP per capita and its square, human capital endowments, the degree of urbanization, trade openness and trade composition using the generalized instrumental variable estimation (GIVE) technique. The instrumental variable for trade composition is estimated as a function of the variables determining comparative advantage; (a) human capital endowments as measured by the variables HK1 and HK2, (b) natural resource endowments and, (c) infrastructure. In addition, we have added the regional dummies to the instrumental function and excluded them from the inequality function. Underlying this specification is the assumption that the distribution of human capital has a direct effect on income distribution whereas the endowments of human capital have, through the composition of trade, an indirect influence. Since the natural resource and infrastructure variables do not reflect their distributions these impacts are only indirect.

The results of table 3.5 are in line with those reported by Wood (1994b), who used a larger sample of countries, including developed countries, where the ratio of a country's manufactured exports to its primary exports is determined by its natural and human capital endowments. The specification of human capital endowments in

regression (1) corresponds to the specification in Wood (1994b). The impact of human capital, as measured by average years of schooling, is positive and statistically significant, which supports the arguments outlined in section 2. The coefficients on LW and INFRSTR are negative and significant suggesting that primary export are relatively infrastructure and natural resource intensive in their production.

The specification of human resources used for regression (2) suggest that the proportion of BASEDs in the population is the key factor for determining trade patterns. The coefficient on HK2 is positive but statistically insignificant. We would expect that a more detailed trade composition measure distinguishing between advanced and less advanced manufactures would give a more significant result. However, that is beyond the scope of this study.

Table 3.5: Trade Composition and Factor Endowments

Dependent variable: Manufactures exports/Primary exports		
Variable	(1)	(2)
	Coefficients	Coefficients
Constant	-1.885*	1.218
	(-3.086)	(0.877)
S	1.641*	
	(2.574)	
HK1		0.827*
		(2.420)
HK2		0.082
		(0.471)
LW	-0.338*	-0.298**
	(-2.219)	(-1.806)
INFRSTR	-0.614*	-0.369*
	(-2.851)	(-1.988)
LA	-1.306*	-0.255*
	(3.006)	(-2.323)
AFRICA	-0.542	-0.235
	(-1.144)	(-1.473)
n	54	54
R^2	0.358	0.360
Adj.R^2	0.306	0.289

All variables are in logs except the regional dummy variables LA and AFRICA.
T-statistics, reported in parentheses, are corrected for heteroscedasticity.
* indicates statistical significance at the 95% level
* * indicates statistical significance at the 90% level
[1] elasticities are evaluated at the mean.

The results for the second stage of the GIVE procedure presented in table 3.6 are similar to the ordinary least square estimates reported in table 3.2 but includes the predicted value of trade composition from regression (2) in table 3.5. The GIVE

specification excludes the direct influence of infrastructure and natural resources since we assume that the inequality effects takes place through trade composition.

The coefficient on HK1 reflects the direct effect on income inequality. The indirect effect of –0.06 (for regression (1)) represents the effect of HK1 on income distribution that occurs as a result of increased shares of manufactured exports. The corresponding indirect effect for regression (2) is –0.07. Thus, comparative advantage based on the relative abundance of human capital is an important determinant of income inequality. The coefficient on trade composition is negative and statistically significant suggesting that countries with high shares of manufactures in their exports tend to have a more egalitarian income distribution than countries with high shares of primary exports.

Regression (3) and (4) includes the interaction term of trade openness and trade composition. The coefficients on the interaction term were negative but only significant when GDPPC and its square were excluded. The negative sign of the elasticity of trade composition indicates that greater openness reinforces the inequality reducing effect of increased manufactures to primary exports[13]. Moreover, the negative sign of the elasticity of openness implies that open economies with high shares of manufacturing to primary exports experience lower income inequality than closed economies[14]. Countries pursuing a trade policy which subsidizes manufactures exports, and thereby indirectly taxes agricultural exports, experience greater income inequality than a country exporting higher shares of agricultural products in line with their comparative advantage. Thus, a higher share of manufacturing exports reduces inequality only if the country has a comparative advantage in these products.

[13] The openness threshold level after which greater (X^m/X^p) reduces inequality is 39.1 (calculated for regression (4)). Algeria, Central African Republic, Rwanda, Sudan, Uganda, Mexico, Brazil, Colombia, Peru, Bangladesh, China, India, Iran, Nepal and Pakistan are below this level and would therefore experience increased inequality as a result of protection and thereby increasing manufactures to primary product exports.

[14] The (X^m/X^p) threshold level after which openness reduces inequality is 2.7 (calculated for regression (4)). The following countries have a trade ratio below this level and would therefore experience increased inequality as a result of increased trade openness: Cameroon, Central African Republic, Egypt, Gambia, Ghana, Kenya, Mali, Mauritius, Rwanda, Senegal, Sudan, Uganda, Zambia, Zimbabwe, Barbados, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Trinidad, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Peru, Malaysia, Nepal, Philippines and Sri Lanka.

Table 3.6: Inequality and Trade Composition

Dependent variable: Gini						
Variable	(1) Coefficients	(2) Coefficients	(3) Coefficients	Elasticities[1]	(4) Coefficients	Elasticities[1]
Constant	-0.894	2.629*	3.524		2.810*	
	(-0.521)	(9.232)	(1.034)		(9.013)	
GDPPC	0.837**		-0.188			
	(1.941)		(-0.223)			
GDPPC2	-0.049**		0.0131			
	(-1.872)		(0.239)			
HK1	-0.107*	-0.087*	-0.119*		-0.123*	
	(-3.242)	(-2.630)	(-3.719)		(-3.331)	
HK2	0.032	0.009	0.003		0.006	
	(1.405)	(0.369)	(0.111)		(0.261)	
URB	0.234*	0.259*	0.177*		0.166*	
	(3.537)	(3.481)	(2.106)		(2.322)	
OPEN	0.042*	0.040**	0.050	-0.011	0.076**	-0.007
	(1.963)	(1.875)	(1.212)		(1.754)	
$(X^m/X^p)^\wedge$	-0.069*	-0.086*	0.187	-0.030	0.257*	-0.029
	(-3.468)	(-3.572)	(0.866)		(2.043)	
OPEN*$(X^m/X^p)^\wedge$			-0.051		-0.069*	
			(-0.922)		(-2.150)	
n	54	54	54		54	

$(X^m/X^p)^\wedge$ is the predicted value of (X^m/X^p) from regression (2) in table 4.7.
All variables are in logs.
T-statistics, reported in parentheses, are corrected for heteroscedasticity.
* indicates statistical significance at the 95% level
* * indicates statistical significance at the 90% level
[1] elasticities are evaluated at the mean.

The results of table 3.6 are further analyzed by decomposing overall inequality by income shares for the second stage GIVE specification. These results are reported in table 3.7.

The results for the income shares show that the richest 20% of the population gain from a higher GDP per capita whereas all other income groups either loose or are not significantly affected. These results are quite similar to those of table 3.4. The coefficients on HK1 are statistically significant for all income groups and these results are robust to the exclusion of GDP per capita. The inequality reducing effect of HK1 from table 3.6 is clearly a result of that richest 20% of the population loose while all other income groups gain from increasing proportions of BASEDs. The indirect effect of HK1 for the poorest 20% of the populations is 016, 0.09 for the second quintile, 0.58 for the third and 0.04 for the fourth quintile. For the richest 20% the corresponding indirect effect is –0.04. Thus, the third quintile gain the most from the indirect effects of basic education. The coefficient on HK2 is positive for the richest 20% but only statistically significant when GDP per capita is excluded. Other income

groups are not significantly affected by higher proportions of PBs to NOEDs. Again, this could be due to the rather high correlation between the human capital variables and GDPPC. When the indirect effects of trade composition are accounted for the coefficients of HK2 for the richest 20% of the population become smaller and the significance level drops.

Table 3.6 reported that the coefficient on URB was positive and significant indicating that countries with high degrees of urbanization experience greater income inequality. Contrary to the results for income shares reported in table 3.4, all the coefficients on URB were statistically significant when the specification included the instrumental variable for trade composition. Thus, given the structure of trade rural-urban migration significantly lowers the income share of the poorest quintiles in descending order. It is only the richest 20% that gain from rural-urban migration whereas they loose from an increase in the manufactures export share.

The previous results reported that trade openness worsens income distribution. This is because the richest 20% gain while the other quintiles either loose or are not significantly affected. The effect of trade composition shows that inequality is reduced because the poorest 20% of the population gain more than the middle income groups while the richest 20% loose. This effect suggests that countries with high shares of manufactures to primary product exports have lower income inequality because manufactures are relatively intensive in their use of BASEDs which benefits the lower and middle income groups.

Table 3.7: Decomposition by Income shares: GIVE

Dependent variable	Poorest 20%		Quintile 2		Quintile 3		Quintile 4		Richest 20%	
Variables	(1) Coefficients	(2) Coefficients	(3) Coefficients	(4) Coefficients	(5) Coefficients	(6) Coefficients	(7) Coefficients	(8) Coefficients	(9) Coefficients	(10) Coefficients
Constant	8.104*	-1.284**	4.474	-0.325	4.277**	-0.213	2.810*	-0.074	-4.175*	-1.431*
	(1.645)	(-1.764)	(1.221)	(-0.485)	(1.688)	(-0.516)	(1.984)	(-0.317)	(-3.194)	(-6.523)
GDPPC	-1.993		-1.024		-0.978		-0.635**		0.610**	
	(-1.553)		(-1.053)		(-1.472)		(-1.736)		(1.805)	
$GDPPC^2$	0.102		0.053		0.053		0.035**		-0.034**	
	(1.381)		(0.960)		(1.380)		(1.636)		(-1.719)	
HK1	0.162*	0.097**	0.164*	0.132*	0.132*	0.105*	0.092*	0.076*	-0.092*	-0.077*
	(2.072)	(1.666)	(2.903)	(1.962)	(3.414)	(2.286)	(3.763)	(2.647)	(-3.832)	(-2.863)
HK2	-0.068	-0.060	-0.047	-0.017	-0.028	-0.027	-0.010	-0.024	0.004	0.027**
	(-1.003)	(-0.849)	(-0.964)	(-0.282)	(-0.780)	(-0.723)	(-0.387)	(-1.073)	(1.630)	(1.821)
URB	-0.414*	-0.444*	-0.387*	-0.401*	-0.266*	-0.276*	-0.170*	-0.176*	0.177*	0.181*
	(-2.230)	(-3.062)	(-2.547)	(-3.185)	(-2.712)	(-3.439)	(-3.092)	(-3.710)	(3.434)	(4.060)
OPEN	-0.018	-0.025**	-0.017	-0.002	0.017	0.007	0.015	0.011	0.080*	0.085*
	(1.207)	(-1.725)	(0.262)	(0.320)	(0.356)	(0.154)	(0.451)	(0.359)	(2.276)	(3.001)
Xm/Xp^	0.189*	0.088**	0.107*	0.056**	0.707*	0.280**	0.044*	0.018**	-0.046*	-0.023**
	(3.330)	(1.649)	(2.567)	(1.865)	(2.544)	(1.664)	(2.448)	(1.810)	(-2.800)	(-1.624)
n	48	48	48	48	48	48	48	48	48	48

All variables are in logs.

T-statistics, reported in parentheses, are corrected for heteroscedasticity.

* indicates statistical significance at the 95% level

* * indicates statistical significance at the 90% level

4. Concluding Remarks

The objective of this study has been to examine the impact of greater trade openness and composition of trade on income distribution. The approach is based on that factor endowments, by determining comparative advantage, have implications for the impact of trade liberalization on income inequality. The focus is on the importance of human capital endowments and their distributions.

The main conclusion of this study is that trade openness in general worsens income distribution. This finding is in line with the findings by Savvides (1998). Edwards (1997), on the other hand, found no evidence linking trade openness to increases in inequality for developing countries.

The evidence presented is consistent with that income distribution in closed economies is more governed by human capital endowments than in open economies but that the effect of trade openness crucially depends on factor endowments and trade composition. Policies aiming at promoting a comparative advantage in manufactures need to include a widespread accumulation of basic education. This will in turn reduce income inequality both directly, by enhancing incomes of the low-income groups, and indirectly through a change in export composition towards manufactures. Open economies with greater shares of manufactures to primary exports experienced lower income inequality than open economies with a smaller ratio of manufactures to primary exports. This is clearly a result of the fact that a comparative advantage in manufactures requires a basic educated labor force which in turn benefits the lower and middle income groups. Increased manufactures to primary exports in particular enhance the incomes of the three bottom quintiles whereas the richest 20% were adversely affected by an increase of the share of manufacturing exports.

The main policy conclusion is that a trade policy promoting manufactures must be accompanied by a widespread accumulation of basic education. Trade policies promoting manufactures based on other factors may not have the necessary poverty and inequality reducing effects.

References

Ahuja, V., Benu, B., Ferreira, F., and M. Walton, (1997), *Everyone's Miracle? Revisiting Poverty and Inequality in East Asia,* Directions in Development, World Bank, Washington D.C.

Balassa, B. (1978), Exports and Economic Growth: Further Evidence, *Journal of Development Economics*, 5 (2): 181-89.

Barro, R. and J-W. Lee, (1993), International Comparisons of Educational Attainment, *Journal of Monetary Economics*, 32 (3): 363-94.

Bourguignon, F. and C. Morrisson, (1989), *External Trade and Income Distribution*, OECD, Paris.

Bourguignon, F. and C. Morrisson, (1990), Income Distribution, Development and Foreign Trade: A Cross-Sectional Analysis, *European Economic Review*, 34 (6): 1113-1132.

Canning, D. (1998), A Database of Stocks of World Infrastructure: 1950-1995, (forthcomming) *World Bank Economic Review.*

Davidsson, R. and J. MacKinnon, (1989), Testing for Consistency using Artificial Regressions, *Econometric Theory*, 5: 363-384.

Deininger, K. and L. Squire, (1996), A New Data Set Measuring Income Inequality*, World Bank Economic Review*, 10 (2): 565-591.

De Long J.B. and L. H. Summers, (1991), Equipment Investment and Economic Growth, *Quarterly Journal of Economics,* 106 (2): 445-502.

Dollar, D. (1992), Outward-oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985, *Economic Development and Cultural Change*, 40 (3): 523-544.

Edwards, S., (1997), Trade Policy, Growth and Income Distribution, *American Economic Review*, 87 (2): 205-210.

Fields, G. (1984), Employment, Income Distribution and Economic growth in Seven Small Economies, *Economic Journal,* 94 (373): 74-83.

Fields, G. (1989), Changes in Poverty and Inequality in Developing Countries, *The World Bank Research Observer*, 4 (2): 167-185.

Fields, G. and G. Jakubson, (1994), *New Evidence on the Kuznets Curve*, Cornell University, Department of Economics, Ithaca, N.Y. Processed.

Gundlach, E. (1997), Openness and Economic Growth in Developing Countries, *Weltwirtschaftliches Archiv*, 133 (3): 479-496.

Heitger, (1987), Import protection and Export Performance – Their Impact on Economic Growth, *Weltwirtschaftliches Archiv*, 123 (2): 249-261.

Heston, A. and R. Summers, (1991), The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988, *Quarterly Journal of Economics*, 106(2):327-368..

Knight J. and R. Sabot, (1983), Educational Expansion and the Kuznets Effect, *American Economic Review*, 73 (5): 1132-1136.

Krueger, A. (1980), Trade policy as an Input to Development, *American Economic Review,* 70 (2): 288-292.

Leamer, E. (1984), Paths of Development in the 3 x n General Equilibrium Model, *UCLA Economics Department Working Paper, No. 351.*

Leamer, E. (1988), Measures of Openness, in Robert Baldwin (ed), *Trade Policy Issues and Empirical Analysis*, University of Chicago Cress, Chicago.

Leamer, E. (1993), Wage effects of a U.S.-Mexican Free Trade Agreement, in P. Garber (ed), *The Mexico-U.S. Free Trade Agreement*, MIT Press, Cambridge, MA.

Leamer, E. and J. Levinsohn, (1995), International Trade Theory: The Evidence, in Grossman G. and K. Rogoff (eds), *Hanbook of International Economics*, Vol.3, Elsevier Science B.V., Amsterdam.

Lee, J-W and P. Swagel, (1997) Trade Barriers and Trade Flows Across Countries and Industries, *Review of Economics and Statistics*, 79(3): 372-382

Li, H., Squire L. and H. Zou, (1998), Explaining International and Intertemporal Variations in Income Inequality, *Economic Journal*, 108 (446): 26-43.

Michaely, M., D. Papageorgoiu, and A. Choksi (eds), (1991), *Liberalizing Foreign Trade: Lessons of Experience in the Developing World*, Vol. 7: Cambridge, Mass. Basil Blackwell.

Mohan R. and R. Sabot, (1988), Educational Expansion and the Inequality of Pay: Colombia 1973-1978*, Oxford Bulletin of Economics and Statistics,* 50 (2): 175-182.

Owens,T. and A.Wood, (1997), Export-Oriented Industrialization through Primary Processing? *World-Development*, 25(9): 1453-70..

Pritchett, L. (1996), Measuring Outward Orientation in LDCs: Can it be Done? *Journal of Development Economics*, 49 (2): 307-335.

Ram R., (1988), Economic Development and Income Inequality: Further Evidence on the U-Curve Hypothesis, *World Development*, 16 (11): 1371-1376.

Ravallion, M., (1995), Growth and Poverty: Evidence for Developing Countries in the 1980s, *Economics Letters*, 48(3-4): 411-417.

Roubini and Sala-i-Martin, (1992), Financial Repression and Economic Growth, *Journal of Development Economics*, 39(1): 5-30.

Sachs, J. and A. Warner, (1995), Economic Reform and the Process of Global Integration, *Brookings Papers on Economic Activity,* 1: 1-95

Savvides A., (1998), Trade Policy and Income Inequality: New Evidence, (forthcoming) *Economic Letters*.

Sheehey, E. (1995), Trade Efficiency, and Growth in a Cross Section of Countries, *Weltwirtschaftliches Archiv*, 131 (4): 723-736.

Spilimbergo, A., Londoño, J. and M., Székely, (1997), Income Distribution, Factor Endowments, and Trade Openness, *Working Paper 356*, Inter-American Development Bank, Washington D.C.

Syrquin, M. (1988), Patterns of Structural Change, in Chenery and Srinivasan (eds), *Handbook of Development Economics,* Vol.1, North-Holland.

Wood, A. (1994a), *North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World*, Clarendon Press, Oxford.

Wood, A. (1994b), *Skill, Land and Trade: A Simple Analytical Framework,* Draft, Institute of Development Studies, University of Sussex.

Wood, A. (1997), Openness and Wage Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom', *World Bank Economic Review*, 11(1): 33-57.

Wood, A. and C. Ridao-Cano, (1996), Skill, Trade and International Inequality, *IDS Working Paper 47*, Institute of Development Studies, University of Sussex.

World Bank, (1987), *World Development Report 1987*, New York, Oxford University Press.

World Bank, (1995), Workers in an Integrating World, *World Development Report 1995,* New York, Oxford University Press.

Appendix A: Summary Statistics

Table A1: Developing Countries Included in the Sample

African Countries	**Latin American Countries**	**Asian Countries**
Algeria	Barbados	Bangladesh
Botswana	Costa Rica	China
Cameroon	Dom. Rep.	Hong Kong
Central African Republic	El Salvador	India
Egypt	Guatemala	Indonesia
Gambia	Honduras	Iran
Ghana	Jamaica	Jordan
Kenya	Mexico	Korea, R.
Lesotho	Nicaragua	Malaysia
Malawi	Panama	Nepal
Mali	Trinidad	Pakistan
Mauritius	Bolivia	Philippines
Niger	Brazil	Singapore
Rwanda	Chile	Sri Lanka
Senegal	Colombia	Taiwan
Sierra Leone	Ecuador	Thailand
South Africa	Guyana	
Sudan	Peru	
Tunisia	Venezuela	
Uganda		
Zambia		
Zimbabwe		

Table A2: Means and Standard Deviations

	All *(n=56)*		**Africa** *(n=22)*		**Latin America** *(n=19)*		**Asia** *(n=15)*	
Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Gini	48.840	9.274	52.042	10.480	51.739	4.897	40.473	6.305
Quintile 1[1]	0.055	0.023	0.057	0.025	0.040	0.013	0.072	0.019
Quintile 2[1]	0.093	0.026	0.090	0.081	0.081	0.015	0.113	0.018
Quintile 3[1]	0.139	0.025	0.139	0.031	0.128	0.018	0.153	0.017
Quintile 4[1]	0.207	0.018	0.202	0.018	0.206	0.021	0.215	0.011
Quintile 5[1]	0.506	0.081	0.512	0.091	0.545	0.058	0.447	0.060
S	4.357	2.081	2.860	1.478	5.268	1.431	5.398	2.300
NOED	74.470	16.098	85.609	11.257	69.300	10.957	64.680	18.431
BASED	20.792	13.409	13.064	10.157	23.032	10.000	29.293	15.649
PB	4.738	4.865	1.327	1.524	7.668	4.299	6.027	5.833
URB	45.318	22.941	31.077	13.398	60.605	15.858	46.840	28.924
LW	0.048	0.086	0.077	0.117	0.046	0.064	0.010	0.010
INFRSTR	4.225	5.768	3.391	2.223	7.207	8.907	1.672	1.068
GDPPC	3084	3318	1516	1643	3661	2382	4652	4995
OPEN	71.040	60.564	63.019	37.726	61.815	29.786	94.491	101.630
X_m/X_p[2]	3.324	5.647	2.527	4.242	1.545	2.222	6.641	8.541

[1] n=50: excludes Cameroon, Central African Republic, Gambia, Malawi, Mali and Iran.
[2] n=54: excludes Botswana and Lesotho.

Table A3: Correlation Statistics: Entire sample

	Gini	*S*	*HK1*	*HK2*	*GDPC*	*URB*	*LW*	*INFRSTR*	*OPEN*	X_m/X_p [1]
Gini	1.000	-0.025	-0.244	-0.068	-0.047	0.228	0.406	0.505	0.124	-0.051
S		1.000	0.892	0.799	0.807	0.599	-0.326	0.158	0.370	0.474
HK1			1.000	0.756	0.785	0.612	-0.352	-0.026	0.348	0.507
HK2				1.000	0.734	0.706	-0.193	0.048	0.174	0.383
GDPPC					1.000	0.675	-0.374	0.017	0.452	0.567
URB						1.000	0.010	0.238	0.330	0.403
LW							1.000	0.522	-0.393	-0.383
INFRSTR								1.000	0.016	-0.238
OPEN									1.000	0.332
X_m/X_p [1]										1.000

All variables are in logs.

[1] n=54: excludes Botswana and Lesotho.

Appendix B: Endogeneity test of Trade Openness

This appendix reports the results for the endogeneity test of OPEN. The test is a version of the Hausman test proposed by Davidsson and McKinnon (1989). The exercise is similar in spirit to Leamer (1988). Leamer used several endowments (capital, land, labor, oil and minerals) to compute the expected trade: he interprets the residuals from this regression as an index of trade intervention.

Trade openness is not only a function of factor endowments but also of the size of the economy. The Sachs and Warner binary measure of open and closed economies was included to reflect policies that may influence the size of trade. Mineral and oil exports is included to account for that countries well endowed with mineral and oil are likely to have a larger openness degree irrespective of trade policy than other countries.

The following specification of openness was estimated:

$$(1)\quad \ln open_i = \alpha + \beta_1 \ln GDP_i + \beta_2 \ln area_i + \beta_3 \ln pop_i + \beta_4 \ln capital_i + \beta_5 sw_i + \beta_6 \min_i + u_i$$

where $lnopen_i$ is the logarithm of (exports+imports)/GDP in country i. $lnGDP_i$ reflects the economic size of country i. $Lnarea_i$, $lnpop_i$ and $lncapital_i$ denote the logarithms of the size of country i in terms of square miles, the total population and kilometer roads, respectively. sw is the Sachs and Warner index as defined in table 4.1 and min is minerals, ores and fuel exports as defined by SITC 68 in UNCTAD trade statistics.

The carry out the endogeneity test of openness, the inequality function is estimated including the residuals from the openness regression as an additional regressor. Table B1 reports the results of the openness regression and table B2 reports the test results. If the OLS estimates of equation (1) are consistent, then the coefficient on the first stage residuals (RES) should not be significantly different from zero. The results show that the hypothesis of consistent estimates can be accepted given the choice of instruments used.

Table B1. Trade Openness and Factor Endowments

Dependent variable: OPEN	
Variable	Coefficients
Constant	4.418*
	(4.041)
GDP	0.172
	(1.217)
S	0.190
	(1.133)
area	-0.094*
	(-1.989)
pop	-0.323*
	(-1.967)
INFRSTR	-0.072
	(-0.814)
sw	0.000
	(0.033)
min	-0.000
	(-0.239)
n	54
R^2	0.627
Adj.R^2	0.551

* Indicates statistical significance at the 95% level.
T-statistics, reported in parenthesis, are corrected for heteroscedasticity.
All variables are in logs.

Table B2. Endogeneity Test

Dependent variable: Gini	
Variable	Coefficients
Constant	1.614
	(1.378)
GDPPC	0.357
	(1.217)
$GDPPC^2$	-0.020
	(-1.081)
HK1	-0.104*
	(-4.241)
HK2	0.020
	(0.893)
URB	0.116*
	(2.151)
LW	0.041
	(0.783)
INFRSTR	0.043
	(1.105)
OPEN	0.029**
	(1.752)
RES	-0.000
	(-0.528)
LA	0.075**
	(1.819)
AFRICA	0.158*
	(2.316)
n	54
R^2	0.557
Adj.R^2	0.441

All variables are in logs except the regional dummy variables LA and AFRICA.
T-statistics, reported in parenthesis, are corrected for heteroscedasticity
* Indicates statistical significance at the 95% level.
** Indicates statistical significance at the 90% level.

APPENDIX C
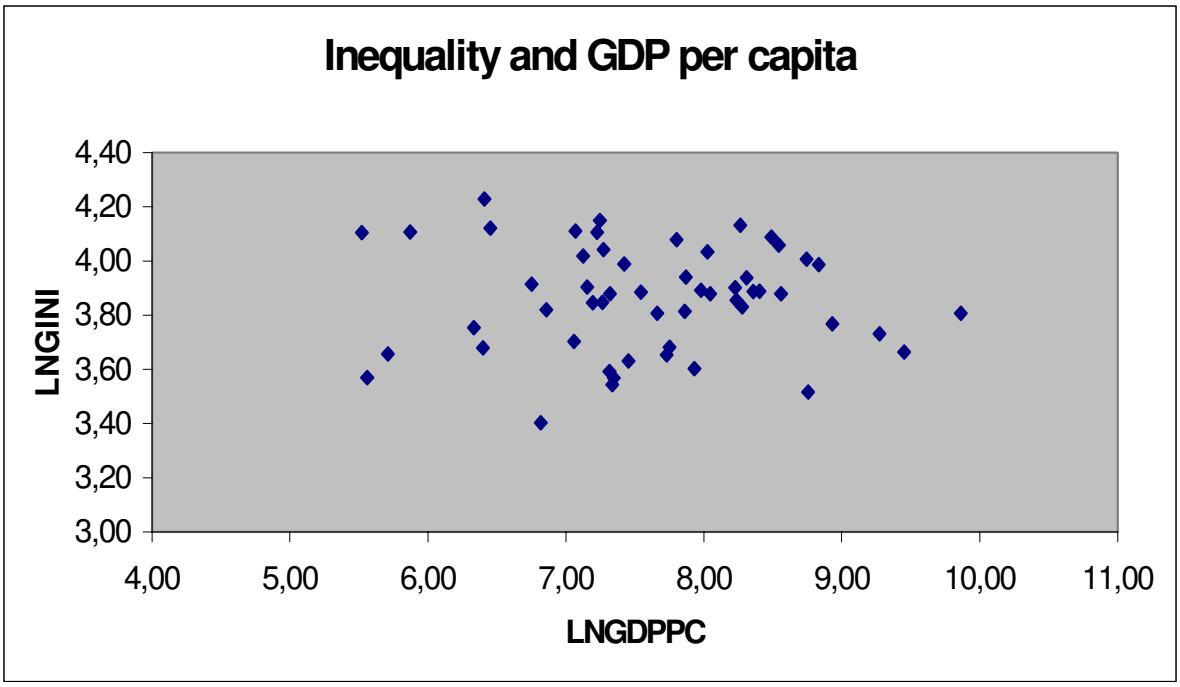
Figure C1