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Education Expenditures, Inequality and Economic Growth: Empirical Analysis of the Transmission Channels

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Abstract

Many economists have confirmed the negative and direct relationship between economic growth and income inequality. Recent studies have tried to analyse the different transmission channels through which inequality may affect economic performance indirectly. In this paper, we are only referring to the education channels: public and private education expenditures and human capital, in order to evaluate the role of each in the explanation of this negative correlation. We noticed that a high level of inequality requires more public resources this may impede economic growth. Income inequality also discourages private financing in education and human capital accumulation which leads to a sluggish economic growth. These findings imply that private education expenditure is the most important channel which explains this negative relationship reported in the literature.

Keywords: Public and private education expenditures; Human capital; Economic growth; Income inequality; Transmission channels.

JEL classification: O40, I22, O15

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1. Introduction

Development strategies in emerging economies are permanently looking for optimal policies that are likely to reduce poverty, income inequality and promote economic growth. The abundant literature linked to the topic tries to give answer to the following questions: is inequality harmful for growth? What are the factors that are likely to account for the inequality differences between countries? A large body of literature is interested in the relationship between income inequality and economic growth. In his seminal contribution, Kaldor (1956) has explained the effect of inequality on economic growth through the capital accumulation channel. Kuznets (1955) has analysed the other side of the correlation: the impact of economic growth on income distribution. However, this negative relationship between inequality and growth, largely studied by theory, is complex because of the interaction of many transmission channels.

Since these studies, the analysis of the impact of unequal distribution of resources on capital accumulation and economic growth are the object of several theoretical and empirical models. These theories are classified in two categories: The first attributed a positive relationship between income inequality and economic growth. The inequality might enlarge the gap between the rich and the poor classes in the society. The rich are more inclined to save and to invest than the poor which leads to an increase in capital accumulation and subsequently economic growth. The second suggests a negative impact of income inequality on growth Alesina and Perotti (1994), Clarke (1995) through transmission channels: socio-political instability, income redistribution and investment in human capital.

The first channel is relative to socio-political instability (Perotti, 1994;1996), Alesina and Perotti (1996), Grossman and Kim (1996) and Banerjee and Duflo (2000). The economy characterised by violence and social discontent finds many difficulties to adopt reforms and economic stabilisation programs that affect positively the economic performance and which benefit all income groups. Following the absence of political stability and the lack of law enforcement, economic growth was hindered and private investment was discouraged. This situation may lead to a poverty trap where the inequalities between rich and poor persist. Poverty is transmitted from one generation to another in a vicious circle and social exclusion tends to have a negative impact on economic growth. The second channel is attributed to the income redistribution. This channel implies that the increase in tax rates which leads to a more equal income distribution may reduce economic incentives there by slowing down investment and economic performance Alesina and Perotti (1994), Persson and Tabellini (1994) and Benabou (1996).

The last channel concerns investment in human capital. In the absence of capital market imperfections, all individuals can allocate the same amount of resources to their education. But when borrowing is costly and geared to high income, poor individuals cannot obtain loans to finance human capital investment. This situation may lead to a poverty cycle because the influence of education investment decisions on the evolution of income which consequently generates permanent social divisions (Galor and Zeira, 1993).

The main purpose of this paper is to study empirically the impact of income inequality on economic growth considering the transmission channels associated to human capital accumulation in a set of developing and

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developed countries during the period 1980-2004[1]. The principal objective, with respect to the empirical literature, focuses on the effect of income inequality on human capital, private and public education expenditures and estimates the contribution of various channels to the overall negative effect of social inequality on the economic performances. We study specifically the direct and indirect transmission channels impacts and we try to find out the significance of each one.

This study shows that (*i*) income inequality affects directly economic growth (*ii*) there exists an indirect relationship between economic performance and social inequality through the transmission channels (human capital, private and public education expenditure) and finally (*iii*) the important channel that influences the negative relationship between economic growth and income inequality is the private fund of education. The impact of public education expenditure channel is less important than the two other channels.

The out line of the paper is the followings: in section 2, we describe the data used in the empirical study. Section 3 presents the findings of the cross section analysis. Section 4 develops the three transmission channels. Section 5 is reserved to estimate the simultaneous equations model in order to isolate the direct and the indirect effect of income inequality and to determine the contribution of each channel. A conclusion follows.

2. Data and Descriptive Statistics

The main objective of this paper is to find the direct and indirect determinants of the negative relationship between economic growth and income inequality in the long run. We use a cross-sectional data during the period 1980-2004. The Gini index is provided by the data base "World Income Inequality Database" UNU-WIDER (2005). The distribution of income is considered equitable when this coefficient is weak and it becomes more unequal with its increase.

The measure of inequality (Gini coefficient) is determined by the area between the Lorenz Curve and the 45 degree line. When this area tends towards zero the income equality is perfect and the Gini coefficient is equal to zero. However, countries adopt different methods and types of data to calculate this index. Generally, these data are heterogeneous. For example, the individual welfare is measured by the level of income or expenditures and the observation unit involves the household, the individual or the family. For this study, we use the Gini adjusted in order to control the differences of measure through the different observations. We take the Gini coefficient at the beginning of the period to solve the problem of correlation between economic growth and income inequality.

The human capital indicator (*HK*) measured by the average schooling years in the total population over 25 was obtained from the International Data on Educational Attainment by Barro and Lee (2000). The data on the private education expenditure (*PREY*) are assembled by the United Nations Statistical yearbook which covers 48 countries in our sample. The institutional variable that measures the law order (*Laworder*) is from the Kaufman *et al.* (2010). The other independent variables: the initial GDP (Y_i), the public expenditure on education (*PEY*), the government expenditure (*GY*), the openness rate (*TRADE*) presented by the percentage of exports and imports sum on GDP, the population density (*DENS*) and the growth rate of population (*POP*), are taken from the World Bank Development Indicators (WDI).

3. Cross Country Growth Regressions

In this section, we estimate the impact of income inequality on economic growth using basic growth regressions. At this stage, we refer to the cross-sectional approach and we do not estimate the effect of the transmission channels. The dependent variable (*Gr*) denotes the growth rate of GDP per capita in the period from 1980 to 2004. We introduce the level of initial GDP per capita (Y_i) (the natural logarithm) as independent variable according to the conditional convergence hypothesis, which predicts a negative coefficient of this variable. This result means that the economic growth is negatively associated with the initial income per capita which implies that developing countries tend to grow faster then the developed ones. In order to study the impact of income inequality on economic growth, we take the Gini index (*GINIi*) as a second independent variable in our regression.

We introduce other variables denoted by the vector (*B*) commonly used in the growth literature (Barro, 1991), Levine and Renelt (1992), Sachs and Warner (1995), De Gregorio and Guidotti (1995) and (Sylwester, 2000;2002) as determinants of economic growth and that may be linked with inequality: trade openness (*TRADE*), the government expenditure (*GY*) (the percentage of government expenditure on GDP). We note by C^j the matrix of variables[2] that we consider as transmission channels in the indirect analysis: the public and private education expenditure (*PEY* and *PREY*) (ratio of public and private education expenditure as a percentage of GDP) and human capital (*KH*) measured by the average years of schooling. The growth regression (equation (1)) is the following where the superscript j shows the country in the sample. We use the (*OLS*) method to assess this equation.

$$Gr^j = \alpha_0 + \alpha_1 Y_i^j + \alpha_2 Gini\ i^j + \alpha_3 C^j + \alpha_4 B^j + \varepsilon^j \qquad (1)$$

[1] We are limited to this period for this study because the lack of data of private education expenditure which have been stopped at this date.
[2] For these regressions, we consider these variables as explanatory.

Table-1. Economic growth and inequality (Dependent variable: $Gr_{1980-2004}$)

	1	2	3
constant	0.073 (2.20)**	0.169 (1.96) **	0.220 (2.71)**
Initial income per capita (Yi)	-0.003 (-1.10)	-0.016 (-3.22) ***	-0.018 (-3.80)***
Humain capital (HK)		0.018 (1.79)*	0.006 (0.67)
Public education expenditure (PEY)		-0.018 (-1.88)*	-0.014 (-1.57)
Private education expenditure (PREY)		0.023 (2.90)***	0.021 (2.95)***
Initial Gini (GINIi)	-0.066 (-2.21)**	-0.040 (-1.51)	-0.038 (-1.58)
Openess rate (TRADE)	0.003 (0.44)	0.006 (0.66)	0.008 (0.94)
Government expenditure (GY)	-0.004 (-0.14)	0.002 (0.08)	-0.012 (-0.52)
Dummy			-0.013 (-2.37)**
R^2	0.1044	0.5205	0.6010
Nb observations	50	31	31

Superscripts *, ** and *** correspond to a 10%, 5% and 1% of significance respectively.
t- Statistics in parenthesis.
OLS estimation with average of the growth rate of real GDP per capita as dependent variables. The variables Y_i, *HK, PEY et PREY* are taken on the natural logarithm.

Table 1 presents the OLS estimations of the equation (1) with the introduction of the set of variables B^j as independent variables. The regression (1) shows the results of the assessed equation when all the plausible transmission channels are not included. We introduce only the logarithm of the income at the beginning of the period *(Yi)*, the initial Gini (*GINIi*), openness rate (*TRADE*) and government expenditure (*GY*). We find that all these coefficients have the predicted signs. However, only the estimated coefficient of Gini (*GINIi*) is statistically significant (95%). With respect to the different empirical studies that use cross countries data (Alesina and Perotti, 1994), Persson and Tabellini (1994) and Sylwester (2000), we find that income inequality has a substantial negative impact on economic growth. An increase of the Gini coefficient level of one standard deviation decreases economic growth by approximately 0.64%[3].

The initial income (*Yi*) has a negative effect on economic growth coherent to the theoretical study but insignificant. The estimated coefficients of openness trade (*TRADE*), government expenditure (*GY*) are also insignificant.

The second equation in table 1 presents the results of regressing growth with the introduction of all the variables of the vector C^j: public and private education expenditure (*PEY* and *PREY*) and human capital (*HK*). In this part of the paper, we consider that these variables affect directly economic performances. The adjusted R^2 is equal to 0.52 and all the variables are significant except for initial Gini (*GINIi*), openness trade (*TRADE*) and government expenditure (*GY*). The estimated coefficient of schooling (*HK*) is positive and statistically significant at a 10% level. This result is consistent with common findings of theoretical literature that suggests a positive relation between human capital and economic growth Nelson and Phelps (1966), Lucas (1988) and Romer (1990) and empirical literature (Mankiw *et al.*, 1992) and Benhabib and Spiegel (1994).

The coefficient of private education expenditure (*PREY*) is positive and significant at a confidence level of 99%. So, more investment in private education leads to economic success. Generally in this private education system, parents devote more time and resources to the education of their children (Glomm and Ravikumar, 1992) because they consider that this type of investment is efficient and may increase their future income.

In fact, the public education expenditure (*PEY*) is negatively correlated with economic growth and statistically significant at 10% level. We can justify this result, which is consistent with the conclusion of Sylwester (2002), by less productivity of these expenditures in the beginning of the period and also by a mediocre quality. Generally, previous expenditures on education are associated with faster growth in later periods.

The introduction of the other control variables in this regression affects the Gini coefficients (*Ginii*) which appear with a negative sign and are statistically insignificant (equation (2) and (3) of the same table). This result implies that the direct effect of inequality on growth is evinced by these variables. It appears that the theoretical thesis, that suggests a negative relationship between economic performances and income inequality transmitted through different channels, is confirmed.

The initial income per capita has a negative sign and significant at a confidence level of 95%. This negative sign confirms the convergence hypothesis (Barro, 1991) and Mankiw *et al.* (1992) where the difference of growth rates between countries is explained by their different characteristics. So, low-income countries tend to grow faster than

[3] From the table 2, we multiply the standard deviation for income inequality (Appendix 1) with its coefficient ((-0.066)*0.098)

the high-income ones. The other independent variables (openness trade (*TRADE*) and government expenditures (*GY*)) present insignificant coefficients.

In order to control the heterogeneity of the sample, we introduce a dummy variable which has the value 0 for developed countries and 1 for developing ones. The results of equation (3) are similar to those of equation (1) and (2) except the indicator of human capital (*HK*) and public education expenditure (*PEY*) who become statistically insignificant. The negative effect of income inequality persists but it remains insignificant. The impact of the dummy variable is negative and significant at 5% level. It means that the membership of a set of the least advanced countries, characterised by a great social gap between rich and poor, impedes development. This result explains the persistence of the negative effect of the initial level of inequality on economic growth considered at this part of the paper as direct effect. The suggested relative insignificance of the Gini coefficient can be justified by the indirect effect transmitted via the channels.

The estimated coefficients of the independent variables, considered as transmission channels in the rest of the paper, have the same sign but they become insignificant except private education expenditure (*PREY*). The initial income (*Yi*) has a negative and significant sign at a confidence level of 99%. The remaining control variables present insignificant estimated coefficients.

4. The Transmission Channels

According to the abundant literature, the income inequality affects growth in several ways. Three channels are largely suggested by the literature (Galor and Zeira, 1993), Alesina and Perotti (1994), Alesina and Rodrik (1994), Persson and Tabellini (1994), Perotti (1993) and Mo (2000) human capital, the imperfections of the credit markets and socio-political stability. However, recent investigations (Sylwester, 2000) found out the presence of many other channels that affect the relationship between income inequality and economic performance.

In this paper, we refer to the empirical work of Sylwester (2000) by studying the influence of income distribution on growth through its effects on human capital investment. However, it differs in the sense that we consider three channels: public and private education expenditure and human capital.

4.1. Private Education Expenditure

Another influence of income inequality on economic growth is through its effects on private education expenditure. Our objective is to find that more inequality decreases the private investment on education which leads to a decrease in the economic growth. Generally, the income inequality tends to widen the gap between rich and poor individuals. The initial differences in the level of parents' income can affect their effort in education investment. So, families with subsistence earning can not invest in the education of their children which leads them to be trapped in a low-education and low-income cycle. However, rich ones invest more in their children's education leading to the absence of intergenerational mobility due to a higher persistence of economic status across generations. Consequently, we find two kind of education: public education for the poor and private for the rich.

In the last decade, many economists gave particular attention to the private education financing and its relation to economic growth and income inequality (Glomm and Ravikumar, 1992), Saint-Paul and Verdier (1993), Eckstein and Zilcha (1994), Epple and Romano (1996), Gradstein and Justman (1997), Kaganovich and Zilcha (1999) and Cardak (2004). However, the empirical studies in this subject are rare and even inexistent.

The model of Glomm and Ravikumar (1992) is the first theoretical study that analyses the effect of educational system both on economic growth and income inequality. These authors claim that private education financing can decrease the income inequality with respect to the parameters value of their model. These results were confirmed by the studies of Epple and Romano (1996), Gradstein and Justman (1997) and Cardak (1999) who consider the hypothesis of preferences heterogeneity. In his model, Cardak (2004) studies the effects of public and private education on income inequality under the assumption of heterogeneous abilities. It appears that a move from a purely private education system to a public one lowers income but leads to a social equality.

More studies are interested in the effect of private education financing on income inequality. In this paper, we study empirically the direct and indirect transmission channels through which inequality affects growth but we focus specifically on the inverse causality sense between inequality and private education expenditure.

4.2. Public Education Expenditure

In this paper, the second transmission channel is public education expenditure which is influenced by income inequality. The studies of Saint-Paul and Verdier (1993), Lee and Roemer (1997), Easterly and Rebelo (1993) and Sylwester (2000) confirm the positive relationship between inequality and public education expenditure. The first and the second papers present theoretical models and use the median elector theorem in order to prove that more social equality is associated with more public education expenditure. In fact, the main objective of the public authority is that all the population benefits from education investment. At the same time, the part of the population that requires public education is considered important if there is more inequality. As a consequence, the elector choice of the fiscal policy is largely influenced by the objective of the government who has to allocate more resources to public education. The latter is provided by tax.

However, the last two empirical studies claim that income inequality increases public expenditure for education (Easterly and Rebelo, 1993) and Sylwester (2000). Many others studies seem to be in contradiction by suggesting that income inequality affects negatively and significantly the investment in human capital, hence lowers the human capital stock which weakens economic growth (Perotti, 1994), Keefer (1995) and Lindert (1996).

4.3. Human Capital

In this paper, the human capital is considered as a third transmission channel through which income inequality influences economic growth. In fact, more inequality in the society impedes human capital accumulation and, consequently, widens the knowledge gap between individuals which affects the economic performances (Perotti, 1993) and Galor and Zeira (1993). Since the studies relative to endogenous growth, the concept of human capital is more present in theoretical and empirical studies (Lucas, 1988) and Mankiw *et al.* (1992). However, for a part of these works, the presence of this factor as a transmission channel through which inequality affects economic growth is less remarkable.

In his empirical study, Mo (2000) confirms the presence of a negative correlation between the level of human capital and the measure of the income dispersion. He finds that this canal can explain respectively 2.3% and 3.5% of the total effect of social inequality on the factors productivity and the economic growth rate. The effect of this channel is the second after the transfer one.

5. Direct and Indirect Effects of Income Inequality

We use a simultaneous equation model, in order to estimate the role of public, private education expenditure and human capital, considered as plausible channels, and to single out the direct and indirect effect of income inequality on economic growth,. In this paper, we try to assess the importance of the relationship between income inequality and public, private education expenditure and the level of human capital. Our main objective is to find out the negative impact of inequality on economic growth which can be transmitted through these channels. This model is more suitable when we have to choose the appropriate policies on education facing choice between inequality and economic performances. In contrast to the empirical study of Sylwester (2000), this paper introduces private education expenditure and human capital as other transmission channels with public education expenditure.

We begin by the basic model composed by four equations. In the first one, we estimate the rate of economic growth in function of the initial level of social inequality (*GINIi*), the initial real GDP per capita (*Yi*). The other explanatory variables are: the level of public and private education expenditure on the GDP (*PEY* and *PREY*), the level of human capital (*HK*), the openness rate (*TRADE*) and government expenditures (*GY*). The other equations are reserved to the estimation of the effect of transmission channels (*TC*): public and private education expenditure (*PEY* and *PREY*) and human capital (*HK*) by considering the initial level of inequality (*GINIi*). In order to eliminate the identification problem of the system, the matrix Z contains control variables including population density (*DENS*), the rate of population growth (*POP*) and a measure of institutional quality (*Laworder*).

The following equations are jointly estimated using the Least Squares (OLS) and the Seemingly Unrelated Regression (SUR) in order to confirm the robustness of the results. The index *i* denotes the initial level and *j* denotes the countries of the sample.

$$Gr^j = \alpha_0 + \alpha_1 Y_i^j + \alpha_2 Gini\ i^j + \alpha_3 C^j + \alpha_4 B^j + \varepsilon^j \quad (2)$$

$$TC^j = \beta_0 + \beta_1 Ginii^j + \beta_2 Z^j + \mu^j \quad (3)$$

To compute the direct and indirect effects of social inequality on growth, we substitute equation (3) into equation (2) yields:

$$Gr^j = (\alpha_0 + \alpha_3 \beta_0) + \alpha_1 Y_i^j + (\alpha_2 + \alpha_3 \beta_1)\, Ginii^j + \alpha_3 \beta_2 Z^j + \alpha_4 B^j + \alpha_3 \mu^j + \varepsilon^j \quad (4)$$

The estimated coefficient of initial inequality proves the presence of two effects: (*i*) the coefficient α_2 measures the direct effect of inequality on growth, (*ii*) $\alpha_3\ \beta_1$ corresponds to the summed indirect effect. We propose the following decomposition of the total effect:

$$\frac{dgr}{dGinii} = \frac{\partial gr}{\partial Ginii} + \sum\left(\frac{\partial gr}{\partial TC}\frac{\partial TC}{\partial Ginii}\right)$$

The results, concerning the importance of each transmission channels to explain the indirect effect of inequality on growth, are reported in Table 2 and (3)[4]:

[4] We use the methods of seemingly unrelated regressions (SUR) and the OLS to estimate simultaneously the basic regression (equation (2)) and the indirect transmission channels (equation (3)). The specification of our system leads to a difference in the results of the OLS and SUR methods because we do not have the same explanatory variables in the indirect transmission channels which may imply a possible correlation between individual error terms.

Table-2. Estimations of the simultaneous equations model

	OLS				SUR			
	Gr	**PEY**	**PREY**	**HK**	**Gr**	**PEY**	**PREY**	**HK**
constante	0.165 (1.93)	-4.363 (-7.72)	-2.251 (-6.51)	2.655 (4.74)	0.178 (2.46)	-4.398 (-8.58)	-2.414 (-7.77)	2.745 (6.28)
Initial réel GDP per capita (Yi)	-0.017 (-3.34)***				-0.017 (-3.86)***			
Human capital (HK)	0.020 (1.97)*				0.018 (2.10)**			
Public education expenditures (PEY)	-0.019** (-1.98)				-0.013 (-1.63)*			
Private education expenditures (PREY)	0.021 (2.66)***				0.020 (2.98)***			
Initial Gini (GINI i)	-0.049 (-1.76)*	1.521 (1.63)*	-1.951 (-2.51)***	-1.961 (-2.53)***	-0.048 (-2.05)**	1.572 (1.84)*	-2.007 (-2.73)***	-2.035 (-2.94)***
Openness rate (TRADE)	0.007 (0.74)				0.006 (0.88)			
Government expenditures(GY)	0.007 (0.30)				0.005 (0.26)			
Institutional quality (Laworder)		0.102 (3.28)***				0.104 (3.72)***		
Density (DENS)			-0.032 (-0.69)				0.011 (0.32)	
Population growth rate (POP)				-0.011 (-0.16)				0.001 (0.03)
R^2	0.6503	0.3476	0.2081	0.2613	0.6417	0.3475	0.1831	0.2604
Nb observations	30	30	30	30	30	30	30	30

The results reported in this table are provided from the estimation of the simultaneous equations model by using the Least Squares regression (OLS) and the seemingly unrelated (SUR).
Superscripts *, ** and *** correspond to a 10%, 5% and 1% of significance respectively.
t- Statistics in parenthesis.
The results reported in this table are provided from the estimation of the simultaneous equations model by using the Least Squares regression (OLS) and the seemingly unrelated (SUR).
Superscripts *, ** and *** correspond to a 10%, 5% and 1% of significance respectively.
t- Statistics in parenthesis.

In the first part of this table (the four columns), we present the results of the estimation of the model using the OLS method. The estimated coefficients in the first equation are similar to those of the cross section analysis (Table 1). For the growth equation, we find that the initial Gini affects negatively and significantly the economic performances with 90% as level of confidence. The estimated coefficients of the transmission channels (*PEY*, *PREY* and *HK*) present the expected signs and are statistically significant for different thresholds. Particularly, the public education expenditure (*PEY*) is negatively correlated with the growth rate (-0.019) and statistically significant at 5% level. These results show that more public education expenditure generates less economic growth along the estimated period. Sylwester (2000) finds that benefits of these expenditures on economic growth appear in the future.

However, the private education financing (*PREY*) and the level of human capital (*HK*) have positive and significant coefficients at 1% and 10% level respectively. These results match the cross section analysis ones (Table 1). So the public education expenditures affect negatively and immediately economic growth, in contrast to private education and human capital that stimulate it.

The coefficient of the initial real GDP per capita (*Yi*) is negative and statistically significant at 1% confidence level. This result confirms the convergence hypothesis which implies that the poor countries that started with a lower income grow faster than the rich ones. The estimated coefficients upon the openness rate (*TRADE*) and the government expenditures (*GY*) remain the same as those of the abundant literature Berthélemy *et al.* (1996) and Barro (1991) but insignificant which means that a priori these variables do not affect the economic growth.

For the first equation of the transmission channels relative to the public education expenditures (PEY) (Column 2), the coefficient upon Gini (*GINIi*) is negative and statistically significant at 10% level. The sign of this coefficient changes but it remains significant at 1% level for the private education expenditures (*PREY*) and the human capital (*HK*) channels (Columns 3 and 4). So, more income inequality can increases public education expenditures but decreases the private ones. At the same time, it can lead to a progressive deterioration of the human capital.

In order to reach the objective of a general education, the countries characterised by more social dispersion have to allocate more resources to their public education. In fact, with this inequality people cannot finance their private education or that of their children. This situation leads to a fall of private education expenditures and the slow down of the human capital accumulation.

For the other explanatory variables (*Laworder*, *DENS* and *POP*), only the measure of institutional quality (*Laworder*) presents a positive sign and is statistically significant at 1% level. This result means that bad functioning of the institutions in the economy can discourage the private financing of education by diverting these resources to other projects (Mauro, 1998).

The last four regressions in the table present the same specification but the only difference is the method of estimation. We use the SUR method in order to confirm the results of the first method (OLS). We find that the results remain the same. The estimated coefficients keep their sign and are significant at conventional levels of confidence. So, the earlier findings of this paper are generally robust to the change of the estimation method. This result confirms that the public and private education and the level of human capital are decisive factors of the negative relationship between economic growth and inequality.

The results concerning the direct and the indirect effects of the transmission channels are summarized as follows (Table 3). The direct effect is measured by the coefficient (α_2). Their part in the total effect is ($\alpha_2/ \alpha_2 + \alpha_3\beta_1$). The indirect effect of the transmission channels is determined by the estimated coefficients ($\alpha_3\beta_1$) and their part in the total effects was measured by ($\alpha_3\beta_1/ \alpha_2 + \alpha_3\beta_1$).

Table-3. The relative importance of the transmission channels

				Relative contribution
Direct effect				
Income Inequality (GINIi)	α_2	-0.048	-0.048	32.846%
Indirect effect	$\alpha_3 \beta_1$			
Public education expenditures (PEY)		-0.013*1.572	-0.021	14.394%
Private education expenditures (PREY)		0.020*(-2.007)	-0.041	27.902%
Human capital (HK)		0.018*(-2.035)	-0.037	24.856%
Effet total	$\alpha_2 + \alpha_3 \beta_1$		-0.149	100%

The direct effect of income inequality on economic growth represents 32% of the total effect. The rest is attributed to the transmission channels (68% of the total effect). This result confirms the conclusion of the empirical literature (Mo, 2000) that suggests the importance of transmission channels, which explain the negative relationship between economic performances and inequality.

Public and private education expenditures (*PEY* and *PREY*) and the human capital level account for respectively 14.39%, 27.90% and 24.85% of the total effect. It is clear that the most important contribution is relative to the private education financing. Although the indirect effect of public education expenditure is less important than the other channels.

This result implies that the distinction between the efficiency and the equity of education system is important in explaining the disparity of different channels. We notice that the contribution of the private education financing is a key element. The impact of this investment is observed immediately because it can motivate people to accumulate knowledge. This system, considered efficient but no equitable, generates more growth but it contributes ineluctably to income inequality (Glomm and Ravikumar, 1992).

However, public education financed by taxation reduces income inequality (Glomm and Ravikumar, 1992) Eckstein and Zilcha (1994) and Zhang (1996). In fact, more taxation affects the investment choice of rich individuals and consequently labour supply. The government intervention in education by financing and the redistribution of expenditures leads to the fact that a great number of people can accumulate human capital. Whilst, this situation increases income, it also reduces the social inequality.

6. Conclusion

This paper points to the negative link between income inequality and economic growth. Theoretical and empirical literatures have advanced many reasons to explain this relationship: social and political instability, transfer and human capital. This paper is about this last channel (human capital) which may affect this negative correlation. Nevertheless, it remains different to the abundant literature as it introduces other channels: public and private education expenditures and human capital.

We find three principal results. The first one implies that the income inequality affects directly the productive process. This relationship is similar to the results of many empirical studies Persson and Tabellini (1994) Alesina and Perotti (1994) and Clarke (1995). A weak economic growth characterizes countries with an unequal distribution of income. In fact, this inequality might lead to macroeconomic instability which has harmful effects on economy.

The second finding of this paper shows that income inequality has an indirect effect transmitted by different channels. So, a high level of inequality is associated with high level of public education expenditure which is also related to less economic growth. However, this level of inequality can discourage private education financing and slows down the human capital accumulation. This situation also lowers the economic growth rate.

Finally, amongst these three transmission channels, the most important one is relative to private education expenditure. Public financing contributes less than the other channels in order to explain the negative relationship between inequality and economic performances.

Following these findings, it appears that the distinction between these three channels is appropriate. Their indirect impact on this relation leads to wonder about the choice of education policy in different countries. In fact, many developing countries, (Latin American) where inequality is higher, opt for private education financing. However, this choice can widen the gap between inequality and economic growth.

Appendix 1: Descriptive Statistics

Observations	Variables	Mean	Std dev	Minimum	Maximum
***Equation* 1**					
50	*Gr*	0.016	0.018	-0.027	0.081
	Yi	8.751	1.005	6.502	10.025
	GINIi	0.395	0.098	0.209	0.584
	GY	0.286	0.115	0.087	0.563
	TRADE	0.652	0.317	0.198	1.593
***Equation* 2**					
31	*Gr*	0.020	0.014	-0.008	0.056
	Yi	9.193	0.799	7.071	10.025
	GINIi	0.368	0.087	0.209	0.54
	PEY	-3.006	0.280	-3.677	-2.580
	PREY	-3.122	0.373	-3.987	-2.691
	HK	1.981	0.328	1.306	2.485
	GY	0.323	0.114	0.144	0.563
	TRADE	0.668	0.323	0.204	1.593
***Equation* 3**					
31	*Gr*	0.020	0.014	-0.008	0.056
	Yi	9.193	0.799	7.071	10.025
	GINIi	0.368	0.087	0.209	0.54
	PEY	-3.006	0.280	-3.677	-2.580
	PREY	-3.122	0.373	-3.987	-2.691
	HK	1.981	0.328	1.306	2.485
	GY	0.323	0.114	0.144	0.563
	TRADE	0.668	0.323	0.204	1.593
	DUMMY	0.419	0.501	0	1

The descriptive statistics presented in this table are relative to the regressions of table 1.

Appendix 2: The simultaneous equations

The economic growth regression:

$$Gr^j = \alpha_0 + \alpha_1 Y_i{}^j + \alpha_2 GINIi^j + \alpha_3 B^j + \alpha_4 C^j + \varepsilon^j \quad \text{(A.1)}$$

The matrix B^j contains the variables considered as the transmission channels by which income inequality affects economic growth : public and private education expenditures on education as part of GDP (*PEY et PREY*) and the level of human capital (*HK*). The matrix C^j contains the other variables: the openness trade (*TRADE*) and government expenditures (*GY*).

$$Gr = \alpha_0 + \alpha_1 Y_i + \alpha_2 GINI\, i + \alpha_{31} PEY + \alpha_{32} PREY + \alpha_{33} HK + \alpha_{41} TRADE + \alpha_{42} GY + \varepsilon^j \quad \text{(A.2)}$$

The equations of the transmission channels:

$$PEY = \beta_{01} + \beta_{11} GINI\, i + \beta_{21} DENS + \mu_1 \quad \text{(A.3)}$$

$$PREY = \beta_{02} + \beta_{12} GINI\, i + \beta_{22} POP + \mu_2 \quad \text{(A.4)}$$

$$HK = \beta_{03} + \beta_{13} GINI\, i + \beta_{23} Laworder + \mu_3 \quad \text{(A.5)}$$

We substitute equations (A.3), (A.4) and (A.5) in the equation (A.1):

$$Gr = (\alpha_0 + \alpha_{31}\beta_{01} + \alpha_{32}\beta_{02+} \alpha_{33}\beta_{03}) + \alpha_1 Y_i + (\alpha_2 + \alpha_{31}\beta_{11} + \alpha_{32}\beta_{12} + \alpha_{33}\beta_{13}) GINIi + \alpha_{41} TRADE + \alpha_{42} GY + \alpha_{31}\beta_{21} DENS + \alpha_{32}\beta_{22} POP + \alpha_{33}\beta_{23} Laworder + \alpha_{31}\mu_1 + \alpha_{32}\mu_2 + \alpha_{33}\mu_3 + \varepsilon^j$$

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