Human Capital Effects Analysis on Income in Developing Countries

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Abstract

The human capital theory teaches that education makes it possible to reinforce the productive potential of the labor force, which contributes to reducing the gaps between individuals' incomes. Given this conclusion, the main question that holds our attention is to know why the increase in the education level in developing countries has not led to a significant and continuous decline in income inequality. Is this downward rigidity due to the low quality of education in these countries? The main objective of this research is to show that investments in both education quantity and quality can significantly reduce the income inequality level. To achieve this objective, we reexamine the relationship between education and income inequality with a composite human capital index defined from information on education quantity and quality.

Key words: education, income, inequalities, macroeconomics
J.E.L. classification: E24

1. Introduction

Extreme world's poverty eradication is one of the major axes of the Sustainable Development Goals (SDG). This objective can be achieved through policies that promote a more equitable distribution of the fruits of growth among individuals. An equitable wealth distribution among individuals promotes inclusive growth, a process in which all population categories contribute to and benefit from the economic growth involved in the process. However, institutions that favor corruption lead to a vicious circle, the result is the continuous increase in the gap between the incomes of the rich and poor people. High inequalities in the income distribution make growth non-pro-poor and consequently lead to an increase in the poverty rate. Several studies have highlighted the income inequality role in explaining poverty persistence. Bandyopadhyay (2022) also agrees by emphasizing the existence of a positive relationship between income inequality and poverty. An effective strategy for reducing the poverty rate would be to develop mechanisms to promote equitable income distribution among individuals.

In research work oriented towards understanding the mechanisms for reducing income inequalities, the generally proposed instruments are the institutions of governance and human capital. Focusing on studies that link human capital and income inequality, it emerges from the increase in the average of education years leading to a reduction in income inequality. In most of these countries, the improvement in the average education years has not been followed by a continuous income inequality reduction. From 2001 to 2021 income inequality decreased while both the average number of years of education over time and the education access have significantly improved for all population categories. These observations and the conclusions of the human capital theory in the relationship between education and income inequality should naturally lead us to obtain a continuous and self-sustaining decline in the income inequality level in developing countries.

2. Literature review

Further development of Bandyopadhyay (2022) work on the relationship between economic growth and income inequality led to the emergence of trickle-down theory in public debate. According to this theory, initial income inequalities should ultimately lead to the realization of

egalitarian societies. The transition from an unequal society to an egalitarian one has been achieved thanks to a significant income from wealthy individuals through their consumption or investment. The income inequality-economic growth-poverty triangle could be seen as an extension of the trickle-down theory, as it establishes a link between income inequality, economic growth, and poverty. From the analysis of the triangle of Brown et al. (2020), it appears that economic growth and the reduction of income inequalities are both channels that the decision-maker can exploit to reduce the level of poverty. The conclusions of the work of Ehrenberg et al. (2020) are also in line with those of Brown et al. (2020).

They highlight the positive effects of reducing income inequality on poverty. Based on these relationships, we can postulate that an effective strategy for reducing the level of poverty in developing countries would be to develop mechanisms that make it possible to reduce income inequalities. In the related literature, human capital would be among the mechanisms, one of the most commonly cited. A review of the major works makes it possible to group the studies that relate human capital and income inequalities into three groups. In the following, we discuss the conclusions of this work.

Analyzing the effects of human capital derived from education on income inequalities, the first group of researchers concludes that investment in education guarantees a supply of highly qualified labor which in turn leads to downward pressure on individual income gaps. In the same dynamic, Taylor et al. (2015), find that the expansion of education and the increase in its level have contributed to a significant reduction in income inequalities in the world. The analyzes conducted by the second group of researchers concluded that human capital derived from education has no significant effect on income inequality.

With this in mind, Shahbaz et al. (2021) studied the effects of education on income inequality in 100 countries. He deduces from his analysis that neither the improvement in average levels of education nor its expansion has produced a significant effect on income distribution. He deduces from his analysis that neither the improvement in average levels of education nor its expansion has produced a significant effect on income distribution. Bento (2022) points out that education plays a rather important role in determining the level of income of individuals, but it has no effect on its distribution. Fraumeni (2021) also show that education has no direct effect on income inequality. For them, education acts as a signal and allows employers to select the best employees during the recruitment process. Finally, Ehrenberg et al. (2020) consider that the convergence of education levels in developing countries has not led to a significant reduction in income inequality in this part of the world.

The third group of researchers explains the differences between individuals' incomes through education expansion and the improvement of its level. In this dynamic, Bank (2020) rely on the case of China to show that the education expansion has played an important role in the income inequality increase. Bank (2020) also reached similar conclusions to those discussed above. These results are contrary to the human capital theory prediction from the developing countries and could be explained by the strong disparities in the educational institutions quality. Indeed, in these countries, a tiny fraction of the population generally has access to higher-quality education while the majority attend low-quality educational institutions. This heterogeneity in the quality of the training received by individuals would be the source of differences in their productivity level and therefore in their income. Looking at the research findings discussed in this section, we find that there is a lack of consensus on the nature of the relationship between human capital derived from education and income inequality. Another observation is that the effects of human capital on income inequalities is essentially articulated around the effects of the education quantity without taking into account its quality.

From the conclusions of the presented work, it cannot be argued that a policy that promotes an increase in the average education years number would systematically lead to a reduction in income inequality. These facts makes an original contribution by weighting the years of schooling according to two different parameters: the quality of the education received, based on the scores on the harmonized test, and a variable return rate to the education years.

3. Research methodology

We use data from several sources. Data on income inequality was provided by the World Income Inequality Database (WIID). Education information comes from World Economic Forum website. Population data is taken from the Penn World Table 9. The information on the quality of institutions and the openness degree comes respectively from the databases of Transparency International and the UN Conference on Trade and Development (UNCTAD). Empirical studies on income inequality are often complex due to lack of data. In the specific case of this study, the information available does not entirely cover the period selected (2001-2021). To remedy this problem, we reorganized the data on five (5) years time intervals. Since income inequality slowly evolves, we'll use five-year observations for close dates. Despite this organization, cases of missing data still exist. To address this concern, we carried out imputations by combining two methods: stationary completion and nearest neighbor. Concretely, this technique consists of a first step in selecting the k most frequent observations for which the distances in terms of time with the missing value are the smallest possible. In the second step, we make a linear combination of the retained information and use the obtained results to fill in the missing data. The equation that allows to obtain the missing values is the following:

$$y_m = y_i^* = \frac{1}{k}\sum_{i=1}^{k} y_i \qquad (1.1)$$

y_m represents the missing data, y_i^* corresponds to the estimated values and yi represents the information about eligible neighbors.

Table 1 presents the variables used to estimate equation (1.6). Table 1.1 below presents the variables used to estimate equation (1.6). In this equation, inflation, quality of institutions, trade openness, and population size are the control variables. We expect inflation to have a positive sign while for the other variables a negative one.

Table no. Variables Used

Description	Variable
Gini Index	Gini
Adjusted human capital index	ajust. hum.
Unadjusted Human Capital Index	hum_PWT
Education Years Number Average	Education
Education Access Inequalities Index	Ed. Ineq.
Population Concentration Index	Pop. Ind.
Institutional Quality	Inst. Qual.
Trade Openness Degree	Trade Open.

Source: Bandyopadhyay (2022)

Correlation Between Human Capital and Income Inequality

Based on the defined index, we will analyze the correlation between human capital adjusted and income inequality. Figure (1.1) below illustrates this correlation. It is obtained from data collected in 14 developing countries. From this graphical representation, we find the existence of an inverse relationship between adjusted human capital and income inequality. From this graphic, we discover the existence of an inverse relationship between adjusted human capital and income inequality. In other words, investment policies that improve the level of education in its quantity and quality components could help reduce income inequality. In the next section, we empirically analyze this relationship.

Figure no. 1 Human capital and income inequality
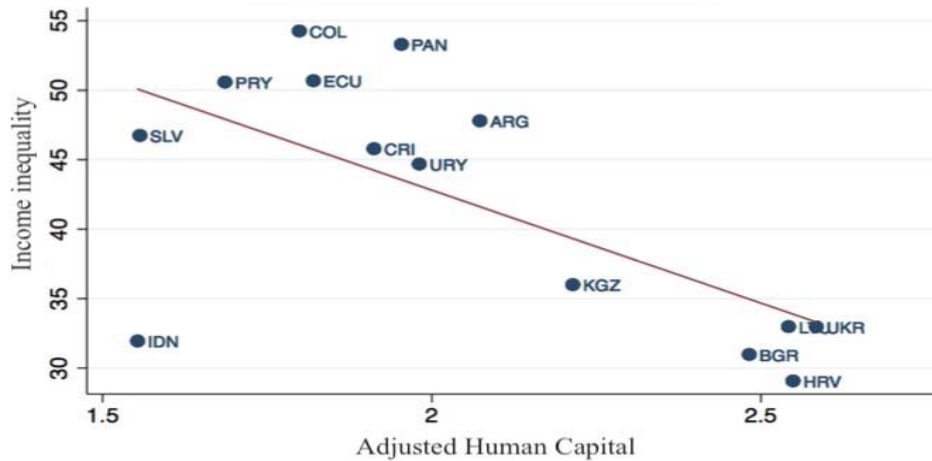
Econometric Model

In this section, we empirically analyze the adjusted human capital on income inequality effects. To do this, we use the following econometric model:

$$I_{it} = \gamma_0 + \gamma_1 \widetilde{h_{it}} + \gamma_2 X_{it} + \upsilon_{it} \qquad (1.2)$$

The model above, it represents income inequality. it is the adjusted human capital index. X represents the vector of control variables and υit is the error term. Given that our human capital index is defined using education data, endogeneity problems related to this variable can alter the quality of the results obtained with the Pooled OLS method. We showed that the existence of measurement errors on education leads to a non-zero correlation between the education variable and the error term. This non-zero correlation leads de facto to a bias in the "OLS" results. In equation (1.2), simultaneity is also another problem that can bias the "OLS" results.

Indeed, while it is widely documented in the literature that education influences the level of income inequality, these can influence the levels of education attained by individuals. For example, more affluent individuals invest more in their education or in that of their children. By doing so, they can persevere in their studies compared to those who are less well off. Given the arguments put forward above, it would be endogenous. Under these conditions, the use of "OLS" estimators produces biased results. However, we have not been able to effectively take into account the measurement errors in education for lack of an suitable instrument. The measurement errors on education would be the source of a downward bias in the obtained results with "OLS" method. For this reason, we expect the coefficients of the "3SLS" to be larger than those of the "Pooled OLS".

4. Findings

Following the above discussions, we empirically estimate the effects of adjusted human capital on income inequality. The results of the various estimates are reported in Table 1.2. These results are obtained with "Pooled OLS" and 3SLS. They are also organized into two blocks. The first block presents the results of the "Pooled OLS" estimations and the second, the results obtained with the 3SLS method. In our comments, we are interested in the results of the "3SLS" because they are relatively less biased about the econometric problems discussed previously. The results obtained with the saturated model indicate that improving adjusted human capital by 1% leads to a reduction in income inequality by 0.685% (column 4). The greater value of this coefficient would be linked to certain variables such as the quality of institutions in the saturated model contributes to increasing the yield of the human capital model. Focusing on the results obtained with the control variables, we find that the estimated effects on the quality of institutions are in line with the conclusions of the related literature. In this literature, it is pointed out that good-quality institutions lead to a reduction in income inequality. Strong institutions can indeed reduce the corruption level to reduce income inequality through more efficient social spending and pro-poor tax systems. Furthermore, in the

obtained results, we find that the increase in the degree of trade openness and the improvement in the population's spatial distribution also lead to an income inequality level reduction. These results could be justified in a context where the institutions are of good quality.

In this case, an improvement in the trade openness would be accompanied by pro-poor growth; the resulting increase in the incomes of the poor leads to a reduction in the gaps between the level of their income and that of the rich. A better distribution of the population favors the process of decentralization and/or deconcentration. A better population distribution favors the decentralization and/or deconcentration process.

The powers transfer or delegation can in turn accelerate the good policies implementation (investments or income transfers) in favor of the poor, which can significantly contribute to reduce the gaps between the individuals incomes (rich and poor). The positive coefficient of inflation is also consistent with the economic theory predictions. Thus, we find that an increase in the inflation rate leads to a rise in income inequality. This result is justified in the developing countries context where many of the individuals' income is not indexed. Under these conditions, a general increase in the prices leads to a greater drop in the individuals purchasing power with non-indexed income compared to that recorded for individuals with indexed income. Consequently, inflation will be likely to widen the gap
between the incomes of the two groups of individuals, especially if it is unforeseen.

Table no. 2 Human Capital and Income Inequality

Dependent variable: Income inequality				
	Pooled OLS		**3SLS**	
	(1)	(2)	(3)	(4)
Pop. Ind.		-0,091***		-0,103***
		(0,027)		(0,024)
Inflation	0,504***	0,442**	0,504***	0,435***
	(0,143)	(0,186)	(0,141)	(0,139)
Trade Open.		-0,134**		-0,127**
		(0,067)		(0,051)
Inst. Qual.		-0,209**		-0,282***
		(0,087)		(0,079)
Human capital	-0,669***	-0,606***	-0,678***	-0,685***
	(0,160)	(0,161)	(0,144)	(0,145)
R^2	0,37	0,45	0,36	0,43
N	70	70	70	70

Note: * $p<0,1$; ** $p<0,05$; *** $p<0,01$
   Source: Personal Computation

Robustness Testing

As discussed, one of the limitations of using the education levels to approximate human capital in a data panel study is the underlying assumption of the education quality homogeneity across countries. In this section, we define another adjusted human capital index using education expenditure per capita as a proxy for education quality. More specifically, the definition of this second index of adjusted human capital is based on the work of Brown et al. (2020):

$$\tilde{h}(s) = \tilde{A}(s)e^{\Phi(s)} \qquad (1.3)$$

An (s) represents investment expenditure on education. In the above expression, we allow A(s) to vary to reflect the differences found in efforts to invest in education quality across our sample countries. Explicitly, A(s) is defined as follows:

$$\tilde{A}(s) = p^{\phi_p} m^{\Phi_m} k^{\phi_k} l^{\phi_l} \qquad (1.4)$$

p, m, k, and l represent respectively the student-teacher ratio, expenditure on academic materials, school infrastructure expenditure (classrooms, gymnasiums, laboratories, etc.), and teacher training expenditure. The φ_i (i = p, m, k, l) are corresponding elasticities. Since data on expenditure on academic materials and school infrastructure are not available, it becomes difficult to determine A(s) based on specification (1.3). Bandyopadhyay (2022), develops an alternative functional form that relates the quality of education to education expenditure per student. According to him, these sorts of expenses strongly explain the quality of the training students received since they reflect the investment efforts in the teachers training, in the acquisition of academic material and in the infrastructures construction. Consequently, the education quality expression developed in equation (1.6) can be redefined by the following formula:

$$\tilde{A}(s) = D^{\phi_d} \qquad (1.5)$$

D represents education expenditure per student and φd is an education expenditure elasticity. Its value is equal to 0.2, by taking the product of (1.2) and (1.9), we obtain an index of adjusted human capital defined as follows:

$$\tilde{h}(s) = D^{\phi_d} e^{\phi_{s*}s} \qquad (1.6)$$

The above-defined index is used to test the robustness of the results discussed in the 4.4.4 subsection. By estimating equation (1.6) with the index defined by function (1.6), we obtain the results shown in Table 1.3. Focusing on the results in column (4), we find that an improvement in the adjusted human capital level by 1% translates into a reduction in income inequality by 0.528%. Based on all of these results, we can deduce that investments that education improvements can reduce developing countries' income inequality levels.

Table no. 3 Human capital and income inequality

	Dependent variable: Income inequality			
	Pooled OLS		**3SLS**	
	(1)	(2)	(3)	(4)
Pop. Ind.		-0,050		-0,086***
		(0,027)		(0,032)
Inflation	0,663***	0,570**	0,681***	0,444**
	(0,139)	(0,228)	(0,145)	(0,191)
Trade Open.		-0,083		-0,142*
		(0,078)		(0,078)
Inst. Qual.		-0,093		-0,223***

		(0,109)		(0,112)
Human capital	-0,505***	-0,446***	-0,562***	-0,528***
	(0,091)	(0,120)	(0,122)	(0,145)
R^2	0,39	0,41	0,39	0,37
N	65	65	65	65

Note: * $p<0,1$; ** $p<0,05$; *** $p<0,01$
Source: Personal Computation

5. Conclusions

The economy's human capital level is an education investment function formed by the individuals who compose it. In the related literature, it is shown that improving the level of education of the population, through its positive effects on economic growth and income inequality, largely determines the level of economic development. and social of a nation. The literature showed that improving the population's education level benefits the nation's social economic development. One of the essential questions in development economics is to understand why some countries succeed more than others in building more egalitarian societies. The argument of differences in investment efforts in education has been very often invoked in the literature to explain this duality. However, this argument does not seem to be unanimous among researchers. Indeed, while a large number of studies have concluded that improving the human capital level resulting from education has a positive and significant effect on income inequality, some studies have concluded that there are statistically insignificant effects and others themselves have concluded the existence of surprising negative effects.

A common denominator that we have exploited in literature is the use of the average number of education years as a proxy for human capital. Due to the low quality of educational institutions in most developing countries, the approach has a limit, since the number of years of study attained by an individual might not reflect his real level of knowledge and therefore its effective human capital. We resumed the analysis of the relationship between human capital and income inequality with a new index defined based on the quantity and quality of education. The results obtained show that investments that improve education in its quantity and quality components can significantly reduce income inequalities. An extension of this chapter also allowed us to analyze the effects of human capital inequalities on income inequalities. The analysis results have shown that the increase in inequalities in the human capital distribution leads to an increase in income inequalities. From all of the findings discussed above, we can conclude that investments that improve education quantity and quality are needed to build a more egalitarian society.

6. References

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