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**Centre d'Analyse Théorique et de
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**EXPLAINING INCOME
INEQUALITIES
IN DEVELOPING COUNTRIES:
THE ROLE OF
HUMAN CAPITAL**

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Abstract

This paper investigates the relationship between human capital and economic inequality in the developing countries. The paper analyses an unbalanced panel of 64 countries for the period 1970-2005. The results show that primary, secondary and tertiary level education is negatively associated with inequality (primary being the strongest). Besides, average years of education and government expenditure on education are also found to be inequality reducing, both in the immediate and the medium run. Thus, to give citizens better and more equal opportunities, policy-makers in the developing countries and the development agencies need to give higher importance to primary education.

Resumé

Prenant en considération le manque de consensus dans la littérature sur le sujet, notre article étudie la relation entre le capital humain et les inégalités économiques, en abordant le cas particulier des pays en développement où les inégalités sont flagrantes. Nous analysons un panel non-équilibré constitué de 64 pays pour la période 1970 à 2005. Les résultats montrent une liaison négative entre l'éducation primaire, ainsi que secondaire et tertiaire, et les inégalités économiques. Les autres indicateurs du capital humain contribuent également à la réduction des inégalités. Donc, afin de réduire les inégalités économiques effectivement pour fournir aux citoyens des opportunités égales, les gouvernements des pays en développement et la communauté internationale devraient se concentrer sur l'éducation primaire et supérieure.

Keywords– Inequality, developing countries, human capital, education

1. Introduction

Economic inequality, in its various forms and manifestations, has attracted the interest of philosophers, economists and other social scientists throughout the ages. Views diverge on the necessity of its existence for prosperity. According to the inequalities as an obstacle to development approach, it is theoretically associated with lower and slower economic development owing to unproductive investments by the rich, fewer investment opportunities, poor skills and productivity level of the poor, subdued domestic demand, pressure for higher wealth redistribution, sociopolitical instability and an unhappy society (Barro, 2000; Persson and Tabellini, 1994; Thorbecke and Charumilind, 2002 and Todaro and Smith, 2005). An opposing camp sees it as a *sine qua non* for higher growth, pointing to the investment indivisibility of today's human and physical capital intensive investments, requiring a higher concentration of capital, as well as the rich's higher marginal propensity to save. More inequitable economies should thus grow faster than the more equal ones (Attanasio and Binelli, 2003 and Thorbecke and Charumilind, 2002).

Notwithstanding an ardent desire of an equal, harmonious and just society, economic inequality has been a persistent phenomenon throughout human history. While some developed countries managed to reduce it in the twentieth century through proactive public welfare policies such as social insurance, publicly provided education and health services and progressive taxation, many developing countries have not been able to tackle it. Following the trickle-down theory, a strong emphasis on growth as the panacea for poverty and extreme inequality without determined efforts for the diminution of inequities has failed to show its beneficial outcome in much of the developing world, leaving the societies less harmonious with sharp bisectoral divisions. Besides, in the last couple of decades, the increasing pace of globalization, with freer trade and capital flows, more open labour markets, skill-biased technological change, and the fall of communism are surmised to have made the societies even more unequal, with the poor often among the losers (Milanovic and Squire, 2005 and Easterly, 2007).

Empirical studies have proliferated in the recent years analyzing different aspects of economic inequality: direction, magnitude and channels of interaction in the world economy. Several studies have looked for a Kuznets curve among the developing countries with mixed success. Fields (2001) does not find the Kuznets curve to be the best description of changes in an economy over time, as economic inequality appears to be independent of growth rate or the level of development. On the other hand, Wells (2006) analyzes a sample of developed and developing countries between 1980 and 2000 and comes up with results supporting the Kuznets hypothesis. Forbes (2000) and Li and Zou (1998) conclude that a rise in income inequality has a salutary effect on a country's future

growth rate in the short and middle term, while Ravallion (2004) and Persson and Tabellini (1994) come up with an opposite conclusion in the long term. These results, taken on face value, reflect a different transmission mechanism between income inequality and growth from the short and the medium to the long term. [For a comprehensive survey of the literature on inequality and economic growth, see Ehrhart (2009)].

The relationship between inequality and international trade is bound in a similar fog of ambiguity. Barro (2000), Easterly (2007), Milanovic and Squire (2005) and Ravallion (2001), among others, find the two to be positively related, while Meschi and Vivarelli (2009) in their study of 65 developing countries for the period of 1980-1999 find no significant evidence of linkage between international trade flows and within country income inequality.

Kremer and Chen (2000), Koo and Dennis (1999) and Perotti (1996) find a positive link for the fertility rate, while Beck et al (2007), Clarke, Xu and Zou (2006) and Li, Squire and Zou (1998) suggest a negative distributional impact of financial development. Research has also shown that political instability negatively affects growth through higher inequality (Perotti, 1994, 1996). Other research finds income inequality likely to be a significant determinant of corruption (You and Khagram, 2005).

Among the factors related to economic inequality, human capital holds an important place, owing mainly to its endogenous nature in all economic activities. The endogenous growth theory emphasizes the role of human capital as an important endogenous factor in economic growth (Romer, 1986 and Lucas, 1988). It is an important source of long-term growth, either because it is a direct input into research or because of its positive externalities. Policies promoting investment in human capital can thus stimulate long term economic growth. Increase in human capital, especially through public education, can help make the income distribution less inequitable.

Theoretical models such as Eckstein and Zilcha (1994), Glomm and Ravikumar (1992), Saint-Paul and Verdier (1992) and Zhang (1996) also propose the same conclusion. However, some studies, such as Jimenez (1986) and Ram (1989) support the opposite view. According to Meschi and Vivarelli (2009, p. 296):

The role of the physical and human infrastructures is crucial in minimizing the negative distributional effects of increasing trade with the more industrialized countries. Conversely, bottlenecks in the supply of educated and skilled labor may condemn a developing country to the economic marginalization and to the high levels of domestic income inequality.

In the absence of a single representative indicator for human capital, empirical studies have employed various variables for human capital, each with its own specificities and shortcomings, leading to varying results. Examining the educational attainment of

different country samples, Checchi (2000), De Gregorio and Lee (2002) and Park (1996) find empirical evidence to support the idea that inequality decreases with the rise in a country's educational level. On the other hand, Barro (1999) finds that primary education is negatively related to inequality as opposed to higher education. Wells (2006), Barro (2000) and Alderson and Nielsen (2002) find that higher secondary school enrollment leads to lower income disparity. Deininger and Squire (1998) and Checchi (2000) determine a positive relationship between inequality and government expenditure on education, while Sylwester (2002) comes to the opposite conclusion. According to him, allocating an additional percentage point of GDP to public education is associated with a one-point drop in the Gini coefficient over a twenty year period. Sylwester (2000) shows that countries with a higher level of income inequality also have higher subsequent expenditures for public education relative to GDP, and these expenditures have a negative impact upon contemporaneous growth, but previous expenditures have a positive impact.

The preceding brief review reflects the lack of clear-cut consensus on the sign, direction and extent of association between human capital and economic inequality. This paper throws some more light at the yet not well-lit corner of empirical research. The paper adds to the literature in the following ways:

1. Lack of suitable and sufficient amount of data has been a serious issue in previous studies. The paper uses more recent, reliable and coherent data. For economic inequality, only consumption data have been used, while for human capital, multiple indicators have been employed in order to better gage the extent of the relationship between human capital and inequality.
2. In previous studies, different econometric techniques were employed, rendering them mutually incomparable. Several studies also suffered from poor choice of technique and model misspecification. In this paper, first the standard panel data regressions are estimated. Secondly, we employ the panel-corrected standard errors model, which is a more appropriate technique in a large heterogeneous panel of developing countries, as it corrects the heterogeneity problem inherent in such samples.

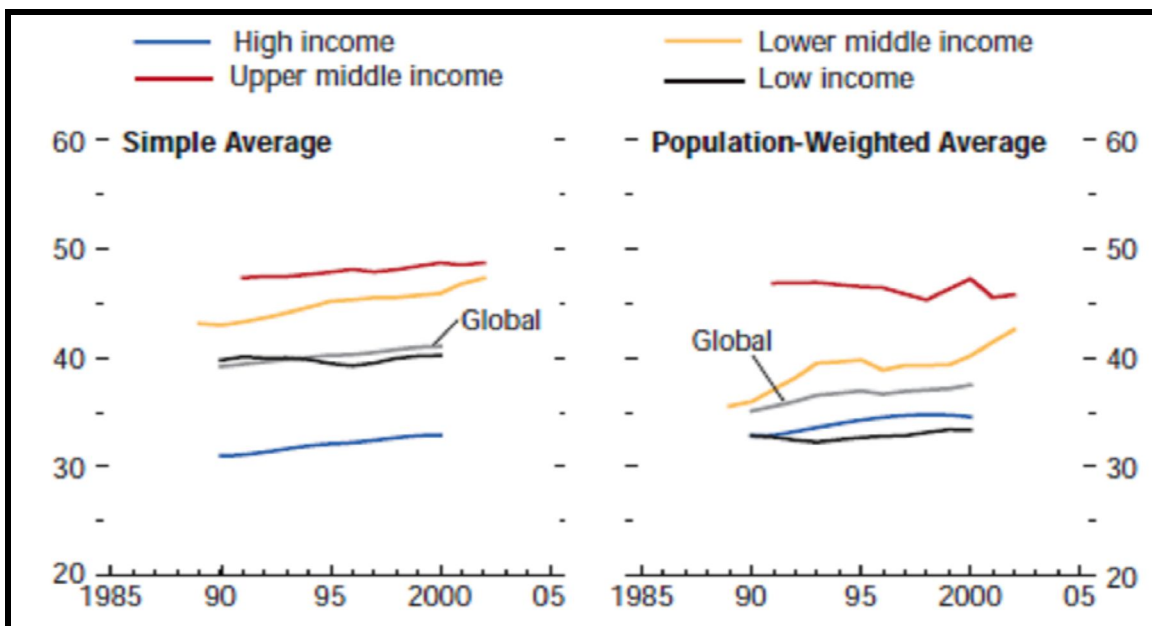
The paper is organized as follows. Section 2 presents some stylized facts related to the status of inequality and education in developing countries. Section 3 presents the data, econometric specification and estimation method. In section 4 the findings are presented, followed by a discussion of the results in the following section. Section 6 gives some concluding remarks.

2. Status of income inequality and human capital in developing countries

Several developing countries have witnessed rapid growth in the recent decades. However, its consequences on poverty and economic inequality have been variable. In some, such as

China, India, Pakistan and Bangladesh, growth has accompanied a rise in inequality, which is in accordance with the Kuznets hypothesis (Wagle, 2007 and Topalova, 2007). The ex-Soviet block countries of East and Central Europe also saw a rise in inequality in the decade following the fall of the Berlin Wall. In contrast, in some countries of East Asia that graduated to upper middle-income or upper-income categories, increase in national income took place along with a reduction of income disparities, though this happened thanks to a strong emphasis on human capital development and land distribution (World Bank, 2003). Lower-income countries, in general, have seen little change in inequality regardless of growth (Figure 1). This unclear picture of the evolution of inequality tends to challenge the Kuznets hypothesis that growth becomes equitable only for countries having reached a high level of development, and prior to that, growth in a country goes hand in hand with inequality. At an average, the developing countries are much more unequal than the developed ones, and there does not appear to be a convergence occurring between them.

Figure 1. Cross-Country Trends in Inequality (Gini coefficients)

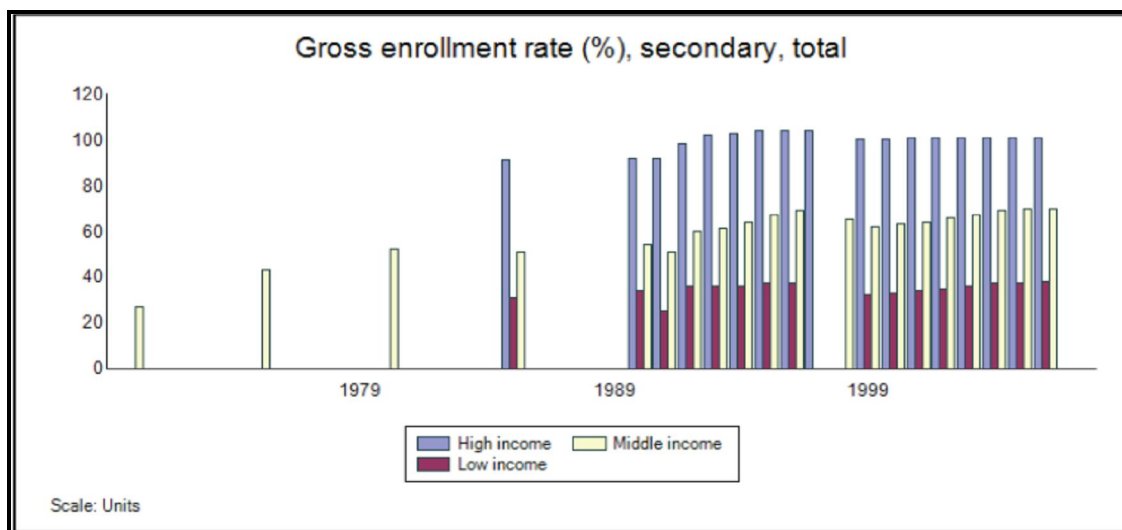


Source: IMF (2007)

The situation is not too different with respect to education, both for within and between country inequalities. The developed world, with merely 10% of the world population aged 5 to 25, spent 55% of global spending on education in 2004 (UNESCO, 2009). On the other extreme, Sub-Saharan Africa, comprising about 15% of the world's 5 to 25 year old population, could spend no more than 2%. Similarly, in 2006, pre-primary gross enrolment ratios averaged 79% in developed countries and 36% in developing countries, falling as

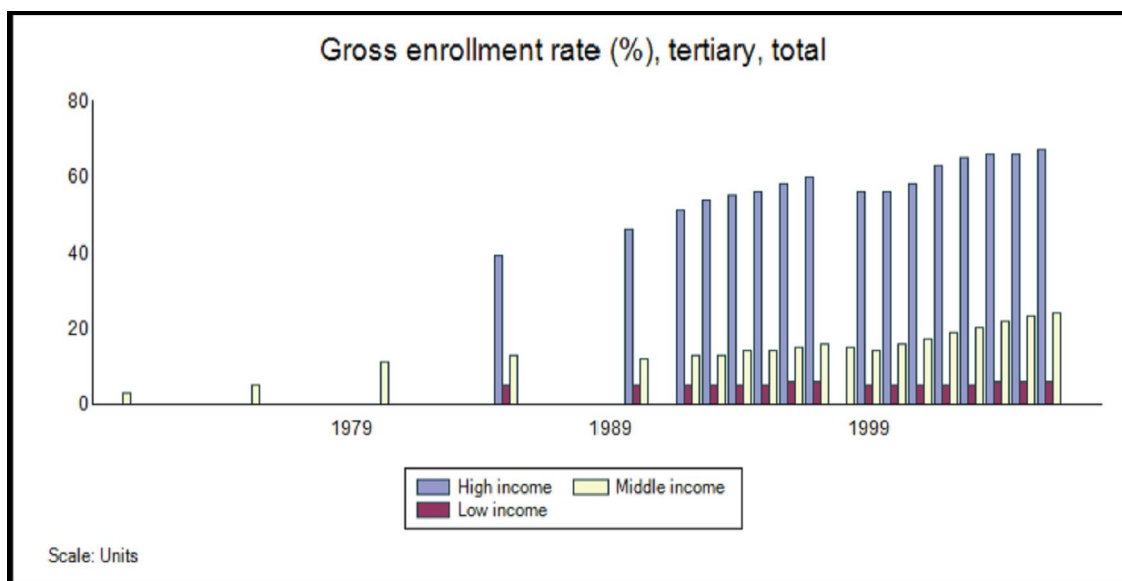
low as 14% in sub-Saharan Africa. The disparities in education attainment have nevertheless come down over the years, mostly due to increased provision of educational facilities in developing countries. For instance, in Sub-Saharan Africa, the average net enrolment ratio jumped from 54% to 70% between 1999 and 2006. The situation is also encouraging on secondary and tertiary levels, even though the within and between country gap in educational attainment seems to be much greater, and the growth in developing countries, particularly certain low-income ones, much slower (Figures 2 and 3).

Figure 2. Comparison of secondary enrolment rates



Source: World Bank (2009)

Figure 3. Comparison of tertiary enrolment rates



Source: World Bank (2009)

From the above figures, some trends of the relationship between education and inequality in developing countries emerge, though with vague silhouettes. Is the inequality in income well explained by the educational disparities? The empirical analysis in this paper attempts to give a clear answer to this question while at the same time also indicating other factors influencing inequalities.

3. The empirical model

3.1 Data description and sources

We use five macroeconomic measures of human capital to grasp the diverse aspects of this complex and hard-to-measure variable. Gross primary, secondary and tertiary education enrollment rates depict the flux of human capital in formation that determine future economic inequality, whereas the average years of schooling reflects to some extent the current state of human capital existing in the country. Public spending on education as a share of GDP is a crude indicator of the importance a government is attaching to the country's human capital development, with implications for current and future patterns of inequality.

Given that current human capital measures cannot explain current consumption inequalities which are more likely to be related with past education levels, we have considered a lag of five years for our human capital variables. Although the impacts of education may begin to appear immediately, it is obvious that the cumulative impacts from changes in enrollment rates are large and may take many years (McMahon, 1999). Education related decisions in developing countries are often taken by parents, keeping in mind their experience as well as the prevailing economic environment. Hence, it may take a generation before the educational decisions' impacts are fully realized. For this purpose, we also consider a twenty year lag. Basic education and level of literacy can also elucidate the level of human capital present in a country, but are not considered in this study. In an increasingly sophisticated open global economy, simple reading and writing skills are no more sufficient, and thus, can not properly represent a country's human capital accumulation.

The GINI index is the most commonly used measure of economic inequality, partly due to its conceptual clarity, and partly due to its ease of calculation and availability of required data. We use the GINI index of consumption instead of combining income and consumption indices, as done in earlier studies using the Deininger and Squire World Income Inequality Dataset. This allows us to have a more consistent dataset less prone to measurement errors. Moreover, in the case of developing countries, consumption patterns are more visible and more readily measurable as opposed to income which is mired in

definitional and data collection difficulties.

Due to the lack of data on inequality, we construct our missing dataset through interpolation and extrapolation using the data taken from the World Bank and the UNU-WIDER World Income Inequality Database (WIID, 2010). The low-quality non-representative inequality and poverty data have been excluded. The data are fitted using a linear extrapolation. A quadratic interpolation was also used with similar results [Results not shown].

Among other variables included in the study, per capita national income (constant per capita GDP and its square) discerns the existence of Kuznets inverted U-curve. We use the Globalization Index, a measure of a country's economic, sociopolitical and cultural opening to the outside world, to measure the impact the recent round of globalization is having on within and among countries' disparities (Wells, 2006). Given the high growth rates which have accompanied the opening up of developing economies in the last two decades, we expect an overall poverty alleviating and inequality reducing impact of globalization.

Demographic growth proxied by the age dependency ratio is an important determinant of evolution of inequalities. The variable is the ratio of people below 15 and above 64 over those between 15 and 64 years of age. In fact, the dependency ratio is expected to be inequality-increasing. In other words, if every household had the same dependency ratio, total inequality would be lower (Wan, 2004).

An indicator for structural changes is considered in the study to take into account the contribution of the economy's sectoral composition in reducing inequality (Bourguignon and Morrisson, 1998). Credit allocated to the private sector by the banks can also be expected to give the entrepreneurs and local firms opportunity to invest, thereby creating jobs and improving the financial situation of many. Economic disparity in a developing country can go down as a result (Clark *et al.*, 2006).

Data on education have been taken from the UNESCO online database, while the economic variables have been drawn from the World Bank's World Development Indicators. Globalization index is taken from Dreher, Gaston and Martens (2008) and measures the three main dimensions of globalization namely economic, social and political. Data are accessible through the KOF Index of Globalization database (<http://globalization.kof.ethz.ch/>). Dummy variables for various developing regions are also used, in order to gauge the specific regional influence over the model.

See Table A.1 in the appendix for the list of developing countries considered in this study.

Summary statistics and data sources of the different variables used in this study are given in Table 1. The dataset consists of an unbalanced panel of at best 64 developing

countries for the period of 1970-2005. The observations are taken at quinquennial intervals. Table 1 shows that there appear to be significant changes in inequality among the countries under study during the period [standard deviation is 1.035 (exponential of 0.034)] with a relatively high mean value [45.42 (exponential of 3.816)]. Besides, there are large differences among countries in terms of per capita income (standard deviation of its logged value being 1.044). Differences in education enrollment are substantial, implying some possible explanatory power of inequalities within countries and with respect to time.

Table 1. Summary statistics

| Variables | Mean | Std. Dev. | Data sources |
|--|-------|-----------|-------------------------------------|
| GINI coefficient | 3.816 | 0.034 | WIDER (2009) |
| Average years of schooling | 1.518 | 0.263 | World Bank (2009) and UNESCO (2009) |
| Primary education gross enrollment rate | 4.503 | 0.104 | World Bank (2009) and UNESCO (2009) |
| Secondary education gross enrollment rate | 3.639 | 0.348 | World Bank (2009) and UNESCO (2009) |
| Tertiary education gross enrollment rate | 2.182 | 0.535 | World Bank (2009) and UNESCO (2009) |
| Public spending on education (% of GDP) | 1.366 | 0.073 | World Bank (2009) and UNESCO (2009) |
| Age dependency ratio | 4.387 | 0.215 | World Bank (2009) |
| Ratio value added industry and services (% of GDP) | 0.865 | 0.148 | World Bank (2009) |
| Domestic credit provided by banks (% of GDP) | 2.950 | 0.812 | World Bank (2009) |
| GDP per capita (constant 2000 US \$) | 6.770 | 1.044 | World Bank (2009) |
| Index of globalization | 3.663 | 0.340 | Dreher, Gaston and Martens (2008) |

Notes: All variables are logged.

3.2. Econometric specification

To empirically investigate the impact of human capital on inequality, we follow the econometric model commonly used in past studies (see Wells, 2006). The empirical model can be specified as follows:

$$GINI_{it} = \alpha GDP_{it} + \beta GDPSQ_{it} + \lambda HUMAN_{it} + \delta Z_{it} + \varepsilon_{it} \quad (1)$$

where $GINI$ is the GINI index of consumption, GDP is the per capita GDP and $GDPSQ$ its square, $HUMAN$ represents the set of human capital variables (enrollment, years of schooling and public spending on education) and ε stands for the errors.

The matrix Z includes a constant as well as control variables related to demographic change (age dependency ratio), macroeconomic policies (globalization, bank credit to

private sector) and structural changes (ratio of sectoral value-added as a share of the GDP).

3.3. Estimation method

The relationship between inequality and human capital is estimated using the random effect (RE) and panel-corrected standard errors (PCSE) estimation methods.

The use of the RE model (our main estimation method) is explained by the following view. Random effect models are appropriate whenever we can consider the observed differences of the group of countries in the data (i.e. the 64 countries included in our sample) to be representative of the total population (dataset constituting all developing countries). The randomness of our sample can be seen in the diversity of the countries in the sample, be it in terms of economic inequality (with less-inegalitarian South and East Asian countries compared to highly unequal Latin American and Sub-Saharan African countries), or in terms of educational attainment (with mostly-literate East European and East Asian countries vis-à-vis the countries of South Asia and Sub-Saharan Africa with high illiteracy rates). This recommendation has also been stated by Hsiao (2003) as a practical suggestion for choosing between the fixed effect and random effect models.

In addition, the Panel Corrected Standard Errors (PCSE) method has been used, as it allows us to take into consideration the problem of homoskedasticity present in a heterogeneous sample, as the error variance differs across cross-sectional units due to characteristics unique to the individual (countries). We find this technique to be appropriate for such datasets.

4. Empirical results

4.1. Results of the random effect model

The estimates of the random effect model are presented in Table 2. Although the choice of the random effect model is based on economic intuition, the results of the Hausman tests reported on the bottom panel of Table 2 recommend the use of the random effect model (probability of the Chi2 is higher than 0.05 in the models examined).

The results in Table 2 show that the gross enrollment rates, public spending on education and average years of education are significantly and negatively associated with the GINI coefficient. The education related variables show a strong equalizing influence. A 10% increase in gross primary enrollment ratio, for example, is associated with a 0.42% drop in consumption inequality in the developing countries, whereas the other human capital indicators have a weaker influence (about 0.1%). The human capital indicators become more equalizing in the estimations with twenty year lags, primary enrollment

being responsible for a concomitant fall in consumption inequality of 1.7% and the rest 0.3-0.6% for a 10% rise in the human capital variable (Table 3).

Table 2 also shows that the Kuznet hypothesis is not verified for our sample. In all estimation [regressions (1) through (5)], the per capita GDP has a positive and its square a negative sign, but none of them is significant at 10%. With twenty lagged variables, the square of per capita income changes its sign to positive, though both the per capita income and its square still remain statistically insignificant.

The dependency ratio has the expected positive sign; the variable in question shows a strong coefficient, and is positively and significantly associated with the consumption Gini in all five regressions. The globalization variable shows a negative sign. Here also, the variable is significant in all five regressions. The developing economies seem to have benefited from the current phase of globalization through increased trade and higher domestic and foreign investments that generate more jobs and ultimately reduce inequality.

The lowering of credit constraints faced by the developing country population, proxied by bank loans to the private sector, has a non-significant impact on inequality.

Similarly, the sectoral change ratio has an inconsistent and insignificant impact on Gini.

We also added the regional or geographical dummies to examine to what extent the different developing regions have contributed to the variation of inequalities observed in the sample. The regions considered are Sub-Saharan Africa, the Middle East and North Africa, South Asia, East Asia and the Pacific, Europe and Central Asia and Latin America and the Caribbean. The findings show that several developing regions, particularly Sub-Saharan Africa, but also to certain extent Latin America and the Caribbean and the Middle East and North Africa, show an inequality reducing influence. On the other hand, the East Asia and the Pacific and Europe and Central Asia region appear to be associated with an increase in inequality. However, this association is positive and significant only at the 10% significance level.

To sum up the results of the random effects model estimation method, it can be said that the average years of schooling, the public spending on education and the education enrollment rates are among the major factors behind the reduction in inequalities over the years, between as well as within the countries. Besides, globalization and the countries' demographic evolution explain a great part of the trend in inequality observed among developing countries. However, we need to go further and test our results using different estimation methods before drawing any definite conclusions. The results of the RE model suffer from the problem of homoskedasticity. The tests for homoskedasticity show that the probability of the Chi2 is 0.00 in most of the cases (see the bottom panel of Table 2). This

problem can be solved by employing the panel-corrected standard errors method, which is the principal aim of the next sub-section.

Table 2. Results of the random effects model, educational variables with 5 years lag

| | (1) | (2) | (3) | (4) | (5) |
|--|---------------------------------|----------------------|----------------------|----------------------|----------------------|
| | Dependent variable: Log of GINI | | | | |
| Human capital | | | | | |
| Log of average years of education | -0.011* (0.007) | | | | |
| Log of primary education enrollment rate | - | -0.042*** (0.016) | | | |
| Log of secondary education enrollment rate | - | - | -0.009* (0.005) | | |
| Log of tertiary education enrollment rate | - | - | - | -0.008** (0.003) | |
| Log of public spending on education | - | - | - | - | -0.008** (0.003) |
| Globalization | | | | | |
| Globalization index | -0.054*** (0.007) | -0.054*** (0.007) | -0.054*** (0.007) | -0.054*** (0.007) | -0.054*** (0.007) |
| Demography | | | | | |
| Log of age dependency ratio | 0.052*** (0.011) | 0.051*** (0.011) | 0.052*** (0.011) | 0.050*** (0.011) | 0.050*** (0.011) |
| Structural change | | | | | |
| Ratio value added industry and services (% of GDP) | -0.003 (0.013) | -0.004 (0.013) | -0.003 (0.013) | -0.004 (0.013) | -0.004 (0.013) |
| Domestic credit | | | | | |
| Log of domestic credit by banks (% of GDP) | 0.000 (0.003) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) |
| Income level | | | | | |
| Log of GDP per capita (constant 2000\$US) | 0.012 (0.019) | 0.012 (0.019) | 0.012 (0.019) | 0.012 (0.019) | 0.012 (0.019) |
| Log of GDP per capita squared | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) |
| Regions | | | | | |
| Sub-Saharan Africa | -0.020** (0.010) | -0.020** (0.009) | -0.020** (0.010) | -0.020** (0.009) | -0.020** (0.009) |
| Middle East and North Africa | -0.015 (0.010) | -0.015 (0.010) | -0.015 (0.010) | -0.015 (0.010) | -0.015 (0.010) |
| East Asia and the Pacific | -0.007 (0.010) | -0.007 (0.010) | -0.007 (0.010) | -0.007 (0.010) | -0.007 (0.010) |
| South Asia | -0.017 (0.010) | -0.016 (0.010) | -0.016 (0.010) | -0.016 (0.010) | -0.016 (0.010) |
| Latin America and Caribbean | -0.013 (0.010) | -0.012 (0.010) | -0.013 (0.010) | -0.012 (0.010) | -0.012 (0.010) |
| Constant | 3.746*** (0.078) | 3.922*** (0.109) | 3.764*** (0.080) | 3.751*** (0.077) | 3.751*** (0.077) |
| Observations | 484 | 484 | 484 | 484 | 484 |
| R2-overall | 0.272 | 0.278 | 0.273 | 0.277 | 0.277 |
| Hausman test (Prob>Chi2) | 0.58 | 0.70 | 0.09 | 0.17 | 0.01 |
| Breusch and Pagan test (Prob>Chi2) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Notes: *, ** and *** stand for significance at 10%, 5% and 1% respectively; z-statistics are in the parentheses.

Table 3. Results of the random effects model, educational variables with 20 years lag

| | (1) | (2) | (3) | (4) | (5) |
|--|---------------------------------|----------------------|----------------------|----------------------|----------------------|
| | Dependent variable: Log of GINI | | | | |
| Human capital | | | | | |
| Log of average years of education | -0.065*** (0.005) | - | - | - | - |
| Log of primary education enrollment rate | - | -0.171*** (0.011) | - | - | - |
| Log of secondary education enrollment rate | - | - | -0.050*** (0.003) | - | - |
| Log of tertiary education enrollment rate | - | - | - | -0.031*** (0.002) | - |
| Log of public spending on education | - | - | - | - | -0.031*** (0.002) |
| Globalization | | | | | |
| Globalization index | -0.079*** (0.006) | -0.065*** (0.006) | -0.070*** (0.006) | -0.069*** (0.006) | -0.069*** (0.006) |
| Demography | | | | | |
| Log of age dependency ratio | 0.073*** (0.010) | 0.065*** (0.009) | 0.068*** (0.009) | 0.068*** (0.010) | 0.068*** (0.010) |
| Structural change | | | | | |
| Ratio value added industry and services (% of GDP) | 0.002 (0.012) | -0.000 (0.011) | 0.000 (0.011) | 0.000 (0.011) | 0.000 (0.011) |
| Domestic credit | | | | | |
| Log of domestic credit by banks (% of GDP) | 0.003 (0.002) | 0.002 (0.002) | 0.003 (0.002) | 0.003 (0.002) | 0.003 (0.002) |
| Income level | | | | | |
| Log of GDP per capita (constant 2000\$US) | 0.014 (0.018) | 0.010 (0.017) | 0.012 (0.018) | 0.011 (0.018) | 0.011 (0.018) |
| Log of GDP per capita squared | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) |
| Regions | | | | | |
| Sub-Saharan Africa | -0.026*** (0.009) | -0.024*** (0.008) | -0.005 (0.006) | -0.025*** (0.008) | -0.025*** (0.008) |
| Middle East and North Africa | -0.022** (0.009) | -0.020** (0.009) | -0.000 (0.007) | -0.020** (0.009) | -0.020** (0.009) |
| East Asia and the Pacific | -0.009 (0.009) | -0.008 (0.009) | 0.012* (0.007) | -0.009 (0.009) | -0.009 (0.009) |
| Europe and Central Asia | | | 0.020** (0.009) | | |
| South Asia | -0.022** (0.009) | -0.019** (0.009) | | -0.020** (0.009) | -0.020** (0.009) |
| Latin America and Caribbean | -0.018** (0.009) | -0.017** (0.008) | 0.003 (0.007) | -0.017** (0.009) | -0.017** (0.009) |
| Constant | 3.794*** (0.072) | 4.474*** (0.083) | 3.864*** (0.069) | 3.768*** (0.069) | 3.768*** (0.069) |
| Observations | 484 | 484 | 484 | 484 | 484 |
| R2-overall | 0.458 | 0.508 | 0.488 | 0.473 | 0.473 |
| Hausman test (Prob>Chi2) | 0.98 | 0.52 | 0.39 | 0.85 | 0.14 |
| Breusch and Pagan test (Prob>Chi2) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Notes: *, ** and *** stand for significance at 10%, 5% and 1% respectively; z-statistics are in the parentheses.

4.2. Results of the PCSE

The results of the PCSE estimations are similar to the RE method but more significant and with mostly expected signs. The results are presented in Tables 4 and 5. With respect to the human capital variables, the findings show that the average years of schooling, the public spending on education, the primary, secondary and tertiary education enrollment rates are all negatively and significantly associated with the Gini coefficient, confirming the important role the human capital plays in reducing inequality in developing countries. This result is in line with Checchi (2000) and De Gregorio and Lee (2002). Primary

enrollment maintains the highest inequality reducing impact.

Table 4. Panel-corrected standard errors, educational variables with 5 years lag

| | (1) | (2) | (3) | (4) | (5) |
|--|---------------------------------|----------------------|----------------------|----------------------|----------------------|
| | Dependent variable: Log of GINI | | | | |
| Human capital | | | | | |
| Log of average years of education | -0.011* (0.006) | - | - | - | - |
| Log of primary education enrollment rate | - | -0.042*** (0.015) | - | - | - |
| Log of secondary education enrollment rate | - | - | -0.009** (0.005) | - | - |
| Log of tertiary education enrollment rate | - | - | - | -0.008*** (0.003) | - |
| Log of public spending on education | - | - | - | - | -0.008*** (0.003) |
| Globalization | | | | | |
| Globalization index | -0.054*** (0.007) | -0.054*** (0.007) | -0.054*** (0.007) | -0.054*** (0.007) | -0.054*** (0.007) |
| Demography | | | | | |
| Log of age dependency ratio | 0.052*** (0.011) | 0.051*** (0.011) | 0.052*** (0.011) | 0.050*** (0.011) | 0.050*** (0.011) |
| Structural change | | | | | |
| Ratio value added industry and services (% of GDP) | -0.003 (0.013) | -0.004 (0.013) | -0.003 (0.013) | -0.004 (0.013) | -0.004 (0.013) |
| Domestic credit | | | | | |
| Log of domestic credit by banks (% of GDP) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) | 0.000 (0.002) |
| Income level | | | | | |
| Log of GDP per capita (constant 2000\$US) | 0.012 (0.019) | 0.012 (0.019) | 0.012 (0.019) | 0.012 (0.019) | 0.012 (0.019) |
| Log of GDP per capita squared | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) |
| Regions | | | | | |
| Sub-Saharan Africa | -0.004 (0.006) | -0.003 (0.006) | -0.004 (0.006) | -0.003 (0.006) | -0.003 (0.006) |
| Middle East and North Africa | 0.001 (0.007) | 0.002 (0.007) | 0.001 (0.007) | 0.002 (0.007) | 0.002 (0.007) |
| East Asia and the Pacific | 0.010 (0.007) | 0.010 (0.007) | 0.010 (0.007) | 0.010 (0.007) | 0.010 (0.007) |
| South Asia | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| Europe and Central Asia | 0.017 (0.011) | 0.016 (0.011) | 0.016 (0.011) | 0.016 (0.011) | 0.016 (0.011) |
| Latin America and Caribbean | 0.004 (0.007) | 0.004 (0.007) | 0.004 (0.007) | 0.004 (0.007) | 0.004 (0.007) |
| Constant | 3.729*** (0.076) | 3.906*** (0.105) | 3.747*** (0.077) | 3.735*** (0.075) | 3.735*** (0.075) |
| Observations | 484 | 484 | 484 | 484 | 484 |
| R-squared | 0.272 | 0.278 | 0.273 | 0.277 | 0.277 |

Notes: *, ** and *** stand for significance at 10%, 5% and 1% respectively; z-statistics are given in parentheses.

The per capita national income and its square indicate an insignificant positive and negative sign respectively. This result invalidates the possibility of a significant inverted-U curve relationship with inequality.

The age dependency ratio, which had shown a strong and positive relationship with inequality in the previous set of estimations, shows similar impact with almost the same coefficients, implying the inequality increasing impact of the dependency ratio. Higher dependency ratios are, in effect, synonyms for increased burden on the currently active segment of population, whether in the form of higher taxes required to finance the rising

schooling, health and retirement related expenditures, or more directly as the responsibility of caring for the increasing number of financially dependent members of the household. As for various reasons, the poor in the developing countries generally have larger families, and hence higher dependency ratios, a further increase in the dependency ratio may add to the burgeoning population of the poor, and cause a subsequent rise in inequalities.

Table 5. Panel-corrected standard errors, educational variables with 20 years lag

| | (1) | (2) | (3) | (4) | (5) |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|
| Dependent variable: Log of GINI | | | | | |
| Human capital | | | | | |
| Log of average years of education | -0.063*** (0.005) | - | - | - | - |
| Log of primary education enrollment rate | - | -0.170*** (0.011) | - | - | - |
| Log of secondary education enrollment rate | - | - | -0.049*** (0.003) | - | - |
| Log of tertiary education enrollment rate | - | - | - | -0.031*** (0.002) | - |
| Log of public spending on education | - | - | - | - | -0.031*** (0.002) |
| Globalization | | | | | |
| Globalization index | -0.071*** (0.006) | -0.060*** (0.005) | -0.064*** (0.006) | -0.064*** (0.006) | -0.064*** (0.006) |
| Demography | | | | | |
| Log of age dependency ratio | 0.069*** (0.009) | 0.062*** (0.009) | 0.065*** (0.009) | 0.065*** (0.009) | 0.065*** (0.009) |
| Structural change | | | | | |
| Ratio value added industry and services (% of GDP) | 0.003 (0.012) | 0.001 (0.011) | 0.002 (0.011) | 0.001 (0.011) | 0.001 (0.011) |
| Domestic credit | | | | | |
| Log of domestic credit by banks (% of GDP) | 0.003 (0.002) | 0.003 (0.002) | 0.003 (0.002) | 0.003 (0.002) | 0.003 (0.002) |
| Income level | | | | | |
| Log of GDP per capita (constant 2000\$US) | 0.010 (0.017) | 0.008 (0.016) | 0.009 (0.016) | 0.008 (0.017) | 0.008 (0.017) |
| Log of GDP per capita squared | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) | 0.000 (0.001) |
| Regions | | | | | |
| Sub-Saharan Africa | -0.005 (0.005) | -0.005 (0.005) | -0.005 (0.005) | -0.005 (0.005) | -0.005 (0.005) |
| Middle East and North Africa | -0.000 (0.006) | -0.001 (0.006) | -0.001 (0.006) | -0.001 (0.006) | -0.001 (0.006) |
| East Asia and the Pacific | 0.011** (0.006) | 0.009* (0.005) | 0.010* (0.005) | 0.010* (0.006) | 0.010* (0.006) |
| South Asia | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| Europe and Central Asia | 0.018** (0.009) | 0.017* (0.009) | 0.017* (0.009) | 0.018* (0.009) | 0.018* (0.009) |
| Latin America and Caribbean | 0.003 (0.006) | 0.002 (0.006) | 0.002 (0.006) | 0.002 (0.006) | 0.002 (0.006) |
| Constant | 3.774*** (0.065) | 4.454*** (0.078) | 3.866*** (0.064) | 3.752*** (0.064) | 3.752*** (0.064) |
| Observations | 484 | 484 | 484 | 484 | 484 |
| R-squared | 0.459 | 0.509 | 0.489 | 0.473 | 0.473 |

Notes: *, ** and *** stand for significance at 10%, 5% and 1% respectively; z-statistics are given in the parentheses.

Globalization seems to be negatively and significantly related to inequality, implying the beneficial effects associated with the recent stage of the third wave of globalization. Both the impacts of the globalization and age dependency ratio variables have a similar

magnitude: a 10% hike in the dependency ratio/globalization leads to a 0.5% (0.6% in the case of 20 year lags) rise/fall in consumption inequality respectively.

In addition, the domestic credit to GDP ratio and the sectoral change ratio appear to have no potent effect on inequality. The statistically insignificant and close to zero impact of domestic credit is telling. A significant positive relationship would have pointed towards an economically inefficient allocation of bank loans in the developing countries in the presence of corruption, nepotism and political manipulation. Likewise, a negative sign would have suggested a reduction of liquidity constraints in a capital-short economy. In such an economy, expansion in the banking and financial sector, and the subsequent increase in loan availability ought to lead to lower inequality.

However, this numerically insignificant coefficient in our analysis implies that in the developing countries overall, domestic credit growth over the last three decades has played little role in the evolution of the economic inequalities.

With respect to the regional dummies, no region shows a substantial association with inequality reduction during the studied period. East Asia and the Pacific, and East Europe and Central Asia, however, show a non-robust positive link with inequality.

5. Discussion

Among the human capital measures, average years of education, public spending on education, gross primary, secondary and tertiary enrollments all show a consistent, significant and negative relationship with the Gini index, primary education being the strongest. In less developed economies the negative effect of primary enrolment is attributable, theoretically, to an increased importance for education during a structural transformation from agricultural to industrial or services-based societies, and practically to the Education for All policies being implemented in pursuit of the Millennium Development Goals. The significance of an inequality decreasing impact of higher education can be explained through the logic of supply and demand, whereby an increase in the supply of educated workers will tend to diminish the gap in wages, and thereby decrease income inequality (Lecaillon *et al.*, 1984 and Wells, 2006). We can therefore deduce that in the developing countries, all education levels have important inequality reducing effects. These results are in line with those determined by Barro (2000) and Alderson and Nielsen (2002) among others, who find education to be the suitable inequality-reducing human capital indicator. Average years of education, even though different from the enrollment variables (being a stock rather than a flow variable), shows a negative impact similar to that of the secondary education enrollment. This highlights the importance of human capital accumulation in an eventual decrease in inequalities.

Our study does not find any evidence for the Kuznets hypothesis. A rising tide of

average national income per capita may after all not lift all the boats. This finding adds to the growing body of literature that has failed to validate this hypothesis.

Among other variables included in our model, there are two that stand out for their strong and robust impact: age dependency ratio and globalization. Developing countries have undergone a rapid demographic transition in the last century with sharp increases in their populations. The population of many Sub-Saharan African countries has quadrupled or even more in only fifty years. In the presence of such high population growth, particularly among the poor, public services of education and health are overwhelmed hurting the poorest of the poor more than anyone else. A more sustainable population growth rate may allow governments to better execute their welfare measures and reduce the age dependency ratio.

The impact of globalization is found to be significant and for the benefit of the poor in the developing countries. Developing countries, particularly in East Asia and Eastern Europe, have surely benefited from globalization by attracting foreign capital flows and opening up their trade. Other developing countries can also follow the same process and obtain the expected gains of globalization.

In addition, the domestic credit allocated by the banking sector seem to be marginally inequality increasing (but the impact is insignificant). In many developing countries, mislocation of bank loans is commonplace, and corruption and political pressures make sure that local business and political elite often benefits the most.

Moreover, all loans might not be dedicated to the production purposes, some of them going in unproductive activities (de Melo, 1988). As a result, domestic credit may not have an inequality reducing impact in a developing country even with a large credit constrained population.

6. Concluding remarks

This paper finds evidence for the important role of human capital in reducing inequality in developing countries. The average years of schooling, public spending on education primary, secondary and tertiary education enrollment rates clearly lead to a more equal society. Therefore, provision of education and skill development of the population is a prerequisite if the developing countries are to make their societies more harmonious and egalitarian. Poverty alleviating measures such as food stamps, minimum wages, guaranteed jobs and cash benefits can surely relieve the plight of the poor in the immediate term, but in the long-run, only the light of education can illuminate the way. Primary education is found to be the most pertinent inequality reducing human capital indicator. A 10% increase in primary enrollment can cause consumption inequality to drop by about 0.4-1.7%. Primary education enrollment's stronger impact, as compared to

Appendix

Table A.1. List of countries included in the study

| | |
|--------------------------|----------------------|
| Albania | Mauritania |
| Algeria | Mauritius |
| Argentina | Mongolia |
| Bangladesh | Morocco |
| Botswana | Mozambique |
| Brazil | Myanmar |
| Burundi | Nepal |
| Cameroon | Nicaragua |
| Central African Republic | Pakistan |
| Chile | Panama |
| Colombia | Papua New Guinea |
| Cote d'Ivoire | Paraguay |
| Dominican | Republic Peru |
| Ecuador | Philippines |
| Egypt | Rwanda |
| El Salvador | Senegal |
| Fiji Sierra | Leone |
| Gabon | South Africa |
| Gambia | Swaziland |
| Ghana | Syrian Arab Republic |
| Guatemala | Tanzania |
| Haiti | Thailand |
| Honduras | Togo |
| India | Tonga |
| Indonesia | Tunisia |
| Iran | Turkey |
| Iraq | Uganda |
| Jamaica | Uruguay |
| Jordan | Venezuela |
| Kenya | Yemen |
| Malawi | Zambia |
| Malaysia | Zimbabwe |

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