Measuring and Analysing Educational Inequality

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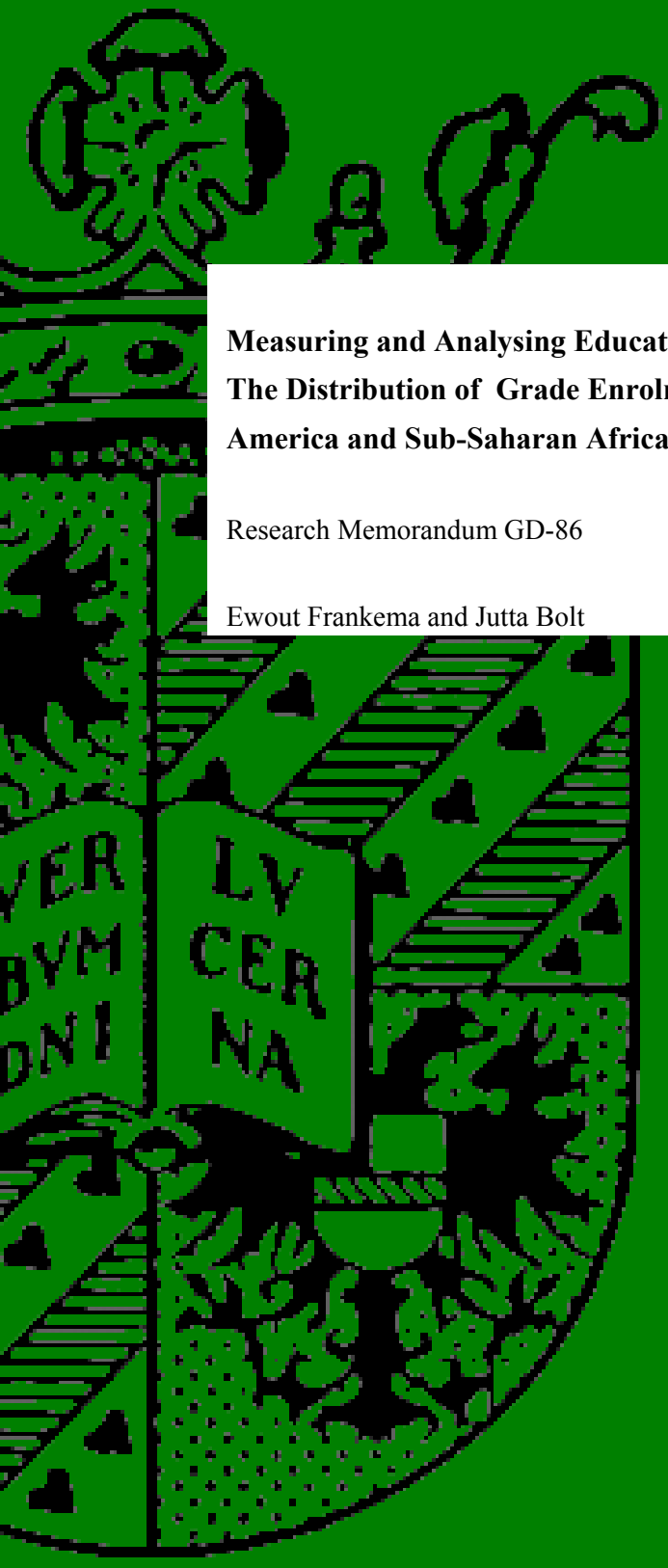

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RESEARCH MEMORANDUM

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Abstract:
Cross-country research on educational inequality presents contrasting views on the extent of educational inequality in Latin America and Sub-Saharan Africa. The differences in opinion also concern the relation between educational inequality and income inequality. This paper argues that part of the reported results are influenced by the type of inequality indicator applied. Moreover, there may be a separate effect of educational attainment and educational distribution on income inequality, which cannot be discerned properly by conventional indicators (in particular the Gini-coefficient faces this problem). A new indicator of educational distribution, which we coined the *grade enrolment ratio*, focuses at the distribution of students among consecutive grades in schooling, apart from average years of schooling (attainment). We find that the grade enrolment ratio outperforms the other indicators in explaining cross-country variation in income inequality and accurately assesses Latin American and Sub-Saharan African educational inequality.

JEL Classification Numbers: C43, D63, I20, I32, O11, O15
Keywords: Educational Inequality, Income Inequality, Latin America, Africa

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1 Introduction

Education plays a key role in the accumulation of human capital in the labour force.[1] In order to enhance social and economic development governments invest huge amounts of money in public education. However, the weak association between educational attainment and output per worker reported in cross-country comparisons poses a puzzle to the growth literature (Pritchett 2001, Easterly 2004). A similar puzzle arises in cross-country comparisons addressing the distribution of education Theory predicts a positive association between educational inequality and income inequality on the basis of plain economic logic: education develops fundamental physical and cognitive skills and those who possess these skills are able to command higher remunerations for their productive efforts. Furthermore, education enhances social and political mobility. Educated people are better prepared to speak up for their rights, to organize themselves and to bargain in the political process where a substantial share of national resources is (re)distributed. In other words, if education is distributed unequally, income will be distributed unequally.

Recent empirical studies have concluded that the relation between educational inequality and income inequality is rather weak (Lopez, Thomas and Wang 1998, Thomas, Wang and Fan 2001, Castello and Domenech 2002, World Bank 2004). Literature also arrives at contrasting views concerning the extent of educational inequality in various regions in the world. In particular the interpretation of the educational distribution in Sub Saharan Africa and Latin America evokes discussion.

This paper addresses the different indicators applied to measure and analyse educational inequality. Our aim is 1) to show that the interpretation of educational inequality to a large extent depends on the choice of the inequality indicator which explains part of the apparent ambiguity in literature and, 2) to present a new indicator, the grade enrolment ratio, that can tackle some of the inconveniencies of conventional indicators.

Part of the problem is that educational attainment levels and the shape of the educational distribution are likely to affect the income distribution via different causal channels, while some conventional inequality indicators, such as the Gini-coefficient and the secondary schooling share of total attainment, are what may be called "level-dependent". Our new grade enrolment ratio enables a more clear distinction between "attainment" and "distribution". In this paper we apply the grade enrolment ratio to primary schooling[2] in Latin America and Sub-Saharan Africa (Africa hereafter). We find that it explains more of the cross-country variation in income inequality than conventional indicators.

In section 2 we discuss the literature and the problems of estimating educational inequality. In section 3 we focus on conventional indicators in more detail and show that the "level-dependency" of distributional indicators is problematic. In section 4 we introduce the grade enrolment ratio as an alternative indicator of educational inequality and in section 5 we run several income inequality regressions to demonstrate its relative performance. Section 6 concludes.

[1] See a.o. Solow (1956), Romer (1986), Lucas (1988), Goldin and Katz (1998) and Galor and Moav (2004).
[2] In a follow-up paper we extend this analysis to secondary schooling.

2 Different indicators, different stories: the cases of Africa and Latin America

In a context of imperfect capital-markets and a weak commitment of governments to educational investments income inequality is likely to result in educational inequality. The lower income classes lack the means to get access to education and get trapped in poverty. Barriers to access lead to a suboptimal development of the human capital stock and suboptimal growth and also to path dependency in the distribution of income (Galor and Zeira 1993). No matter which way causality runs, theory seems to be clear: educational inequality and income inequality go hand in hand. However, the empirical underpinning of this positive relation in cross-country studies is weak. Castello and Domenech (2002, pp. 191-192) for example concluded that there is a "*surprisingly low correlation*" (0.27) between educational inequality and income inequality.[3]

One of the reasons for the low correlation may have to do with data limitations. The majority of recent cross-country studies on educational inequality use the educational stock data produced by Barro and Lee (BL hereafter)[4] which has been a significant improvement compared to previous datasets (Kaneko 1987 or Psacharapoulos and Arriagada 1986) in terms of coverage and distributional detail. An important shortcoming of these data is that they refer to the quantity of years of schooling and do not incorporate quality-adjustments. Although there is various research aimed to fill this gap, the coverage of this research in terms of countries and time periods has so far been limited (OECD 2000, De la Fuente and Domenech 2002).

Hanushek and Kimko (2000) show that adjusting for educational quality indeed improves the explanatory power of the human capital variable in a cross-country growth model substantially. However, the absence of "quality-data" cannot explain why studies based on "quantity-data" conclude differently on the extent of educational inequality in Latin America or Africa. And more practically: for the period 1950-2000 there is hardly any quality data available since there were no standardized surveys of broad spatial coverage which make cross-country comparisons possible. In other words, there are still good reasons to be concerned about the measurement and analysis of the quantity-distribution of education.

2.1 Africa: Attainment or distribution?

The extensive literature addressing the African growth problems stresses, amongst other things, that the suboptimal level of public investments in education hampers growth and a more equitable distribution of income (Fielding 2000)**.** The political economic context allows non-democratic elites to pursue "divide and rule" strategies inducing rent seeking behaviour in order to sustain the

[3] In cross-country growth literature it also appears problematic to establish a relation between human capital and growth (Pritchett 2001, Easterly 2004). Pritchett (2001) argues that the impact of educational attainment levels on growth depends on the country-specific institutional context. Moreover, he points out that in some countries the quality of schooling may be so poor that additional years of schooling hardly contribute to the accumulation of human capital.

[4] See a.o. Barro and Lee (1993) and (2001). The Barro and Lee dataset is the most extensive dataset on educational attainment. Most of the data Barro and Lee use are derived from the UNESCO Statistical Yearbooks, which give gross enrolment rates for a large sample of countries in the post-war period. By means of a perpetual inventory method enrolment rates are reconfigured into attainment levels of two samples of the working-age population; 15-64 and 25-64. In addition Barro and Lee have calculated the average years of schooling of seven separate categories of attainment: The seven categories are: 1) no schooling, 2) uncompleted primary schooling 3) completed primary schooling, 4) uncompleted secondary schooling, 5) completed secondary schooling, 6) uncompleted tertiary schooling and 7) completed tertiary schooling. De la Fuente and Domenech (2002) have started a project to revise these educational data to correct for inconsistencies in the Barro and Lee data. So far they have only considered a sample of OECD countries, which is still insufficient for estimating a cross-country regression.

distributive status quo. Many of the distributional conflicts over natural resources take place between urban and rural communities or involve ethnical divisions (Easterly and Levine 1997, Milanovic 2003). The ruling elites face little incentives to direct public resources to education, since education can function as an important vehicle for people to organise themselves and become politically involved. Underinvestment in public education may be part of an intentional strategy to repress political opposition (Bourguignon and Verdier 2000).

Studies investigating the development of education in Africa indeed report that attainment levels are comparatively low, even when controlled for GDP per capita. It is also reported that the extent of educational inequality in Africa is extraordinary high (Castello and Domenech 2002, Gregorio and Lee 1999). Sahn and Stifel (2004) further point out that the extent of educational inequality is significantly greater and that attainment levels are significantly lower in rural areas than in urban areas. Lloyd and Hewett (2004) find that African countries have the lowest primary completion rates of any region in the world. Regarding the levels of primary school completion[5] they argue that "*the poor are the least likely to send their children to school and their children, when enrolled, are most likely to perform poorly and drop out*". Lloyd and Hewett emphasize that there is a strong interdependence between income levels and educational performance: there is a reciprocal causal relation between educational inequality and income inequality.

Gregorio and Lee (1999) agree there is a negative relationship between educational attainment and educational inequality in Africa, but when they distinguish between attainment and distribution they find that attainment levels are much more important in explaining income inequality. Apparently the low levels of attainment in Africa influence income inequality mainly because of the barriers it poses to political and social reforms inhibiting the redistribution of income and resources. The impact of educational inequality on the distribution of direct income-generating capacities (i.e. human capital) only plays a modest role. The literature on Africa shows that, in order to assess the impact of educational inequality on income inequality properly, it is crucial to make a distinction between "attainment" and "distribution", since both factors probably have a different impact on the distribution of income.

2.2 Latin America: choosing the right indicator

The World Bank concludes in a recent report that "Latin American countries appear to have "too much" income inequality, given their levels of inequality in years of schooling […] However, before jumping to the conclusion that educational disparities are definitely not the reason for high income inequality in Latin America, it should be pointed out that the years of schooling is a very imperfect measure of the human capital stock embodied in a person"[6]. Yet, irrespective of the role of the quality of education other studies emphasise that the unequal distribution of education is one of the crucial forces behind high levels of Latin American income inequality (Birdsall et.al. 1997, see also the

[5] (percent completion rate of poorest 40%) / (percent completion rate of richest 20%). (pp. 1).

[6] World Bank (2004) *Inequality in Latin America. Breaking with History*?, Washington, D.C. pp. This part of the World Bank report is based on studies by Castello and Domenech (2002) and Thomas et.al. (2000). In an analysis of the distribution of student performances the authors find some tentative evidence that quality matters indeed more in Brazil compared to a sample of OECD countries, yet for Mexico this is not found. Other developing countries are not included. In this analysis Germany turns out to have relatively large gaps in student performances (World Bank 2004). Sahn and Younger (2004) further report that education inequality among young women has fallen rapidly in the 1980's and 1990's in six Latin American countries in spite of increasing levels of income inequality.

results in Nehru et.al. 1995). It appears that the choice of the indicator plays a crucial role in the assessment of educational inequality.

There are at least three widely applied types of educational inequality indicators in the literature. The indicators are: (1) The *Gini-coefficient* based on the attainment distribution of the labour force.[7] (2) The *Secondary schooling share* which simply states the percentage of the labour force that has attained and completed secondary schooling without having entered tertiary schooling. (3) The *Standard deviation* of the attainment distribution of the labour force.[8]

All the studies that we are aware of reporting a weak association between educational and income inequality in Latin America, employ Gini-coefficients based on BL data (World Bank 2004, Castello and Domenech 2002, Thomas et.al. 2000, Sahn and Younger 2004). In figure A.1 (appendix) we present a scatter plot of educational Gini's and income Gini's (a) and educational Gini's and average educational attainment levels (b) for the year 1990.[9] The scatter plots indeed reveal a moderate relation between educational inequality and income inequality ($R^2 = 0.59$). More important it reveals a suspiciously large correlation between attainment and distribution ($R^2 = -0.95$). On the basis of Gini-coefficients of educational distribution Thomas et.al. (2000) conclude that the majority of countries have managed to reduce educational inequality dramatically since the 1960's, but they might as well have concluded that the attainment levels have increased dramatically since the 1960's**.**

Birdsall et.al. (1997) argue that the access barriers to education have lead to a skewed distribution of education in Latin America. In their view underinvestment in education plays a crucial role in explaining slow growth and persistent income inequality in the region. Their analysis is based on the secondary schooling share of the labour force (see also Nehru et.al. 1995). The secondary schooling share is a very crude but simple indicator, referring to the idea that secondary schooling represents the rise of mass education at more advanced levels. The higher the percentage of the labour force having attained secondary schooling, the more equal education is distributed. Contrary to the Gini-coefficient the secondary schooling share points out that the extent of educational inequality in Latin America is comparatively high.[10]

In figure A.2 we show (using BL data) that scatter plots for the secondary schooling share and income inequality (a) and average attainment levels (b) respectively. The correlation between the secondary schooling share and income inequality is substantially higher ($R^2 = -0.73$) than in case of the educational Gini, but this indicator also appears to be strongly dependent on attainment levels ($R^2 = 0.88$).

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[7] An alternative measure is the Theil coefficient which produces almost exactly the same results on the cross-country variety of educational inequality. An example of the formula we applied in calculating the educational Theil is presented in the appendix. The results are shown in table 2.2.

[8] A close substitute of the standard deviation is the ratio between the top and the bottom quintile of the attainment distribution.

[9] Our Gini's are calculated on the basis of quintile shares and are comparable to the data in Castello and Domenech (2002) who use quintiles as well. Thomas et.al. (2001) use a septile distribution. As mentioned above, the Barro and Lee dataset classifies the working age population in seven categories of educational attainment which forms the basis of the percentage distribution required to construct the Lorenz curve and calculate the Gini. The year 1990 is chosen because it provides the largest sample of educational attainment data and comes close to the preferred benchmark year for income inequality data. The income inequality data are derived from the UNDP, World Income Inequality Database (WIID), covering the period 1985-1999. Ginis based on expenditure data are upgraded with 0.05 to correct for the general underestimation of expenditure Ginis compared to Ginis based on proper Gross or Net income data (Deininger and Squire 1996). The sample consists of 96 countries matching the Barro and Lee sample. The countries included can be found in the appendix table A.X **.** The formula used for calculating the educational Gini can be found in the appendix.

[10] In the historical work of Engermann and Sokoloff it is suggested that a comparative neglect of educational investments in Latin America has not only slowed growth but also caused persistent high levels of income inequality, see a.o. Engermann, Haber and Sokoloff (2001) and Mariscal and Sokoloff (2000).

The standard deviation expresses the absolute spread in years of schooling around the average level of attainment, rather than the relative spread.[11] Ram (1990) suggests that the spread of education follows an inverted U-curve resembling Kuznets' curve of income inequality (Kuznets 1955). Increasing educational investments first enhance educational inequality and after a turning point at approximately 7 years of attainment convergence sets in. We replicated his analysis employing standard deviations and attainment levels (BL data) in figure A.3.a. When we subsequently plot the standard deviation of years of schooling versus the income Gini's (figure A.3.b) we find, in line with Ram's own conclusion, that there is virtually no correlation between educational inequality and income inequality across countries.

In table 2.1 we present unweighted regional averages of educational inequality based on BL data according to the three indicators discussed so far. We also added the regional average years of attainment and an unweighted regional average of income Gini's.

Table 2.1: Interregional comparison of educational attainment, educational inequality and income inequality (unweighted averages).

	no. of countries *	Educational gini 1990	secondary sch. share 1990	standard deviation 1990	income gini 1985-1999	years of attainment 1990
Asia	19	0,52	27,4	4,33	0,41	5,31
Sub Saharan Africa	25	0,79	11,0	3,38	0,54	2,67
North Africa and Middle East	10	0,72	18,7	5,28	0,41	4,50
Transition Economies	14	0,32	45,7	4,14	0,29	8,38
Europe and Western Offshoots	20	0,28	40,3	4,35	0,33	8,80
Latin America	21	0,45	18,7	4,66	0,51	5,25
World	**109**	**0,51**	**26,0**	**4,24**	**0,42**	**5,65**

Source: Barro and Lee 2001, WIID; *The regional averages of the income Gini's are, due to data limitations, based on a total of 96 corresponding countries.

Table 2.1 perfectly illustrates the point we want to make here: the use of different indicators explains why literature is ambiguous about the extent and impact of educational inequality in Latin America.

Latin American educational inequality is comparatively mild according to educational Gini's, but the secondary schooling share gives the impression that educational inequality is comparatively high. Notice that the interpretation of educational inequality in Africa is subject to even larger contradictions. According to the Gini and the secondary schooling share Africa obtains the highest educational inequality in the world, whereas the standard deviation suggests that the distribution of African years of schooling is the most equal in the world.

In table 2.2 we present a pair-wise correlation matrix of the variables discussed above, including estimates of the educational Theil coefficient and the ratio of the 5th to 1st quintile of attainment (the quintile ratio). Table 2.2 shows high levels of correlation between attainment and the distribution of education according to the Gini, the Theil and the secondary schooling share. This complicates the question to which extent income inequality is driven by the distribution of education or by average attainment levels. In order to solve this problem, we need to find out what causes the

[11] The results of his analysis are based on educational attainment data of 100 countries decomposed into 6 categories of attainment compiled by Psacharopoulos and Arriagada (1986).

relationship between educational distribution and attainment levels. Is it a statistical artefact or a real world phenomenon?

Table 2.2: Correlation matrix of educational attainment, educational inequality and income inequality (pair-wise).

	Years of attainment 1990	Educational Gini 1990	Educational Theil 1990	Standard deviation 1990	Quintile ratio 1990	Secondary sch. Share 1990
Income Gini 1985-1999	-0,647	0,587	0,478	-0,130	-0,200	-0,725
Years of attainment 1990		-0,953	-0,878	0,383	0,536	0,883
Educational Gini 1990			0,955	-0,290	-0,463	-0,835
Educational Theil 1990				-0,447	-0,602	-0,739
Standard Deviation 1990					0,958	0,308
Quintile difference 1990						0,414

Source: Barro and Lee 2001, WIID

3 The level dependency of conventional educational inequality indicators

Consider the following example. In table 3.1 we show three possible distributions of schooling years among five persons, which are translated into a quintile distribution employed to calculate the Gini-coefficient. Although the gap in schooling years in case A is only one year at most, inequality according to the Gini-coefficient is higher than in case C (A>B>C), where the schooling gap between person 5 and 1 is as big as 14 years suggesting a more plausible distribution C>B>A.

Table 3.1 Quintile distribution of education and educational Gini

	person 1	person 2	person 3	person 4	person 5	Average years of attainment	**Gini**
A							
Years of schooling	0	0	0	0	1	0.2	**1**
Quintile distribution	0	0	0	0	1		
B							
Years of schooling	0	0	0	1	2	0.6	**0.83**
Quintile distribution	0	0	0	0,333	0,667		
C							
Years of schooling	1	2	3	9	15	6.0	**0.58**
Quintile distribution	0,033	0,067	0,1	0,3	0,5		

Table 3.1 shows that the gaps in years of schooling have a greater impact on the Gini the smaller the total amount of schooling years in the overall distribution. Countries with low average levels of attainment, specifically countries in which a certain share of the working age population has received no schooling at all, are those which are depicted as countries with the most skewed distribution of education[12]. Since the educational Gini is a function of the average attainment level, educational inequality automatically equalizes if education spreads.[13] This positive relationship between educational distribution and overall attainment level may be called "level dependency".

The "level dependency" problem can be resolved by excluding the "no schooling" share of the labour force population and re-estimate the Gini. If we do this than the ranking in Table 3.1 will become C > B > A. The proportion of the labour force that has received no schooling can, to a large extent, be controlled for by including average attainment levels.[14] This approach ensures that the Gini and the Theil more accurately reflect the distribution of schooling years. We denote these new variables as the "adjusted" Gini or Theil and will estimate the adjusted Theil in the OLS regression presented in section 5. However, excluding those who receive no education at all from the distribution is of course not quite satisfactory.

[12] Whenever the distribution includes quintile shares with average attainment levels below 1 year of schooling the Gini increases disproportionately. For example, the relative difference between 0.5 years of schooling and 1 year of schooling is the same relative difference between 5 years and 10 years of schooling. Their absolute differences are 0,5 and 5 years of schooling respectively. It is hard to imagine that the relative difference would be more consistent to the actual distribution of skills and the capacity to earn a given income than the absolute difference in schooling years.

[13] Income Gini's do not suffer from this mechanism so much because there is always a substantial amount of income in the bottom brackets (e.g. deciles or quintiles) of the income distribution. To put in a different way, there are no people with zero income. To resolve this problem the Theil coefficient can be used as an alternative comprehensive measure of inequality, but the Theil would not alter the ranking of table 4.1. since this indicator is similarly level-dependent, albeit less severe.

[14] The correlation between average years of attainment and the percentage share of the labour force having received no schooling is a mere -0.90. See correlation matrix in the appendix.

The use of the secondary schooling share in fact faces a comparable problem. Suppose the entire labour force has only received primary education, so that the secondary schooling share will be zero. Does this imply that education is highly unequally distributed? Indeed, the higher the average years of attainment the higher the potential share of the working age population having attained secondary schooling. In other words, the secondary schooling share incorporates a distribution effect and an attainment effect as well. A ranking in table 3.1 according to the secondary schooling share would give A=B > C. Both in the case of A and B, no person enjoyed secondary schooling, leading to a secondary schooling share of zero, representing maximum educational inequality. In contrast, in case C, persons 4 and 5 enjoyed secondary schooling, leading to a secondary schooling share of 0.40, indicating less inequality compared to case A and B. Therefore the use of the secondary schooling share can provide a proper comparison of educational inequality in a cross-country analysis including developed and less-developed countries, if it is controlled for average attainment levels. Imputing the secondary schooling share together with the average years of attainment in an OLS regression however provokes multi-collinearity which influences the significance of both variables in the model.

Finally, the standard deviation of educational attainment concentrates on absolute, rather than relative, differences in schooling years in the labour force population. It presupposes that each year of schooling generates identical marginal returns: the standard deviation of each of the following dual distributions, 20 and 16, 12 and 8, 6 and 2 years of schooling is 2.8. The standard deviation can be imputed in an OLS regression without problems of multi-collinearity with average years of attainment. Yet, its rather strong distributional assumptions may very well explain why the standard deviation correlates so poorly with income inequality.

4 An alternative indicator of educational inequality: the grade enrolment ratio

To counter some of the disadvantages of the conventional indicators discussed above, we introduce an indicator that concentrates in more detail on the quality of school performance and helps to disentangle the combined measurement of distribution and average attainment. The grade enrolment ratio is based on the percentage distribution of pupils among grades in a particular schooling system. The indicator is derived from the UNESCO Yearbook of Statistics (various issues). In this paper we confine its application to primary schooling only Table 4.1 shows an example of the grade enrolment distribution in four countries for the year 1975.

Table 4.1: Percentage distribution of grade enrolment in primary school

Grade	I	II	III	IV	V	VI
Honduras	36	21	16	12	9	7
Ghana	23	18	17	16	14	13
Malaysia	18	17	17	16	16	15
Netherlands	18	17	16	16	17	16

Source: UNESCO, *Statistical Yearbook*, 1980

The distribution of grade enrolment varies from country to country. In the Netherlands the distribution is more or less even, as we would expect, but in Ghana and Honduras the lower grades contain more students then the higher grades. Several factors are responsible for a distribution biased to the lower grades: irregular school attendance, grade repetition and drop-out rates.[15] In many developing countries children do not attend school on a daily basis and therefore repeatedly attend the lower grades or drop-out at a certain point in time before reaching higher grades. The grade enrolment distribution reflects the progress children make in primary schooling.

The grade enrolment distribution is expressed by the ratio of the percentage share of pupils in the upper grades (4 to 6) to the lower grades (1 to 3). The more skewed the grade enrolment distribution, the lower the grade enrolment ratio. The grade enrolment ratio naturally consists of a number between 0 and 1.[16] For example Honduras has a ratio of 0.38 and the Netherlands of 0.96. Most countries have six grades in primary school but there are exceptions. In case of more than six grades we exclude the shares of the post-six grades and normalize the grade distribution over 1 to 6. In case of less than six grades we apply the formula (4+5+(0.5*3))/(1+2+(0.5*3)) (5 grades) or (3+4)/(1+2) (4 grades)[17].

The children having received no schooling are deliberately excluded from the grade enrolment distribution. Although this group of course has an impact on the distribution of education, we argue it is better to include this group separately into the regression analysis. This strategy prevents that the measurement of distribution becomes dependent on the level of attainment.

The advantages of the grade enrolment ratio are that 1) the grade enrolment ratio captures student performances in much greater detail, 2) the measurement of the grade enrolment ratio is not influenced by average attainment levels, although there is, of course, a natural level of correlation

[15] These factors are also mentioned by Lloyd and Hewitt (2004), see section 2.
[16] In a few countries we obtained a ratio exceeding 1.0 because of rounding differences or demographic irregularities. However, we set 1.0 as an upper boundary.
[17] The latter only applies to a 13 countries out of the 96 in the sample.

between both, and 3) since the grade enrolment ratio is directly based on source data from the UNESCO it reduces the risk of reproducing inconsistencies such as in the Barro and Lee dataset (see De la Fuente and Castello 2002).

The biggest disadvantage of this new indicator is that the data do not directly refer to the working age population, but to the age group 4 and 12 (predominantly). There is a time lag. Students listed in primary grades will enter into the labour force after a lag of approximately 5 to 15 years. For that reason we selected four benchmark years, namely 1960-1965, 1970, 1975 and 1980, to account for the distribution of education in the labour force in the period 1985-1999. The four series combined give an average grade enrolment ratio for the period 1960-1980. The entire sample consists of 506 observations for 164 countries, of which 120 countries have an estimate for at least two of the four benchmark years.

Table 4.2: Interregional comparison of the grade enrolment ratios, 1960-1980

	no. of countries	average 1960-1980	1960-1965	1970	1975	1980	years of attainment 1990	Income gini 1985-1999
Asia	16	0,67	0,59	0,66	0,70	0,74	5,31	0,41
Sub Saharan Africa	24	0,59	0,49	0,62	0,62	0,64	2,67	0,54
North Africa and Middle East	10	0,78	0,65	0,78	0,84	0,85	4,50	0,41
Transition Economies	6	0,91	0,81	0,95	0,96	0,88	8,38	0,29
Europe and Western Offshoots	20	0,92	0,88	0,84	0,96	0,97	8,80	0,33
Latin America	20	0,55	0,39	0,55	0,61	0,64	5,25	0,51
World	**96**	**0,70**	**0,60**	**0,70**	**0,75**	**0,76**	**5,65**	**0,42**

Source: Barro and Lee 2001; UNESCO, Statistical Yearbook, various issues between 1972 and 1984.

An interregional comparison of grade enrolment distribution in table 4.2 reveals that regions with higher income inequality (i.e. Latin America and Africa) are characterised by lower grade enrolment distribution ratios in primary schools. The grade enrolment distribution in Latin American is highly skewed, especially when taking its average years of educational attainment into account. It is noteworthy that the African grade enrolment ratio does not deviate much from the Latin American. African countries are indeed specifically characterised by low average years of attainment.

5 Regressing educational inequality on income inequality

In this section we estimate the effects of educational inequality on income inequality in an OLS regression using the following equation:[18] $I_i = c_i + \alpha 1 x_i' + \alpha_2 y_i' + \alpha_3 z_i' + \varepsilon_i$. Where I_i is income inequality in the 1990's, c_i is a constant, x_i' refers to educational attainment, y_i' is a vector of educational distribution indicators referring to the 1990's and z_i' is a vector of control variables of income inequality such as the distribution of land and quality of institutions, and ε_i captures the residuals. In the first set of specifications we set α_3 to zero, in the second set we remove this restriction and estimate the extended regression. The results are respectively shown in table 5.1 and table 5.2.

Table 5.1 shows that the level of educational attainment is negatively related to the level income inequality. The adjusted Gini-coefficient (1) and the standard deviation (2) perform weakly and are both insignificant. The secondary schooling share turns out to be a strong explanatory variably for income distribution (3) yet, as mentioned above, this indicator includes both, the effects of attainment and distribution at once. The attainment variable turns out to be insignificant and this may be the result of the involved multi-collinearity (0.88) which negatively effects the efficiency of the estimation. When the secondary schooling share is substituted for the grade enrolment ratio (4) both variables are significant with the sign expected. The grade enrolment ratio obtains a significance-level of 99% and the years of attainment is significant at the 95% level.

Table 5.1 Effect of educational distribution on income distribution.

Dependent Variable: Income inequality 1985-1999 (Gini)
Method: OLS; t-statistics in italic

	1	2	3	4
Years of attainment 1990	-0,023	-0,027	-0,002	-0,010
	-6,41	*-8,21*	*-0,35*	*-2,34*
Educational Gini 1990 (adjusted)	0,146			
	1,00			
Standard deviation 1990		0,013		
		1,36		
Secondary schooling share 1990			-0,005	
			-4,59	
Grade enrolment ratio 1960-80				-0,245
				-4,17
Constant	0,514	0,529	0,557	0,669
	8,30	*1,31*	*3,01*	*2,17*
Adjusted R-squared	0,41	0,42	0,52	0,48
no. of countries	96	96	96	86

In the extended equation we include some control variables that are generally referred to in literature as being crucial in explaining income inequality. The first variable is the historical

[18] We rejected the option of a panel analysis since income inequality time series are notorious for comparability problems.

distribution of land[19], which is not only representative for the distribution of assets and wealth, but also determines much of the path dependent character of income inequality (Frankema 2005). For example, it is generally acknowledged that the high levels of Latin American income inequality have their roots in the unequal distribution of land from the colonial era onwards (World Bank 2004). The second variable controls for the risk of expropriation. The risk of expropriation is used by Acemoglu et.al. (2001) as a proxy for the development of extractive institutions in a country. The risk of expropriation influences the level of transaction costs and institutional barriers to investment. Moreover, a high risk of expropriation[20] reflects the presence of institutions enabling the politically powerful to seek rents via expropriation and concentrate wealth in the hands of a few.

A measure of ethnical fractionalisation[21] is added to account of the social context in which the risk of expropriation may lead to the concentration of wealth and power in the hands of a distinctive ethnic group. Ample literature points out that the distribution of resources in Africa is shaped along ethnic divisions (Easterly and Levine 1997, Milanovich 2003). The interaction of both variables reflects the hypothesis that an ethnic fractionalised society *per se* does not induce inequality, nor does a high risk of expropriation necessarily lead to an unequal distribution of the potentially expropriated wealth (think of former socialist countries for example), but weakly defined and protected property rights in a context of ethnic fractionalisation are likely to induce income inequality.

Finally we included an indicator of democratic accountability. According to Bourguinon and Verdier (2001) and Tilly (1998) and others., underinvestment in public education is a crucial instrument for social exclusion. Non-democratic elites directed at maintaining the status quo have little incentives to give voice to the masses. If governments are held accountable in a democratic system, public education is likely to be one of the priorities of peoples demands. The correlation coefficient between average attainment levels and the measure of democratic accountability[22] is indeed quite high at 0.67.

The results in table 5.2 show that the control variables for land distribution and risk of expropriation in an ethnically fractionalised environment have rather robust levels of significance. The indicators for educational inequality again perform differently. Most important is that the grade enrolment ratio has the correct sing and is significant at a 99% level (1 and 2). Substituting educational attainment for the proxy of democratic accountability (2) enhances the fit of the model (R^2 rises to 0.62), and does not disturb the grade distribution variable. These results again support to the idea that income inequality may be effected by education in two ways. The attainment level determines the ”peoples voice” in general and the interpersonal distribution of schooling years determines the extent of “human capital inequality”. Both are important in explaining the cross-country variation in income inequality.

[19] The sample of Land Gini’s is derived from Frankema (2005). The sample is based for the far majority of countries on some year close to 1960 and at least within the period of 1950-1975. The excpetions are Algeria 1930, Czechoslovakia 1921, Estonia 1925, Ethiopia 1977, Guyana 1984, Jordan 1983, Latvia 1925, Lithuania 1930, Mauritius 1930, Niger 1980, Romania 1930

[20] Derived from the PRS Group, International Country Risk Guide (ICRG), www.prsgroup.com \

[21] Derived from http://weber.ucsd.edu/~proeder/elf.xls.

[22] Derived from the PRS Group, International Country Risk Guide (ICRG), www.prsgroup.com

Table 5.2 An extended income inequality regression

Dependent Variable: Income inequality 1985-1999 (Gini)
Method: OLS; t-statistics in italic

	1	2	3	4	5
Years of attainment 1990	-0,011		-0,009	-0,021	-0,022
	-2,64		*-1,42*	*-6,79*	*-5,30*
Educational Gini 1990 (adjusted)					-0,012
					-0,06
Standard deviation 1990				-0,010	
				-0,99	
Secondary schooling share 1990			-0,003		
			-2,25		
Grade enrolment ratio 1960-80	-0,213	-0,218			
	-3,69	*-5,11*			
Land Gini 1960	0,127	0,132	0,161	0,232	0,214
	2,38	*2,77*	*2,82*	*4,03*	*3,42*
Expropriation risk * Ethnic Fractionalisation	0,007	0,008	0,005	0,008	0,008
	1,74	*2,07*	*1,11*	*1,78*	*1,76*
Democracy		-0,023			
		-4			
Constant	0,543	0,567	0,432	0,426	0,405
	10,45	*12,37*	*10,51*	*9,01*	*5,59*
Adjusted R-squared	0,53	0,62	0,54	0,51	0,50
no. of countries	72	74	73	73	73

6 Conclusion

We have argued that the contrasting results in the literature on the nature and impact of educational inequality is to a considerable extent due to the very measures of educational inequality that are used. Previous studies showing that Latin American educational inequality is relatively mild, when compared to the rest of the developing regions are all based on the Gini-coefficient of educational attainment; studies that conclude the opposite have employed the secondary schooling share.

We have argued that both indicators are disputable when analysing educational inequality. The main drawback is that they do not, under all circumstances, rank educational inequality in plausible manner. The Gini puts a disproportional weight on high proportions of people with no schooling. As a result the Gini is strongly correlated to the average years of educational attainment (-0.95) which, in turn, frustrates the empirical distinction between the distributional effects of "attainment" and "distribution": countries with a low stock of education are automatically presented as countries with a highly skewed distribution. This is a statistical artefact, rather than a representation of real world educational inequality, but it especially deceives the interpretation of African inequality. Estimates of the Gini and the secondary schooling share both suggest that Africa is the region in which education is most unequally distributed. According to the standard deviation of attainment, Africa is the region with most egalitarian distribution of education however! Yet, in a comprehensive cross-country regression the standard deviation appears insignificant with respect to income inequality, which suggests that an absolute measure of inequality does not represent the impact of educational distribution on income distribution very well either.

The new indicator presented in this paper, the grade enrolment ratio, is less dependent on attainment levels. Moreover the distribution of children across consecutive grades in primary schooling reveals important underlying quality characteristics of the educational distribution related to school attendance, repetition rates, drop-out rates and student performance in general. Precisely these aspects are likely to be linked closely to the distribution of income.

The grade enrolment ratio does not only have some convenient properties which make it a good substitute for conventional measures, the indicator also proves to make empirical sense. In combination with the average years of schooling the grade enrolment ratio is able to explain a fair share of the variety in income inequality across countries. Moreover, the grade enrolment ratio sheds a clear light on Latin American educational inequality. The enrolment by grade in primary schooling is very unequally distributed and suggests that in spite of considerable levels of attainment, educational inequality does substantially contribute to the regions' extraordinary high levels of income inequality. On the other hand, for African countries it is the low level of attainment rather than a skewed educational distribution, that is predominant in explaining African income inequality.

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www.wider.unu.edu/wiid/wwwwiid.htm

Appendix

Figure A.1.a

Figure A.1.b

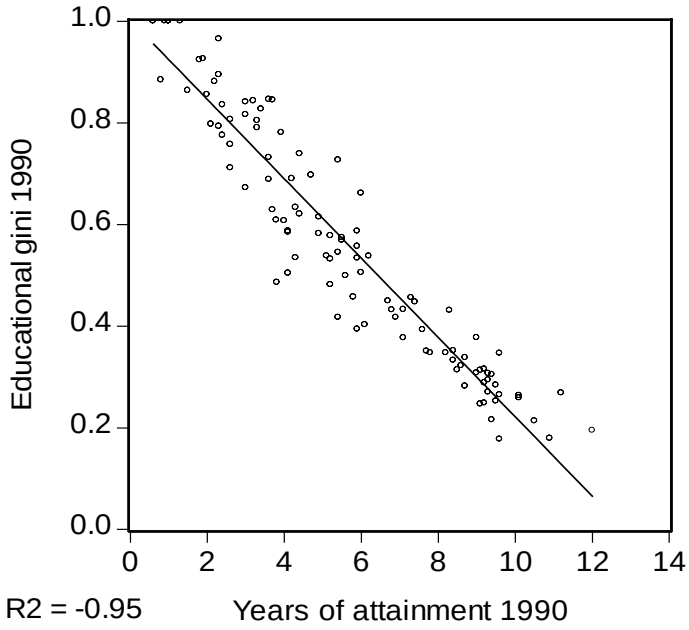


Figure A.2.a

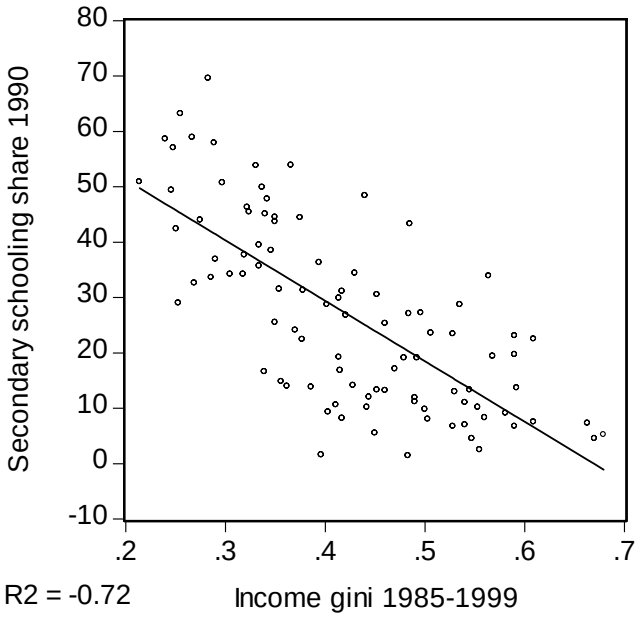


Figure A.2.b

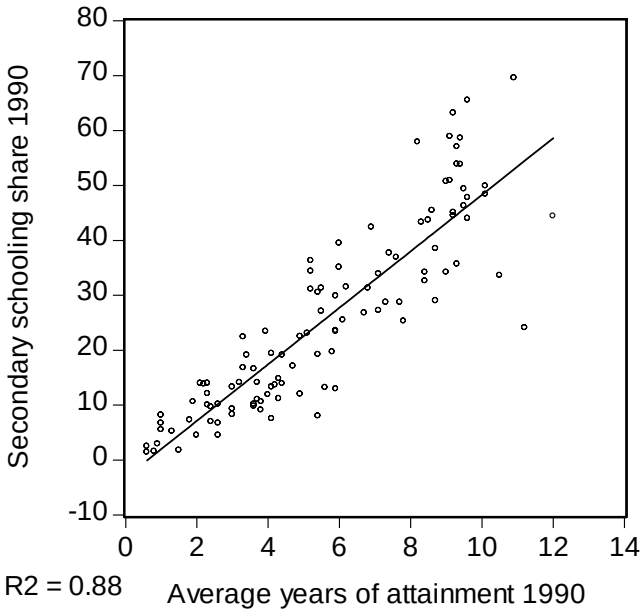


Figure A.3.a

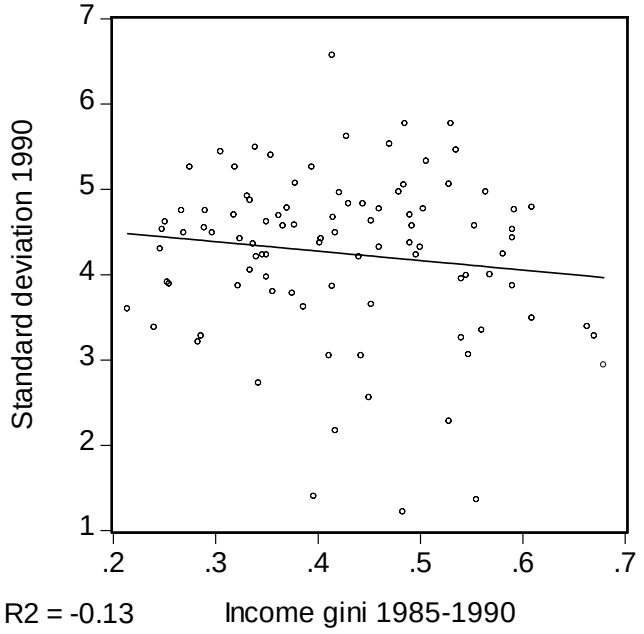
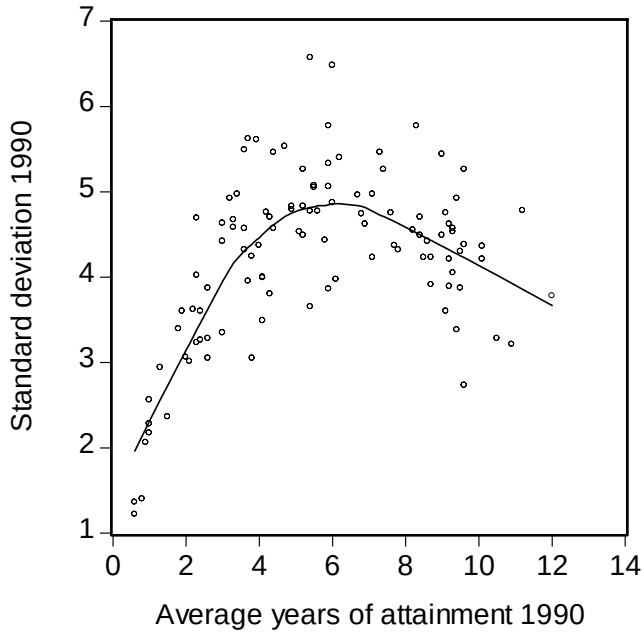


Figure A.3.b



Calculation example

Gini: $((\Sigma_{j=1} \Sigma_{k=1} n_j n_k \Sigma e_j - e_k \Sigma) / 2n^2 * (1/n)) * n/n-1$

n = amount of quintile shares = 5.
e = education in years.

Theil: $\Sigma_{i=1} s_i (\log s_i - \log (1/n))$

s_i = the years of education of the *i*th quintile
n = amount of quintile shares = 5

Correlation of adjusted Gini-coefficient, adjusted Theil-coefficient and years of attainment.

	eduTheil adjust.*	% No Schooling	Attainment
EduGini adjust.**	0.97	0.29	-0.54
EduTheil adjust.*		0.33	-0.56
% No Schooling			-0.90
Attainment			

* Theil calculated excluding the people with no schooling.
** Gini calculated excluding the people with no schooling.

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