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26 April 2011

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April 2011

Abstract:

The paper analyses the relationship between the popular Barro and Lee (2001) 'Average years of Schooling' with income inequality, wage inequality, and income deciles and income percentiles for the sample of developed and developing countries. The results suggest that countries where students complete higher numbers of years of schooling on average also perform better on relative incomes meaning that increase in average income comes from improvements in the earning capacity of the lower income groups or unskilled labor. The paper also finds that an educated population means that there is redistribution of income from the rich to the poor creating thriving middle class.

Key words: Education, Inequality

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Introduction:

Education enhances the earnings potential of the poor, both in competing for jobs and earnings and as a source of growth and employment. The distribution of physical and human capital emerges from the theoretical and empirical literature as key to distributional consequences of growth, and a determinant of growth itself. Along with the processes of globalization, the comparative advantage of developed nations lie in high skill intensive goods and services as production of lower skill intensive goods and services is outsourced to developing nations. As the demand for skills is increasing at greater pace than its supply, so are the wages of high skilled and educated labor which in turn increases wage inequalities in developed and developing nations. Harrigan and Balaban (1999), show that relative factor supply is an important factor in determining the growing return to skills in the US during 1963-91. Acemoglu (2001) provides a good discussion on the role of human capital (education) in determining income and wage inequality in a number of OECD countries: 'Increased income inequality in OECD economies reflects greater wage inequality and higher skill premia and that the most likely cause of the rise in skill premia is technical change that has increased the demand for skills and education, though changes in labor market institutions, such as minimum wage laws and the importance of union bargaining, are also likely to have played some role. Although increasing the supply of skills may have some beneficial effects, the most useful policies to reduce inequality would be those that can close the gap of skills between the top and the bottom of the income distribution, such as policies to improve the quality of secondary schooling and to encourage on-the-job training'. (p. 0)

Given the current situation of increasing inequality in most developed societies, with globalisation as the most oft-cited culprit, policymakers have been very keen to demand further public funding for schooling. (Pereira and Martin 2000: 2) Similarly, education inequalities lead to wage inequality in developing countries, specifically Latin America. Coincidently Latin America has a *Gini* coefficient of 0.50 for the region as a whole, which is approximately 15 points above the average for the rest of the world. Londoño and Székely (1997) estimate that the low level of education of Latin American workers and the enormous inequality in educational assets account for most of the region's excessive inequality, larger than other contributing factors—lower physical capital accumulation, relative abundance of natural resources, and high concentration of land resources. In Latin America, only a relatively small proportion of the total population completed secondary or higher education. These relatively few skilled workers earn a substantial wage premium due to their limited supply. Thus, a poor distribution of education contributes to differentials in the returns to different levels of education, magnifying the effect of education gaps on income inequality.

Birdsall (1999) summarizes 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.' (11)

Table 1: *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 Africa	2	28	150
Developing Countries	14	41	370
	22	24	49

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

The unequal education policies have resulted in rising social inequalities. The literature suggests that in most developing countries skills are unevenly distributed. (Ravallion 2003) Thomas, Wang and Fan (2000) find that Gini coefficients 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 the Middle East and North Africa (MENA). The distribution of public resources on education is highly unequal, as shown in Table 1 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 overrepresented at all levels of education, particularly at the university level. Table 1 illustrates 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 seven per cent of the relevant population enroll in higher education.

Developing countries practice unequal education policies where emphasis on higher education leads to lower levels of schooling among the population. Low levels of average schooling means that education levels are low and illiteracy is higher. Once developing countries open up to international trade and due to low supply of educated and skilled labor, the rise in incomes due to processes of international competition would benefit the educated more than ones with low

levels of education. This suggests that countries where average years of schooling is high, they are immune to inequality.

2. Data, Methodology and 1st Stage Results:

The objective of the paper is to analyse the effects of schooling on relative incomes while taking into account trade among countries including developed and developing countries. The analysis includes average schooling years in the total population at 25 (*Sch*) from Barro and Lee (2001). As mentioned above, international trade is also a significant determinant of inequality. Thus international trade enters the regression model to enhance its explanatory power. The ratio of nominal imports plus exports to GDP (*Lcopen*) is the conventional openness indicator. Two other measures of openness are overall trade penetration (*tarshov*) derived from the World Bank's TARS system and overall import penetration (*Impnov*) respectively. Import tariffs as 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 (*Totimpov*) can all be considered as good proxies for trade restrictiveness and have also been employed in this study. Other measures that capture restrictions in overall trade are non-tariff barriers. Overall non-tariff coverage (*Ntarfov*) and non-tariff barriers on intermediate inputs and capital goods (*Owqi*) are used here as two proxies for non-tariff barriers. Sachs and Warner's (1995) openness index (O*pen80*) is utilised as a composite measure of trade policy.

The analysis employs GINI income inequality index (*Gini*) which is available from UNU/WIDER World Income Inequality Database (WIID). Before moving ahead with the analysis, it is important to highlight the vulnerabilities in the use of within country *Gini* and the limitations which are associated with its calculation. WIDER User Guide (2008) discusses the measurement problems in detail: 'There are no easy ways to use income/consumption distribution data. Unlike national accounts data which are in principle comparable across countries, there is no agreed basis of definition for the construction of distribution data. Sources and methods might vary, especially across but within countries. This may be the case even if the data comes from the same source. In their influential article on the use of secondary data in studies on income distribution, Atkinnson and Brandolini (2001) discuss quality and consistency in income distribution data both within and across countries. They show how both levels and trends in distributional data can be affected by data choices. In light of this, it is not easy task to construct a secondary database with distribution data. Regardless of different views, the collection of inequality observations is restricted to what in practice is available. In most industrialized countries inequality and poverty are assessed with reference to income, not consumption (Deaton and Zaid, 2002). This tradition is followed in much of Latin America. By contrast, most Asian and African surveys have always collected detailed consumption data. The fact that distribution data can be based on both income and consumption is the first step stone in the construction of comparable statistics. In WIID (reference to WIDER data base) we strived to collect observations with reference to both income and consumption, whenever possible.' (p.4)

Table 2
Summary Statistics

Variables	Code	Source	Obs	Std . Dev
Dependent				
GINI Coefficient in Percentage Points as calculated by WIDER, 1995	Gini	UNU/WIDER World Income Inequality Database (WIID) http://www.wider.unu.edu/wiid/wiid.htm	117	(35.00)
UTIP-UNIDO Wage Inequality THEIL Measure, 1999	Theil99	University of Texas Inequality Project (UTIP) http://utip.gov.utexas.edu	155	(0.099)
Lowest income decile, 1995	Low10	UNU/WIDER World Income Inequality Database (WIID) http://www.wider.unu.edu/wiid/wiid.htm	117	(1.05)
Fifth income percentile/ First income percentile , 1995	High20/ Low20	UNU/WIDER World Income Inequality Database (WIID) http://www.wider.unu.edu/wiid/wiid.htm	117	(2.28)
Third income percentile, 1995	Thrd20	UNU/WIDER World Income Inequality Database (WIID) http://www.wider.unu.edu/wiid/wiid.htm	117	(2.22)
Highest income decile, 1995	High10	UNU/WIDER World Income Inequality Database (WIID) http://www.wider.unu.edu/wiid/wiid.htm	117	(7.50)
Endogenous Independent				
Openness Variables				
(Exports +Imports)/GDP at current dollar prices, 1985	Lcopen	World Development Indicators	170	(0.589)
Import Penetration: overall, 1985	Impnov85	Pritchett (1996)	96	(21.08)
Import Penetration: overall, 1982	Impnov82	Pritchett (1996)	95	(23.85)
TARS trade penetration,: overall, 1985	Tars85	Pritchett (1996)	96	(36.91)
TARS trade penetration,: overall, 1982	Tars82	Pritchett (1996)	93	(83.10)
Trade Policy Variables				
Import duties as % imports,1985	Tariffs	World Development Indicators	99	(8.903)
Tariffs on international inputs and capital goods, 1985	Owti	Sachs and Warner (1995)	98	(0.165
Trade taxes/ trade, 1982	Txtrdg	Pritchett (1996)	54	(0.031)
Weighted average of total import charges, 1985	Totimpov85	Pritchett (1996) (Available for developing countries only)	76	(21.30)
Non trade barriers frequency on intermediate inputs, 1985	Owqi	Sachs and Warner (1995)	96	(0.24)
Non-tariff barriers Coverage: overall, 1987	Nontarr87	Pritchett (1996) (Available for developing countries only)	76	(36.305)
Sachs and Warner's composite openness index, 1980	Open80s	Edwards (1998)	61	(0.446)
Average years of Schooling, 1999	Sch99	Baro and Lee (2001)	109	(2.914)
Instruments				
Natural logarithm of predicted trade shares computed from a bilateral trade equation with 'pure geography' variables,	Lfrkrom	Frankel and Romer (1999)	163	(16.75)
Drop out rate, 1990s	Drop90	Barro and Lee (1996)	125	(0.802)
Number of school days	Schday	Barro and Lee (1996)	139	(23.43)
Distance from the equator of capital city measured as abs (Latitude)/90	Disteq	Acemoglu, Johnson and Robinson (AJR) (2001)	208	(16.65)

These are introductory lines of the user manual which have quite nicely summarized the problem faced with the collection of comparable data to construct within country GINI index across a set of countries. To address this critique of data problem faced with the measures of income distribution; in addition to GINI this chapter has employed other concepts of within country inequality. UTIP-UNIDO Theil measure (*Theil*) calculated by the University of Texas Inequality Project (UTIP) captures wage inequality between skilled and unskilled labor in manufacturing pay sector and available for both developed and developing countries. On the data methodological front 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, for nearly 40 years most countries around the world have measured manufacturing pay with reasonable accuracy as a matter of official routine. (Galbraith and Kum 2002) Like GINI, wage inequality is also rising for both developed and developing countries. Though Dollar and Kraay (2004) down play the negative fall out of rise in wage inequality by suggesting that manufacturing sector represents only a minority of population in developing countries and unskilled are a minority in developed countries, the point is not valid and labor market distortions in manufacturing sector cannot be ignored for such sector is a high growth oriented sector of the economy.

Another issue in the empirical debate on income inequality revolves around redistribution of resources. Redistribution is opposite to inequality. *Gini* and *Theil* are measures of inequality. In order to add direct measures of redistribution into the empirical exercise, this chapter employs income deciles and percentiles derived from UNU/WIDER World Income Inequality Database (WIID). Schooling will be good for redistribution of resources if they are positively related with the incomes of the bottom 10 per cent (*low10*) and negatively related with the income of the top 10 per cent (*high 10)*. Income groups are also divided into quintiles anticipating the effect of schooling to be negative for the ratio between the top 20 per cent and bottom 20 per cent (*high20/low*20) and positive for the middle-income groups (*Middle20*). Of special interest is how schooling relates to the incomes of the middle-class or the ones living in the bottom income share. Each country observation for all inequality measures come from the last year for which data is available and in most cases represent inequality in the mid-1990s. Our basic inequality and income share equations would look like:

Inequality or Income Share = f (Schooling, Integration, Geography) ..... *(1)*

Corresponding to equation 1, inequality model say based on *Gini* has 1 equation, whereas it corresponds to schooling with each integration combination. Then, the model specifications for *Theil*, *High20/Low20*, *Midlle20*, *Low10* and *High10* contain same classification of endogenous independent variables**.**

$$Gini_{1i} = \alpha_1 + \beta_1 Schooling_i + \chi_1 Trade_i + \delta_1 Geo_i + \varepsilon_{1i} \quad \text{.....(2)}$$

The variable $Gini_i$ is Gini inequality in a country i, $Schooling_i$ respectively measures for average years of schooling in 1999, whereas $Trade_i$ measures general openness or trade policy in the economy and ε_i is the random error term. Geo_i represents distance from the equator.

There are potential endogeneity problems between schooling and integration and between schooling and inequality itself. Therefore schooling, trade policy and openness proxies were first regressed on a set of instruments. Frankel and Romer (1999) (FR) makes up for the instrument for all the outcome and incidence measures of trade barriers utilized in this chapter. FR instrument uses trade/GDP shares constructed based on a gravity equation for bilateral trade flows. Dropout rates (*drop90*) and school days in a year (*Schday*) are used as educational instruments. Distance from the equator is the fifth instrument (proxy for geography

Following are the model specifications for first stage regressions based on IV:

$$Schooling_i = \sigma_1 + \varsigma_1 Drop90_i + \theta_1 Sch_i + \vartheta_1 FR_i + \tau_1 Disteq + \mathrm{E}_{1i} \qquad (3)$$

$$Trade_i = \sigma_2 + \varsigma_2 Drop90_i + \theta_2 Sch_i + \vartheta_2 FR_i + \tau_2 Disteq + \mathrm{E}_{2i} \qquad (4)$$

Drop90 is annual drop out rate and *Sch* is schooling day in a year. Both are instruments for average years of schooling. FR_i is instrument for trade. $Disteq_i$ is proxy for geography showing distance from the equator. At the second stage, the income share equations employ the predicted values of respective schooling and openness / trade policy variables.

Table 3. *Higher Order Relevance Tests*

(Instruments= Disteq, Lfrkrom, Drop80, Schday)	*Maximal 2SLS Bias*					
	Wage Inequality (Theil)	Income Inequality (Gini)	High20/ Low20	Middle20	Low10	High10
For Average Years of Schooling(Lcopen)	*0.0005*	*0.0004*	*0.00023*	*0.00025*	*0.0004*	*0.0005*
For Average Years of Schooling(Impnov85)	*0.0028*	*0.0045*	*0.0031*	*0.0027*	*0.0014*	*0.0021*
For Average Years of Schooling(Impnov82)	*0.0037*	*0.0071*	*0.0053*	*0.0069*	*0.0082*	*0.0055*
For Average Years of Schooling(Tarshov85)	*0.0027*	*0.0011*	*0.0016*	*0.0024*	*0.0021*	*0.0017*
For Average Years of Schooling(Tarshov82)	*0.1699*	*0.1822*	*0.1771*	*0.1331*	*0.1112*	*0.1511*
For Average Years of Schooling (Open80s)	*0.2078*	*0.2000*	*0.1452*	*0.2212*	*0.2014*	*0.1975*
For Average Years of Schooling(Tariffs)	*0.0037*	*0.0004*	*0.0031*	*0.0097*	*0.0045*	*0.0057*
For Average Years of Schooling(Owti)	*0.007*	*0.0009*	*0.0012*	*0.0032*	*0.0058*	*0.0066*
For Average Years of Schooling (Txtrdg)	*0.5023*	*0.5001*	*0.6002*	*0.5147*	*0.7666*	*0.4918*
For Average Years of Schooling(Totimpov85)	*0.0145*	*0.0111*	*0.0173*	*0.0201*	*0.0555*	*0.0117*
For Average Years of Schooling (Owqi)	*0.5023*	*0.5094*	*0.6738*	*0.5934*	*0.6203*	*0.5122*
For Average Years of Schooling(Ntarfov87)	*0.0023*	*0.0145*	*0.0112*	*0.0571*	*0.0045*	*0.0004*

When the number of instruments are moderate or large, higher order asymptotic tests needs to be carried out. Higher order asymptotic tests include (1) obtaining Craag and Donald (1993) critical values to reject 2SLS bias and (2) Anderson-Rubin test of joint significance of endogenous regressors for relevance of instruments; (3) Hansen or Sargan over identification test statistics for endogeneity; and (4) Baum, Schaffer and Stillman's recommended test for heteroskedasticity robust 1st stage estimates for reducing omitted variable bias. We carry all these tests but only provide 2SLS bias tests in table 3. For most of the cases, the instruments work well and values closer to 0 pass Craag and Donald (1993) critical values. We conclude that 2SLS bias is minimum (approximating 0) voting in favor of using instrumental analysis.

Table 4: *Average Years of Schooling*

Independent Variables	**Dependent Variables**					
	Wage Inequality (Theil)	Income Inequality (Gini)	High20/ Low20	Middle20	Low10	High10
Average Years of Schooling(Lcopen)	-0.02	-3.34	-1.07	0.58	0.17	-1.90
	(-4.37)***	(-5.70)***	(-2.75)***	(4.49)***	(2.89)***	(-4.03)***
Average Years of Schooling(Impnov85)	-0.02	-3.00	-0.79	0.48	0.16	-1.57
	(-3.73)***	(-4.65)***	(-1.80)*	(3.29)***	(2.14)**	(-3.06)***
Average Years of Schooling(Impnov82)	-0.03	-3.091	-0.85	0.50	0.15	-1.63
	(-3.79)***	(-4.95)***	(-1.99)**	(3.52)***	(2.11)**	(-3.30)***
Average Years of Schooling(Tarshov85)	-0.02	-3.00	-0.79	0.49	0.17	-1.60
	(-3.72)***	(-4.56)***	(-1.73)*	(3.24)***	(2.26)**	(-3.00)***
Average Years of Schooling(Tarshov82)	-0.02	-3.04	-0.86	0.51	0.17	-1.66
	(-3.85)***	(-4.83)***	(-1.96)*	(3.52)***	(2.28)**	(-3.28)***
Average Years of Schooling (Open80s)	-0.02	-3.13	-0.12	0.16	0.004	-0.56
	(-2.92)***	(-3.82)***	(-0.20)	(0.71)	(0.03)	(-0.69)
Average Years of Schooling(Tariffs)	-0.004	-4.34	-1.92	1.12	0.52	-3.56
	(-0.24)	(-2.13)**	(-1.02)	(1.43)	(1.19)	(-1.37)
Average Years of Schooling(Owti)	-0.02	-2.77	-0.27	0.33	0.15	-1.10
	(-3.17)***	(-3.13)***	(-0.38)	(1.36)	(1.43)	(-1.34)
Average Years of Schooling (Txtrdg)	-0.01	-7.46	-1.38	0.64	0.14	-2.18
	(-1.45)	(-1.63)*	(-1.89)*	(2.70)***	(1.26)	(-2.63)***
Average Years of Schooling(Totimpov85)	-0.02	-4.93	0.82	-0.12	-0.14	0.46
	(-2.05)**	(-2.47)**	(0.74)	(-0.38)	(-0.97)	(0.42)
Average Years of Schooling (Owqi)	-0.01	-1.52	0.34	0.07	-0.09	-0.26
	(-2.47)**	(-0.62)	(0.23)	(0.13)	(-0.35)	(-0.14)
Average Years of Schooling(Ntarfov87)	-0.04	-4.94	1.93	-0.51	-0.27	1.77
	(-1.02)	(-2.44)**	(0.90)	(-0.75)	(-1.15)	(0.77)

-***, **, * corresponds to 1%, 5% and 10% level of significance respectively.

- Control variables are in parentheses in the first column,

- Due to space constraints only the results for schooling is provided under its various specifications.

3. Second Stage Results:

The results in Table 4 show that average years of schooling (*Sch*) is negatively related with the *Gini,* and the relationship is significant at 1% level in most cases suggesting countries that have a more educated population are also the ones where distribution of income is relatively less unequal. The relationship between schooling and *Theil99* has also been highly significant and negative. The results suggest that countries with well educated population are better prepared to absorb the unequal effects of rise in technical change bias skill demand. Since technical

change in sectors like manufacturing have high potential to raise the productivity levels in favor of higher economic growth rates, countries would always promote such technical changes. Any negative effects they may exert on relative wages may then be avoided by raising the average levels of education through allocation of sufficient funds into the education sector. Investment in education through an increase average years of schooling have a strong redistributive power. The results can easily be substantiated by cross country comparisons between countries that differ in average years of schooling: In comparison to Latin America, the US has a highly educated population with average years of schooling at little more than 12 years and 99 per cent of the adult population literate. In the US, the per-capita income of the richest decile exceeds that of the second richest decile by 60 per cent only. In Latin America where *Gini* is also one of the highest among developing countries, the richest decile exceeds that of the second richest decile by 160 per cent.

4. Conclusions:

As discussed at the start of the paper, developing countries face education inequalities. These inequalities occur due to an emphasis on higher education to benefit from trade whereas primary and secondary education suffers. This is one of the reasons why average years of schooling for developing countries are lower than developed countries. The empirical evidence in the paper suggests that schooling has strong redistributive power as well as it can significantly improve the capacity of the lower income groups. In view of this finding, the developing countries can invest in higher levels of education to exploit social externalities which can generate and sustain technical progress amid globalization. However, social returns to education by raising overall education level may carry more deep rooted positive effects in the economy. Our results strongly support in favor of raising over all education levels in the society The education bias of trade liberalization can be exploited in favor of the poor in a country through investments in all levels of education. That is one way to make trade induced growth good for the poor.

For developed countries where wage inequality is rising, the findings vote in favor of more emphasis on primary and secondary education.

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