

# Human Capital and Income Inequality: Some Facts and Some Puzzles

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## Introduction

- Most developing countries have made a great effort to eliminate illiteracy rates
- As a result, the average human capital Gini coefficient dropped from 0.549 in 1960 to 0.280 in 2005
- In spite of the equalizing process in the distribution of education, inequality in the distribution of income has hardly changed
- The income Gini coefficient for the same group of countries was almost equal in 1960 (0.415) than in 2005 (0.411)
- This paper analyzes this evidence in detail and tests several hypothesis that can explain the lack of correlation between the evolution of human capital and income inequality



## Contributions

- 1 Computation of new human capital inequality measures, augmenting the sample of Castelló and Doménech (2002) both in time and space using new attainments levels from Barro and Lee (2010)
- 2 We compare the evolution of income and human inequalities measures, showing that both variables have evolved quite differently over time
- 3 We test alternative explanations of this puzzling evidence

## Alternative explanations

- Despite better education at the bottom (reduction of human capital inequality), its share of income did not increase because this improvement may have coincided with an increase of wages at the top due to:
  - ▶ Skill-biased technological progress (Katz and Murphy, 1992)
  - ▶ Convex returns to education
  - ▶ External effects of education (Lucas, 1988)
  - ▶ Globalization (Goldberg and Pavcnik, 2007)

## Structure

- Improved measures of human capital inequality
- Stylized facts about the evolution of human capital inequality
- Comparisons between the distribution of income and human capital inequality
- Alternative explanations of the lack of correlation between income and education inequality
- Conclusions

## New improved measures of human capital inequality

- We use the new Barro and Lee (2010) data set, which reduces measurement error by using more information from census data and a new methodology that makes use of disaggregated data by age group
- Following Castelló and Doménech (2002), the human capital Gini coefficient has been defined as

$$Gini^h = n_o + \frac{n_1(n_2x_2 + n_3(x_2 + x_3)) + n_2n_3x_3}{\bar{H}} \quad (1)$$

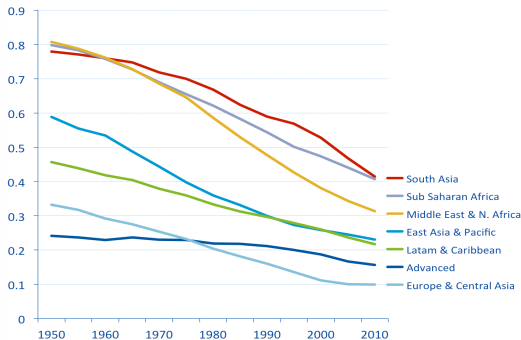
$$Gini^h = n_o + (1 - n_o)Gini^{LIT} \quad (2)$$

- The new inequality indicators are available for 146 countries from 1950 to 2010 in a 5-year span

## Stylized facts about human capital inequality

**Fact 1:** From 1950 to 2010 there has been a significant reduction in human capital inequality around the world

Human Capital Gini Coefficient of population 15+

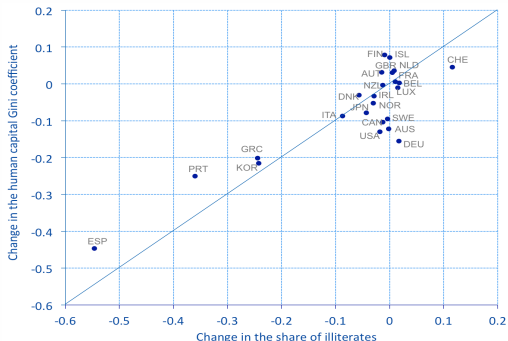




## Stylized facts about human capital inequality

**Fact 3:** In most advanced countries there is not a clear correlation between education inequality and the human capital Gini coefficient

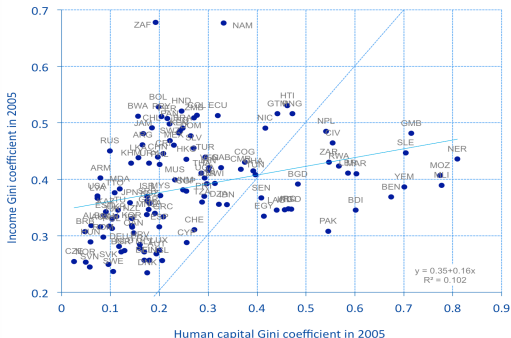
**Change in the human capital Gini coefficient and the share of illiterates. High income countries, 1950-2010**



## Human capital and income inequality

**Fact 4:** The correlation between income and human capital Gini coefficients is low and non-significant

**Human capital and income Gini coefficients across countries in 2005**

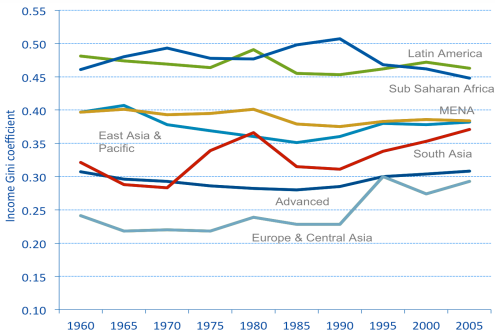




## Human capital and income inequality

**Fact 5:** Both across world regions and a large sample of countries, income inequality has remained relatively stable, despite the significant reduction in human capital inequality from 1960 to 2005

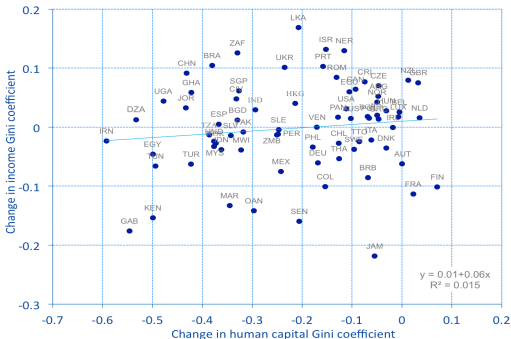
**Evolution of the income Gini coefficient across regions, 1960-2005. World Income Inequality Database, v3.0**



## Human capital and income inequality

**Fact 6:** The reduction in human capital inequality has not been accompanied by an improvement in the income Gini coefficient

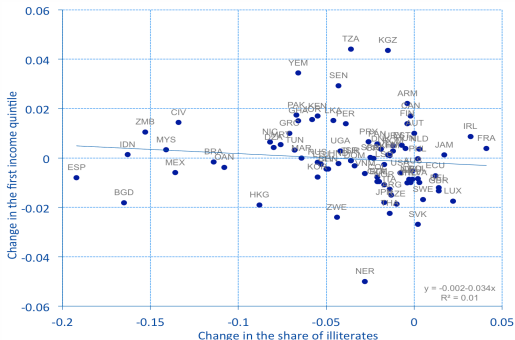
**Change in income and human capital Gini coefficients across 75 countries, 1960-2005**



## Human capital and income inequality

**Fact 7:** The reduction in the share of illiterates has not resulted in an increase in the share of income going to the poorest 20 percent

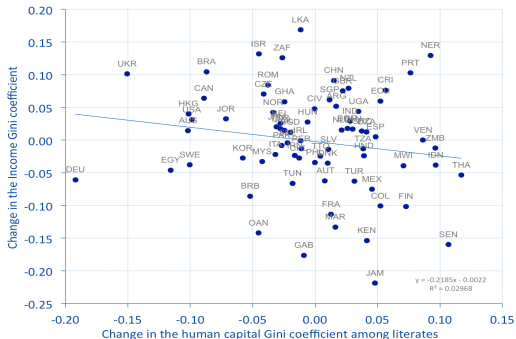
**Changes in the shares of illiterates and the first income quintile**



## Human capital and income inequality

**Fact 8:** Changes in the income Gini coefficient are not correlated with changes in the Gini coefficient for education of the literate population

**Changes in the Gini coefficients for income and education of the literate population**



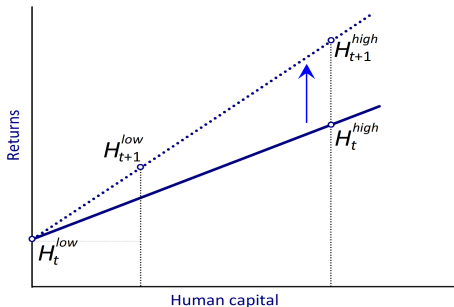
## Human capital and income inequality

- **Main result:** The evidence shows that most countries have experienced a very significant reduction in human capital inequality, mainly due to the decrease in the share of illiterates, which has not been accompanied by a fall in income inequality

## Explanation #1: Skill-biased technological change

**Intuition:** The effects on income inequality of the increase of human capital at the bottom of the distribution may have been offset by skill-biased technological changes

Skill-biased technological change and human capital



## Explanation #1: Skill-biased technological change

- Canonical model of the race between education and technological change (e.g. Katz and Murphy, 1992; Card and Lemieux, 2001; Acemoglu and Autor, 2012):

$$\ln \frac{w_{H_{it}}}{w_{L_{it}}} = \frac{\sigma - 1}{\sigma} \gamma_0 + \frac{\sigma - 1}{\sigma} \gamma_1 t - \frac{1}{\sigma} \ln \frac{H_{it}}{L_{it}}$$

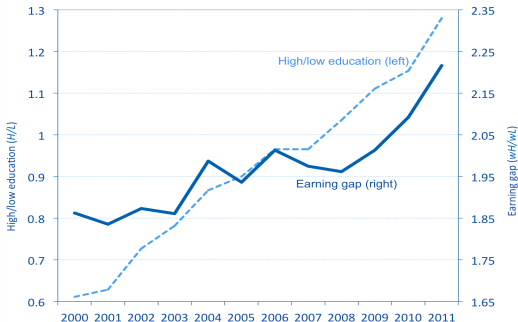
- The evidence confirms that higher education at the bottom does not ensure a higher income share, since wages at the top are increasing due to skill-biased technological change:

Decreasing education inequality }  
Increasing wage inequality }  $\Rightarrow$  Constant income inequality

## Explanation #1: Skill-biased technological change

Evidence for a sample of 31 countries (from OECD EAG, with some emerging economies) shows that wages at the top ( $w_H$ ) and at the bottom ( $w_L$ ) have diverged despite the increase of  $H/L$ :

Relative earnings and relative supply. OECD average, 2000-2011





## Explanation #1: Skill-biased technological change

*Dependent Variable:  $\ln \frac{w_H}{w_L}$*

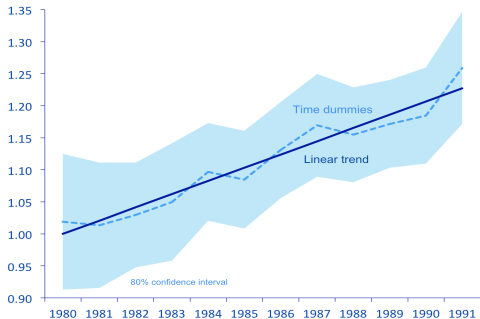
	(1)	(2)	(3)
$\ln \frac{H}{L}$	-0.108 (5.23)	-0.109 (5.38)	-0.250 (10.7)
<i>Trend</i>		0.021 (4.69)	0.028 (7.36)
$R^2$	0.15	0.14	0.40
<i>Obs.</i>	250	250	250
<i>Countries</i>	31	31	31
$\delta_t$	Y	N	N

Notes: Regression from 2000 to 2011. Column (3) includes two set of dummies: one for the USA and other for IRE, ITA, ESP and TUR.

## Explanation #1: Skill-biased technological change

The earning gap between high and low human capital has increased 20 pp on average in just 10 years due to the skill-biased technological change:

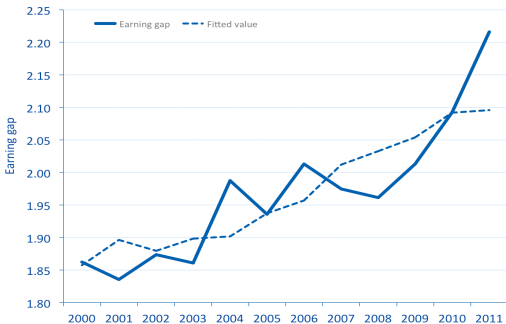
**Estimated times dummies and linear trend. 31 countries, 2000-2011**



## Explanation #1: Skill-biased technological change

The increase of the relative labour supply of adults with high education ( $H/L$ ) has partially compensated (only 7 pp) the effects of the skill-biased technological change:

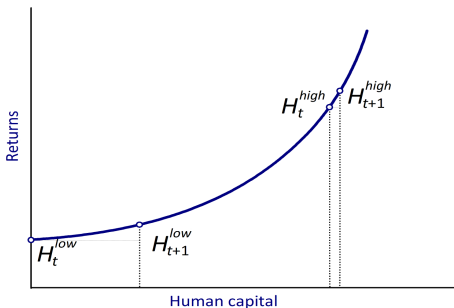
Average skill premium in the OECD, 2000-2011



## Explanation #2: Increasing returns to education

**Intuition:** The effects on income inequality of the increase of human capital at the bottom of the distribution may have been offset by increasing returns to education

Increasing returns to education and human capital



## Explanation #2: Increasing returns to education

- Relative low returns in primary education in relation to secondary and tertiary education could explain why the observed reduction in the share of illiterates has not been accompanied by an increment in the income of the bottom quintiles
- We estimate the returns to primary, secondary and tertiary education using the following production function:

$$\ln \frac{Y}{L_{it}} = \beta_0 + \beta_1 \ln \frac{K}{L_{it}} + \beta_2 S_{i,t}^{pri} + \beta_3 S_{it}^{sec} + \beta_4 S_{it}^{ter} + \gamma_i + \delta_t + \mu_{it}$$

- Given the lack of homogenous microeconomic data for a large panel of countries, we test this alternative explanation using aggregate international data: PWT 7 and Barro and Lee (2010)
- In all specifications the estimated coefficient of the average years of primary education is lower than that of any other level of schooling

## Explanation #2: Increasing returns to education

Dependent Variable:  $\ln Y/L$ 

					Instrumental Variables				Avge.
	OLS	FE	$\Delta$ 10y	$\Delta$ 60y	OLS	FE	$\Delta$ 10	$\Delta$ 60y	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\ln \frac{K}{L}$	0.06 <sup>a</sup>	0.27 <sup>a</sup>	0.17 <sup>a</sup>	0.28 <sup>a</sup>	0.05 <sup>a</sup>	0.30 <sup>a</sup>	0.19 <sup>a</sup>	0.30 <sup>a</sup>	0.20
$S^{pri}$	0.11 <sup>a</sup>	-0.00	-0.03 <sup>b</sup>	0.04	0.12 <sup>a</sup>	0.06 <sup>a</sup>	0.03	0.09	0.05
$S^{sec}$	0.20 <sup>a</sup>	0.05 <sup>a</sup>	0.02 <sup>c</sup>	0.16 <sup>b</sup>	0.21 <sup>a</sup>	0.06 <sup>a</sup>	0.03 <sup>b</sup>	0.12	0.10
$S^{ter}$	0.32 <sup>a</sup>	0.12 <sup>b</sup>	0.08	0.64 <sup>a</sup>	0.17	0.18 <sup>a</sup>	0.16 <sup>b</sup>	0.89 <sup>a</sup>	0.32
$R^2$	0.59	0.44	0.15	0.29	0.59	0.42	0.12	0.28	
Obs.	1093	1093	825	120	1093	1093	825	120	
N	137	137	124	120	137	137	124	120	
$\gamma_i$	N	Y	Y	N	N	Y	Y	N	
$\delta_t$	Y	Y	Y	N	Y	Y	Y	N	

Note: a, b, and c are 1, 5, and 10 per cent significance level.

## Conclusions

- This paper computes and analyses trends in human capital inequality from 1950 to 2010 using an improved data set on human capital
- The evidence shows that most countries have experienced a very significant drop in human capital inequality, mainly due to an unprecedented decrease in the share of illiterates, which has not been accompanied by a similar reduction in income inequality
- Increasing literacy is not a sufficient condition to reduce income inequality

## Conclusions

- A plausible explanation for this puzzle could be that returns to schooling are increasing with the level of education
- If returns to primary schooling are low, a large reduction in the share of illiterates may not be reflected into a sizeable increment in the wages of the population at the bottom end of the income distribution
- Using data for real GDP per worker for a large sample of countries, we compute aggregate returns for different levels of education
- Our findings reveal that the returns to primary education are lower than those of secondary and tertiary education



## Conclusions

- An alternative explanation is that improvements in literacy at the bottom end of income distribution have also coincided with an increase of wages in other cohorts of population with higher education, such that all of them maintain their incomes shares
- The latter could reflect external effects of having a more educated population or other exogenous forces (e.g., globalization or skill-biased technological progress) that have increased wages at the top
- We have tested the skill-biased technological hypothesis using a sample of 31 countries, with some emerging economies
- Our results show an annual increase of 2 percent in the relative wages of adults with tertiary education
- Thus, higher education at the bottom does not ensure a higher income share, since wages at the top are increasing due to skill-biased technological change

## Conclusions

- The evidence presented in this paper is relevant for development policies: governments have made a great effort in eradicating illiteracy rates, but these policies have not been accompanied by a more even distribution of income
- However, our evidence does not imply that educational policies have not reduced poverty and improved wages and the standards of living of hundreds of millions with better education
- On the contrary, better education is crucial to increase average earnings per worker, and the eradication of illiteracy is a necessary condition to ensure access to higher levels of education for all people