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P K V Kishan

W. P. No. 2017-09-01

September 2017

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Globalization and Inequality – A Pathway Through Education

P K V Kishan

Economics Area

Indian Institute of Management, Ahmedabad

pkvkishan@iima.ac.in

abhimant@iima.ac.in

Abstract

This study investigates the effect of globalization on economic inequality in a country through the channel of education. We measure globalization by the KOF globalization index (a composite index consisting of elements of economic, social, and political dimensions of globalization), economic inequality by the Gini coefficient of consumption/income distributions, and education outcomes by mean years of schooling in a country. An econometric model using appropriate panel data techniques is estimated for a sample of about 100 countries over the period 1990-2013. The results suggest that globalization improves the situation of economic inequality in a country, i.e. inequality in the country decreases. As the country becomes more globalized, and the educational outcomes improve, the restorative effects of globalization on income inequality go down. At a turnaround point of about 6.73 mean years of schooling, globalization works towards worsening income inequality. The empirical results are robust to the use of inequality index from separate data sources and the change in time spans of the study.

Keywords: Globalization, Educational outcomes, Economic inequality, Panel data

1. Introduction

In the last few decades, the world has seen an order wherewith there has been a free movement of people, goods and services, technology and information, and capital across national borders. This has brought about a convergence - of ideas, in trade and commerce, of policies, and of cultures, globally. In the economic space specifically, domestic deregulation, privatization, and trade liberalization have ensured that barriers to international trade have been dismantled at best and lowered at worst. This phenomenon of economies and nations opening up to each other has been termed as globalization.

The knowledge integration and the spread of ideas have ensured that the developing economies have ventured on a journey of catching up, in turn securing the well-being of their respective societies through the channel of economic growth and development. However, in addition to the benefits accrued to various nations as a result of the integration of the world economies, detractors of globalization have questioned the social and natural sustainability of long-term economic expansion and have also pointed out to the costs and unintended consequences in the form of structural inequality (Sen, 2014), deterioration of the environment, spread of new diseases, increasing poverty and alienation (Capra, 2004), etc. Lall et al. (2008) indicate the importance of controlling the rise in inequality to maintain the sustainability of globalization, failing which there would be “clear losers” in relative as well as absolute terms. They attribute the failure in fully capturing the opportunities created by globalization to the inability of the governments in maintaining broad support across the population. So, the question apropos the bearing globalization has on the distributional aspects of welfare is - has globalization endangered entitlement to certain sections of the population by exacerbating inequality or has it enhanced the size of the pie for everyone ensuring that each person is a winner, notwithstanding whose pie has increased and by how much?

Among other things, globalization is said to have an impact on transmission of knowledge as information and innovation stand out as two of the main bases of globalization (Carnoy, 2005). The interactions among various countries for economic exchanges, cultural exchanges, and expertise sharing involve pathways that pass through vistas of knowledge. This essentially alters the education landscape of a country which has opened itself to be an integral part of the global economy. The impact of globalization on education can then be understood as a larger ideological package that includes decentralization and privatization,

education choice and accountability, testing and assessment of educational achievements, and transmission and overall delivery of schooling (Carnoy and Rhoten, 2002).

Next, regarding the link between education and economic inequality, it has been argued that increasing access to education is, on an average, associated with more equitable earnings distribution (O'Neill, 1990; Neal & Johnson, 1996; Lall et al., 2008). Concerning the wage differences between black and white men in the USA, O'Neill (1990) found that improvements in quality of education and increase in access to schooling for successive generations of black households led to enhancements of their educational achievements. This, in turn, contributed to the bridging of the racial earnings gap. Neal and Johnson (1996) also came up with a similar result where controlling for educational attainments eliminates the wage gaps between blacks and whites, and Hispanics and whites. However, once an antecedent factor such as globalization comes into play, the relationship between education and inequality ceases to be straightforward. Globalization rewards the skilled and the educated as they can keep in tune with the latest developments in production technology and innovations. While this happens, the wage premium for higher skilled workers and returns to investment on higher levels of education increase. Concurrently, the demand for low skill activities decreases and in tandem the two effects exacerbate income inequality in both developing and developed economies. It then depends on the supply response of the government to meet the increase in demand for higher education and skilling to nullify this effect. Even if the overall access to education improves and the average attainment levels increase, it may not be necessary for the economy to keep up with the quality and quantity (specifically in the case of higher education) of education demanded.

Inequality in a society is undesirable as it limits the growth potential on account of opportunities existing in the nation not getting tapped. Thence, it becomes essential to study and understand the linkages between globalization and inequality and the role education plays in strengthening or weakening of this relationship. This is important as education is one of the primary mechanisms by which the global forces affect the lives of populations across the world (Tikly, 2001). Going further, the resulting evidence would potentially enable policymakers to take more informed choices pertaining the benefits of globalization and facilitate them to be shared more equitably. Moreover, understanding the causes of inequality is of equal essence to devise policies for its alleviation.

The rest of the paper is structured as follows. Section 2 presents the linkages between globalization and inequality as contained in literature. We lay down the theoretical framework for this study in the next section while section 4 covers the data sources and the variables along with the methodology adopted in this paper. Section 5 presents the empirical results. The final section provides broad implications of the empirical results, identifies the limitations, and recognises the scope and areas for future research.

2. Literature Review

The debate surrounding the impact of globalization on income inequality is weighed in favour of economic globalization adversely impacting income inequality. Birdsall (1999) asserts that globalization and market reforms will put populations of developing countries at risk and exacerbate inequality, at least in the short run. In addition to welfare and social concerns on account of income disparities, the drivers of growth are also affected as the opportunities created by globalization may not get fully tapped (Lall et al., 2008). Moreover, widening income disparities might also put the sustainability of globalization itself at risk as its success depends on “*maintaining broad support across the population*” (Jaumotte, Lall, & Papageorgiou, 2013, p. 31). However, Birdsall (1999) also points out that in addition to increasing integration in terms of good and services, globalization also leads to the spread of ideas, information and technology that have huge benefits for the developing countries and that the goal is to tap the potential benefits and limit the countervailing costs.

Dependency theory posits that wealthy states benefit at the expense of the poor and the underdeveloped countries as resources flow from the ‘periphery’ of the latter to the ‘core’ of the former. Based on dependency theory and the use of panel design models, Beer and Boswell (2001) employed the ratio of accumulated stocks of foreign investment and the host nations’ GDP as a proxy for dependency. They concluded that relinquish of control by the host developing nations to the multinational companies increase inequality by changing the development patterns of the host nations, in turn influencing changes in domestic income distributions. They also found significant evidence supporting the importance of education for decreasing inequality in most of their models. These findings coincide with Stack (1980) and Prechel (1985), where it is reasoned that large export sectors, which are by-products of dependent patterns of unequal exchange between the industrial countries and the industrializing countries, are positively related to income inequality. Bluestone and Harrison

(1988) and Braun (1991) use openness (nation's participation in world trade) as a dimension for globalization to reason that openness is expected to increase inequality in advanced countries and decrease inequality in developing countries. Increase in inequality in advanced economies happens due to 'deindustrialization' wherein high paying unionized and protected industries face competition from the labour force in developing countries and through competition with imports. In developing countries, however, inequality is expected to fall following the rise in employment among low skilled workers in export industries. The findings of Milanovic (2005) suggest otherwise. He finds strong evidence that openness has a disequalizing effect on the income distribution of countries with low average income levels. With the rise in national income, the income gap between the poor, middle class and the rich abbreviates.

Wood and Ridao-Cano (1996), Davis (1996) and Kremer and Maskin (2003) make use of certain theoretical ideas to discern how trade affects income distribution. One of them, the Heckscher-Ohlin (HO) model suggests that a given country specializes in the production of commodities which use those resources or factors of production it is majorly endowed with. As a consequence, in an open economy set-up, developing countries export goods that are intensive in unskilled labour, whereas, developed countries export goods that are skill-intensive. Hence, in the poor country, trade boom would facilitate an increase in demand for unskilled labour and drive down demand for skilled labour, thus reducing earnings inequality. Analogous forces would add up in the case of the advanced countries to increase income inequality. Wood and Ridao-Cano (1996), however, argue that in the case when the supply of skilled workers depend positively on relative wage, supply responses work to widen the initial gap in skill endowments of the two classes of countries, leading to a divergence in terms of income between developed and developing countries. Their empirical analysis lends support to their hypothesis. A study on inequality and growth using a panel of countries also supports the preceding hypothesis and finds a negative association between openness and inequality for developed countries and a positive one for developing countries, with the turnaround point at per capita GDP level of \$13,000 (Barro, 2000). In Kapstein and Milanovic (2003), the turnaround point occurs at \$6000. Departing from the standard two-good, two-type Heckscher-Ohlin model, a three-good (differing in capital intensiveness), two-type variant was proposed to explain the increase in inequality in some developing countries after their economies opened up (Davis, 1996). Kremer and Maskin (2003) recognize that opening up of world economies entails globalization of the production process,

instead of the proliferation of trade in just goods. They model this character of globalization wherein "a product is designed in one country, manufactured in a second and customer service is provided by a call centre in a third country" (p. 11). They argue that globalization weakly worsens inequality in the developing country albeit with certain reservations.

Exploring various dimensions of globalization, Lall et al. (2008) investigate the impact of trade and financial globalization on income inequality using a panel framework and find that trade globalization and financial globalization have offsetting effects. While trade globalization leads to a decrease in inequality, financial globalization (specifically FDI) along with technological progress increases inequality. All the same, greater access to education is said to have an equalizing effect on the distribution of income and dissipate the disequalizing effects of FDI once the increased demand for higher education and enhanced skills is met with adequate supply. The analytical principle connecting trade liberalization and inequality is derived from Stolper-Samuelson theorem which implies that in a two-country two-factor framework, increased openness (by the way of tariff reduction) in a low-skilled labour intensive developing country results in an enhancement in wages of the low-skilled workers and a decrease in those of skilled workers, leading to an overall reduction in income inequality (Stolper & Samuelson, 1941 as cited in Lall et al., 2008). This result comes through by the channel of reduction in prices of the importable high skill-intensive product after the tariffs are reduced. Vice-versa would be true for the developed country.

In the Indian context, the hypothesis stands supported as per Kumar and Mishra (2008) who evaluated the impact of 1991 trade liberalization on industry wages using micro-level NSSO data for the years 1980-2000. They found that reduction in tariffs led to the reduction in wage inequality between skilled and unskilled workers. On the contrary, Topalova (2005)'s study on the causal impact of trade liberalization on poverty and inequality in Indian districts using a difference-in-difference estimation design established that trade liberalization led to an increase in inequality, especially in the urban regions.

In Lall et al. (2008), the inequality data is drawn from the World Bank Povcal database by Chen and Ravallion (2004, 2007). However, the authors caution against the interpretation of results on account of the analysis using inequality data based on income surveys for some countries and expenditure/consumption surveys for the rest. Moreover, consumption-based inequality indices underestimate inequality, partly because of governments' social security programmes (World Bank, 2006) and partly due to consumption smoothing across time.

Some of the other inequality databases include Deininger and Squire (1998) and the World Income Inequality Database (2005).

Most of the differences in the findings from various studies are on account of empirical and methodological differences as well as the choice of control variables. For example, while covering the same period and similar countries, Lundberg and Squire (2003) and Dollar and Kraay (2001) came up with contradictory evidence on the impact of globalization on inequality. Lundberg and Squire (2003) use Sachs-Warner measure as the openness variable and the Gini coefficient as per Deininger and Squire (1998) and find that openness has a mildly negative effect on inequality. In Dollar and Kraay (2001), openness is measured as the ratio of trade to GDP in PPP terms and its effect on income share of bottom quintile is analysed. The authors observed that openness positively impacts per capita income growth. However, the magnitude and the sign of this effect is same for the mean of income that goes to the poorest quintile as well as for the overall average income level. This renders the relationship between openness and inequality insignificant.

According to Ravallion (2004), these results are to be interpreted with certain caution as the studies depend on fairly noisy data, work with averages, and heterogeneity in country-specific conditions is too great. In addition, Milanovic (2005) observes that although there are conclusions that “run nearly the full gamut”, there are hardly any empirical findings that show a negative relationship between openness and inequality (Barro, 2000; Dollar & Kraay, 2001; Ravallion, 2001; Lundberg & Squire, 2003). All the same, in summary, certain ways through which trade liberalization is argued to be helpful in alleviating inequalities include – One, generation of new labour-intensive jobs in agriculture and manufacturing, in turn raising the incomes of the poor. Two, making the economies more competitive, thus reducing the disequalizing rent-seeking behaviour. Three, bringing in cheaper imports, thus reducing the real costs of consumption for the poor, which in fact constitutes the biggest chunk of their income spend (Birdsall, 1999). It can be concluded that the debate surrounding the distributional effects of globalization hardly seems resolved.

3. Economic Framework

In this study, our objective is to understand the association between globalization and economic inequality when education is the mediating channel. We essentially set out to test the following path.

Globalization → Higher returns on higher levels of education → Endowment effect – People seeking higher education hail from higher social or economic class → Higher returns to those who are already well endowed in terms of social capital and wealth → Inequality rises

One of the key factors in the proliferation of trade and globalization is the role of technology. It is clear that technological advancements favours those with higher skills and reduces the demand for lower-skilled activities, in process aggravating the skills gap and income distribution in turn (Birdsall et al., 2005). Although greater access to education can alleviate income inequalities, developing countries are marred by resource constraints. Compensation hypothesis, in part, also explains higher returns to higher levels of education in the wake of globalization as described in the previous section. Additionally, in case of developing countries, Wood and Ridao-Cano (1996) argue that supply responses to wage differentials between skilled and unskilled workers would come into force to belie the Heckscher-Ohlin model and further add to the skill premium. Another model in support for an increase in returns to higher levels of education was proposed by Stokey (1996).

Next, a rise in returns to higher education would consequently lead to increase in demand for university education. This would have ramifications for the entire higher education system for higher quality schooling at lower levels, ensuing perverse educational consequences from the viewpoint of equity (Carnoy, 2005). Increase in demand for higher education puts pressure on the system and increases competition for the limited seats in the system. This entails onus on lower levels of schooling to deliver quality education and hence changes the stakes at primary and secondary levels of education. Also, a call for expansion of the supply of university system puts continuous pressure on the entire education system to expand and thus have severe repercussions on the quality of deliverance.

There is a contention that in most countries, people from higher social class backgrounds are the ones who get a shot at higher levels of education (Carnoy, 2005). So, an endowment effect is in play. In an already unequal society, those who have higher social, economic and human capital accumulate further higher returns and exacerbate inequality. This happens as only those at a higher socio-economic status are able to *“get access to “better” schools in regions that are more likely to spend more per pupil for education, particularly in those schools attended by higher socio-economic class pupils. Competition for such higher-payoff education also increases as the payoff to higher education increases, because the stakes get higher”* (Carnoy, 2005, p. 9). As a result, schooling becomes layered at the lower levels

especially in countries with limited resources. This is a testable hypothesis and although out of the scope of the present work, future research can test whether globalization leads to stratification of schooling at lower levels in terms of quality of deliverance.

Burbules and Torres (2000) lay down another channel that relates globalization to inequality through education. Globalization has created a new world order in response to which different nations have gone through different patterns of economic restructuring. Economic restructuring has gone hand in hand with the implementation of neoliberal policies, some of which hadn't worked out as intended at that time with profits going down, labour unions fighting to maintain the wages at a high level, and prices remaining controlled at lower levels owing to foreign competition. This had led to many countries facing a fiscal crisis as their respective governments failed to match state revenues with social expenditures. Ensuing budget reductions affected the public sector and size of welfare state diminished. Privatization of essential social services such as housing, health, and education increased and as a result, “*social salary (public expenditure distributed in the form of social benefits) diminished at the expense of individual salaries*” (Burbules & Torres, 2000, p. 7). Thus, as a consequence of such process, large sections of the population were left excluded while the limited few were taken care of by the state leaving the society fragmented and unequal.

4. Data, Variables, and Empirical Methodology

From the discussion on literature thus far, nothing can be conclusively said about the associations between globalization, education outcomes, and inequality. Although certain models such as Heckscher-Ohlin and Stolper-Samuelson propose a decrease in inequality in developing countries and an overall convergence across the developed and the developing countries in the wake of globalization, certain other theories such as the dependency theory and modifications thereof suggest otherwise. In addition, the empirical literature positions itself on either side of the fence. As for the connection between globalization and education, considering that information and knowledge sharing/exchange is integral to globalization, countries which have opened up to the forces of globalization have experienced changes in their education systems in terms of their policies, practices, institutions, etc. In empirical terms, drawing from an earlier (unpublished) study that we took up, globalization is seen to have a positive effect on educational attainment of countries, both advanced and developing.

Proceeding further, to the best of our knowledge, there hasn't been any study to have specifically looked at the impact of globalization on inequality through the channel of education. Hence, based on the gaps in the literature, we attempt to understand how globalization relates to income inequality within an economy and more importantly assess the relationship when education is one of the main mediating forces. To do this, we have considered a panel of countries across the world as per data availability for the variables of our interest. Hence, we have attempted to include as many countries as possible in each model for the time-period between 1990 and 2013. In this dataset, the data over the period 1990 – 2005 is spaced every five years (E.g.1990, 1995 . . .) and from 2005 till 2013, data is considered for each year. This constraint of having to work with unequally spaced time panels is given the limited data availability of one of the primary explanatory variables - education outcomes, i.e. mean years of schooling.

Most of the dataset is derived from World Development Indicators (WDI) of The World Bank. This database is a compilation of international sources that are officially recognized and include national, regional and global estimates. The list of variables used in our analysis is presented in table 1 along with their brief descriptions and respective data sources.

Table 1

Data set – descriptions and sources

Variable	Description	Source
Dependent Variables		
gini	Gini index measures the extent of deviation from a perfectly equal distribution of income or in some cases consumption expenditure	1. World Development Indicators, The World Bank 2. Lessmann and Seidel (2017) 3. Estimated Household Income Inequality Data Set (EHII), UTIP
Explanatory Variables		
kof	Globalization Index that encompasses three main dimensions of globalization – economic, social and political	KOF Index of Globalization Database, Dreher, Axel, Noel Gaston and Pim Martens (2008)
ays	Average number of years of education received by people aged 25 and older	Barro and Lee (2013), UNESCO Institute for Statistics (2013b) and HDRO estimates
Control Variables		
gdppc	GDP per capita based on purchasing power parity (PPP) at constant 2011 dollars	
pop	Total Population	World Development Indicators, The World Bank
gfce	General government final consumption expenditure (% of GDP)	
lfse	Labour force with secondary education (% of	

	total)
ae	Employment in agriculture (% of total employment)
ie	Employment in industry (% of total employment)
sse	Employment in services (% of total employment)
infl	Inflation, consumer prices (annual %)
fed	Financial Crisis Dummy – All years following 2008 assigned 1

4.1 Dependent Variable

We have used Gini coefficient for income/consumption expenditure inequality as the dependent variable in this study. The Gini coefficient¹ is a widely used measure and it captures the range between a perfectly egalitarian society (Gini coefficient of zero) and a society where all the wealth is hogged by one person (Gini coefficient of one). In spite of Gini Index's popularity, various conceptual and methodological issues make comparability of Gini Indices over time and across countries difficult. As pointed before, some Gini indices are based on household surveys that investigate consumption expenditure (commonly in Asia, Sub-Saharan Africa, Central and emerging Europe etc.). Others are based on income surveys (mainly in developed economies), and this introduces differences of the order of 0.15 points on the basis of methodological differences (Lall et al., 2008). Moreover, consumption based Gini coefficients underestimate the inequality on the account of consumption smoothing by households, inaccuracy in reporting, variation in number of consumption items, changes in length of recall period etc. It is also argued that household surveys do not capture the top and bottom ends of income distribution (Emran & Shilpi, 2015).

In this paper, we use Gini coefficients drawn from World Development Indicators, The World Bank database and Estimated Household Income Inequality Data Set (EHII) of the University of Texas Inequality Project. We also make use of a novel dataset on regional

¹ The Gini coefficient satisfies three basic properties that an inequality index is expected to satisfy – One, mean or scale independence (Index remains invariant if the income of everyone in the population is changed by the same proportion. Two, population-size independence (index remains unaffected by the change in number of people at each income level by the same extent, and third, the Pigou-Dalton condition (Transfer from a richer person to a poorer person that does not reverse their ranks reduces the value of the index (Sen, 1973, p.27 as cited in Anand, 1983)) (Anand, 1983 as cited in Subramanian, 1997).

income inequality based on satellite nighttime luminosity data by Lessmann and Seidel (2017). In the former database, i.e. The World Development Indicators, the Gini coefficients have been calculated from the data on the distribution of income or consumption from nationally representative household surveys (The World Bank, 2005) or the best available grouped data and have been further adjusted for household size. The coefficients have been attempted to be made as comparable as possible in view of the difference in survey methodologies, welfare definitions – income or consumption, weighing procedures etc.

On the other hand, the EHII data set has been created by a statistical approach to create a consistent Global dataset. The statistical procedure is based on a regression that shows a very close relationship between industrial pay inequalities and household income inequalities as measured in 430 overlapping country-year observations from a separate standard dataset – Deininger and Squire (DS) (1996). Control variables that specify whether the DS dataset measures inequality of households or of individuals, whether the data is based on income or consumption expenditure, or whether it is gross or net of tax, are used in this regression. The resulting coefficients are stable and consistent and are further used to produce the near-complete table of estimated Gini Coefficients (Galbraith et al., 2015). The data for EHII Gini coefficients are available for 149 countries from 1963 to 2008.

Finally, Lessmann and Seidel (2017) use nighttime satellite data to create a regional income inequality dataset for 180 countries spanning the period 1992-2012. They follow a two-step procedure. First, the authors use the relationship between luminosity data and regional incomes of the countries where such information is available and perform an out-of-sample prediction of regional income of countries where income data is lacking. Second, from the predicted income data, they compute different measures of income inequality within countries including the population-weighted Gini coefficient. For our study, we have considered Gini coefficients from the three data sources in separate regressions with all other variables remaining the same. This also helps us check for robustness of the findings.

4.2 Explanatory Variables and Control Variables

There have been more than 100 studies to have used the KOF index of globalization (Potrafke, 2014) to probe the association between globalization and other variables such as inequality, growth, health outcomes, etc. A more common practice is to measure globalization as financial and trade openness with the variables being total of imports and

exports as a percentage of GDP denoting openness to trade, and inflows of FDI as a percentage of GDP indicating financial openness. However, trade openness or financial openness is not a sufficient measure to capture the effects of globalization or even economic aspects of globalization. The process of globalization goes beyond mere trade and commerce as it entails the creation of networks of connections among people and entities across multi-continental distances and interceded through a multitude of flows such as people, capital and goods, information and ideas, among others (Dreher, 2006). Hence, our choice of the explanatory variable to measure the effect of globalization on economic inequality is the KOF index of globalization.

The KOF Globalization Index was conceived as part of a study in Dreher (2006) and is brought out annually by KOF Swiss Economic Institute. It captures the multidimensional nature of globalization comprising economic, political, cultural and technological aspects. The final index is an aggregation of three most important facets of globalization – economic integration, social integration and political integration, which in turn are an aggregation of 23 variables (Dreher, 2006). The same is listed in Appendix table A.1. The economic dimension is made up of two components – actual flows and restrictions. Measures of trade, foreign direct investment (FDI), portfolio investment, and income payments to foreign national, all as a proportion of GDP, combine to form actual flows. The composite sub-index of Restrictions is composed of measures of hidden import barriers, tariff rates prevalent in the country under consideration, taxes on international trade, and capital account restrictions. The political dimension of the KOF index simply measures embassies in a country, membership in international organizations, and level of participation in UN security council missions. Finally, the social component subsumes data on personal contact, information flows, and cultural proximity.

Next, we denote the educational attainment of a country by ‘mean years of schooling’ of its population. ‘Number of years of schooling’ is perhaps the most instinctive and simple way of measuring the education a person receives. Although education and schooling is not the same thing as education can come from factors others than formal schooling such as family, colleagues, culture etc., schooling plays a central role in the education of citizens of a country.

The other candidates for the choice of the variable representing educational outcomes were countries’ average standardized scores in international surveys cum tests such as Programme

for International Student Assessment (PISA)² and The Trends in International Mathematics and Science Study (TIMSS)³. The objective of such evaluation tests is to measure problem-solving skills and cognitive skills of students in daily life. Moreover, these standardized tests facilitate the creation of comparable data across countries and consequently enable nations to improve their education policies and outcomes. It can hence be argued that the scores in international tests represent educational quality in a country. Studies which have included such measures in growth regressions have found that the quality of education is important for economic growth and also that its effect is larger than that of educational quantity (school enrolment and attainment) (Hanushek & Woessmann, 2007).

In spite of its inherent strengths, we do not consider PISA and TIMSS scores in our main analysis as the two have been in existence only since the years 2000 and 1995 respectively. Also, these are only conducted every three years and four years respectively. Moreover, the countries participating in these surveys are not representative of the global population as most of them belong to the Organisation for Economic Co-operation and Development (OECD) group of countries. Hence, because of the data constraints with respect to the PISA and TIMSS test scores as a measure of educational outcomes; we restrict ourselves to the measure of average years of schooling (ays) as one of the explanatory variables for this study.

In addition to the explanatory variables, we control for per capita gross domestic product (GDPPC) and its squared term, country's population, government's consumption expenditure in a country's GDP, the percentage of labour force with secondary education, occupation structure, and inflation.

4.3 Methodology

Although the term globalization has been in the common parlance since the 1980s thanks to Levitt (1993), the world has been integrated since long and the phenomenon of globalization has been around since time immemorial. For the purpose of our study, we delve into the association between globalization and inequality in the period between 1990 and 2013. The time period of our consideration includes the period of the sub-prime crisis in the US and the

² PISA tests a sample of 15-year-old school pupils' scholastic performance in mathematics, science, and reading of its member and non-member nations.

³ TIMSS conducts evaluations for a sample of students in grades four and eight of participating nations in mathematics and science.

subsequent economic slowdown of 2008-09. To account for the same, we include a dummy variable assuming the value of zero for the pre-slowdown period i.e. all years preceding 2008, and the value of one post-crisis, i.e. 2008-2013.

Empirical studies on the impact of globalization on other variables have commonly used cross-country regressions or panel data methods. Cross-sectional studies suffer from certain limitations such as the simultaneity effect (difficulty in disentangling cause and effect), multicollinearity problem (covariates being correlated with each other and imperfectly measured, making it difficult to figure out the actual determinant), endogeneity (correlation between explanatory variable and the error term) and omitted variable bias (Mankiw et al., 1995). Moreover, the cross-sectional studies do not consider time trends/lagged effect of variables. On the other hand, panel data methods benefit from the fact that as sample size and in turn degrees of freedom increases, unobserved time-invariant variables of the unit of analysis can be controlled for (heterogeneity) and causal analysis is made possible. Hence, in this study, we use panel data methods.

To resolve the research question, several variants of the following general regression model were estimated. The base model is -

$$II_{it} = \beta_0 + \beta_1 G_{it} + \beta_2 EO_{it} + \beta_3 (G_{it} * EO_{it}) + \gamma_k \mathbf{X}_{it} + a_i + \epsilon_{it}$$

where, II_{it} is Gini Index for Income inequality, G_{it} denotes KOF Globalization Index, EO_{it} captures education outcomes of i^{th} country for the t^{th} time period, \mathbf{X}_{it} is the vector containing all the control variables, a_i captures unobserved time invariant country level effects or unobserved heterogeneity, ϵ_{it} is the error term where $E(\epsilon_{it}/X_{it}) = E(\epsilon_{it}) = 0$; $Var(\epsilon_{it}) = \sigma_\epsilon^2$; $Cov(\epsilon_{it}, \epsilon_{is}) = 0$ where $t \neq s$; $Cov(X_{it}, \epsilon_{it}) = 0$ (Weak Exogeneity Assumption); $Cov(X_{it}, a_i) = 0$ (in case of Random Effects); $Cov(X_{it}, a_i) \neq 0$ (in case of Fixed Effects), and finally, the coefficient β_3 can be interpreted as the amount of change on the slope of the regression of income inequality on globalization when number of years of schooling changes by one unit.

The error structure in the two parts given above is based on the assumption of a_i and ϵ_{it} being IID, i.e. no heteroscedasticity, no autocorrelation and no cross-sectional dependence.

Given our data, we are also dealing with unequally spaced time intervals and an unbalanced panel⁴.

In running panel regressions, we need to choose between random effects model and fixed effects model. Attributing random effects to a model is a more restrictive assumption as the regressor X_{it} is taken to be strictly exogenous, i.e. $Cov(X_{it}, \epsilon_{it}) = 0$ as well as $Cov(X_{it}, a_i) = 0$, whereas in case of fixed effects only the weak exogeneity condition is assumed. If the underlying model obeys fixed effects assumptions, then a fixed effects regression would yield consistent estimates and a random-effects regression would yield inconsistent estimates. On the other hand, if the underlying model fulfils random effects assumptions, both fixed effects and random effects regressions would bear consistent estimates, although the estimates in fixed effects regressions would not be efficient. In this case, we are conducting a cross-country study. We are not picking up a representative sample randomly from a given population. Rather, our inferences shall be made on the population, i.e. all countries, subject to data availability for different variables. Hence, as per Searle, Casella, and Mc Culloch (2009), since our interest is in the population (countries of the world) itself and not on a random sample of countries, we employ fixed effects model in the regressions.

Moreover, it would be extremely constrictive to assume that the unobserved time-invariant country effects or the omitted variables are uncorrelated with the explanatory and control variables already present in the study. However, we shall still test for the robustness of our assumptions by applying Hausman test (Hausman, 1978). This test evaluates whether the random effects model is more suitable when compared to the fixed effects model. Under the null hypothesis, estimators resulting from both models are consistent but the random effects coefficients are more efficient as they have a smaller standard error. In case the null hypothesis is rejected, we are left with the fixed effects estimators, which are at least, consistent.

Post Hausman test, in order to ensure robustness of the estimators, we conduct a few tests. We earlier assumed our error structure to be free of heteroscedasticity, autocorrelation and cross-sectional dependence. However, these are tenuous assumptions as according to Hoechle

⁴ As STATA commands handle unbalanced data, we tread further by ruling out selection/attrition bias as an assumption.

(2007), most panel datasets are likely to exhibit all kinds of serial correlations and cross-sectional dependencies.

The first test is to check the standard errors of the coefficient estimates for heteroscedasticity and modified Wald Test is employed for the same. The modified Wald Test⁵ tests for group-wise heteroscedasticity. Since it is restrictive to assume that all countries have similar variance distributions, the test examines whether the error structure across time and countries has the same variance.

Next, we test for the presence of autocorrelation or serial correlation in the error structure. If an error structure is autocorrelation inconsistent, it means that errors are correlated across periods⁶. Since autocorrelation biases the standard errors and renders the coefficients to be less efficient (Drukker, 2003), to check for the presence of autocorrelation in the error structure, we apply Wooldridge's test for autocorrelation in panel-data models proposed in Wooldridge (2002)⁷. That being so, the treatment for serial correlation in error structure is done by adjusting VCE for clustering at panel level (Drukker, 2003). This procedure also makes the standard errors robust to heteroscedasticity in addition to serial correlation.

Lastly, we need to test our final assumption of the error structure being free from any cross-sectional dependence, i.e. $Corr(\epsilon_{it}, \epsilon_{jt}) = 0$, where $i \neq j$. Given the scope of study wherein, we analyse the interactions between globalization, education outcomes and income inequalities across the world, the supposition that the dependent variables and the independent variables are not related across the unit of analysis (countries) is fragile. The

⁵ The null hypothesis of the modified Wald Test assumes the errors to be homoscedastic. Consequently, if the null hypothesis is rejected, we correct for heteroscedasticity by using the "robust" option (in STATA) with the fixed effects panel regression command and thus generate standard error estimates robust to heteroscedastic disturbances.

⁶ In a simple linear regression framework - $u_{it} = \theta u_{i(t-1)} + \delta_{it}$, where $|\theta| < 1$ is called the autocorrelation parameter and $\delta_{it} \sim iid N(0, \sigma^2)$. In this stated case, the autoregressive model follows AR(1). That is, the dependent variables and the independent variables at time t most likely bear a relationship with the ones at time $(t-1)$.

⁷ Wooldridge's test uses the residuals obtained from a regression in first-differences after which the time-invariant effects are eliminated and we are left with - $\Delta EO_{it} = \alpha_j \Delta G_{it} + \gamma_k \Delta X_{it} + \Delta \epsilon_{it}$, where Δ is the first-difference operator. Then, the parameters α_j and γ_k are estimated by running the above regression and the residuals are obtained. Under null hypothesis, if the errors in the original model are not autocorrelated, then - $Corr(\Delta \epsilon_{it}, \Delta \epsilon_{i(t-1)}) = -0.5$.

very concept of globalization is grounded on interconnections and interdependencies among actors across the world and a variety of flows among countries. Therefore, it is necessary to account for spatial dependence in the standard errors to lend robustness to the model. One of the tests for assessing cross-sectional dependence is Pesaran cross-sectional dependence⁸ (CD) test as it is also applicable to panels with short T and large N . Under the null hypothesis, there is no cross-sectional dependence in the error structure of the model. In case the null hypothesis stands rejected, we need to employ an estimator that corrects for cross-sectional dependence in the data. One such estimator is given by Driscoll and Kraay (1998) who proposed an estimator which, in addition to accounting for general forms of spatial dependence, also produces standard errors that are heteroscedasticity consistent and are robust to general forms of serial correlation⁹.

In this paper, the structure of data for our variables of interest is in form of unequally spaced panels. To overcome this limitation of unequally spaced panel data patterns, Baltagi and Wu (1999) came up with a procedure that handles unequally spaced panel data and also overcomes the problem of serial correlation in the errors. The procedure¹⁰ makes use of feasible generalized least squares (FGLS) estimation method for unbalanced panels.¹¹

Having set down the data description, variables and methodology in place, we move on to the results of the analysis in the next section.

⁸ The test statistic of CD test is “based on a simple average of all pair-wise correlation coefficients of the Ordinary Least Square (OLS) residuals from the individual regressions in the panel” (Pesaran, 2004, p. 3). It is given as - $CD = \sqrt{\frac{2T}{N(N-1)} (\sum_{i=1}^{N-1} \sum_{j=i+1}^N \widehat{\rho}_{ij})}$, where, T represents number of time

periods, N represents total number of cross-sectional units, $\widehat{\rho}_{ij}$ is pairwise correlation of errors given by - $\frac{\sum_{t=1}^T \widehat{\epsilon}_{it} \widehat{\epsilon}_{jt}}{(\sum_{t=1}^T \widehat{\epsilon}_{it}^2)^{1/2} (\sum_{t=1}^T \widehat{\epsilon}_{jt}^2)^{1/2}}$.

⁹ In contrast to the original Driscoll and Kraay’s (1998) estimator which only considers balanced panel, the estimators produced by the “xtsc” command in STATA works with unbalanced panels as well (Hoechle, 2007).

¹⁰ The STATA command that implements this procedure is ‘xtregar’.

¹¹ In case of a fixed effects model, ‘xtregar’ proposes a within estimator which does away with the nuisance parameter (α_i) and produces a linear AR(1) model, with unequally spaced observations. A Cochrane-Orcutt transformation is then performed on each panel, within-panel means are removed, and the overall mean is then added back for each variable. In the final step, ordinary least squares regression is performed on the transformed data to yield the within estimates of β_0 , α_j , and γ_k (Stata manual for ‘xtregar’).

5. Results

Now, we present the results which attempt to discern the association between globalization and income inequality in a country through the channel of education. We start by listing the descriptive statistics in table 2.

Table 2

Summary Statistics

Variables	N	Mean	Std. Dev.	Min	Max	Form
Gini Coefficient (gini)	421	36.732	8.943	23.72	63.38	log
Mean years of Schooling (ays)	421	9.970	1.965	3.6	13.1	level
Globalization Index (kof)	421	72.994	12.740	36.88	92.63	log
Per Capita GDP (gdppc)	421	25,384.880	17,002.110	1,374.2	95,577.9	log
Total Population (pop)	421	2.57E+07	4.18E+07	206962	3.09E+08	log
Government Consumption Expenditure (gfce)	421	17.388	4.510	6.344	28.064	level
Labour Force with Secondary Education (lfse)	421	45.226	16.341	1.4	79.1	level
Employment in Agriculture (ae)	421	13.280	12.738	0.6	82	level
Employment in Industry (ie)	421	24.165	6.184	3.4	41.7	level
Employment in Services (sse)	421	61.882	11.596	14.6	84.2	level
Inflation (infl)	421	5.119	6.138	-4.480	66.007	level

Figure 1.5 displays the matrix plot where we focus on the graphical representation of the relationships between economic inequality and per capita GDP, economic inequality and globalization, and economic inequality and average years of schooling. Although not perfectly clear, there appear to be negative correlations between each set of variables. Prima facie, our study seems to be siding with the literature which supports a decline in income inequality as the forces of globalization become stronger in a country. The negative relationship between income inequality and average years of schooling as well as between income inequality and per capita GDP is not definitively expected as per theory and prior literature. To understand the relationships further, we proceed to the regression results and subsequently attempt to explain the findings.

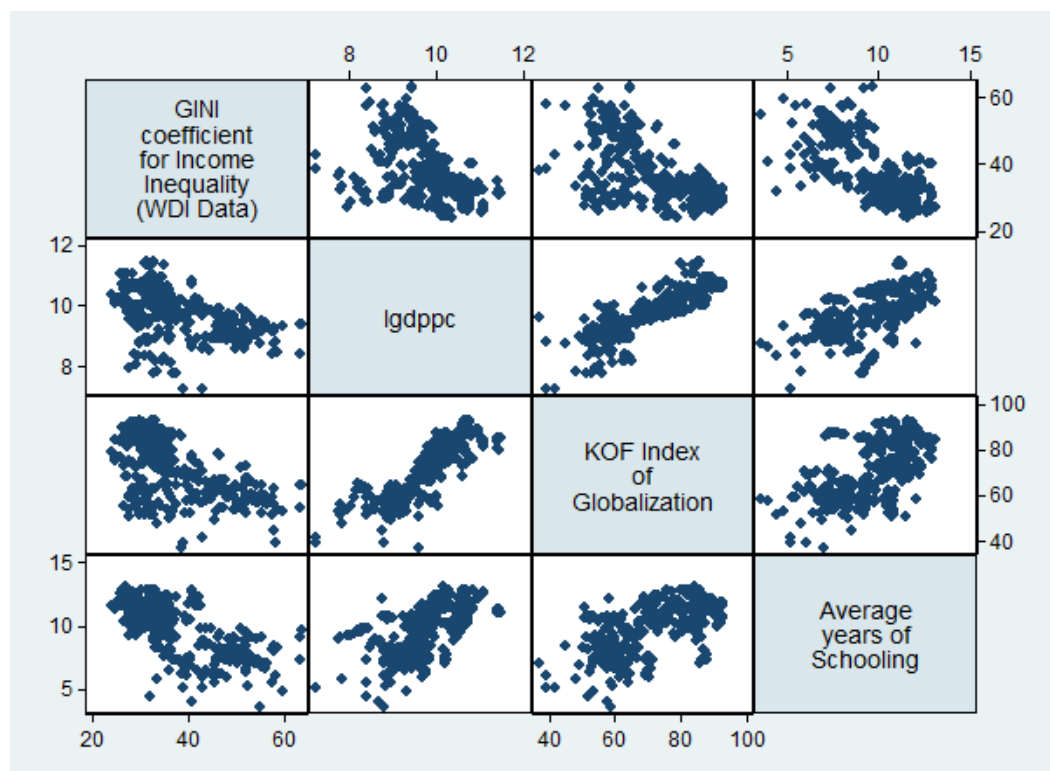


Figure 1 Matrix Plot

Notes: ‘lgdppc’ – natural log of GDP per capita; In the matrix of plots above, cell (1,2) contains the scatter plot between Gini Coefficient and natural log of Per Capita GDP, cell (1,3) contains the plot between Gini Coefficient and KOF Globalization Index, and cell (1,4) contains the plot between Gini Coefficient and Average Years of Schooling.

5.1 Empirical Results

Our main enquiry in this study is whether the effect of globalization on economic inequality is higher at higher levels of education. That is, we shall be focusing on the estimated coefficient on the interaction between globalization variable (lkof) and education outcomes (ays). The coefficient is to be interpreted as the amount of change on the slope of the regression of income inequality (lgini) on globalization when mean years of schooling in a country changes by one unit. To this effect, we have estimated various specifications using the method derived in Baltagi and Wu (1999) for unequally spaced panels. Our main dataset of income inequality measure as Gini coefficients extracted from World Development Indicators, The World Bank Data. We conduct robustness checks on our empirical results by considering Gini coefficients from Estimated Household Income Inequality (EHII) database, University of Texas Inequality Project and Lessmann and Seidel (2017) and see if they remain consistent.

To start with, let us focus our attention on Regression 4 in table 1.12. Once we include the estimated coefficients, the model looks like –

$$lgini = 1.785 - 0.298 * lkof - 0.215 * ays + 0.0446 * kofaysint + \text{Rest of the terms}$$

Table 3

Association between Globalization and Income Inequality (WDI Data) (Dependent Variable – 'lgini')

VARIABLES	Model 1	Model 2	Model 3	Model 4 ^{\$}	Model 5
lkof	-0.393* (0.232)	-0.363 (0.229)	-0.370 (0.233)	-0.298 (0.232)	-0.232 (0.230)
ays	-0.265** (0.107)	-0.246** (0.107)	-0.220** (0.107)	-0.215** (0.107)	-0.158 (0.106)
kofaysint	0.0554** (0.0258)	0.0532** (0.0256)	0.0463* (0.0257)	0.0446* (0.0257)	0.0303 (0.0254)
lgdppc	0.438 (0.317)	0.617* (0.316)	0.402 (0.324)	0.810** (0.316)	0.592** (0.290)
lgdppc2	-0.0271 (0.0168)	-0.0370** (0.0168)	-0.0276 (0.0169)	-0.0462*** (0.0167)	-0.0371** (0.0153)
lpop		0.0164 (0.0118)	0.0175 (0.0108)	0.0148 (0.0111)	0.0182* (0.00977)
gfce		-0.00717*** (0.00191)	-0.00886*** (0.00200)	-0.00789*** (0.00195)	-0.00982*** (0.00198)
lfse		-0.000285 (0.000469)	-0.000391 (0.000478)	-0.000279 (0.000477)	-0.000250 (0.000487)
infl			-0.0000398 (0.000602)	-0.000142 (0.000593)	0.000287 (0.000620)
ae			-0.00378*** (0.00146)		
ie				-0.00356** (0.00163)	
sse					0.00504*** (0.00111)
fcd			0.00481 (0.00682)	0.00182 (0.00699)	0.00120 (0.00698)
Observations	421	421	421	421	421
Country Effects	RE ^{#1}	RE	RE ^{#2}	RE	RE

Notes: Baltagi and Wu standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Diagnostics - Hausman Test - #1 Prob>chi2 = 0.6394, #2 Prob>chi2 = 0.1900. The null hypothesis of the country-level effects being adequately modelled by random effects cannot be rejected at the significance level

of 1%. We choose Random effects model; Inflection point in the non-linear relationship between Income Inequality and Per Capita GDP - $\$ \exp(-0.810)/(2*-0.0462) = \$ 6412.47$.

'kofaysint' represents the interaction between KOF Globalization Index (lkof) and average years of schooling (ays). Looking at the model, it can be said that the effect of Globalization on income inequality is not limited to its own coefficient of -0.298 but is different for different values of 'ays'. The same is represented by $-0.298 + 0.0446*ays$. Hence, the coefficient on lkof, i.e. -.298 can be interpreted as the unique value of globalization on income inequality only when $ays = 0$. Our main parameter of interest here is the coefficient on 'kofaysint'. From the expression $-0.298 + 0.0446*ays$, it can be construed that as education level in a country increases, the ameliorative effect of globalization decreases. In other words, when $ays = 0$, an increase of a percent in KOF globalization leads to a drop in economic inequality (represented by a decrease in Gini coefficient if income inequality) by 0.298 percent. However, as educational achievements in the country increase and assuming the average years of schooling attains a value of two, then if a country becomes more open (an increase in KOF globalization index by one percent), the income inequality lessens by a lower extent, i.e. $(0.298 - 2*0.0446) = 0.2088$ percent. The turnaround point, in this case, i.e. the point where increasing globalization worsens the income inequality occurs at $(0.298/0.0446) = 6.68$ mean years of schooling in a country. Similar figures emerge in case of other specifications as well. To the best of our knowledge, there is no support in the literature for the obtained value of the turnaround point of approximately 6.7 average years of schooling. This is one of the contributions of this study and further robustness checks by way of alternative data sources, and/or specifications, and/or estimators, need to be performed to establish this result.

As for the control variables in these regressions, the coefficients on most of them show expected behaviour with some being statistically significant. In all specifications, GDP per capita displays a non-linear relationship with income inequality. Taking the specific case of regression 4, 'lgdppc' shows an inverted U-shape profile with respect to income inequality with the inflection point occurring at \$6412.47. This finding is consistent with Kuznets inverted U-curve hypothesis wherein as an economy develops, economic inequality first rises and then at a certain stage of development, it falls. The turnaround point obtained in our study also approximately matches the figure of \$6000 obtained in Kapstein and Milanovic (2002).

Next, we included the variable of population to control for the size effect (Williamson, 1965; Ezcurra & Rodriguez-Pose, 2013). This is in view that country size may affect regional

inequality as heterogeneity is greater in larger countries than smaller countries. As is apparent from table 3, larger the population of a country, higher is its economic inequality. The positive coefficient on the log of population (lpop) stays consistent with respect to its magnitude and is statistically significant in three of the nine specifications.

We also took into account the share of government's consumption expenditure in a country's GDP as a variable to control for the size of the public sector. Rodriguez-Pose and Ezcurra (2010) use the size of public sector as a proxy for redistributive capacity of a country. Redistribution of resources across regions would then ameliorate skewed distribution of income and hence reduce regional inequality. In this study, we fail to reject this hypothesis as the negative relationship between size of the public sector and economic inequality in a country is statistically significant in all specifications.

One of the prime reasons behind rising inequality is the rise in earnings/skill premium (Stokey, 1996; Wood and Ridao-Cano, 1996). The earnings of workers depend on their productivity, which in turn depends on the workers' capabilities/skill and the scarcity of their skillset. The skill premium arises by the virtue of how scarce a skill is. A more scarce skill commands a greater premium. By this logic, if the skill set in the labour market is relatively homogenous, i.e. the variance in education levels/skill levels of potential employees is relatively low, the earnings premium remains contained. Hence, we controlled for the education level of the labour force, specifically, with the use of variable – the percentage of labour force with secondary education of the total labour force – and conjecture that this variable is negatively associated with inequality. Although this negative association reigns true in all regressions listed in table 3, the effect size is not statistically significant.

Additionally, we included controls for occupation structure of the population to examine if the changes in labour market structure have resulted in a rise in income inequality (Mikhalev, 2000). With the nations making a transition as market economies, new social and economic classes have emerged and with rising capitalism, the social hierarchy has undergone a change wherein blue-collar workers, farmers and state-sector employees have borne the cost of transition. While the proportion of workers in agriculture in the total labour force and the workers in the industrial sector as a percentage of the total labour force bear a negative association with income inequality, a higher service sector employment in the labour force worsens economic inequality (by the virtue of having a positive impact on Gini coefficient). All three relationships are statistically significant.

A similar set of regression models have been run with the data on the measure of inequality (lgini) extracted from EHII, University of Texas Inequality project and Lessmann and Seidel (2017) to check the robustness of the obtained empirical results. The same are listed in the appendix (Tables A.2 and A.3).

6. Conclusion

Previous studies have investigated the relationship between globalization and income inequality in the context of a single country or country groupings (E.g. Latin American Countries, OECD Countries, etc.) due to the paucity of worldwide data. This paper attempts to bridge this gap in the literature by examining how globalization relates to economic inequality through the pathway of education. Our dataset includes a panel of about 100 countries over a period of 20 years (1990 – 2013) including a wide number of developing and developed economies.

The study yields an outcome wherein globalization improves the situation of economic inequality in a country, i.e. the forces of globalization work towards decreasing inequality in a country. The pre-condition to this is an initial condition where a high proportion of a country's population is illiterate, and in general, the educational attainment levels are very low. Beginning at this situation, as the people of the country start attaining education, the restorative effects of globalization on income inequality go down. The result can be explained in the following way: as the country opens up to the rest of the world, there is a spread of ideas and proliferation of information and technology. This creates a need for the people of the country to equip themselves with skills and higher education on account of higher returns to higher levels of education. In case the government is unable to respond to the demand due to lack of resources, it creates a situation where competition increases for the limited places in the system and those already endowed have better opportunities at acquiring those places. Even if gaps are filled with respect to the increasing demand for higher education, there are repercussions on the quality of deliverance at all levels of education as each level acts as a feeder to the next level and hence, are interconnected. In such a scenario, the already well-endowed accumulate further returns and worsen the income inequality existing in the society.

As for other associations, economic inequality in a country bears a non-linear relationship with income per capita and a positive relation with the size of the country (which is assumed to indicate heterogeneity in its population). The economic inequality of the country is also

negatively dependent on the size of the public sector in the country and the degree of homogeneity in the skill-set/education levels of its population. Further, it was also found that a country with a greater proportion of its workforce engaged in agriculture and the manufacturing sector as compared to the proportion engaged in the service sector is economically more equal.

Considering the results, it would be instructional for the government of a country to engage greater percentage of its resources in expanding the scope and quality of the education system. Expansion in education aggravates income inequality in a highly globalized country only when there exists heterogeneity in skill levels of its population which gives rise to the skill premium. Hence, it is imperative for the public sector to bridge the gap in educational achievements of the society at large by focusing on the quality aspect in addition to a general expansion of educational facilities at all levels.

Going further, it would be informative to break the data on countries down to a homogenous set of groupings representing geographical regions, income levels, development levels etc. However, in our current attempt, we were constrained by data availability on the main dependent variable, thus limiting our analyses. In future, we also intend to determine lagged effect of globalization (in interaction with educational outcomes) on income inequality in a similar enquiry. Additional robustness checks would involve the use of inequality indices from other data sources such as World Income Inequality Database (WIID) by UNU-WIDER, and World Wealth and Income Database (WID.world) by the economists from Paris School of Economics and University of California at Berkeley. Another possibility for analysis lies in using the change in inequality measure rather than the inequality measure itself. This would essentially take care of the inherent biases in level estimation, for e.g. biases due to different definitions of welfare used in calculating inequality indices – wealth, income, and consumption expenditure, etc.

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Appendix A

Table A.1

Components of KOF Globalization Index

A.	Economic Integration	[35%]
	(i) Actual flows	{50%}
	Trade (in percentage of GDP)	(23%)
	Foreign direct investment (in percentage of GDP)	(29%)
	Portfolio investment (in percentage of GDP)	(27%)
	Income payments to foreign nationals (in percentage of GDP)	(22%)
	(ii) Restrictions	{50%}
	Hidden import barriers	(20%)
	Mean tariff rate	(30%)
	Taxes on international trade (in percentage of current revenue)	(24%)
	Capital account restrictions	(26%)
B.	Political Integration	[28%]
	Embassies in country	{34%}
	Membership in international organizations	{34%}
	Participation in UN Security Council missions	{32%}
C.	Social globalization	[38%]
	(i) Data on personal contact	{24%}
	Outgoing telephone traffic	(31%)
	Transfers (in percentage of GDP)	(9%)
	International tourism	(1%)
	Telephone average costs of call to USA	(33%)
	Foreign population (in percentage of total population)	(26%)
	(ii) Data on information flows	{39%}
	Telephone mainlines (per 1000 people)	(18%)
	Internet hosts (per capita)	(15%)
	Internet users (as a share of population)	(18%)
	Cable television (per 1000 people)	(16%)
	Daily newspapers (per 1000 people)	(16%)
	Radios (per 1000 people)	(17%)
	(iii) Data on cultural proximity	{37%}
	Number of McDonald's restaurants (per capita)	(100%)

Source – Dreher (2006)

The sub-indices and variables have been combined using a statistical procedure. The sub-indices of globalization are individually constructed as follows. The variables as listed in table A.1 are transformed to an index on a scale of one to hundred, where hundred is the maximum value for the given variable over the period between 1970-2013 and one is the minimum value. Higher values of a variable would mean greater globalization. Then,

principal components (PCA) analysis is used to calculate the weights for the sub-indices for the entire sample of countries and all years. PCA partitions the variance of the variables in each sub-group and the weights are then determined to maximize the variation of the resulting principal component so as for the indices to capture the variation fully. Finally, this procedure is then applied to sub-indices to finally derive the overall index of Globalization (Dreher, 2006).

Table A.2

Association between Globalization and Income Inequality (EHII Data) (Dependent Variable – 'lgini')

VARIABLES	Model 1	Model 2	Model 3	Model 4 ^s	Model 5
lkof	0.0730 (0.174)	0.0974 (0.174)	-0.00109 (0.182)	-0.121 (0.165)	0.176 (0.178)
ays	-0.00332 (0.0766)	0.00781 (0.0771)	-0.0360 (0.0806)	-0.0621 (0.0724)	0.0533 (0.0790)
kofaysint	-0.00161 (0.0182)	-0.00300 (0.0182)	0.00729 (0.0191)	0.0116 (0.0171)	-0.0146 (0.0187)
lgdppc	-0.368 (0.243)	-0.328 (0.245)	-0.133 (0.269)	0.484** (0.241)	-0.360 (0.240)
lgdppc2	0.0147 (0.0126)	0.0128 (0.0127)	0.00392 (0.0137)	-0.0273** (0.0124)	0.0132 (0.0124)
lpop		0.00338 (0.00772)	0.00153 (0.00778)	0.00161 (0.00655)	0.00555 (0.00737)
gfce		-0.00377* (0.00193)	-0.00309 (0.00202)	-0.00309* (0.00181)	-0.00496** (0.00200)
lfse		-0.000822 (0.000520)	-0.000762 (0.000537)	-0.000288 (0.000511)	-0.000786 (0.000540)
infl			-0.000121 (0.000313)	-0.000134 (0.000302)	0.0000119 (0.000323)
ae			-0.00176* (0.00101)		
ie				-0.00894*** (0.00135)	
sse					0.00279** (0.00110)
fcd			0.00266 (0.00863)	0.00119 (0.00846)	0.00491 (0.00884)
Observations	222	222	222	222	222
Country Effects	RE	RE	RE	RE	RE

Notes: Baltagi and Wu standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Inflection point in the non-linear relationship between Income Inequality and Per Capita GDP - \$ exp(- (0.484)/(2*-0.0273)) = \$ 7076.03.

Table A.3

Association between Globalization and Income Inequality (Lessmann and Seidel (2017) data)
(Dependent Variable – 'lgini')

VARIABLES	Model 1	Model 2	Model 3	Model 4 ^{\$}	Model 5 [#]
lkof	-0.522 (0.514)	-0.345 (0.227)	-0.436* (0.231)	-0.394* (0.230)	-0.391* (0.230)
ays	-0.323 (0.231)	-0.263** (0.106)	-0.294*** (0.108)	-0.270** (0.107)	-0.270** (0.108)
kofaysint	0.0654 (0.0540)	0.0568** (0.0251)	0.0660** (0.0256)	0.0601** (0.0253)	0.0602** (0.0258)
lgdppc	0.955** (0.439)	0.730 (0.469)	0.879* (0.476)	0.868* (0.477)	0.791* (0.467)
lgdppc2	-0.0542** (0.0223)	-0.0463* (0.0247)	-0.0527** (0.0249)	-0.0530** (0.0250)	-0.0488** (0.0246)
lpop		0.0181 (0.0255)	0.0269 (0.0255)	0.0283 (0.0240)	0.0275 (0.0255)
gfce		-0.00535** (0.00268)	-0.00352 (0.00278)	-0.00447* (0.00278)	-0.00401 (0.00280)
lfse		-0.0000787 (0.000625)	-0.0000196 (0.000622)	-0.0000249 (0.000635)	-0.0000473 (0.000621)
ae			-0.00128 (0.00149)		
ie				-0.00106 (0.00215)	
sse					0.000114 (0.00145)
fcd			-0.0231** (0.00928)	-0.0235** (0.00973)	-0.0233** (0.00938)
Observations	500	594	594	594	594
Country Effects	RE	RE	RE	RE	RE

Notes: Baltagi and Wu standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Inflection point in the non-linear relationship between Income Inequality and Per Capita GDP - \$ exp(- (0.868)/(2*-0.0530)) = \$ 6754.74; Inflection point in number of years of schooling where Globalization exacerbates income inequality - # -0.391/(-0.0602) = 6.495 years

