DO EQUAL LEARNING OPPORTUNITIES BOOST LONG-TERM ECONOMIC GROWTH?

Marcell D. Orban[1]
B.Sc Economics
2nd year
University College London

Explore Econ Undergraduate Research Conference
February 2020

[1] I would like to thank Silvia dal Bianco and Lorenzo Incoronato for their support and feedback on my work.

Introduction

Sometimes the most fundamental questions prove to be the hardest to answer. Exploring the link between different measures of inequality and economic growth (both in the short and long-term) has been puzzling economists' minds for several decades. Two reasons sparked my interest in this field of research. The first is its relevance to public policy: Being aware of the wider implications of inequality on society allows policymakers to design public spending schemes better. Secondly, there is a rich academic discussion to which I want to contribute. The earliest influential scholarly paper in this field was written by Simon Kuznets in 1955. Then Deininger and Squire (1996) sparked significant interest by presenting a new high-quality database. The latest prominent work is 'Capital in the 21st Century' by Thomas Piketty (2013). Most studies have found that higher income or wealth disparity has positive effect on short-term growth while depressing it over the long term (Halter et al, 2014; Berg and Ostry, 2011), but there is no consensus in academia to date on the issue.

My aim in this essay is to investigate the relation between long-term economic growth and dynamics of human capital inequality between generations. To examine this, I have chosen to proxy human capital by years of education (this is widely used in literature, see Benhabib and Spiegel, 1994; Krueger and Lindahl, 2001; de La Fuente and Doménech, 2002). My key variable of interest is change in years of education Gini coefficient between generations. I obtain the years of education Gini coefficient for individuals born in the same decade and subtract their parents' years of education Gini to compute the change.

I use this measure rather than income or wealth disparity for two reasons. Firstly, it has a straightforward and instinctive interpretation in contrast to comparing quintiles. Secondly, income data can suffer from problems, including but not limited to: using different measures (pre or post-tax) of income, availability and quality of data in developing countries (Castelló and Doménech, 2002). This is not the case for educational data, so it can potentially provide a better estimate.

Furthermore, there is no clear answer economic theory suggests to this question. Human capital inequality affects economic growth through various channels (Castelló-Climent, 2010), so the overall impact can be positive or negative. Using OLS estimation techniques, I found a significant negative relation between the two. In other words, countries with increasing human capital disparity between generations have experienced slower economic growth.

The structure of my paper is the following: it began by an introduction of this field of research and an explanation for my estimation. The next section discusses the theoretical background for my study followed by presenting my estimated equation. Then I talk about the results of my empirical investigation. The final segment concludes my analysis and provides some policy recommendations.

Theoretical background

Years of education is a widely used proxy for human capital in the existing literature (E.g.: Benhabib and Spiegel, 1994; Krueger and Lindahl, 2001; de La Fuente and Doménech, 2002). Following this line of thought, the Gini coefficient for years of education can be a good measure of human capital inequality in society. If I now take the change in this years of education Gini coefficient between two generations (parents and their children) I get a good estimator on how human capital disparity is altering across generations.

Human capital inequality can affect economic growth through three main routes: income distribution, fertility differences, and life expectancy or health condition (Castelló-Climent, 2010). If human capital distribution is more uneven, a larger share of the population will form an impoverished class in society. Poor people decide to raise more children (de la Croix and Doepke, 2003), increasing the ratio of penniless population in a country. This limits long-term economic prosperity. Another channel is through life expectancy. People with low human capital live shorter lives. Therefore, their individual rate of return to education is lower. They act rationally by choosing to invest less in their education – making this a vicious cycle. Ultimately, a country with more disparity in human capital levels is expected to grow slower in the long-term due to its effect on health and fertility (Castelló-Climent, 2010).

The effect of human capital inequality on economic growth through income is not this clear-cut. The big question of theoretical literature is whether there is a loss in total economic growth arising from the inefficiency created by redistribution, which reduces income inequality (for a summary, see Bénabou, 1996). There is no conclusion in academia, meaning that greater income inequality can lead to either less or more economic growth.

The overall impact of human capital inequality on economic growth is the sum of the three channels of influence earlier. As the sign and magnitude of each is not clear, economic theory cannot decisively establish whether a more uneven human capital distribution is beneficial for long-term economic growth. Ultimately, this provides no prediction on how the dynamics of human capital inequality affect economic prosperity.

Empirical Strategy

To investigate this relation empirically, I carried out analysis using OLS estimation techniques. Based on relevant literature (Benabou, 2000 mentions 12 studies which utilize cross-sectional data and OLS to measure the effect of inequality on economic growth) and the results of Sala-i-Martin, 1997; I specified the following equation:

$$GDPgr_i = \beta_0 + \beta_1 \Delta eGINI_i + \beta_2 Educ_i + \beta_3 Inv_i + \beta_4 Trd_i + \beta_5 PolR_i + \beta_6 CivLib_i + \beta_7 Region_i + u_i$$

I organized the source, description, and abbreviation of each variable present in the above equation into a table. A more detailed discussion on how I calculated the two key variables of interest (GDPgr and ΔeGINI) and the list of countries included in each regression can be found in the appendix.

Abbreviation	Description of variable	Source dataset
GDPgr	Real, PPP-adjusted per capita GDP growth between 1990 and 2010	World Bank "GDP per capita, PPP (constant 2011 international $)."
ΔeGINI	Change in years of education Gini coefficient between parents' and children's generation	World Bank Global Database on Intergenerational Mobility
Educ	Average years of education of people aged 15 and older	Barro and Lee, 2013
Inv	Total Investment (as % of GDP)	World Bank, TCdata360 dataset
Trd	Exports and Imports as a % of GDP	World Bank, "Trade (% of GDP)"
PolR	Political Rights on scale 1-7, 7 is full democracy	Freedom House, "Country and Territory Ratings and Statuses, 1973-2018"
CivLib	Civil Liberties on scale 1-7, 7 equals full democracy	Freedom House, "Country and Territory Ratings and Statuses, 1973-2018"
Region	Regional dummies for countries.	World Bank Global Database on Intergenerational Mobility
u	Error term	-

Table 1: Description of variables in my regression

I ran this regression on data from three different cohorts of the population: those who were born in the 1960s, 1970s and 1980s. Therefore, my key variable of interest is lagged relative to GDP growth. This is done to combat potential reverse causality between GDP growth and education (used commonly in literature, e.g. Banerjee and Duflo, 2003). All of the other control variables I use (Educ, Inv, Trd, PolR and CivLiv) were observed for the year 2000, which reflects a mid-period state.

As can be seen in the table above, I used various sources to obtain my data. After taking an initial look, I established that I need to eliminate some extreme observations (e.g. "inflated" GDP for some former Yugoslav countries or Iraq – both due to war). I tried to limit my efforts when cleaning the data to reduce the noise I generate.

Results

I present my estimates for each cohort in the table below. Note that the computed coefficient for my key variable of interest is statistically significant and negative in each regression.

Variables	**(1)** **1980 Cohort**	**(2)** **1970 Cohort**	**(3)** **1960 Cohort**
ΔeGINI	-1.122*	-1.276**	-1.086**
	(0.641)	*(0.568)*	*(0.515)*
Region: Europe	0.179	0.167	0.144
& Central Asia	*(0.206)*	*(0.210)*	*(0.215)*
Region: East Asia	0.696*	0.814*	0.810*
	(0.394)	*(0.457)*	*(0.443)*
Region: Latin	-0.0477	0.00803	0.0451
America	*(0.194)*	*(0.196)*	*(0.197)*
Region:Middle	-0.503	-0.754	-0.662
East & N Africa	*(0.395)*	*(0.453)*	*(0.437)*
Region: South	0.137	0.247	0.287
Asia	*(0.300)*	*(0.290)*	*(0.298)*
Region: Sub-	-0.0164	0.0377	0.0381
Saharan Africa	*(0.265)*	*(0.258)*	*(0.267)*
Educ	0.0147	0.0318	0.0253
	(0.0327)	*(0.0376)*	*(0.0367)*
Inv	0.0692***	0.0781***	0.0753***
	(0.0224)	*(0.0220)*	*(0.0218)*
Trd	-0.00347	-0.00451	-0.00468
	(0.00282)	*(0.00295)*	*(0.00292)*
PolR	0.0935	0.257**	0.251**
	(0.0910)	*(0.117)*	*(0.115)*
CivLib	-0.0148	-0.164*	-0.166*
	(0.0862)	*(0.0864)*	*(0.0879)*
Constant	-1.272**	-1.551**	-1.410**
	(0.631)	*(0.676)*	*(0.649)*
Observations	80	69	69
R-squared	0.484	0.587	0.588

Table 2: Regression results
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

I established that the relation is statistically significant. Now I argue for its economic significance. My result implies that if a country reduced its years of education Gini coefficient

between generations by 0.10 (i.e. the parents' cohort has a years of education Gini 0.10 higher than their children's years of education Gini), it had a 10.8-12.7% higher GDP growth in the examined period, ceteris paribus.

My findings are in line with similar analyses conducted in academia. Greater human capital (educational) inequality is found to slow down economic growth in the long-term. This result was established both in cross-section datasets comparing countries (Castelló and Doménech, 2002) and cross-section data on regions within countries (Yu et al, 2015). However, there might be a positive effect between educational inequality and economic growth (Rodríguez-Pose and Tselios, 2008). Again, there is no consensus in academia on this matter.

I cannot ignore the fact that my estimates are not consistent for different timespans. During my analysis, I evaluated these regression for several periods between 1990 and 2015 and predominantly found that the coefficient of ΔeGINI is mostly not statistically different from 0 or, in one case, it being positive (0.46) with a t-statistic of 2.05. My result is not robust when adding or removing additional controls either. This implies that further investigation, and additional data, is required. It is early to say what the exact effect of change in human capital inequality between generations on economic growth is. Unfortunately, surveying the unevenness in people's education or human capital and long-term economic outcomes requires much time due to its nature.

Also, there is some argument present in academic literature that inequality might not affect growth in a linear manner (e.g. Banerjee and Duflo, 2003). This was also suggested for human capital inequality (Güngör, 2010; Wail et al, 2012). In this case, it becomes much harder to prove the validity of my results due to the linearity assumption OLS relies on. Further investigation of this relationship is certainly mandated to establish better models, allowing more accurate predictions.

Conclusion

The relation between different measures of inequality and economic growth has been a hot topic in academia for decades. Exploiting that there is a strong link between an individual's total years of schooling and human capital, I attended to estimate whether dynamics of human capital inequality are correlated with long-term economic growth. I found a statistically and economically significant negative effect. Countries which reduced disparity between parents' years of education Gini coefficient and their children's years of education Gini have seen considerably higher GDP growth rates.

What this result means for policymakers? For starters, it is worth investing in programmes aimed at reducing educational disparities in society. Two examples suggested in the literature are increased funding for early childhood programmes (Elango et al., 2016) and encouraging financial markets to develop. (Outreville, 1999). The former is probably the most cost-effective way to smooth out differences arising from socio-economic background while the latter example can boost growth by enabling poorer cohorts of society to invest in their own education, increasing economy-wide efficiency.

There is scope for examining this relation further. While my result was consistent for a given period across different age groups, I have not found a persistent result valid for different cohorts in alternate timespans. A further complication in my estimates is that I used OLS, which is prone to be biased by measurement errors or a non-linear true model. There is some evidence for the latter. Finally, I want to mention that the reliable data we have on this issue is rather scarce. Further investigation and gathering more information is required.

Appendix

More on how I derived/calculated my key variables of interest:

GDP Growth Rate (*GDPgr*): Total, per capita, PPP-adjusted real economic growth rate between 1990 and 2010 for country i:

$$GDPgr_i = \frac{GDP_{2010,i} - GDP_{1990,i}}{GDP_{1990,i}}$$

Where $GDP_{2010,i}$ denotes per capita, PPP-adjusted GDP of country i in 2010 and $GDP_{1990,i}$ denotes per capita, PPP-adjusted GDP of country i in 1990. Multiplying $GDPgr_i$ by 100 gives the total % of GDP growth in country i between 1990 and 2010.

Change in years of education Gini coefficient between generations (ΔeGINI): I subtracted the years of education Gini coefficient calculated for the children's generation from the same metric calculated for their parents' generation. In other form:

$$\Delta\text{eGINI} = eGINI_{children} - eGINI_{parent}$$

Where $eGINI_{children}$ is the Gini coefficient for years of education for a certain cohort of people born in the same decade (1960s, 1970s, or 1980s) and $eGINI_{parent}$ is the Gini coefficient for years of education of the parents of those children. If this metric is negative, then years of education is more evenly distributed in the children's generation than their parents' generation (This arises from how the Gini coefficient is calculated. For further explanation, see CORE Economics Unit 5.12). My metric was computed using educational Gini data present in the Global Database on Intergenerational Mobility dataset.

List of countries included in each regression (in alphabetical order):

1980 cohort	Albania, Armenia, Australia, Austria, Bangladesh, Belgium, Bolivia, Botswana, Brazil, Bulgaria, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Cote d'Ivoire, Cyprus, Czech Republic, Denmark, Ecuador, Finland, France, Gabon, Germany, Ghana, Greece, Guatemala, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Namibia, Nepal, Netherlands, Niger, Norway, Pakistan, Panama, Papua New Guinea, Peru, Philippines, Portugal, Romania, Rwanda, Senegal, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Togo, Tonga, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Vietnam
1970 cohort	Albania, Armenia, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Cyprus, Czech Republic, Denmark, Ecuador, Finland, France, Germany, Ghana, Greece, Guatemala, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Malawi, Malaysia, Mali, Mauritania, Mexico, Mongolia, Morocco, Nepal, Netherlands, New Zealand, Niger, Norway, Pakistan, Panama, Peru,

	Philippines, Portugal, Romania, Rwanda, Senegal, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tajikistan, Tanzania, Togo, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Vietnam
1960 cohort	Albania, Armenia, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Cyprus, Czech Republic, Denmark, Ecuador, Finland, France, Germany, Ghana, Greece, Guatemala, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Malawi, Malaysia, Mali, Mauritania, Mexico, Mongolia, Morocco, Nepal, Netherlands, New Zealand, Niger, Norway, Pakistan, Panama, Peru, Philippines, Portugal, Romania, Rwanda, Senegal, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tajikistan, Tanzania, Togo, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Vietnam

References

- Banerjee, A.V. and Duflo, E., 2003. Inequality and growth: What can the data say?. *Journal of economic growth*, *8*(3), pp.267-299.
- Benabou, R., 1996. Inequality and growth. *NBER macroeconomics annual*, *11*, pp.11-74.
- Benabou, R., 2000. Unequal societies: Income distribution and the social contract. *American Economic Review*, *90*(1), pp.96-129.
- Benhabib, J. and Spiegel, M.M., 1994. The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary economics*, *34*(2), pp.143-173.
- Berg, A.G. and Ostry, J.D., 2017. Inequality and unsustainable growth: Two sides of the same coin?. *IMF Economic Review*, *65*(4), pp.792-815.
- Bowles, S., Carlin, W. and Stevens, M. (2017). 'Property and power: Mutual gains and conflicts'. Unit 5.12 in The CORE Team, The Economy. Available at: http://www.core-econ.org. [Accessed on 14 Feb 2020].
- Castelló, A. and Doménech, R., 2002. Human capital inequality and economic growth: some new evidence. The economic journal, 112(478), pp.C187-C200.
- Castelló-Climent, A., 2010. Channels through which human capital inequality influences economic growth. *Journal of Human Capital*, *4*(4), pp.394-450.
- De La Croix, D. and Doepke, M., 2003. Inequality and growth: why differential fertility matters. *American Economic Review*, *93*(4), pp.1091-1113.
- De la Fuente, Á. and Doménech, R., 2002. Educational Attainment in the OECD, 1960-95.
- Deininger, K. and Squire, L., 1996. A new data set measuring income inequality. *The World Bank Economic Review*, *10*(3), pp.565-591.
- Elango, S., García, J.L., Heckman, J.J. and Hojman, A., 2015. Early childhood education. In *Economics of Means-Tested Transfer Programs in the United States, Volume 2* (pp. 235-297). University of Chicago Press.
- Güngör, N.D., 2010. Education, human capital inequality and economic growth: Evidence from Turkey. *Estudios Economicos Regionales y Sectoriales: EERS: Regional and sectoral economic studies: RSES*, *10*(2), pp.53-68.
- Halter, D., Oechslin, M. and Zweimüller, J., 2014. Inequality and growth: the neglected time dimension. *Journal of economic Growth*, *19*(1), pp.81-104.
- Krueger, A.B. and Lindahl, M., 2001. Education for growth: Why and for whom?. *Journal of economic literature*, *39*(4), pp.1101-1136.
- Kuznets, S., 1955. Economic growth and income inequality. *The American economic review*, *45*(1), pp.1-28.
- Outreville, J.F., 1999, October. Financial development, human capital and political stability. United Nations Conference on Trade and Development.
- Piketty, T., 2014. Capital in the 21st Century.
- Rodríguez-Pose, A. and Tselios, V., 2010. Inequalities in income and education and regional economic growth in western Europe. *The annals of regional science*, *44*(2), pp.349-375.
- Sala-i-Martin, X.X., 1997. I just ran four million regressions (No. w6252). *National Bureau of Economic Research.*
- Wail, B., Said, H. and Abdelhak, K., 2012, June. Human capital inequality and economic development: new evidence from nonparametric and semiparametric panel data models, 1955–2010. In *The 4th Development Conference of the GREThA/GRES.*.

Available at: http://jourdev. gretha. u-bordeaux4. fr/sites/jourdev. gretha/IMG/pdf/5d_benaabdelaali_hanchane_kamal. pdf (accessed 22.02. 2020).

- Yu, N., Yu, B., de Jong, M. and Storm, S., 2015. Does inequality in educational attainment matter for China's economic growth?. *International Journal of Educational Development*, *41*, pp.164-173.

Datasets used

- "GDIM. 2018. Global Database on Intergenerational Mobility. Development Research Group, World Bank. Washington, D.C.: World Bank Group." Accessed 29 Jan. 2020.
- Barro, Robert and Jong-Wha Lee, 2013, "A New Data Set of Educational Attainment in the World, 1950-2010." Journal of Development Economics, vol 104, pp.184-198. Available at: http://www.barrolee.com/ . Accessed 29 Jan. 2020.
- Freedom House. "Country and Territory Ratings and Statuses, 1973-2018". Freedom House, 2019. Available at: https://freedomhouse.org/content/freedom-world-data-and-resources . Accessed 29 Jan 2020.
- TCdata360 "Total investment (% of GDP)" (https://tcdata360.worldbank.org/indicators/inv.all.pct?country=BRA&indicator=345&viz=line_chart&years=1980,2024), World Bank Group, 2018. Accessed 29 Jan 2020
- World Bank. "GDP per capita, PPP (constant 2011 international $)." World Development Indicators. The World Bank Group, 2018, data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD Accessed 29 Jan. 2020.
- World Bank. "Trade (% of GDP)" World Development Indicators. The World Bank Group, 2018, data.worldbank.org/indicator/NE.TRD.GNFS.ZS Accessed 29 Jan. 2020.