Education and Income Inequality: A Meta-Regression Analysis

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- FIRST DRAFT -

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Abstract

This paper revisits the literature that investigates the effects of education on inequality. Specifically, the paper provides a comprehensive quantitative review of the extant econometrics literature through a meta-regression analysis of 64 empirical studies that collectively report 868 estimates of the effects of education on inequality. We find that education affects the two tails of the distribution of incomes; it reduces the income share of top earners and increases the share of the bottom earners, but has no effect on the share of the middle class. Inequality in education widens income inequality. Education has a larger negative effect on inequality in Africa. The heterogeneity in reported estimates can be largely explained by differences in the specification of the econometric model.

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1. Introduction

Income inequality is a critically important social, political and economic issue in the study of economic development. Inequality can affect economic growth and development and it can impact upon political stability and class and ethnic tensions.[1] The empirical literature identifies various factors that shape inequality, such as urbanization, the level of development, political regime, government intervention and land inequality. While these are all important factors, it is education that often occupies the centre stage.

A large theoretical and empirical literature has explored the effects of education on inequality. Some studies look at the effects of education on individual earnings while others look at the effects on the aggregate (national) distribution of income. The aim of this paper is to revisit this later body of evidence through a quantitative literature review (Stanley, 2001). Specifically, this paper provides a comprehensive review of the extant econometrics literature through a meta-regression analysis (MRA) of 64 empirical studies that collectively report 868 estimates of the effects of education on aggregate inequality. The aims of our MRA are twofold:

(1) Assess the effect of education on inequality. Does education increase, decrease, or have no effect at all on inequality at the national level? Under what conditions does education shape national inequality?

(2) To model the heterogeneity in the empirical estimates. What factors explain the wide variation in the reported estimates of the effect of education on inequality?

We show in this paper that education is an effective mechanism for reducing inequality. We also show that it is possible to explain most of the variation in the reported estimates.

The paper is organized as follows. Section 2 presents a review of the main theoretical arguments. Section 3 presents a brief discussion of the meta-analysis data. The results and analysis of the effect of education on inequality are presented in section 4. Conclusions are drawn in section 5.

[1] For example in Malaysia, inequality directly resulted in ethnic tensions between Malays and Chinese (Faaland *et.al,* 1990).

2. Theoretical Background and Prior Evidence

Education is widely seen as one of the most efficient ways to reduce inequality (Toh, 1984). Education provides greater economic opportunities, especially to the poor (Blanden and Machin, 2004).[2] It determines occupational choice and the level of pay and it plays a pivotal role as a signal of ability and productivity in the job market. Education shifts the composition of the labour force away from unskilled to skilled. While this process may very well initially increase income inequality (Chiswick, 1968), in the long term it is expected to reduce income inequality (Schultz, 1963).

Educational attainment plays a key role as a signal of ability and productivity in the job market; education is an effective signal of achievement. The selection and assessment process inherent in the education system indicates that individual performance has been determined before workers: '… will be selected into the occupational structure in which their particular educational background will be most productively employed' (Tan, 1982:26). Although education may not necessarily always produce an accurate signal of labour productivity, limited information compels employers to use education as the main indicator. Stiglitz (1973:136) argues that:

> It is often difficult for the employer to identify who will be a good employee; however, firms have observed that the qualities which lead to success in school are related to the qualities which make the individual more productive on the job. Although the correlation may be imperfect, competitive firms can use this information and offer the individuals who do well in school and complete more years of schooling the better jobs.

Better educated individuals are perceived to be better able to cope with technological and environmental changes that directly influence productivity levels. Thus, at the macro level, human capital is an important determinant for labor productivity and eventually economic growth (Tsu-Tan Fu *et.al*, 2002). Individuals with higher education are rewarded with higher earnings as payment for their productivity and ability (Knight and Sabot, 1990).

Demand for higher education has grown tremendously and experienced rapid changes in past decades. This has been partly driven by the link between education and socioeconomic status; more highly educated individuals are more likely to gain better employment. The expansion of higher education increases the supply of higher educated workers into labour markets. This changes the composition of the labour force, as unskilled

[2] It should be noted that poverty and inequality are quite distinct processes.

workers move into the skilled workers cohort. Initially this is expected to increase income inequality, but further increases in the supply of higher educated workers tend to lower the wage premium for skilled workers. However, based on their study in Tanzania and Kenya, Knight and Sabot (1983) argue that education expansion has two conflicting effects; there is a compression effect as well as a composition effect. The composition effect is the change in the proportion of the labour force that is educated; this affects inequality similar to the process postulated by Kuznets.[3]. An increase in the number of educated workers tends to initially increase inequality. However, inequality declines after reaching a certain threshold because of the compression effect. The compression effect refers to competition in the labour market. Increased supply of skilled workers decreases the wage premium to higher skill levels and thus lowers income inequality. Knight and Sabot (1983: 1136) explain the process as below:

> …the expansion of the supply of educated labor relative to the demand has a powerful compressing effect on the intraurban educational structure of wages. The composition effect of educational expansion can indeed raise intraurban inequality, but the consequent compression effect outweighs it: relative educational expansion reduces inequality. Since this process occurs within the relatively expanding high-income, urban sector, it is hastening the arrival at the point beyond which economic growth is associated with a reduction in overall inequality.

The contribution of education to reducing inequality among various socioeconomic groups is more ambiguous. Empirical evidence, especially at the macroeconomic level, fails to identify a significant role for education, even though it is widely believe to reduce inequality. According to Checchi (2001: 44), the effect of education will be significant if the initial level of education attainment is lower and the expansion of education is relatively faster. Therefore, the countries that have higher initial education attainment levels tend to produce unexpected or insignificant results.

The impact of education will depend on many factors, such as the size of education investments made by individuals and governments, the rate of return on these investments and degree of government intervention. In many countries the expansion of higher education is not equally distributed and tends to benefit those in higher income brackets. For example, a study of Brazil in 1977 revealed that higher income earners enjoyed greater benefit from investment in education since their children had better educational opportunities compared to those from lower income groups (World Bank, 1977). Blanden and Machin (2004) also found

[3] In his Presidential address delivered to the American Economic Association in 1955, Simon Kuznets postulated a relationship between economic growth and inequality. Kuznets argued that inequality worsens initially as economic growth takes off but then slowly decreases as growth continues beyond a certain threshold.

a strong relationship between family income and university degree attainment in Britain as participation in higher education has increased. They claimed that:

> Despite the fact that many more children from richer backgrounds participated in HE (higher education) before the recent expansion of the system, the expansion has actually acted to significantly widen participation gaps between rich and poor children.

These concerns notwithstanding, in most countries, governments subsidise the costs of public higher education. In South-East Asian countries for instance, educational development has received strong financial support from governments, with some countries allocating a relatively high proportion of their government expenditure to education (Asian Development Bank, 2008: 7-9, Lee and Francisco, 2010: 9-10). Education subsidies increase the opportunities for poor children to access education. Larger subsidies also mean a greater number of children will go to university in the future. Nevertheless, Glomm and Ravikumar (2003) argue that the role of subsidies and government spending to reduce income inequality is not entirely clear. Public spending in education may widen the income gap between the rich and poor even though everyone has equal access to education. Education expansion would not benefit the poor if they do not have sufficient resources to attend school, particularly if they are taxed to raise government revenue to fund education (Sylwester, 2000; 2002). Educational spending, especially in higher education, usually benefits middle and upper class children rather than the lower income groups that would be expected to be the main target for redistributive policy. Stiglitz (1973:137) for instance argues that:

> … since the beneficiaries are mainly children of the middle and upper income groups and state taxes are often regressive, the net effect of state support of higher education is redistribution from the poor to the middle and upper income groups.

Jiminez (1986) postulated that public education expenditures 'do not benefit the poor at all', and thus, fail to reduce income inequality. There is evidence in Greece that public transfers of education services in primary and secondary led to a decline in aggregate inequality but transfers in tertiary education were found to have a negligible distributional impact (Tsakloglou and Antoninis, 1999).

Inequality has attracted a great deal of attention from empirical researchers, particularly those working in the areas of economic development. For example, the Kuznets hypothesis alone has generated hundreds of articles and research programs since the 1950s.[4]

[4] The Social Science Citation Index records more than 500 articles that have discussed the hypothesis (Moran, 2005:210).

After Kuznets postulated his idea, economists (including those from international institutions such as The World Bank), commenced collecting time series and cross sectional data in order to test his hypothesis. The initiative for compiling inequality data was started by the United Nations in the 1950s. Since then there has been a continuous effort to assemble datasets by international agencies such as The World Bank, as well as individual researchers. One of the most influential datasets was developed by Deininger and Squire (1996) who assembled about 2,600 Gini index observations from different sources. Deininger and Squire's dataset has been recognized as a high quality dataset as they used strict procedures to accept (include) an observation in their dataset. To be accepted in their dataset, observations must be based on household surveys which include different types of income and cover most of the population (Deininger and Squire, 1996:568). With the accumulation of data, researchers have been able to use time series data rather than depending on cross sectional data, and many have used panel data in inequality studies including the relationship between education and inequality.

Much empirical evidence suggesting a strong association between education and inequality has emerged since the seminal work of Mincer (1958). However, some of the evidence is contradictory. For example, Chiswick (1974) found that higher levels of schooling increase inequality. In contrast, Ahluwalia (1976) found a negative association between school enrolment and inequality. However, Ahluwalia's results vary according to the measures employed. Secondary schooling is positively related to the shares of the middle 40 percent and the lower income group, while an increase in the literacy rate is negatively associated with the income share of all income groups except the lowest 20 percent quintile. Winegarden (1979) also reports similar findings; education increases the income share of the bottom quintile income. More recent studies by Sylwester (2003) and Georgio (2003) find a negative relationship between higher education enrolment and inequality. However, they also find that education has less impact on inequality in African countries compared to other regions.

Studies on education and inequality have changed especially in term of the methodology. In 1950 to 1960s period, most of the studies, such as Anderson (1955) and Soltow (1960), used simple cross tabulations with some numerical examples. The studies from this era were also very much influenced human capital theory and the Mincer equation pioneered by Mincer (1958) and Becker and Chiswick (1968). Most of the studies are single country and focused on United States only (e.g Aigner and Heins, 1967 and Chiswick, 1968).

Meanwhile in 1970-1980s, studies in education and inequality extended Kuznets' hypothesis by adding education in the inequality econometric model. Education had been used as one of the inequality determinants (Ahluwalia, 1976 and 1976a). The studies in 1990s onward, with the availability of new dataset especially from Deininger and Squire (1996), employed more complicated methods. Most of the studies did not employed just simple OLS but used panel data and other non-OLS estimators such as GMM, IV and ML. In addition, it is the fact that education level is also increasing over time due to many factors such as economic development, government policies and people awareness.

Of particular interest to our paper is that the relationship between education and inequality can very well vary between regions, the level of development and the type of political regime in place. Moreover, the relationship might not necessarily be linear. Figure 1 illustrates the relationship between the Gini index of inequality and the average number of years of schooling among the 5 most developed countries in South-East Asia (Malaysia, Indonesia, Singapore, Thailand and The Philippines). Even if the three largest observations are removed, inequality and education follow a non-linear relationship, though it is not as pronounced.

FIGURE 1 ABOUT HERE

3. Meta-Analysis Data

In this section we discuss the search strategy for identifying studies and the criteria studies had to have met in order to be included in the meta-dataset.

3.1 Search for studies

According to Stanley and Jarrell (1989), meta-analysis should commence with an extensive literature search. A comprehensive search was conducted from January through to May 2011, to identify the relevant econometric studies on the effects of education on inequality. Numerous databases and search engines were explored, including Econlit, Jstor, Google Scholar and RePec. Keywords used in the search included 'education', 'higher education',

'inequality', 'income distribution', 'distribution of incomes', 'gini', and 'income shares'. These keywords identified 852 articles in the Jstor database and 1,414 articles retrieved from the Econlit database. In addition, references cited in prior literature reviews and empirical papers were also investigated.

3.2 Criteria for inclusion

Although there are over two thousand articles that investigate the relationship between education and inequality, meta-analysis requires comparable estimates. The studies that were ultimately selected satisfied the following three criteria:

(1) Reported econometric estimates: Meta-analysis in economics involves a compilation of *regression* results drawn from previous studies (see Stanley and Jarrell, 1989). Therefore, only empirical studies that provide regression results were included in the data set. This criterion excludes numerous earlier studies such as Soltow (1960), Stiglitz (1973) and the first study on education and inequality by Anderson (1955), because these studies do not employ econometric or regression methods; Anderson (1955) and Soltow (1960) use descriptive statistics while Stiglitz (1973) is a theoretical study. Note that we include both published and unpublished studies in the meta-dataset.

(2) Income inequality as the dependent variable and education as an explanatory variable: The econometric study must have used inequality as the dependent variable and at least one measure of education as an explanatory variable. That is, to be included in the dataset, the estimated inequality equation needed to be some variant of the following general specification:

$$I = \alpha + \beta_1 Edu + \beta_x \mathbf{Z}_x + \mu \tag{1}$$

Where I is inequality, Edu is education, $\mathbf{Z}$ is a vector of other explanatory variables and μ is the error term. With this criterion, numerous studies such as Muller (2002) and Checchi (2003) were excluded because although these studies explore the relationship between education and inequality, inequality is not the dependent variable. Rather, inequality is one of the explanatory variables. Influential studies such as Becker and Chiswick (1966), Tinbergen (1972) and Marin and Psacharopoulos (1976) were also excluded as these studies used the

return-to-education as the dependent variable. Finally, as our focus is on *income* inequality, we excluded studies of land inequality and wealth inequality.

(3) Aggregate income inequality: The focus of this paper is on the aggregate relationship between income and education. The Mincer (1974) equation is probably the most influential equation in the entire human capital literature.[5] According to this framework, earnings differentials are determined in part by the level of schooling. Many studies of the effects of education on inequality have applied the Mincer approach to investigate the relationship between education and inequality. Nevertheless, studies based on Mincer's approach were excluded from the meta-dataset as these refer to the earnings differential between individual workers, rather than aggregate income inequality. Therefore, numerous studies including those from the most prominent scholars in this field such as Mincer (1958) are excluded from the meta-analysis. This selection criterion is not likely to bias the results, since the focus of the paper in on the aggregate effects of education.

Sixty-four studies met these criteria. These studies report a total of 868 comparable estimates that can be included in the meta-dataset. Table 1 lists the authors of these studies, the year of publication, the sample coverage and the time period investigated.

TABLE 1 ABOUT HERE

3.3 Effect size

The studies included in our dataset vary in terms of measures of the dependent and explanatory variables. Nevertheless, they all provide estimates of the key association – the effect of education on inequality. All estimates were converted into a common and comparable measure. The choice of measure was the partial correlation. The partial correlation measures the strength of the association between education and inequality, holding all other factors constant. The partial correlation is a suitable measure for our purpose as it is comparable across and within studies and is fairly straightforward to calculate (see Stanley and Doucouliagos, 2012 for detailed technical notes).

[5] Mincer's human capital earnings function takes the following generic form: $\log Y = \log Y_0 + rS + \beta_1 X + \beta_2 X^2 + \mu$, where Y is earnings, Y_0 is an individual's earnings with no education and no experience, S is years of schooling and X is labour experience.

Table 2 presents descriptive statistics for the included studies. The majority of the reported estimates show a positive effect of education on inequality, *i.e.* education increases inequality. Of the 868 estimates, 479 or 55.2 percent recorded positive partial correlations between education and inequality, with 223 of these, or 25.7%, being statistically significant. On the other hand, 388 or 44.7 percent estimates recorded negative coefficient while 196 or 22.6 percent were reported to be statistically significant. There is only one estimate (0.1%) reporting a zero coefficient. This distribution of results, however, tells us relatively little as it is likely to be dominated by sampling error, specification bias and possibly selection bias. Hence, it is necessary to delve much deeper into the reported estimates.

TABLE 2 ABOUT HERE

4. Does education affect inequality?

In this section we apply MRA to the meta-dataset to address the two research questions noted in the introduction: (1) what is the effect of education on inequality? and (2) what factors explain the heterogeneity in reported results.

4.1 Unconditional Estimates

The unconditional relationship between education and inequality was estimated by running the following simple MRA:

$$r_{ij} = \beta_0 + \varepsilon_{ij} \tag{2}$$

Where *r* is the partial correlation between education and inequality of the *i*th estimate from the *j*th study (there are 64 *j*s and 868 *i*). Equation 1 assumes that the only source of variation is sampling error, the ε_{ij} term. Table 3 reports estimates of the unconditional relationship between education and inequality. Column 1 reports the results using standard errors robust to heteroscedasticity. The results show that the average effect of education on inequality is +0.025; there is a positive relationship between education and inequality. Most researchers follow Cohen's (1988) suggestion when interpreting the magnitude of a zero order correlation; the effect is considered small if it less than 0.1, moderate if 0.25 and large if more

than 0.4. Hence, the education-inequality association is very small according to Cohen's criteria and of no practical significance.

The results reported in Column 1 do not control for data dependence. Once this is controlled for, in column 2, the unconditional average is no longer statistically significant. Column 3 reports the results using weighted least squares, using precision as weights and controlling for data dependence. The conclusion from Table 3 is that there does not appear to be any link between education and inequality. However, before accepting this conclusion, it is necessary to consider whether the reported results are affected by selection bias and heterogeneity. This is particularly important for our dataset as we include the results of several different measures of the dependent variable (inequality) and, hence, there is the real possibility that unconditional estimates are affected by heterogeneity.

TABLE 3 ABOUT HERE

4.2 Publication Bias

The estimates reported in Table 3 may be affected by publication selection bias. Researchers may have a strong preference, and incentive, to report only statistically significant results, suppressing insignificant results in order to increase the probability to secure publication (Card and Krueger, 1995:239). Simply looking at Table 2 it is clear that there is a range of results reported in this literature. Moreover, the theoretical literature "allows" for both negative and positive results. Hence, there is no strong reason to believe that there will be bias in this literature.

Stanley and Doucouliagos (2010) suggest a funnel plot to detect the presence of publication bias. The funnel plot is a useful graphical method to identify the shape or distribution of reported observations. Publication bias can be observed by plotting precision (inverse standard error) with partial correlation. Figure 2 illustrates the funnel plot when partial correlations are used. Figure 3 repeats this but for the Fisher z-transformed partial correlations.[6]

[6] Partial correlations are truncated at -1 and +1, potentially distorting the shape of the funnel plot. The Fisher z-transformation removes this truncation. Because of the truncation, partial correlations might be a downward biased. However, the truncation does not affect the majority of the estimates in our meta-dataset. Moreover, Hunter and Schmidt (2004) caution against the use of the Fisher z-transformed correlations as they are likely to lead to an upward bias; it replaces a negative bias with an upward bias.

FIGURE 2 ABOUT HERE

FIGURE 3 ABOUT HERE

The funnel plot will be symmetrical if the reported estimates are free from publication bias. The estimates with a larger standard error (less precision) will be spread at the bottom of the graph. Meanwhile more precise estimates form the top of the funnel. At least two important points can be noted from the above funnel plot. First, the reported results are widely spread. This means that the results are heterogeneous and it is important to identify the factors that drive this heterogeneity. Secondly, the distribution of results appears to be symmetrical; both positive and negative estimates are reported. Symmetry is an important characteristic in a funnel plot as it indicates the absence of publication bias.[7] Therefore, based on the funnel plot above, there is no clear visible sign of publication bias in the studies of education and inequality.

However, like all graphs, interpretation of funnel plots is largely subjective. Stanley (2005 and 2008) proposed an empirical test – the FAT-PET regression - that has to be conducted prior to the confirmation of any existence of publication bias. The existence of publication bias can be tested using the following regression:

$$r_{ij} = \beta_0 + \beta_{se} SE_{ij} + \varepsilon_{ij} \tag{3}$$

Where *SE* denotes the standard error of the partial correlation.[8] These results are presented in Table 4. In column 1, we report the results of simple OLS using robust standard errors. In column 2 we correct for data dependence (multiple estimates reported within the same study), using clustered standard errors. Finally, in column 3 we use WLS, using precision as weights. The coefficient on SE is not statistically significant, regardless of the estimation approach (columns 1, 2 and 3). This suggests the absence of publication selection bias in this literature

[7] Note that it is symmetry that is the issue. The distribution does not need to contain both positive and negative correlations; a funnel plot can be symmetrical with all positive (or negative) valued observations.
[8] Note that SE is *not* the standard error of the regression coefficient.

and also that there is no evidence of an empirical effect either. However, we need to be careful with both of these conclusions. It might be the case that heterogeneity (recall the spread in the funnel plot) dominates both the test for selection bias and genuine empirical effect. Hence, in the following section we embed both tests within a multivariate framework.

TABLE 4 ABOUT HERE

4.3 Exploring Heterogeneity in Reported Results

The general form of the MRA is given by:

$$r_{ij} = \beta_1 + \sum \beta_k \mathbf{Z}_{ki} + \beta_0 SE_{ij} + \sum \alpha_j SE_i \mathbf{K}_{ji} + \varepsilon_{ij} \quad (4)$$

where ***Z*** is a vector of variables that reflect the distribution of genuine empirical effects and misspecification biases, ***K*** is a vector of variables that reflect publication selection heterogeneity, and SE is the estimates' standard error. See Stanley (2008) for details on this general MRA model.

In this paper we estimate versions of the following specification:

$$r_{ij} = \beta_1 + \sum \beta_k \mathbf{Z}_{ki} + \beta_0 SE_{ij} + \varepsilon_{ij} \quad (5)$$

That is, we control for heterogeneity in the **Z** vector variables but not the **K** vector variables; we are not here interested in modeling the publication process itself. All estimation is carried out through weighted least squares, using precision as weights. Equation 5 offers estimates of the conditional effects of education on inequality.

The following groups of variables were included in the **Z** vector:

Measures of the dependent variable: The dependent variable in the primary econometric studies is income inequality (recall equation 1). In broad terms, inequality is measured using the Gini coefficient, the income share of the top earners, the income share of the middle class, or the income share of the bottom earners. Controlling for these different inequality measures

is important, as in theory the effects of education on inequality can very well differ depending upon which part of the income distribution we are analysing. For example, it is possible that education might have an entirely different effect on the share of the top income earners compared to the share of the bottom income earners.

Measures of the explanatory variable: The key explanatory variable is education. A range of measures of education have been employed in the field: literacy; years of total schooling; secondary schooling; primary schooling; mean years of schooling; and expenditure on education. We wish to test whether these alternative measures impact on the reported results.

Composition of data: Some studies use data for developed countries (66.2%), others for developing (33.8%). Some studies relate to democratic countries, while others to authoritarian and socialist countries. Geographical regions covered include Africa, Latin America and Asia. The education-inequality association might very well vary by region, level of development and political regime.

Type of data: Most studies use panel data, but others use time series or cross-sectional data.

Time variation: The average year of the data used is included in order to explore whether the effect of education on inequality varies with time (or is reported to vary over time).

Estimator: Most studies use OLS. However, some do account for endogeneity between education and inequality using the IV estimator. We wish to explore whether estimation differences matter.

Specification: Studies differ also in their chosen econometric specification. There is a fairly wide set of econometric specifications used throughout this literature. Unfortunately, the use of too many dummy variables to capture all the specification differences may lead to econometric problems. Specifically, we can easily run out of degrees of freedom and multicollinearity might be a challenge. Therefore, some of the potential moderator variables were combined to form the following five broad MRA variables:

a. *Government*: This category incorporates all variables related to government activities, such as welfare, public administration and government transfers.

b. *Liberalization*: All variables related to the liberalization process such as trade and openness, foreign direct investment and patents[9] were combined to form this variable.

c. *Labour*: All variables related to labour force structure, including women's access to labour markets and labour regulation had been included in this variable.

d. *Non Agricultural Sector and Urbanization*: The aim of creating this variable was to capture the Kuznets' process. All related variables such as manufacturing, services, wholesale and urbanization had been incorporated into this variable.

e. *Demographic*: All variables related to demographics, such as age, population, non-white and female had been combined in this variable.

On the other hand, some variables such as consumption and density were excluded entirely from the MRA as they appeared in a very small number of studies. Further, some variables were highly collinear and had to be omitted. For example, Latin America and Africa were dropped because they were highly correlated with the Asian region dummy. The variables included in the MRA are listed and described in Table 5, together with their means and standard deviations.

TABLE 5 ABOUT HERE

The MRA results are reported in Table 6. Column 1 reports the general model with all potential explanatory variables included in the specification of the meta-regressions. Column 2 reports the specific model after removing, sequentially, any variable that was not statistically significant at least at the 10% level. Column 3 and 4 repeat the general and specific versions of the MRA after including author-study fixed effects. The fixed effects are included here to capture any unobserved heterogeneity in the studies. The fixed effects were constructed as author-study dummy variables. For this purpose, we assign the same value to studies that had the same author. The MRA model with fixed effects is:

[9] Patents are included in some studies as a measure of knowhow emanating from overseas.

$$r_{ij} = \beta_1 + \sum \beta_k Z_{ki} + \beta_0 SE_{ij} + \lambda_i + \varepsilon_{ij} \quad (6)$$

Where λ are the study-author fixed effects. Note that the use of the term fixed effects might cause some confusion. In meta-analysis, models are divided into fixed effects and random effects. These terms, however, denote something different to the normal usage in empirical economics. The fixed effects meta-analysis model assumes that all studies measure the same underlying population effect. In contrast, the random effects meta-analysis model assumes that the population effect sizes are randomly distributed about a population mean. Equations 2 to 5 are fixed effects meta-analysis models. Hence, equation 6 can be considered to be an extension of the traditional fixed effects model with conventional economics fixed effects added (the λ). For technical details on this model see Stanley and Doucouliagos (2012). For our dataset, we find that the inclusion of the λ improves the overall fit of the MRA. A Wald test confirms the joint statistical significance of the fixed effects (see notes to Table 6).

TABLE 6 ABOUT HERE

4.3.1 Measures of inequality

As already noted, various measures of inequality are available. While the Gini coefficient has some limitations,[10] it remains one of the most popular inequality measures in inequality studies. Indeed, in our data set, 49.0 percent of the estimates used the Gini coefficient, 15.0 percent used the income share of the bottom, 13.0 percent used the Theil Index, 11 percent used the income share of the rich and 5.0 percent and 3.0 percent used the income ratio and 'other' measures such as Atkinson Index, respectively.

The constant in the MRA (Table 6) quantifies the size of the effect of education on inequality as measured by the Gini coefficient. This is not statistically, suggesting that when inequality is measured using Gini, there is no effect of education on inequality. The MRA results also reveal that the *Income Share Top* variable has a robust negative coefficient. This indicates that, compared to the Gini coefficient, studies that used the income share of the rich report a larger negative association between education and inequality. Figure 4 illustrates this in the form of a partial regression plot. In contrast, the coefficient on the *Income Share*

[10] For example, it fails to capture between group changes, see Lambert and Aronson (1993) and Leigh (2007).

Bottom variable has a robust positive coefficient. This indicates that, compared to the Gini coefficient, studies that use the income share of the bottom earners report a positive relationship between education and inequality. Note that an increase in the share of bottom earners means a *reduction* in income inequality. Hence, both these MRA variables indicate that an expansion in education erodes the income share of the top earners and increases the share of lower income group. That is, education reduces inequality at both tails of the income distribution. These results are consistent with the mainstream literature that advocates education as an effective tool for promoting income equality (Ahluwalia, 1976; Marin and Psacharopoulos, (1976; Winegarden, 1979; Perugini and Martino, 2008). Hence, we conclude from the MRA that education affects the two tails of the income distribution, but interestingly education appears to have no effect on the share of the middle class.

The Thiel index is statistically significant in the fixed effects version of the MRA, with a negative coefficient. Hence, all else equal, studies that use the Thiel measure of inequality report larger negative partial correlations between education and inequality.

FIGURE 4 ABOUT HERE

4.3.2 Measures of education

Several measures of education are used in the literature. Data on literacy have been available since the nineteen-century.[11] This is not, however, a popular measure of educational attainment as it is often just an indicator of the 'ability to sign document' (Houston, 1983).[12] Thus, the literacy rate might not be a good proxy for educational attainment, as it measures only low levels of education (van Leeuwen and Foldvari, 2008: 226). Psacharopoulos and Ariagada (1986) compiled information about the educational attainment of the labour force to fill the gap in education data. However, an inadequate number of observations for most countries, as well as differences in the coverage across the countries, are major drawbacks in the use of their data. Currently, data on the school enrolment rate, average years of schooling and the literacy rate are more readily available (van Leeuwen, 2008:20). In their highly influential dataset on education, Barro and Lee (1993, 2000, 2010) used the average year of

[11] European countries have used literacy to measure educational attainment since the Renaissance era.
[12] As Houston (1983: 270) noted: 'Those who signed their name in full are held to be literate, those who used initials or a mark are deemed illiterate.'

schooling as a measure of human capital. Their dataset also has limitations, as it neglects the quality of education such as government spending on education and teaching and learning quality (Barro and Lee, 1993:364). While it has some statistical validity, the use of the enrolment rate as a proxy for human capital has been criticized because students are outside of the labour force (Permani, 2009:6). Therefore, their contribution to the economy economic is difficult to justify; although autoregression in the dataset might mean that enrolment rates are a useful proxy for human capital in the labour force. In our dataset, secondary schooling appears to be the most popular measure, with about 38.6% of the 868 observations using secondary school as the education measurement, while 24.8% used education attainment (*e.g.* the number of years of schooling).[13]

Secondary schooling is statistically significant in the MRA with a negative coefficient. This suggests that compared to primary schooling, secondary schooling is more effective at reducing inequality. This finding is consistent with the previous literature that found secondary schooling to reduce inequality (Ahluwalia, 1976; 1976a; Knight and Sabot, 1983). This effect however disappears when author-study fixed effects are introduced in the MRA.

Education *inequality* appears to be an important determining factor. Inequality of education appears to have a positive correlation with income inequality. This effect is rather robust in the MRA. Some prior studies (*e.g*. Psacharapoulus, 1977 and Park, 1996) also found that increases in education inequality increase income inequality. This is in contrast to the study by Castelló and Doménech (2002), who find a low correlation between education inequality and income inequality (correlation = 0.27).

4.3.3 Regional differences

Location and geography might very well condition the effects of education on inequality. Education is readily accessible in developed countries.[14] Therefore, people who are living in developed countries have relatively greater opportunities in obtaining higher quality education that eventually influences occupational choice and salary (Tselios, 2008:405).

[13] On the other hand 7.9% used primary schooling, 13.5% used tertiary schooling, 6.3% used literacy, and 12.4% used education inequality.
[14] More than half of the highly ranked universities in the world are located in the United States and Europe.

The base in the MRA is Latin America. The MRA coefficient on *Africa* is negative, as is the coefficient on *Developed* (when fixed effects are included). This means that studies that include data from Africa and/or developed nations report, on average, large negative correlations between education and inequality. That is, education has a greater effect at reducing in inequality in Africa and the developed countries (largely the OECD nations). Figure 5 illustrates the MRA results for Africa in the form of a partial regression plot.

In contrast, the *Asia* dummy is significant with positive coefficient in the study-author fixed effects model. This suggests that controlling for all other influences, studies that include Asian countries in the sample find smaller effects of education on inequality. In one sense, this finding is actually not in line with our expectation. Education has been widely recognized as an important factor for Asian economic success (World Bank, 1993). Human capital accumulation is relatively high in Asia, with the enrolment rate for primary and secondary schools being more than 90 percent and 80 percent, respectively. Educational development has received strong support from Asian governments, with some countries allocating a relatively high proportion of their government expenditure to education (Asian Development Bank, 2008: 7-9, Lee and Francisco, 2010: 9-10). As an example, cross-country studies in Southeast Asia, such as Indonesia (Armida *et.al*, 2008), Thailand (Israngkura, 2008) and The Philippines (Balisacan and Piza, 2008), reveal that education is an important determinant of income differentials and income inequality. Hence, the MRA result is surprising.[15] On the other hand, figure 1 illustrates that for South-East Asia, there is a non-linear relationship. However, for a large part of the sample, there is a positive relationship between education and inequality rather an inverse one.

4.3.4 Time Dimension

The results in Table 6 suggest that time does not have a significant impact on the reported findings when study-author fixed effects are excluded from the MRA. However, when these effects are included in the MRA, *YearData* emerges with a positive (+0.007) and highly statistically significant coefficient. Hence, the study-author fixed effects version of the MRA suggests that, holding all else constant, studies that use more recent data find smaller negative partial correlations. Over the course of a decade, the partial correlation weakens by

[15] It is possible that the coefficient for *Asia* in the MRA is capturing some influence other than Asia.

0.07, which is a very large reduction in the effect. Figure 6 illustrates this in the form of a partial regression plot.

The number of years of data included in a sample also has a positive coefficient in the study-author fixed effects MRA (+0.04). In contrast, the number of countries included in the sample has no effect on the reported estimates.

4.3.5 Econometric Specification

Several variables in the MRA reflect specification differences in the underlying econometric models.

Democracy: has a negative coefficient in the MRA with study-author fixed effects. Studies that control for the degree of democracy find larger effects on inequality flowing from education. Democracy is potentially an important factor in determining inequality. Lipset (1959) found that democratic countries tend to record higher levels of economic development, faster industrialization and urbanization progress, and greater education attainment.[16] Democratic states provide greater space for their citizens to form unions and other political and economic organisations and offer equal rights to vote regardless of social status. Democratic systems allow their citizens including the poor to vote in elections, leading to more equal income distribution (Gradstein and Milanovic, 2004: 519). The redistributive channel through the democratic and political system has been investigated in numerous studies, such as Saint-Paul and Verdier (1993), Alesina and Rodrik (1994) and Persson and Tabellini (1994). These studies conclude that inequality falls as a result of the median voter's power.

It has long been recognized that democratic states tend to be more open in terms of access to education. Moreover, Lipset (1959:80) claimed that education is a fundamental device for promoting democracy. According to Lipset:

> If we cannot say that a "high" level of education is a sufficient condition for democracy, the available evidence does suggest that it comes close to being a necessary condition in the modern world. Thus if we turn to Latin America, where widespread illiteracy still exists in many countries, we find that of all the nations in which more than half the population is illiterate, only one, Brazil, can be included in the "more democratic" group. There is some evidence from other economically impoverished culture areas that literacy is related to democracy. The one member of the Arab League which has maintained

[16] As Lipset (1959:75) postulated: 'In each case, the average wealth, degree of industrialization and urbanization, and level of education is much higher for the more democratic countries…If we had combined Latin America and Europe in one table, the differences would have been greater'

democratic institutions since World War II, Lebanon, is by far the best educated (over 80 per cent literacy) of the Arab countries.

Although the relationship between democracy and inequality is still unclear, many studies have a found negative relationship; democratic countries tend to experience lower income inequality (Muller, 1988:50). Given these arguments, it is important that democracy be included in a well econometric constructed econometric model of inequality. And, this affects the reported effect of education on inequality.

EcoFreedom: has a robust positive coefficient. Berggren (1999) found that countries with higher levels of economic freedom have relatively lower inequality. Berggren postulated that most countries which recorded increases in the level economic freedom and civil liberties, have also successfully reduced income inequality. However, there is also evidence that economic freedom has positive relationship with inequality. For example, Scully (2002) found higher levels of economic freedom to be associated with higher inequality. Economic freedom promotes asset ownership, which might benefit higher income groups. The MRA suggests that conditioning on economic freedom (*i.e.* including economic freedom in the primary specification) reduces the size of the effect of education on inequality.

Liberalization: has a negative coefficient when study-author fixed effects are excluded from the MRA. Developing countries have embraced trade liberalization as one tool to boost growth and stimulate economic growth, technology transfer, increase productivity and improve international competitiveness. Since the implementation of the GATT agreement, it has been estimated that more than 80 developing countries began to open their markets in line with trade liberalization (UNCTAD, 1997). The effect of liberalization has long been a central debate in economic development.[17] Globalization and trade liberalization opponents argue that it will reduce the role of government in the economy. National governments sometimes have to compromise with the private sector as well as foreign direct investors by lowering taxes and providing greater incentives to business. This might restrict resources for education and other income redistributive measures. There is some evidence that in China and Mexico, external factors such as liberalization and foreign direct investment have had a

[17] See Savvides (1998) and Park (1995) for further discussion on the effect of trade and foreign direct investment on inequality.

significant impact on regional inequality (Zhang and Zhang, 2003; Wan and Chen, 2007; Rivas, 2006; Wei *et.al*, 2009). Our MRA shows that controlling for liberalization increases the inverse relationship between education and inequality, although this effect disappears once study-author effects are included in the MRA.

Land and natural resources: has a negative coefficient in the MRA, though this is not robust to the inclusion of study-author fixed effects. The availability of land and natural resources increases a country's wealth that can be utilized to finance education and other initiatives. It has been argued since the classical era that natural resources and education have negative relationship. Marshall (1920:176) postulated that natural resources are 'wasteful' and can create a low mentality generation. Recent evidence has revealed a negative association between the level of schooling and natural resources (Gylfason, 2001). Gylfason (p. 858) argues that naturally resources rich countries are:

> … overconfident and therefore tend to underrate or overlook the need for good economic policies as well as for good education. In other words, nations that believe that natural capital is their most important asset may develop a false sense of security and become negligent about the accumulation of human capital.

The MRA suggests that the inclusion of land and natural resources in primary regression models (recall equation 1) results in larger negative partial correlations between education and inequality.

Government: has a positive coefficient when study-author fixed effects are included in the MRA. This indicates that studies that control for the effects of government spending find more positive (less negative) partial correlations. Government spending and welfare variables are expected to have a negative relationship with inequality, through the direct effect of government spending in general or indirectly through education spending channel. However, there is also some evidence that government spending in education in Malaysia tends to favour higher income groups (Selowsky 1979; Bowman *et.al*, 1986).

Non-Agricultural Sector and Urbanization: has a robust negative coefficient in all MRA models. Urbanization is an important factor to the determination of inequality. In his seminal

paper, Kuznets (1955) argued that the non-linear pattern in income inequality emerges from fundamental structural change, such as the modernization or urbanization process. Income inequality is usually lower in rural areas as most people are involved in similar economic activities, predominantly in agriculture. In contrast, *per capita* income in urban areas is generally based on education attainment, skills and entrepreneurship, which tends to increase faster than in the agricultural rural areas, resulting in an overall increase in income inequality. Thus, '…the increasing weight of urban population means an increasing share for the more unequal of the two component distributions'[18] (Kuznets, 1955:8). When a country develops from an agrarian economy to a more modern one, income inequality is expected to increase. Ultimately, however, inequality starts to decline as education and urbanization provide opportunities for people from lower income groups to successfully move up the social hierarchy and improve their economic position. This process helps to reduce the gap between upper and lower income groups.

In some developing countries, especially newly industrialised economies, expansion of education has been accompanied by rapid industrialization. This has created job opportunities, stimulated economic growth, and lowered inequality. For example, in Malaysia, industrialization since the 1970s has provided job opportunities and increased household income in both rural and urban areas (Ragayah, 2008:187-188). Education expansion has contributed to 24 to 29 percent of inequality decomposition in rural and urban Indonesia, but rapid industrialization has provided job opportunities in high level poverty areas, particularly in rural areas, thus reducing inequality (Armida *et al.* 2008, p. 115).

The MRA results show that controlling for these effects of urbanization on inequality increases the negative partial correlation between education and inequality.

4.3.6 Publication process and selection bias

Standard Error is included in the MRA to capture and correct the estimates for selection bias. This variable is statistically significant in neither the general nor the specific versions of the MRA. This confirms the results from the simple FAT-PET MRA, as well as visual inspection of the funnel plots, that there is no publication selection bias in this literature. Unpublished studies appear to report larger negative partial correlations. It is difficult to explain why this might be the case. However, only 6% of estimates come from unpublished studies and, hence, the MRA coefficient on *Unpublished* might reflect something unique about these studies.

[18] This refers to the distribution between urban and rural areas.

Sociology journals report larger negative partial correlations compared to economics journals. There does not appear to be any difference in the reported results between economics and development journals. The *SSCI* variable is not statistically significant, indicating that there is no difference in the results between studies on the basis of the journal Impact Factors.

5. Summary

This paper presented a quantitative review of the literature on the effects of education on inequality. Drawing upon the findings of 64 econometric studies, our MRA produces several interesting results.

First, education appears to have its greatest effect on the two tails of the income distribution, reducing the income share of the rich and increasing the income share of the poor. Hence, we can conclude that education reduces the gap between the rich and the poor. Education appears to have no effect on the share of the middle class. Hence, it does appear from the MRA that education is, on average, on effective tool for reducing income inequality.

Second, the distribution of education is important. The more unequal is the distribution of education the greater will be income inequality. Hence, it appears that it is important to ensure a fairly equitable access to education. Some of the results also indicate that the level of secondary education appears to be more important in reducing inequality than does primary schooling.

Third, there are some important regional differences in the effects of education. The MRA suggests that education in Africa is more effective in reducing inequality than it is in Asia. Further research is required to investigate the source of such regional differences in the effects of education.

Finally, about half of the variation in reported estimates can be explained by study-specific factors, as well as measurement, specification and data differences employed in the primary econometric studies; research design shapes reported results. An important extension would be to apply MRA to investigate the effects of other factors on inequality. This would then assist policy makers in formulating a cost-benefit analysis of alternative interventions.

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Table 1: Studies Included in the Meta-Regression Analysis, Author(s) and Year of Publication

Author(s)	Sample Coverage	Time Period	Author(s)	Sample Coverage	Time Period
Ahluwalia (1976)	All countries	1960s-1970s	Gupta, Davoodi and Terme (2002)	All countries	1980-1997
Ahluwalia (1976a)	All countries	1960s-1970s	Higgins and Williamson (1999)	All countries	1960s-1990s
Aigner and Heins (1967)	US	1960s	Janvary and Sadoulet (2000)	US	1970-1994
Ashby and Sobel (2007)	US	1980-2003	Jha (1996)	All countries	1960-1992
Barro (2000)	All countries	1960-1990	Keller (2009)	All countries	1970-2000
Beck et.al (2007)	All countries	1960-2005	Koechlin and Leon (2007)	All countries	1970-2001
Bourguignon and Morrison (1990)	Developing countries	1960s-1980s	Kumba (2009)	Indonesia	1996-2005
Braun (1991)	US	1979	Lundberg and Squire (2003)	All countries	1960s-1990s
Breen and Penalosa (2005)	All countries	1960-1990	Motonishi (2006)	Thailand	1975-1998
Brempong (2002)	African	1993-2002	Nielsen and Alderson (1995)	All countries	1952-1988
Calderon and Chong (2009)	All countries	1970-2000	Nord (1980)	US	1960-1970
Carter (2006)	All countries	1975-2004	Nord (1980a)	US	1960-1970
Carvajal and Geithman (1978)	US	1960s	Nord (1980b)	US	1960-1970
Chambers (2010)	All countries	1960-1990	Odedokun and Round (2004)	African	1960s-1990s
Checchi (2001)	All countries	1970-1995	Papanek and Kyn (1985)	All countries	1952-1978
Chiswick (1971)	All countries	1950-1960	Park (1996)	All countries	1960s-1980s
Chong (2004)	All countries	1960-1997	Park (1998)	All countries	1960-2006
Chong, Gradstein and Calderon (2009)	All countries	1971-2002	Partridge, Partridge and Rickman (1998)	US	1960-1990
Cloutier (1996)	US	1979-1990	Perugini and Martino (2008)	European Union	1995-2000
Conlisk (1967)	US	1960	Pose and Tselios (2009)	European Union	1995-2000
Edwards (1997)	All countries	1970s-1980s	Psacharopoulus (1977)	All countries	1970s
Glaeser, Matt and Kristina (2009)	US	1980-2000	Ram (1981)	All countries	1970-1975
Gregorio and Lee (2002)	All countries	1960 and 1990	Ram (1984)	Developed countries	1970s
Gupta and Singh (1984)	All countries	1960-1970	Rodgers (1983)	All countries	1970

Savvides (1998)	All countries	1970s-1990s	Tsai (1995)	Developing countries	1960s-1990s
Scully (2003)	US	1960-1990	Tsakloglou (1988)	All countries	1950-1975
Silva (2007)	African	1997-2000	Tselios (2008)	European Union	1996-2000
Stano (1981)	US	1970	Tselios (2009)	European Union	1995-2000
Sylwester (2002)	All countries	1960 and 1990	Winegarden (1979)	All countries	1960s
Sylwester (2003)	All countries	1960s-1990s	Xu and Zou (2000)	China	1985-1995
Sylwester (2003a)	All countries	1970-1990	Yorukoglu (2002)	US	2000
Sylwester (2005)	All countries	1970-1989			

Notes: All countries means the sample cover both developed and developing countries. Source: Authors' compilation. See Appendix for full references.

Table 2: Descriptive Statistics

Statistics	**Number**	**Percentage**
Number of Studies	64	-
Number of Estimates	868	-
Total Sample Size	178,488	-
Distribution of results		
Positive	479	55.2%
Positive and statistically significant	223	25.7%
Zero	1	0.1%
Negative	388	44.7%
Negative and statistically significant	196	22.6%
Total	868	100%

Table 3: The Effect of Education on Inequality, Unconditional Estimates (Dependent variable = partial correlation)

	OLS (1)	Clustered SE (2)	WLS & Clustered SE (3)
Constant	0.025***	0.025	-0.0004
	(2.86)	(1.12)	(-0.02)
Adjusted R^2	0.000	0.000	0.000

Notes: Number of observations is 868. Column 1 reports OLS results, using robust standard errors. Column 2 adjusts standard errors for data clustering. Column 3 uses weighted least squares, using precision as weights.

Table 4: MRA-FAT-PET Test for Publication Selection (Dependent variable = partial correlation)

	OLS (1)	Clustered SE (2)	WLS & Clustered SE (3)
SE	-0.0003	-0.0003	0.567
	(-0.37)	(-0.18)	(1.30)
Constant	0.025***	0.025	-0.037
	(2.86)	(1.12)	(-0.80)
Adjusted R^2	-0.001	-0.001	0.006

Notes: Number of observations is 868. Column 1 reports OLS results, using robust standard errors. Column 2 adjusts standard errors for data clustering. Column 3 uses weighted least squares, using precision as weights. SE is the standard error of the partial correlation.

Table 5: Meta-Regression Variable Definitions: Education and Inequality studies

Variable Name	**Variable Description**	(n=868)	
		Mean	**S.D**
Partial Correlation	Partial correlation of the effect of education on inequality. This is the dependent variable in the MRA	0.024	0.258
	Publication		
Standard Error	Standard error of partial correlation. Used to correct publication selection bias.	0.531	8.692
SSCI	Social Science Citation Impact Factor	1.095	0.95
Unpublished	BD = 1: Study is unpublished	0.063	0.24
DevelopmentJournal	BD = 1: Study published in a development journal (economics journal is the base)	0.265	0.44
SociologyJournal	BD = 1: Study published in a sociology journal (economics journal is the base)	0.068	0.25
	Inequality Measures		
Gini	BD=1: Gini coefficient (used as the base)	0.492	0.500
Income Share Top	BD=1: Income share of the top quintile	0.106	0.308
Income Share Middle	BD=1: Income share of the middle quintile	0.038	0.191
Income Share Bottom	BD=1: Income share of the bottom quintile	0.151	0.358
Income Share Ratio	BD=1: Income ratio between the top and the bottom quintile	0.048	0.215
Theil Index	BD=1: Theil index	0.134	0.340
Other Inequality	BD=1: Other inequality measures, such as the Atkinson index	0.024	0.154
	Education Measures		
Primary School	BD=1: Primary school enrolment or attainment (used as the base)	0.079	0.271
Secondary School	BD=1 Secondary school enrolment or attainment	0.386	0.487
Tertiary School	BD=1: Tertiary school enrolment or attainment	0.134	0.340
Education Attainment	BD=1: Education enrolment/attainment	0.247	0.431
Education Inequality	BD=1: Education inequality	0.123	0.329
Literacy	BD=1: Literacy rate	0.062	0.242
	Location		
Latin America	BD=1: Countries in Latin American region included in samples (used as the base)	0.576	0.494
Asia	BD=1: Countries in Asian region included in samples	0.690	0.463
Africa	BD=1: Countries in African region included in samples	0.586	0.493
Developed	BD=1: Developed countries included in samples	0.664	0.473
Socialist	BD=1: Socialist countries included in samples	0.048	0.215
	Estimator		
OLS	BD=1: OLS estimator (used as the base)		
Non OLS	BD=1: Non-OLS estimator used (such as 2/3SLS, GMM and ML)	0.433	0.534
	Types of Data		
Cross Section	BD=1: Cross sectional data used (used as the base)	0.520	0.500
Panel Data	BD=1: Panel data used	0.501	0.500
Nocountries	Number of countries included in the sample	43.64	35.58
NoYears	Number of years of data used in the sample	21.65	12.57
YearData	Average year of data used in the study	1982	10.59

Socioeconomics and Political Variables			
Democracy	BD=1: Degree of democracy included as a control variable	0.044	0.205
Political Stability	BD=1: Political stability included as an explanatory variable	0.021	0.143
Government	BD=1: Government expenditure (welfare, public administration and government transfers) included as an explanatory variable	0.203	0.402
EcoFreedom	BD=1: Economic freedom included as an explanatory variables	0.074	0.26
Liberalization	BD=1: Liberalization measures (such as trade and openness, foreign direct investment and patents) included as explanatory variables	0.222	0.416
Labour	BD=1: Labour force structure, womens' access in labour market and labour regulation, included as explanatory variables	0.099	0.299
Employment	BD=1: Employment included as an explanatory variable	0.112	0.315
Non Agricultural Sector	BD=1: Non-agricultural sector such as manufacturing, services, wholesale and urbanization, included as explanatory variables	0.196	0.397
Land and Natural Resources	BD=1: Land and natural resources included as explanatory variables	0.059	0.235
Demographic	BD=1: Demographic variables such as age, population, black and female included as explanatory variables	0.247	0.431

Notes: BD means binary dummy, with a value of 1 if condition is fulfilled and zero otherwise

Table 6: MRA of the Effects of Education on Inequality, (Dependent variable = partial correlations)

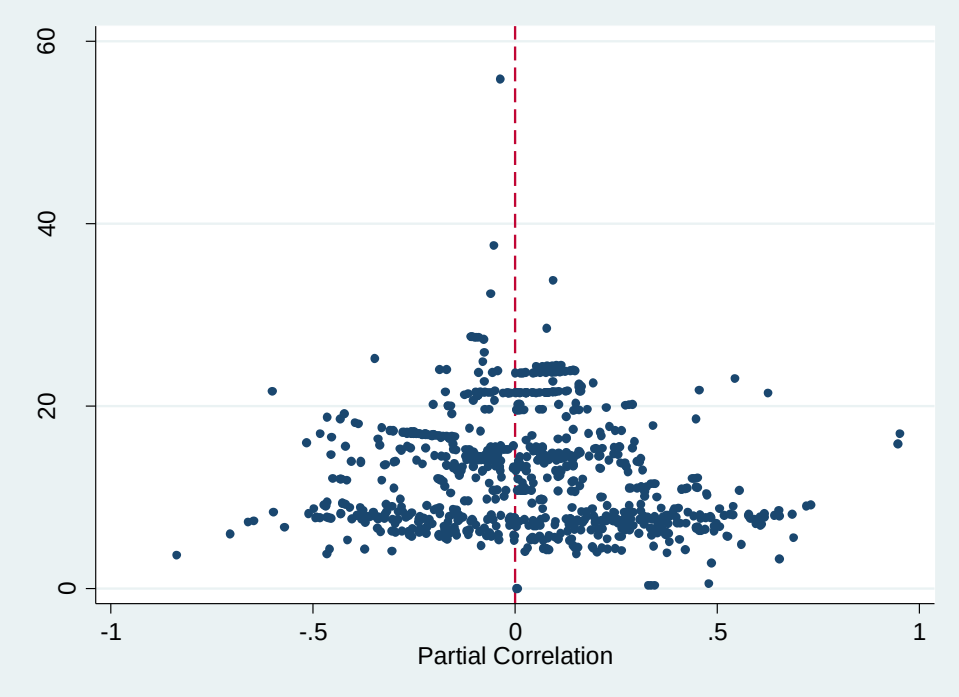
VARIABLES	**General** (1)	**Specific** (2)	**General with study-author fixed effects** (1)	**Specific with study-author fixed effects** (2)
Standard Error	0.186		-0.619	
	(0.48)		(-0.90)	
Income Share Top	-0.093**	-0.093***	-0.099**	-0.096***
	(-2.62)	(-2.90)	(-2.33)	(-2.69)
Income Share Middle	0.049		0.052	
	(0.88)		(0.73)	
Income Share Bottom	0.140**	0.134**	0.109	0.110*
	(2.22)	(2.46)	(1.51)	(1.76)
Income Share Ratio	-0.050		-0.069	
	(-0.94)		(-1.06)	
Theil Index	-0.142*	-0.156***	-0.162*	-0.205***
	(-1.81)	(-4.02)	(-1.90)	(-5.91)
Other Inequality	-0.053		-0.022	
	(-0.95)		(-0.77)	
Secondary School	-0.093*	-0.091*	-0.030	
	(-1.77)	(-1.82)	(-0.54)	
Tertiary School	-0.011		0.070	
	(-0.11)		(0.63)	
Education Attainment	-0.020		0.011	
	(-0.32)		(0.11)	
Education Inequality	0.062	0.084***	0.105	0.084***
	(1.15)	(5.90)	(1.05)	(6.62)
Literacy	-0.006		0.004	
	(-0.10)		(0.07)	
Asia	-0.014		0.191**	0.085***
	(-0.20)		(2.18)	(3.60)
Africa	-0.098*	-0.163***	-0.230**	-0.193***
	(-1.67)	(-4.77)	(-2.12)	(-4.86)
Socialist	0.055		-0.018	
	(1.38)		(-0.52)	
Developed	-0.003		-0.041	-0.044***
	(-0.11)		(-1.15)	(-4.00)
Democracy	-0.029		-0.038***	-0.046***
	(-0.96)		(-4.21)	(-4.10)
Non OLS	0.059		0.080	0.078*
	(1.20)		(1.54)	(1.86)
Panel Data	-0.048		-0.123	-0.111**
	(-0.75)		(-1.44)	(-2.54)
Political Stability	0.134*	0.174**	-0.087	-0.082**
	(1.79)	(2.33)	(-1.62)	(-2.49)
Government	0.035		0.098**	0.088***
	(0.80)		(2.43)	(2.88)
Liberalization	-0.065*	-0.058**	-0.029	
	(-1.94)	(-2.38)	(-1.38)	
Labour	0.023		0.015	
	(0.38)		(0.54)	
Employment	-0.071		0.154*	

	(-0.76)		(1.87)	
Non-Agricultural Sector	-0.066***	-0.057*	-0.073***	-0.062**
	(-3.35)	(-1.90)	(-3.93)	(-2.55)
Land and Natural Resources	-0.046	-0.075**	0.055	
	(-0.69)	(-2.23)	(0.92)	
Demographic	0.046		0.023	
	(0.62)		(0.69)	
Inflation	0.009		0.017	
	(0.14)		(0.34)	
Growth	-0.003		0.004	
	(-0.12)		(0.59)	
YearData	0.001		0.009	0.007***
	(0.50)		(1.53)	(4.07)
EcoFreedom	0.175**	0.197***	0.197***	0.219***
	(2.06)	(3.36)	(4.60)	(11.02)
SSCI	0.002		-0.046	
	(0.08)		(-1.33)	
Nocountries	-0.001		-0.000	
	(-1.30)		(-0.41)	
NoYears	0.001		0.003	0.004**
	(0.33)		(1.04)	(2.35)
Education lag	-0.042		-0.045	
	(-0.44)		(-0.45)	
Capital	0.097	0.109***	-0.012	
	(1.32)	(4.29)	(-0.21)	
Income	0.148**	0.125***	0.235***	0.204***
	(2.30)	(2.72)	(3.59)	(5.01)
Unpublished	-0.167***	-0.171***	-0.733**	-0.457***
	(-2.94)	(-7.03)	(-2.03)	(-9.62)
DevelopmentJournal	0.023		-0.106**	
	(0.39)		(-2.51)	
SociologyJournal	-0.093	-0.098**	-0.146	-0.199***
	(-0.97)	(-2.55)	(-0.58)	(-8.06)
Constant	0.005	0.045		
	(0.04)	(0.84)		
Observations	868	868	868	868
R-squared	0.394	0.359	0.556	0.534
Adj. R2-squared	0.364	0.348	0.506	0.503

Notes: Figures in brackets are t-statistics using standard errors adjusted for data dependence. Estimation using WLS, with precision used as weights. Shaded cells highlight variables that are robust. Wald test for study-author fixed effects: 42650.73, p =0.00.

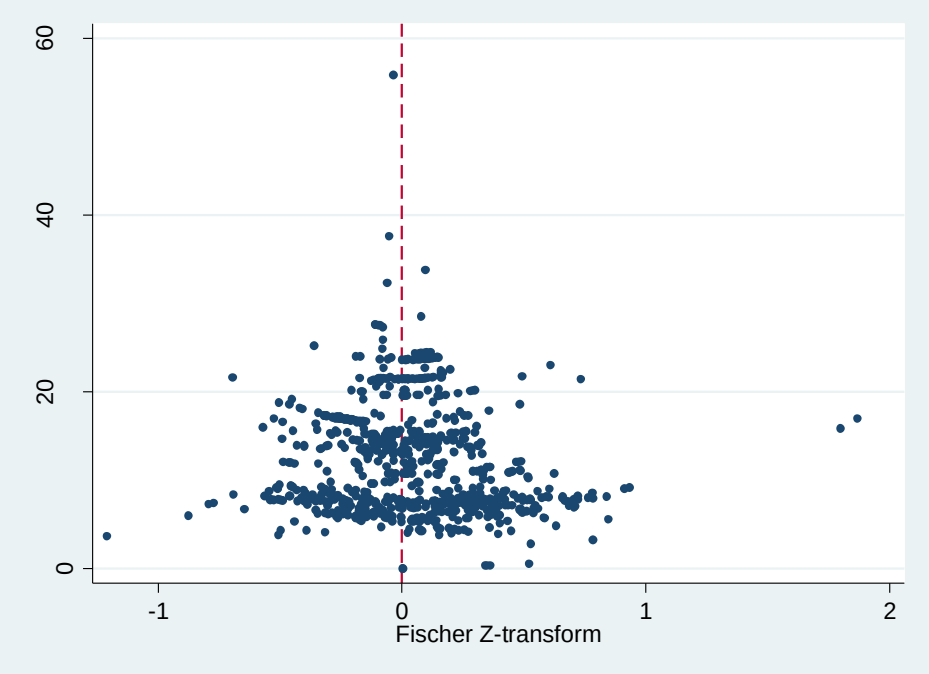
Figure 1: Inequality and Education in South-East Asia, 1964-2005

Figure 2: Funnel plot, partial correlations of the effects of education on inequality (n=868)



Note: Dotted line indicates position of a zero partial correlation

Figure 3: Funnel plot, z-transformed partial correlations of the effects of education on inequality (n=868)



Note: Dotted line indicates position of a zero partial correlation

Figure 4: Partial Regression Plot, Income Share of Lowest Earners

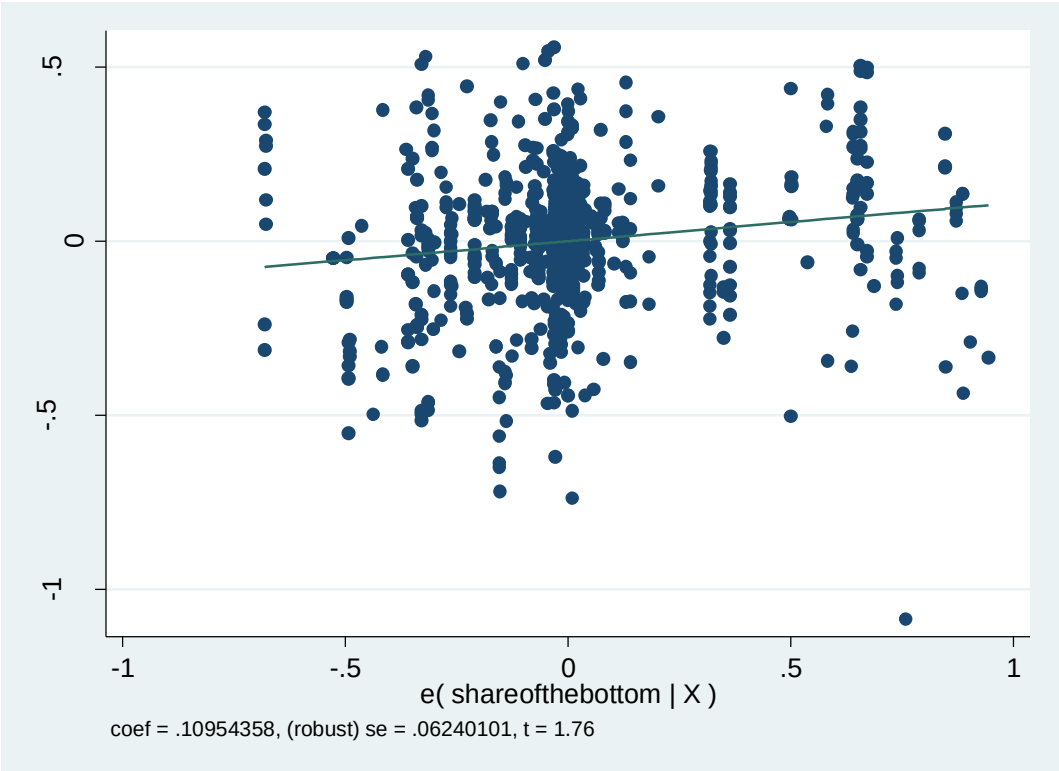


Figure 5: Partial Regression Plot, Africa

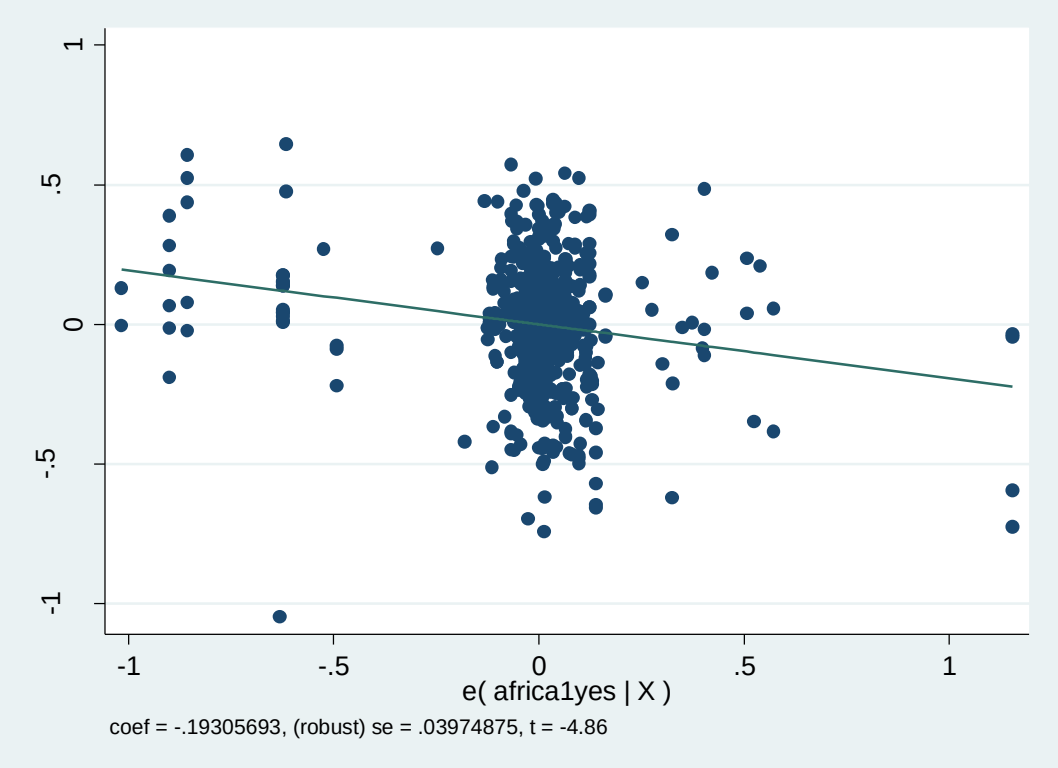


Figure 6: Partial Regression Plot, Average Year of Data