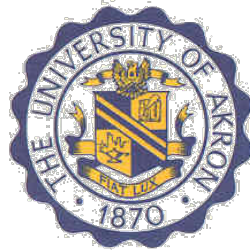*Senior Project First Draft*

Department of Economics

Textbook Inequality

The Relationship Between Education and Income Distribution

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Abstract

In this paper, the research question of whether education has an impact on income inequality will be tested under the hypothesis that countries with higher government educational expenditures and educational attainment within the population will have lower Gini coefficients. In the pooled OLS model run, it is concluded that educational expenditures are statistically insignificant in their effect on Gini coefficients. However, attainment is found to have a significant negative relationship with income inequality. According to this research, policies targeting secondary educational enrollment and completion would be the most effective for developing countries to reduce income inequalities.

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The relationship of economic growth and income inequality has been questioned and investigated by economists for the better part of the last fifty years. Cecilia García-Peñalosa (2009) found that while income inequality has a positive incentive effect towards promoting economic growth, there is a negative opportunity effect because these inequalities restrain investment in human capital.

Because they earn less, poorer households must work more to maintain their standard of living. Those currently living in poverty are not able to invest as much time and money into their education which in turn leads to them earning less in the future. This phenomenon, commonly referred to as a poverty trap, can be remedied when these households are given access to the same level of education as richer households.

In the last few decades the top one percent of U.S. households share of total income has increased dramatically. Since the late 1970's and 1980's their share of income has grown from less than a tenth of all income to more than a fifth of the income. This means that one percent of households are receiving twenty percent of the income within the United States. What this has done is to create a large gap in the incomes of the wealthy and non-wealthy, and undermine the existence of the middle class. Even among similarly developed countries the US has the smallest middle class which is defined by Steven Pressman as "*those households with a disposable income within the range of two-thirds to twice the median income for their household size.*" The U.S. has also experienced a decrease in the size of the middle class from almost 60 percent of households in the later 1970's to hardly over 50 percent in 2013.

This all goes to say that in recent decades, the rich have been getting richer. What the rich tend to do with their disproportionate share of the country's total income is to save, not spend. Because of this saving, we will likely see a drop in total consumer spending as a percentage of

total income and, possibly, increased unemployment rates. We have not seen either of these things however, so the pressure within the system must be felt elsewhere. The most likely place is the families who are on the lower end of the income spectrum. These families have been given a decreasing portion of the income in the economy without being given a proportionate decrease in costs of living. In fact, the cost of living has risen greatly since the 1970s. This has resulted in lower real buying power for these families, and has contributed to their lower overall quality of life.

António Afonso, Ludger Schuknecht, and Vito Tanzi (2008), aim at determining if public spending, specifically in the education sector, is an effective and efficient tool for a government to use to decrease income inequality. Effectiveness in this study is defined as the ability of a policy to achieve its goal of making income distributions more equal. Efficiency is determined as a parsimonious use of government resources. The authors use human capital theory to argue that when lower income households can access more education, they can increase their incomes, and thus reduce income inequality. The impact of government spending is measured through two channels. The first is the input channel, where government expenditures are measured as social spending and public education spending in the year 2000. The second is the output channel, where PISA test scores are used as a variable for the effectiveness of education received. These two variables are compared to several others in a Data Envelopment Analysis model. This DEA is a non-parametric model and it estimates a production frontier, or in the case of this study a "best practice frontier". What this model allows the authors to do is to measure the overall efficiency of a policy with multiple inputs and outputs. Their results find that redistributive spending and educational performance both impact income distribution significantly in OECD countries. Nordic countries show consistent measures of efficiency in public spending, meaning

that in those countries spending is determined to be an effective method of battling income inequality along with high educational achievements. Countries with lower educational achievements show lower efficiencies. A two-step Tobit regression points towards a strong indirect link between institutional indicators and efficiencies of social spending. This result points to the idea that educational spending is an effective and efficient method of reducing income inequalities.

De Gregorio (2002) investigates the relationship between educational attainment and income inequality within a population, as well as the effect government social spending has on income distributions. The data he used came from a range of countries from 1965 to 1990. There were 23 countries surveyed in 1965 and 71 in 1990. The equation built to test these countries for educational attainment measures is a fixed effect model using variables for educational distribution, educational attainment, economic development, social expenditure, and some dummies for region. From this equation "seemingly unrelated regression" SUR is run on the sample from data taken in 1965-1990 in 5 year intervals. Four separate regressions were run, each with more variables included than the last. Results are shown that as educational attainment for the populace increases, income inequality decreases. An increase in educational attainment by one standard deviation, between 2.5 and 2.9 years, results in a 0.06, or six percentage point decrease in the Gini coefficient. The average increase in educational attainment during the 30 years within the study was 2.5 years. When educational inequality decreases, income inequality decreases. A reduction of one standard deviation in educational inequality results in a decrease in income inequality, as measured by a Gini coefficient by 0.014 or 1.4 percentage points. Economic development as measured by the log of income per capita shows evidence of supporting a Kuznets curve within the panel data in this study. That is to say that as economies

develop from very low income to middle income economies, the distribution of income becomes highly unequal, but as they develop further into advanced economies income inequality begins to decrease. This is captured within the regression by variables for log of GDP per capita (0.454) as well as log of GDP per capita squared (-0.029). The coefficient for Social expenditure (-0.002) implies that as social expenditure rises by one percent, income inequality will decrease by 2 percent. This is likely either from income transfer from the rich to the poor, or from the poor having access to more government funded programs, such as education grants or healthcare plans. The regions with the greatest impact on the model were Africa and Latina America, where inequality was greater, and Asia, where inequality was smaller. The conclusion of this paper is that education certainly has an effect on income inequality. This is found in the relationship between both attainment and the distribution of education. Increased educational attainment within an economy does reduce income inequality, and reduced educational inequality has a stronger effect on the reduction of income inequality. Furthermore, government social spending has a direct, negative relationship to income inequality. The author of this paper's policy recommendation is to focus on policy which would reduce the inequality in distribution of education in order to equalize incomes.

In Keller (2010) the effects of primary, secondary, and higher education expenditures on income distribution are studied. When inequalities of education exist, inequalities of income will follow. Theoretically government sponsored education policies, when targeted towards the lower income persons will result in more equal opportunities to increase human capital, and therefore wages. This paper uses panel data taken from OECD countries which is applied to a pooled OLS regression. The results of this regression show that secondary schooling expenditures and enrollment rates are the most significant factors for equalizing income distributions. With

enrollment rates in secondary schooling shown to have an effect of (-0.089) at the 1%

significance level on Gini coefficients, meaning that as enrollment in secondary schooling

increases by 1, income inequality as measured by the Gini falls by 8.9%. Secondary educational

spending as a percentage of GDP has a statistically and economically significant negative effect

on Gini measures before non-educational control variables are accounted for. Once these

variables are included, public spending is nonsignificant.

Koeller, Joumand, and Koske (2014), review existing literature which study the recent

trend in OECD countries of increasing income inequality. Multiple conclusions are drawn from

previous literature. However, the one most relevant to my subject concerns education. In this

paper, it is concluded that policies which lead to higher educational attainment and availability in

secondary schooling lead to decreased income inequality.

In Koske, Fournier (2012), the theoretical base lies in the construction of a wage gap ratio

within the population they study. Mincer's work on the result of human capital attainment on the

wage of an individual is relevant here because an individual's educational attainment relates to

their working wage. That isn't the end of the story however. The model used in this paper relates

the logarithm of an individual's labor earnings with that of several explanatory variables

consisting of education measures. The levels of education analyzed in this paper are upper

secondary education (high school level) and post-secondary tertiary schooling (college degrees).

There is also a dummy for if an individual has received a PHD. One conclusion drawn from this

model, which directly affects my research question, is that as the share of workers with upper-

secondary or post-secondary non-tertiary degrees rises, a narrowing of the income distribution

occurs. This conclusion suggests that if a government can put in place a policy which can

increase individuals' ability to receive education, they will also narrow their income distribution.

Previous literature has looked at the relationship between education and income on a macroeconomic level. However, they don't all control for multiple sources of macroeconomic influence on the story they are telling. Keller's paper accounts for trade and investment, other papers account for region. My paper will account for these things. One of the best (read easiest) sources for macroeconomic data is the World Bank. However, in the literature I have reviewed, I noticed no one seemed to use the World Development Indicators. I will use this source and it will be interesting to see if the same story is told.

Theoretical Background

In the literature, education is emphasized as a variable influencing income distribution. However past empirical studies have not always found the relationship between these variables to be clear. For instance, the work of Shultz, Becker and Mincer on human capital's effect on the income distribution suggests that income distribution is determined by educational distribution. The higher discrepancy in level of education within a population the higher the discrepancy in incomes. But raising average schooling may have an ambiguous effect on the distribution. The rate of return to schooling would affect whether increased average education lowers the Gini coefficient.

Additionally, development economics predicts wage composition and compression to occur when human capital accumulation is increased within an economy. The "composition effect" takes account of the relative ratio of the population receiving more education increasing. This would usually lead to an initial increase in inequality followed by a decrease. The "compression effect" is the decrease in value of an education, as the ratio of educated to non-educated workers rises.

This paper will strive to find out the true relationship of education to income inequality. It will attempt to do so from two pathways. The input pathway, through government spending on education, and the output pathway, that of educational attainment within a country. The model will be as follows below. The factors on the left side contribute to the Income distribution within an   economy.
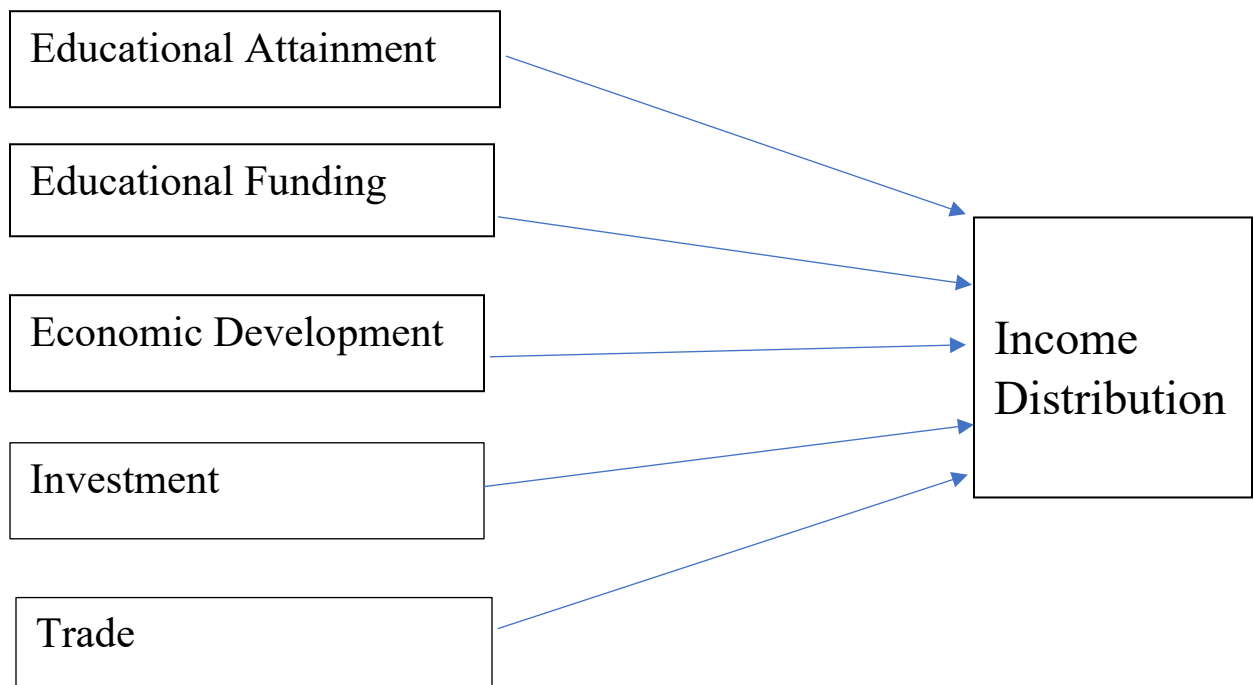
Empirical Model

The empirical model the work in the paper will be adapted to take cues from the fixed effects model in Jose De Gregorio's paper, and the pooled OLS from Keller's. These models both used educational expenditure and attainment as their main explanatory variables, but each has a different set of non-education variables. In Keller's paper trade and investment are accounted for, and in De Gregorio's region is included. The model in this paper will include all

of these. Because of limitations within the data set, a fixed effect couldn't be performed. Pooled OLS was run in the format of the following equation.

$$Y_{it} = \beta_{1it}LnGDPPC + \beta_{2it}LnGDPPC2 + \beta_{3it}Expenditure + \beta_{4it}Attainment + \beta_{5it}Trade$$
$$+ \beta_{6it}Investment + \beta_{7it}Region + \varepsilon_{it}$$

Where Y_{it} is the Gini coefficient within an economy. β_{1it} And β_{2it} symbolize the log of GDP per capita and that measure squared. These variables should tell us if the Kuznets curve exists within this dataset. If it does, the LnGDPPC will be positive and the LnGDPPC2 will be negative. $\beta_{3it}Expenditure$ is measured by the percentage of a country's GDP which is used to fund education. This is a measure of the priority governments give to public education within their countries. This variable is expected to be negative, as government spending would benefit low income households and allow them to shift their income upwards, thus reducing the gap between them and high income houses.

$\beta_{4it}Attainment$ measures the percentage of a country's population aged 25 years or older who have a lower secondary education. Secondary education was selected due to the multiple conclusions drawn within the literature that it was the most significant level of education when regressed against income distribution. The literature has found this to be negative in the past. This makes sense when we consider the idea that more equal distribution of human capital would likely result in more equal wages.

$\beta_{5it}Trade$ accounts for the percentage of GDP made up by trade. This variable may be positive or negative as trade brings money into economies, but whether it is distributed evenly among the population is the question. I expect it to be negative, however, because distribution of extra money would likely be favorable for all within an economy. $\beta_{6it}Investment$ is the net

inflows of Foreign Direct Investment as measured in current US dollars. Like trade, it has a somewhat ambiguous relationship with income distributions, but I expect it to be negative because as foreign investment increases, local firms should want to hire additional workers to produce output to match the investment.

The final variable $\beta_{7it} Region$ is a dummy for region. The positivity or negativity of this variable will likely be determined by the development of countries within their respective regions, following Kuznets, countries in the middle of the development curve should have the highest inequalities.

Data

The data used in this project will come from the World Bank and World Development indicators. The following is a preliminary table of variables I will use.

Gini Coefficient (Gini)	This describes the income distribution within a country (from 0 to 100)
GDP per capita (GDPPC)	This is a measure of the "development" of a country's economy
Educational Expenditures (EdExpGDP)	This statistic measures the proportion of education spending in a country
Attainment (PopLower2ndary)	The percentage of adults (25+ years of age) with a lower secondary education.
Trade (TradeGDP)	The portion of an economies GDP made up of trade
Investment (FDIinGDP)	The Foreign Direct Investment in an economy measured in current US dollars
Region	Which of the 7 World Bank Regions a country lies within

Summary Statistics

Variable	N	Mean	Std. Dev.	Min.	Max.
Year	12369	1988	16.4526153	1960	2016
Gini %	1265	39.3375494	10.0540811	16	65
GDPPC	8890	7410.95	14836.54	35.3677268	193648.13
EdExpGDP	3367	3.9405999	2.0040156	0	44
PopLower2ndary	647	65.1561051	25.6721179	2	99
TradeGDP	8175	79.2664352	54.4571856	0	860.8
FDIinGDP	6811	3.0875055	6.4551297	-9	89

Results

Three iterations of the model described above were run using OLS regression. All three iterations present results indicating the presence of Kuznets curves within these data. The first utilized only the variables pertaining economic development and education. This model is unique in that it is the only one in which education expenditures are shown to have a negative effect on the Gini coefficient. Once other factors are included within the model, expenditure becomes positively related to income inequality. This is very likely due to endogeneity within the model. When a country has high inequality they would likely spend on programs which would reduce said inequality. Unfortunately, expenditures are never statistically significant, meaning they really don't do anything. However, attainment is significant in both regressions run before region is included, and it is always negative.

Trade and investment are included in the second and third regression. Trade has a significant negative relationship with income inequality within both iterations. Investment has a positive relationship with inequality in both. However, it is only significant in the second regression.

Dependent Variable	Gini Percentage		
	1	2	3
Intercept	-51.928	-51.737	-1.02063
	(22.191)**	(20.053)**	(14.419)
LnGDPPC	25.237	25.935	11.25818
	(4.879)***	(4.412)***	(3.135)***
LnGDPPC2	-1.519	-1.577	-0.67521
	(0.268)***	(0.242)***	(0.172)***
EdExpGDP	-0.315	0.299	0.00402
	-0.320	(0,297)	(0.194)
PopLower2ndary	-0.153	-0.098	-0.00986
	(0.018)***	(0.018)***	(0.013)
TradeGDP		-0.102	-0.04614
		(0.013)***	(0.009)***
FDIinGDP		0.123	0.02766
		(0.050)**	(0.032)
SAsia			-11.3169
			(3.533)**
EurCentAsia			-7.36946
			(2.895)**
SubSahAf			10.75483
			(3.403)**
LatAmCar			7.27285
			(2.980)**
N	266	266	266
Adj. R squared	0.459	0.5646	0.8247

Note: *: p < 0.10 , ** p<0.05, *** p<0.01

Standard errors in parentheses

Statistically insignificant regions excluded from results

North America is captured in the intercept

Finally region is included. In regression 3 attainment and trade both remain negative in their relationship with income inequality, but attainment becomes insignificant statistically. Regions are found to be very important to this model, where 5 of 7 had statistical significance.

Conclusion

Unfortunately, the results given from this model must be taken with several grains of salt. The dependent variable, according to theory, has an endogenous relationship with several of the explanatory variables, and omitted variable bias is present. Nonetheless, my research has resulted in output similar to that of previous literature. Kuznets curves are found to be present in all three of the models run and, therefore, it can be concluded that inequality increases at a decreasing rate as economic development increases. This continues until it hits a tipping point and begins to decrease. Educational expenditure has a negative relationship with inequality until factors outside of development and education are considered. However, it is likely that endogeneity within the relationship of inequality and spending has led to a misrepresentation of its impact. Educational attainment is shown to have a significant negative relationship in two of the three models and remains negative in the third. Both education variables follow the trend within previous literature, that educational spending and attainment both have negative relationships with income inequality. Attainment has the stronger significance. Once trade and investment are included, expenditures are shown to have a weaker relationship with inequality, and region is the king variable in the final data set having the largest coefficients and significances. In the future I would like to include data on the educational attainment of women within these economies. Literature has shown a positive relationship with women's role in economies and the development of the economies they are involved in. It also stands to reason that as women's educational attainment increases their wages may also increase, which would cause an effect on

the income distributions within their countries. To improve the methodology of this paper it would be beneficial to run a non OLS regression like a fixed, or random effect. However limitations in the current data prevented this when controlled for a fixed effect the dataset only contained a little over a decade's worth of observations. This is problematic for a model with very slow moving variables such as GDP per capita and expenditure numbers. When fixed effect was run on the dataset, it eliminated multiple variables through incredibly high correlation with the fixed effect of time. Public policy takes too long for ten years to be an accurate timeframe for observation. In order to use fixed effects it would likely be required to find a different data source or wait another ten years or so for the World Bank to have further observations.

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