

Trend of income inequality in Asia and effects of education

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ABSTRACT

This study considers how education and globalisation affect income inequality in Asia, with the unbalanced panel data. The evidence supports the validity of Kuznets inverted-U hypothesis for the connection between the income level and income inequality. However, when more variables are integrated into the model, the consistency of inverse U-shaped curve becomes weaker. The empirical results suggest that educational variables are highly influential in affecting income distribution. Our analysis indicates that a higher level of education achieved by the population aged 15 and over has improved income distribution in Asia, while educational inequality, measured by the educational Gini, has a negative effect on income distribution. Higher levels of globalisation are correlated with higher levels of income inequality, while freedom, either political or economic have marginal effects on the level of inequity in income distribution. Main point; in Asia, a higher level of schooling has contributed to improvement of income distribution, while a larger dispersion of schooling has increased income inequality.

Key words: Education inequality, globalisation, income inequality

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1. Introduction

Many scholars have focused on the economic and social effects of income distribution as an enduring topic of consequence. Many studies have analysed the relationship between income distribution and economic progress (e.g., Park, 1996b; 1998). Some have further extended their analysis to the linkage of income inequality and political violence (Park, 1986). A pioneering study by Kuznets (1955) proposed that income inequality tends to initially increase, peak and then fall as economies develop. The economic development process involves structural changes which, along with dualism, cause this progression. Urbanisation and population growth associated with the early stages of economic development initially exacerbate income inequality, but subsequent political factors and economic policies decelerate income growth of the upper income group while simultaneously promoting the situation of the lower income group. The recent rise of national income inequality has prompted inquiry into the causes of the resurgence of income inequality. Recent globalisation and cooccurring outsourcing and wage compression may have fostered a reversal of the inclining trend of balanced income distribution.

This widely-recognised inverted-U hypothesis of Kuznets has a long history as a contentious subject in economics. The academic world witnessed a surge of research on the Kuznets hypothesis in the 1970s, principally comparative empirical studies with cross-country data (Kravis, 1960; Kuznets, 1963; Ahluwalia, 1974; Robinson, 1976; Stewart, 1978; Winegarden, 1979 to name a few). When updated data on distribution of income became available later in 1990s and 2000s, there was a revival of cross-country empirical studies on the Kuznets hypothesis again (Nielsen & Alderson, 1995; Checchi, 2000; Wells, 2006).

The majority of the cross-country empirical research (Kuznets, 1963; Ahluwalia, 1974; Papanek & Kyn, 1986; De Gregorio and Lee, 2002) found evidence that supports the Kuznets hypothesis while a few studies disputed this hypothesis (Saith, 1983; Ravallion, 2004). More recent studies have proposed the 'great U-turn' hypothesis, implying that the trend again reverses further down the timeline of development for countries with very high income (Alderson & Nielsen, 2002; Ciburiene et al., 2019).

Due to the variety of classifications and types of income inequality, the concepts of income inequality that are used in the literature are clarified as follows. The concept of 'world income inequality (or global income inequality)' will rank all individuals in all countries and territories from the richest to the poorest, not taking into account their country of origin. The citizen of the world is the unit of analysis instead of countries. The next concept is 'international income inequality (or between countries income inequality)', which measures income inequality existing between countries resulting from contradistinction of their per capita GDP or per capita income. In this second concept, countries are the units of analysis rather than individuals. The final, most commonly studied inequality is 'national income inequality (or within countries income inequality)', which measures variance of income distribution within a country. Yitzhaki (1994) presented that 'global income inequality' can be formulated as the sum of international income inequality, national income inequality and the residual. The trends of these income inequalities for the period of 1820–1992 are analysed by Bourguignon & Morrisson (2002), relying on the data from 15 individual countries with copious data and 18 other regions composed of country clusters. Figure 1 shows the trends of the three different income inequalities. In our research, focus is on national income inequality, also known as within-countries income inequality.

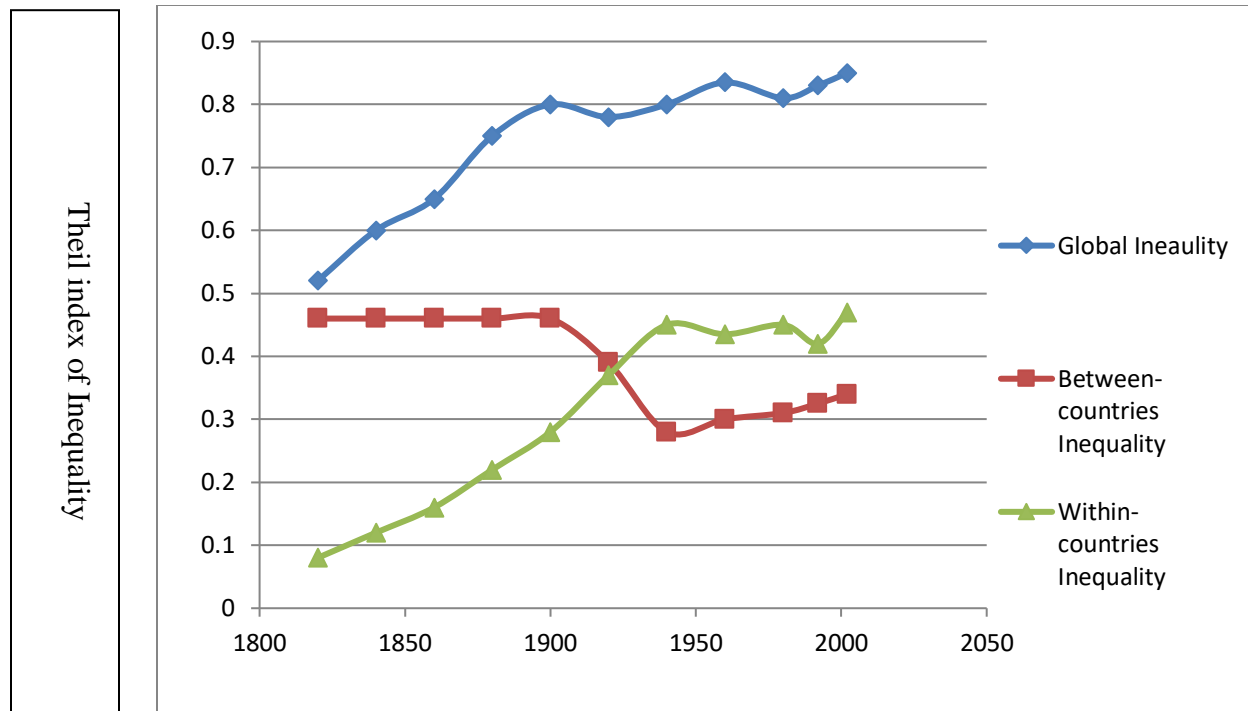


Figure 1. Three Income Inequalities by Bourguignon and Morrisson (2002)

Although this study is an extension of abundant cross-country analyses previously performed on the Kuznets hypothesis, some particulars distinguish our research from past research. First, instead of focusing on the inverted-U hypothesis itself, the importance of education variables as significant explanatory variables for income inequality is emphasised. Second, the effect of globalisation on income inequality is considered. Beginning in the 1980s, many countries have executed financial and trade liberalisation policies and the level of globalisation have been generally increasing with few exceptions. Globalisation affects income inequality both directly and indirectly by affecting education levels. Finally, the present study analyses how globalisation and education affect income inequality with a focus in the Asian and the Pacific regions.

Our research tries to more accurately define the connection between education and income inequality in the framework of an ever more globalised and integrated world economy, using expanded and recently updated data. The rest of the paper is organised as follows. Section 2 concisely reviews the relevant literature on the variables affecting income inequality, particularly on the connection between education and income inequality. The third section discusses educational attainment and educational inequality in the Asian and Pacific areas whereas Section 4 discusses income inequality in Asia and the Pacific. Section 5 presents the models of estimating the influences of education and globalisation on income inequality along with the description of data and variables applied in analysis. The regression results of the models are interpreted in Section 6. Conclusions and policy considerations are given in the final section.

2. Review of Literature

Subsequent to publication of ‘human capital theory’ by Becker (1964), several studies have considered education variables’ influence on distribution of income. As reported by Park (1996a), four different categories of education variables are commonly presented in the literature to explain their

influence on income distribution. First, a flow variable of schooling signified by institute enrolments at different levels of education is usually utilised (e.g., primary and secondary education in Ahluwalia, 1976 and secondary and tertiary education in Barro, 2000, and Alderson & Nielsen, 2002). Second, a stock variable of schooling characterised by the average or median years of schooling of the labour force or general population is utilised (Winegarden, 1979; Ram, 1984; De Gregorio & Lee, 2002).

A number of studies applied both the flow and stock variables, that is, enrolments at each level of schooling and the average years of education as the independent variables (e.g., Psacharopoulos & Tilak, 1991). The third and fourth types of education variables applied in regard to income inequality are education inequality derived from the distribution of educational attainment (Checchi, 2000) and the rate of return to education (Tilak, 1988; Gokalp, 2019). There has been a substantial amount of research that consider both the average years of schooling and education inequality as main explanatory variables (Ram, 1984; Park, 1996a; De Gregorio & Lee, 2002; Feyisayo, Kareem & Oluwasegun, 2019).

We limited our literature review to empirical research that analyse the influence of both the education level and education inequality on income inequality. Numerous findings (Tinbergen, 1972; Winegarden, 1979; Park, 1996a) indicate that more years of schooling and more balanced dispersion of schooling among the population promote improvement in income distribution. However, Ram (1984) reported contrary empirical results. Ram found that more advanced education exerts a mild balancing influence on income distribution, which corresponds with most findings. Yet, his inference that larger dispersion of schooling improves income distribution conflicts with many previous studies. Furthermore, the coefficients of the education inequality variable in his findings are not statistically significant.

Barro (2000) found different consequences of schooling on income inequality, based on the different levels of education applied in his models: An inverse relationship between primary education enrolment and income inequality, but a direct relationship between tertiary education enrolment and income inequality. Alderson & Nielsen (2002) findings indicate that income inequality has an inverse relationship with the average years of schooling in developed countries.

Other likely factors that influence income inequality have been studied by others. Li et al. (1998) concluded no connection exists between political freedom and income inequality while Li & Zou (2002) examined the effect of economic freedom on income inequality. Barro (2000) saw no evidence relating democracy to income inequality. Milanovic & Squire (2005) found the magnitude of liberal policies was inversely related with greater income equality in more impoverished countries and with less income equality in more affluent countries.

Some research concentrated on the link between globalisation and income inequality. Alderson & Nielsen (2002) focused on influences of three facets of globalisation, which are migration, North-South trade, and direct foreign investment. Heshmati (2003) finds that the Kearney globalisation index published by the Foreign Policy Magazine describes only 7-11% of the variations in income inequality. Harjes (2007) suggested that general trends associated with globalisation, such as technological changes and trade liberalisation, may not be key drivers of income inequality. Ruffin (2009) suggested that globalisation tends to improve global income inequality since poorer countries tend to benefit more from the exchange because of cheaper living costs. Seeing the heterogeneous results of the aforementioned empirical findings, our research tries to redefine the connection between education and income inequality in the framework of an ever more globalised and integrated world economy, using expanded and updated data, with focus in the Asian and Pacific areas.

3. Education Attainment and Education Inequality in Asia

Barro and Lee (2010) updated their existing panel data set of 1993 and 2001 on educational attainment for 146 countries from 1950 to 2010. This new dataset includes 31 Asian and Pacific (hereafter Asian) countries. In 1950, the Asian population aged 15 and over had an average 2.59 years of schooling, increasing steadily to 5.24 years in 1980 and 8.29 years in 2010. Compared to the world population aged 15 and over, Asian countries started at a lower level than the world average of 3.2 years in 1950, but reached at a higher level than the world average of 7.8 years in 2010. Figure 2 shows average years of schooling over time by education level, indicating steady growth in average years of schooling over time in all three levels of education, primary, secondary and tertiary.

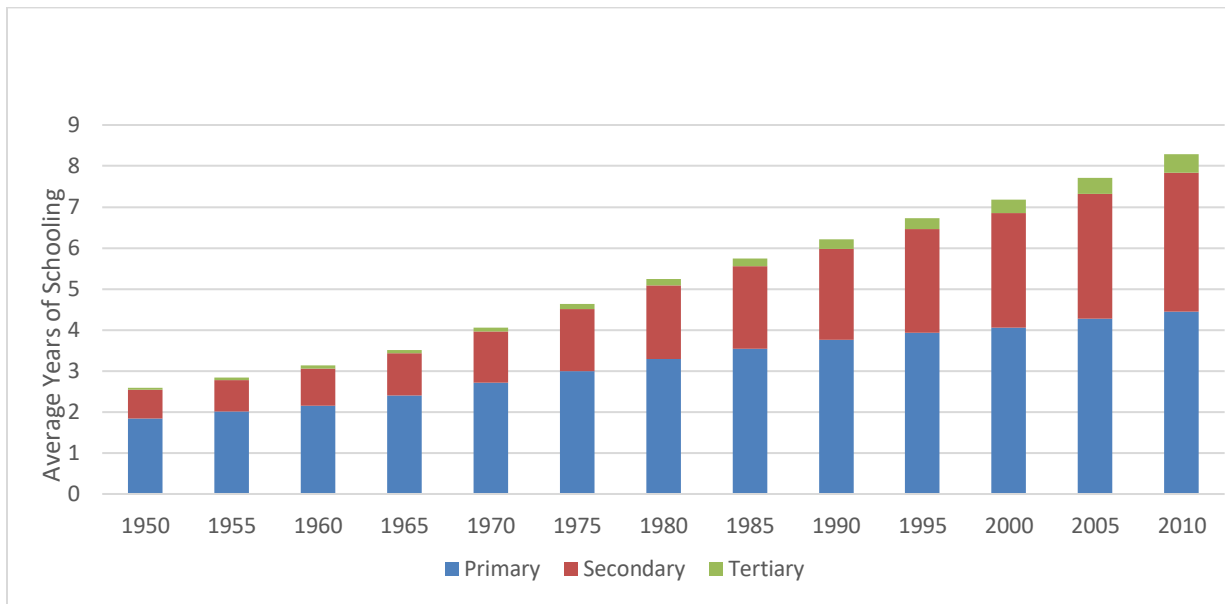


Figure 2. Average years of schooling by education level: Asia

Educational inequality can be obtained by the following education Gini formula proposed by Thomas et al. (2003) with the mutually exclusive and collectively inclusive seven categories of Barro and Lee (2010). The seven categories are non-schooling, partial primary education, complete primary education, partial secondary education, complete secondary education, partial higher education and complete higher education.

$$EDGini = 1/\mu \sum \sum p_i | y_i - y_j | p_j$$

where EDGini represents the education Gini index derived from the dispersion of educational attainment, μ is the mean years of education for the relevant population, p_i and p_j represent the proportions of population with specified levels of education, y_i and y_j are the years of education at different educational attainment levels, $n = 7$ where it indicates the number of levels/categories in education attainment data. The cross-country pattern of the distribution of education in Figure 3 shows that education Gini coefficients decline continuously as the average years of schooling increase over time.

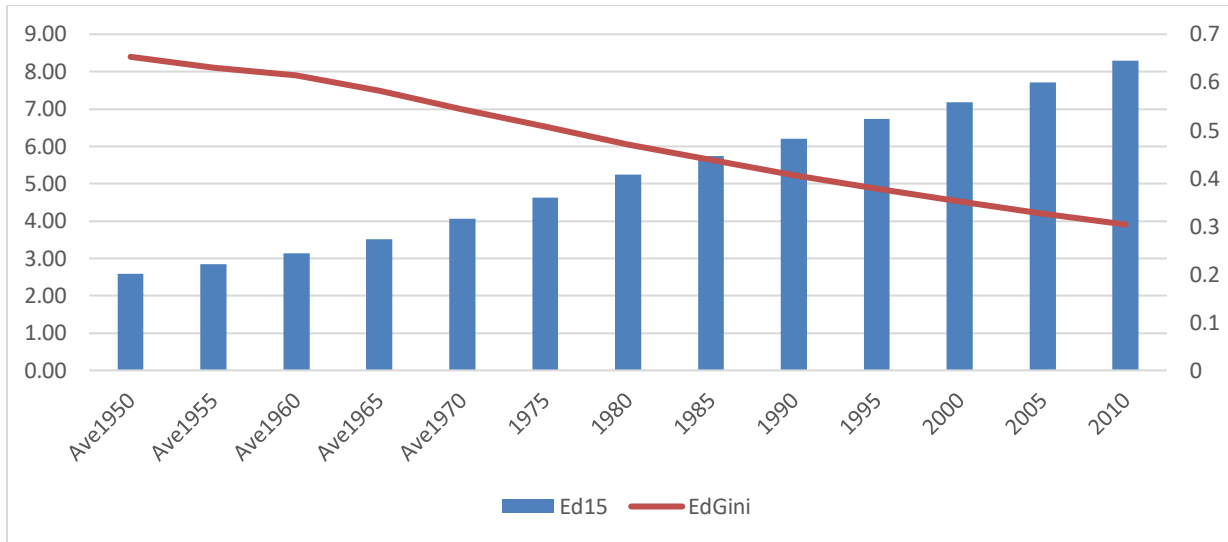


Figure 3. Average years of schooling and education inequality: Asia

This inverse relationship between educational attainment and educational inequality is confirmed not only over time (Figure 3) but also across-country in 2010 (Figure 4). The only outlier from this pattern is Cambodia.

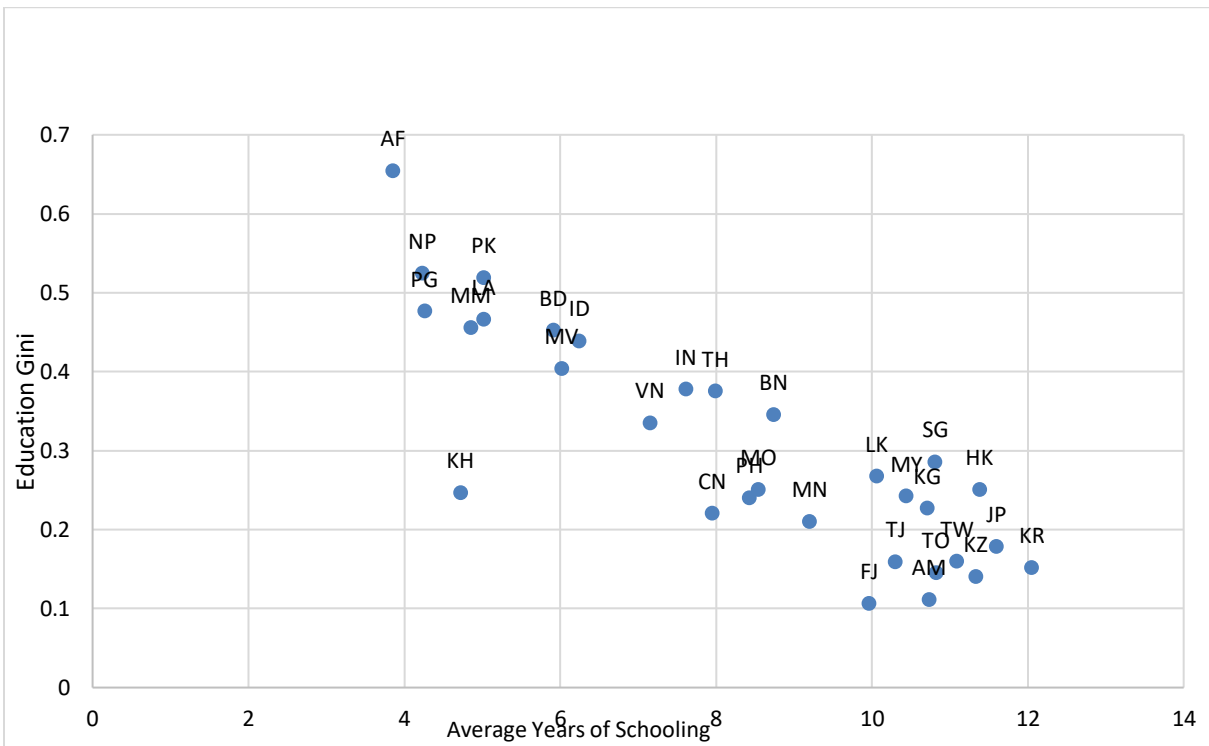


Figure 4. Education Gini and average years of Schooling, 2010

See Table 1 for country abbreviation codes.

Alternative measure of educational inequality can be calculated by the standard deviation of schooling (EDSD) by the following formula.

$$EDSD = \text{SQRT} \left[\sum p_i (y_i - \mu)^2 \right]$$

Contrary to EDGini, ESDS does not show a clear relationship, whether positive or negative, with educational attainment, as shown in Figure 5. The standard deviation of schooling seems to have no consistent pattern. Therefore, education Gini is more robust and better measure for educational inequality than the standard deviation of schooling.

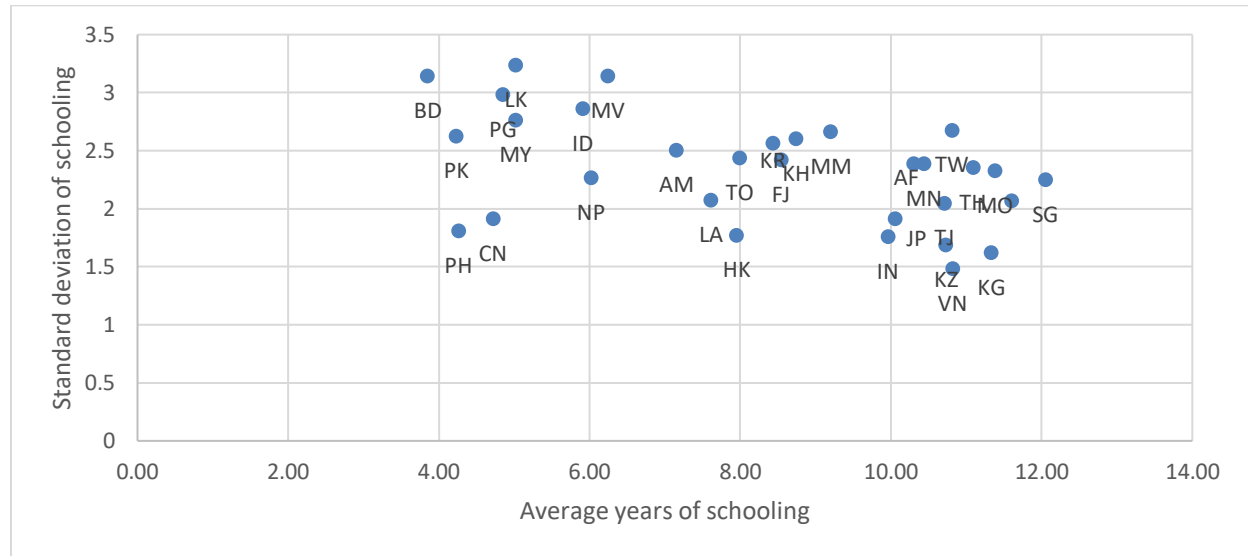


Figure 5. Average years of schooling and standard deviation, 2010

4. Income Inequality in Asia

The World Income Inequality Database (WIID) provides the most comprehensive set of income inequality statistics available for developed, developing and transition countries. The WIID3.3, released in 2015, covers 175 countries for the period of 1950–2012 for most countries. However, the dataset, being a collection of data from various sources, has missing years for many countries as well as many different observations for the same year. For example, in the case of China, seven different Gini coefficients are reported in 2010 while no observations are reported for 1954–1963, 1965, 1969, 1971 and 1976.

Table 1 shows the trend of the Gini coefficient as well as the bottom 20% share and the top 20% income share in Asian countries between the mid-1990s and around 2010. Out of the 30 countries with available data in the mid-1990s, 14 showed high-income inequality with their Gini coefficients >40, the commonly known threshold for high inequality, while ten out of the 32 countries around 2010 showed high-income inequality. A decrease in the number of countries with high-income inequality might give a spurious indication of improvement in income distribution, which would be misleading.

Table 1. Trends in income inequality in Asia

Country	Code	Mid-1990s			Around 2010			Δ Gini		
		Year	Gini	Bottom 20%	Top 20%	Year	Gini		Bottom 20%	Top 20%
Afghanistan	AF					2008	27.4	9.4	37.48	
Armenia	AM	1996	48.2	4.56	55.3	2010	36.2	5.00	45.00	-12
Azerbaijan	AZ	1996	45.8	7.98	40.98	2008	33.7	7.99	42.08	-12.1

Bangladesh	BD	1996	38.7	5.79	47.9	2010	45.8	5.22	51.79	7.1
Bhutan	BT					2012	36	7.10	43.70	
Cambodia	KH	1997	44.7	5.96	54.16	2010	36	2.80	60.47	-8.7
the PRC (China)	CN	1993	35.5	7.35	43.23	2010	48.1	6.44	39.24	12.6
Fiji	FJ	1991	46	5.1	50.1	2009	42.8	6.20	49.59	-3.2
Georgia	GE	1998	50.3	3.44	54.5	2010	43	5.38	46.90	-7.3
Hong Kong, China	HK	1996	52	3.7	56.3	2011	48.9	4.40	54.20	-3.1
India	IN	1992	32	8.8	41.1	2010	36.8	8.12	42.46	4.8
Indonesia	ID	1996	36.1	7.78	44.9	2010	38	7.15	45.47	1.9
Japan	JP	1993	24.9	10.58	35.65	2009	31.1	7.54	40.89	6.2
Kazakhstan	KZ	1996	39.4	6.68	42.33	2009	27.8	9.12	38.41	-11.6
Republic of Korea	KR	1996	32.8	5.99	38.8	2009	34.5	6.52	38.40	1.7
Kyrgyz Republic	KG	1996	48.5	3.08	54.1	2009	36.2	6.82	43.38	-12.3
Lao PDR	LA	1997	34.9	8.02	43.28	2008	36.7	7.64	44.84	1.8
Malaysia	MY	1995	48.5	4.21	55.26	2009	46.2	4.54	51.45	-2.3
Maldives	MV	1998	46.2	6.51	44.24	2010	37	7.00	43.00	-9.2
Mongolia	MN	1995	33.2	7.37	40.76	2008	36.5	7.10	44.04	3.3
Myanmar	MM					2010	30.3	11.98	31.97	
Nepal	NP	1996	38.8	7.59	46.97	2010	32.8	8.27	41.46	-6
Pakistan	PK	1996	31.2	9.45	41.09	2011	30.6	9.40	40.10	-0.6
Philippines	PH	1997	42.7	6.01	48.91	2009	44.8	5.10	51.90	2.1
Singapore	SG	1997	44.4	3.6	48.2	2010	47.2	5.08	43.99	2.8
Sri Lanka	LK	1996	46.6	5.03	53.88	2007	40.3	6.94	47.79	-6.3
Taipei, China	TW	1996	31.7	7.23	38.39	2010	34.2	6.49	40.19	2.5
Tajikistan	TJ	1999	30.4	7.67	41.58	2009	30.8	8.29	39.37	0.4
Thailand	TH	1996	42.9	5.7	50.1	2009	40.8	6.10	48.70	-2.1
Turkmenistan	TM	1993	35.8	6.7	42.76	1999	35.8	6.70	42.76	0
Uzbekistan	UZ	1993	33.3	7.28	40.74	2003	36.7	7.14	44.19	3.4
Viet Nam	VN	1998	35.4	7.38	45.46	2008	35.6	7.42	43.41	0.2

From the last column of Table 1, a majority of Asian countries, 16 out of 32 countries, actually experienced worsening income distribution. In particular, Gini coefficient of the PRC (China) jumped by 12.6 points from 35.5 in 1993 to 48.1 in 2010 while Japan's Gini coefficient jumped by 6.2 points from 24.9 in 1993 to 31.1 in 2009. Figure 6 presents all Gini coefficient estimates for the PRC collected by WIID 3.3 over the period of 1964–2013, a total of 152 estimates. A rising income inequality in the PRC over time is clearly exhibited.

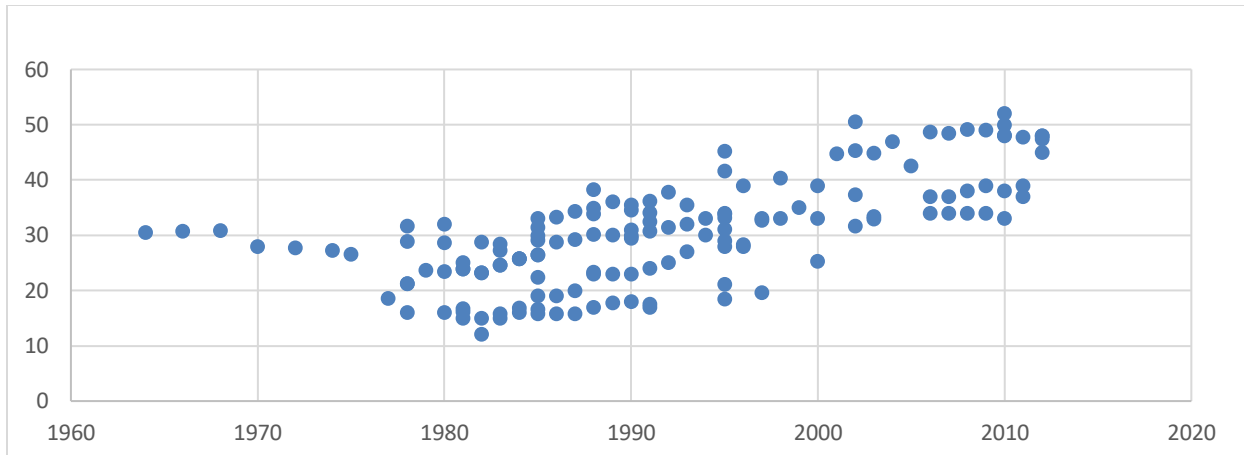


Figure 6. Gini trend in the PRC (China)

The countries that recorded an improvement in their Gini coefficients are mainly from Central Asia. They include Armenia, Azerbaijan, Georgia, Kazakhstan, and Kyrgyz Republic. When they experienced drastic changes in their social and economic structures in the process of transition from a command economy to a market economy in the 1980s and 1990s, their Gini coefficient initially surged. As their economies have stabilised and more income opportunities have become available, their Gini coefficients have also steadily declined. For example, Armenia's Gini coefficient fluctuated from 26.9 in 1986 to 48.2 in 1996 to 36.2 in 2010. Other former Soviet Union countries such as Georgia, Kazakhstan and Kyrgyz Republic, show a similar pattern. Cambodia also experienced a similar trend with its regime changes in 1975 and 1997. The trend of Gini coefficients in Kyrgyz Republic is presented in Figure 7 with a total of 47 Gini coefficient estimates between 1981 and 2009, and the graph clearly indicates the presence of the Kuznets Curve, an inverted U-curve.

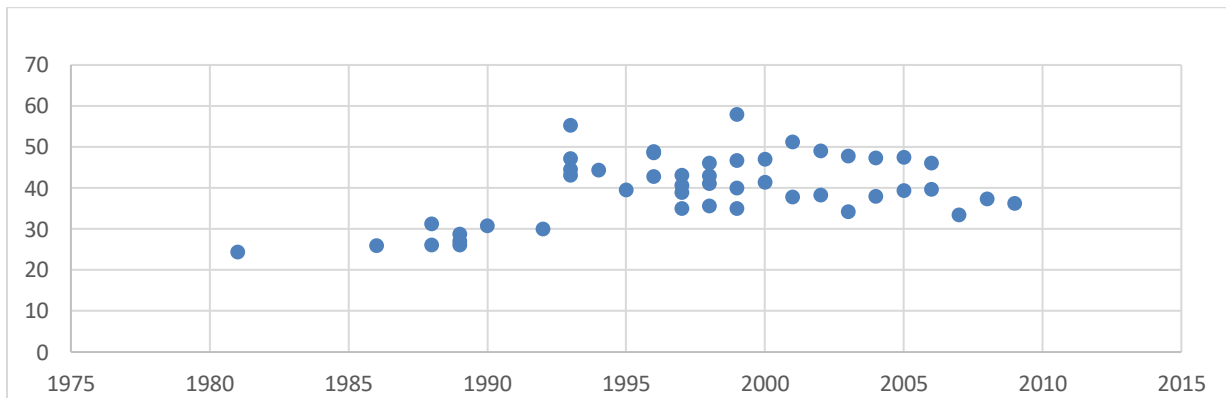


Figure 7. Gini trend in Kyrgyz Republic

Most Asian countries, except for some Central Asian countries, Cambodia and a few small countries, experienced rising income inequality. Zhang et al. (2014) pointed out technological progress, globalisation and market-oriented reform as the key driving factors. These factors helped rapid growth of developing Asian countries in the past two decades. However, they also had negative consequences in income distribution in the region. Technological progress combined with capital intensive technology tends to favour skilled labour over unskilled labour, increasing skill premiums and causing income inequality. Globalisation could favour particular regions (e.g., coastline over inland in the PRC) or

particular industries (the industries with comparative advantage), thus causing more income inequality. On the other hand, the Stolper and Samuelson theorem and ‘growth with equity’ experiences in the Republic of Korea, Taipei, China and Singapore suggest improvement in income distribution. Therefore, whether globalisation has a positive or negative effect on income distribution in the Asia and Pacific areas will be empirically tested in this study.

Compared with OECD countries, Asia’s income inequality is higher by 5.46 points on average. The average Gini coefficient of Asia’s 32 countries around 2010 is 37.46, as shown in Figure 8 while the average Gini coefficient of 34 OECD countries is 32, as shown in Figure 9. While changes in the Gini coefficients in the OECD countries over time tend to be mild, many Asian countries experienced drastic surges or drops in their Gini coefficients between 1990s and 2010.

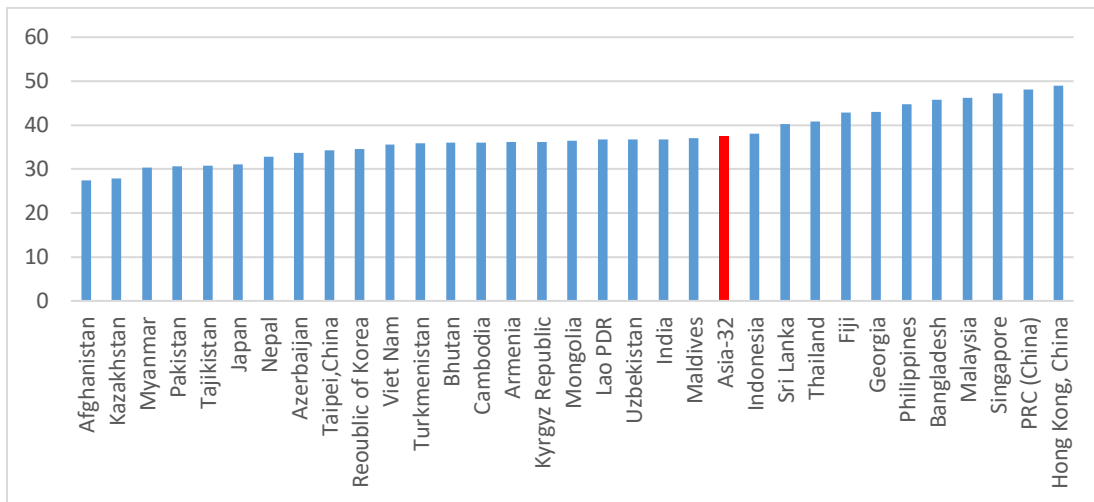


Figure 8. Asia Gini coefficients, 2010

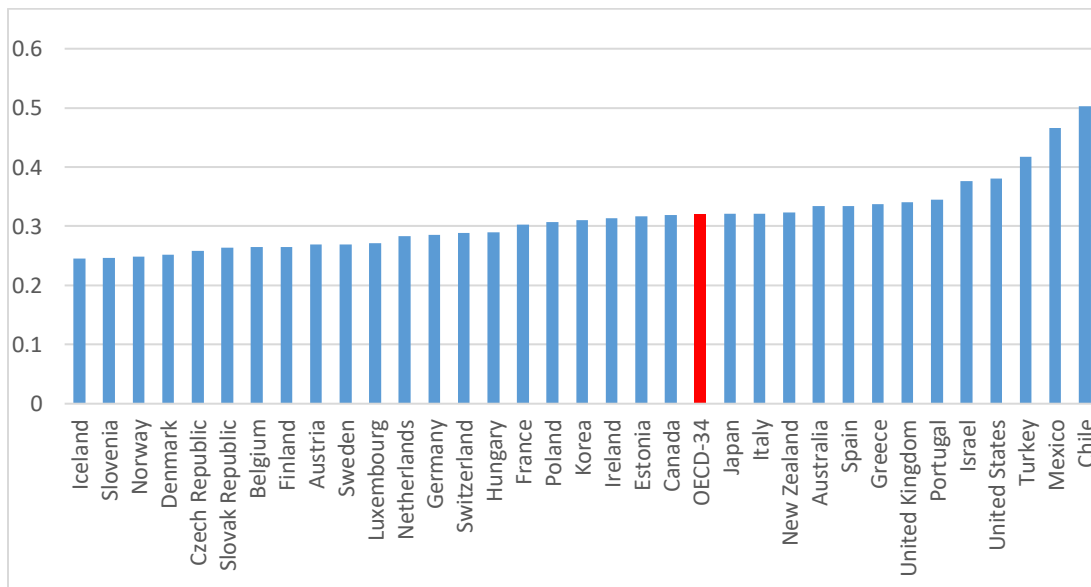


Figure 9. OECD Gini coefficients, 2011

5. Model and Variables

There are different ways to structure models to formulate the Kuznets inverted-U hypothesis. A characteristic model that numerous authors (Park, 1996a for one) have utilised may be presented as follows.

$$\text{Gini} = a_0 + a_1 \ln Y + a_2 (\ln Y)^2 + u \quad (1)$$

where Gini is the Gini index, an indication of income inequality, $\ln Y$ is shorthand for the logarithm of income of per capita GDP, which generally represents the level of economic development, and u is the residual. We expect a positive sign for a_1 while a negative sign is predicted for a_2 .

Several other independent variables that have been incorporated into cross-sectional studies are included along with the income variables to better analyse income inequality. Two education variables are added to the model on the basis of human capital theory as follows.

$$\text{Gini} = b_0 + b_1 \ln Y + b_2 (\ln Y)^2 + b_3 \text{ED} + b_4 \text{EDGini} + u \quad (2)$$

where ED represents the level of schooling or educational attainment and EDGini stands for the dispersion of schooling or educational attainment.

The human capital theory proposes that the income level of an individual is determined by years of education and the rate of return to education. The human capital model as expressed by De Gregorio & Lee (2002) is given below.

$$\ln Y_s = \ln Y_0 + \sum \ln (1+r_i) + \varepsilon \quad (3)$$

where Y_s is the income level with s years of schooling, r_i is the rate of return to the i th year of schooling, \sum is summation form $l = 1$ to s years, and ε is the residual. Equation (3) can be approximated as $\ln Y_s = \ln Y_0 + r S + \varepsilon$. After taking variance transformation on both sides, the reformulated equation is shown below.

$$\text{Var} (\ln Y_s) = r^2 \text{Var} (S) + S_\mu^2 \text{Var} (r) + 2 r S_\mu \text{Cov} (r,S) + \text{Var} (\varepsilon) \quad (4)$$

where S_μ is the average schooling years.

This formula obviously states the existence of a direct correlation between education inequality and income inequality. However, the years of schooling have an inconclusive influence on income inequality. If the level of education (s) and the rate of return (r) are independent, an increase in the years of schooling will make income inequality to rise. Yet, if the covariance between the years of schooling (s) and the rate of return (r) is negative, a rise in the average years of schooling can diminish income inequality. Hence, the sign of b_3 is ambiguous while a positive sign is predicted for b_4 . A country's globalisation level and its degree of freedom, either political or economic, may influence distribution of income, especially in the progressively integrated and globalised world. Relevant significant control variables are added to equation (2) as shown below.

$$\text{Gini} = c_0 + c_1 \ln Y + c_2 (\ln Y)^2 + c_3 \text{ED} + c_4 \text{EDGini} +$$

$$c_5 \text{FREEDOM} + c_6 \text{GLOBAL} + u \quad (5)$$

where FREEDOM represents either a country's degree of economic freedom or degree of political freedom, and GLOBAL indicates the degree of globalisation of a country.

There are various measures of income inequality and Park (1984) compared their similarities and differences. The well-known and widely used measure of income inequality is the Gini coefficient. The WIID 3.3 by UNU-WIDER (2015) has the most extensive data collection on the Gini coefficient, covering a

large number of countries in the world for a long period of time. In addition, the income shares of the top 20% of the population (TOP20), and the income share of the bottom 40% of the population (BOTTOM40) is utilised as alternative measures of the income inequality variable. As proxy variable for the income level (or economic development), the logarithm of per capita GDP is used and the data are from the World Bank's World Development Indicators (WDI). One education variable, the mean years of schooling (ED), is acquired from the new dataset of educational attainment in the world 1950–2010 by Barro and Lee (2010) and the second education variable, the dispersion of schooling (EDGini), is calculated by the author according to the formula given in section 3, using Barro and Lee (2010) data. Two different measures of freedom are used to estimate the variable FREEDOM. First, economic freedom of a country is determined by the degree of freedom of businesses and individuals from government restrictions on their economic activities. How well legal and institutional systems are structured to preserve economic freedom that is also considered. Since 1994, the index of economic freedom has been annually published by the Heritage Foundation. Its publication, *Economic Freedom*, rates countries in the world based on 50 independent variables that are organised into ten broad categories of economic freedom.

Second, political freedom is a fundamental factor of democracy. A country's political freedom is rated by estimating the degree people are unrestricted in the areas of political rights and civil rights. Beginning in 1978, the index of political freedom has been annually published by the Freedom House; a New York based non-profit organisation that monitors political rights and civil liberties around the world. Its publication, *Freedom in the World*, lists country rankings by the level of political freedom derived from their data on such rights and liberties.

Among the various indices to indicate the level of globalisation of individual nations, the KOF globalisation index is utilised as a proxy variable for globalisation. This index is available for 208 countries for the period 1970–2016 and most suitable for our research because it covers many countries for a long period of time. The KOF globalisation index is based on economic, political and cultural integration of a country to the world and the degree of personal contact across national borders. The metrics for economic integration include convergence of domestic and international prices, movements of goods and services and outward and inward directed foreign investment as well as portfolio capital flows. On the other hand, the metrics for the degree of personal contact across national borders include international travel, memberships in international organisations, cross-border remittances, internet users and servers and international phone calls.

6. Results

The data for income inequality are obtained from WIID 3.3. Despite the improvements of WIID data over time, some observations of the Gini index are missing in the dataset. In some instances, there exist discrepancies in estimates for the same country in the same year. A possible method to analyse such data with many missing observations is to do an unbalanced panel data analysis. Therefore, the unbalanced panel data analysis, with 1990, 2000 and 2010 data, is done in this study. The sample size is inevitably reduced due to many missing observations of the Gini index. To eliminate possibility of reverse causality, we used lagged independent variables. Whereas 1990, 2000 and 2010 data points are used for independent variables, the dependent variables, Gini, TOP20 and BOTTOM40, are from data of a few years later (at least 2-3 years) than 1990, 2000 and 2010, respectively.

Table 2 shows the regression results of estimating equation (1). The empirical results supported the Kuznets hypothesis. We observe an inverse U-shaped curve relationship for Gini and TOP20, while BOTTOM40 exhibits a U-shaped curve relationship. We obtained the predicted signs for all coefficients, and most of them are significant statistically at the 5% level, regardless of whether Gini, TOP20 or

BOTTOM40 are used as the dependent variable. Due to the nature of the panel data, the sizes of the adjusted R² statistic tend to be small.

Table 2. Regression of income inequality on income

	GINI	TOP 20%	BOTTOM 40%
Constant	-22.78 (31.65)	-11.57 (12.63)	32.49 (25.18)
ln Y	23.29** (10.08)	18.82** (7.87)	-10.62** (3.75)
(ln Y) ²	-2.14** (0.81)	-1.66** (0.74)	1.19** (0.57)
N	78	78	78
Adj. R ²	0.264	0.329	0.243

The first entry for each predictor is the coefficient estimate, and the second in parentheses is the standard error of the coefficient estimate. *Indicates significance at the 10% level and ** at the 5% level.

Table 3 shows the regression results of estimating equation (2) with two more variables added. These two added explanatory variables are the mean years of schooling and dispersion of schooling (or inequality in education). The mean years of schooling of the labour force (ED) is used as a proxy variable for the educational attainment level. As a proxy variable for the dispersion of educational attainment, EDGini is calculated by the author from Barro and Lee (2010) data of educational attainment.

The regression results of Table 3 with inclusion of these additional education variables, ED and EDGini, are quite different from the results of Table 2. First, inclusion of the additional variables raised the adjusted R² statistic, thus contributing to improvement in the explanatory power of the model. Second, both education variables have significant effects on income inequality while the magnitude and significance of the income variables declined as can be seen from smaller and less significant coefficients of both ln Y and (ln Y)². A negative and significant coefficient of ED on Gini and TOP20 indicates that a higher level of schooling reduces overall income inequality (lower Gini index and less TOP 20% income share) while a positive and significant coefficient of ED on BOTTOM40 indicates that a higher level of schooling improves income share of the poor (more BOTTOM 40% income share). On the other hand, a positive effect of EDGini on GINI and TOP20 and a negative effect of EDGini on BOTTOM40 indicate that the larger the dispersion of schooling, the more unequal the distribution of income.

Table 3. Regression of income inequality on income and education variables

	GINI	TOP 20%	BOTTOM 40%
Constant	14.85 (22.75)	4.36 (7.27)	22.73 (30.34)
ln Y	14.68* (8.02)	13.90* (7.71)	-6.14 (4.68)
(ln Y) ²	-1.32 (1.67)	-1.05 (0.81)	0.64 (0.42)
ED	-2.39** (0.67)	-1.47** (0.59)	1.02** (0.43)
EDGini	6.18** (1.98)	5.97** (2.17)	-3.92** (1.64)
N	72	72	72
Adj. R ²	0.397	0.425	0.353

The first entry for each predictor is the coefficient estimate, and the second in parentheses is the standard error of the coefficient estimate. *Indicates significance at the 10% level and ** at the 5% level.

Table 4 shows the regression results of estimating equation (5), which includes two control variables in addition to two income variables and two education variables. These two control variables signify a country's the degree of freedom and the degree of globalisation. To measure a country's freedom, the economic freedom index published by the Heritage Foundation as well as the political freedom index published by the Freedom House is utilised. To measure the effect of globalisation of a country on its income inequality, the KOF globalisation index is utilised. A moderate improvement in the adjusted R² statistic, the explanatory power of the model is obtained. The significance of the two education variables remains unchanged while the two income variables become less significant, though they exhibit predicted signs.

Economic freedom, though not significant, is positively related to income inequality. Our results do not provide meaningful association between political freedom and income inequality. This study also confirms that some variations in income inequality can be explained by globalisation, sustaining the great U-turn hypothesis proposed by Alderson and Nielson (2002). Hence, the longitudinal tendency toward rising income inequality may be partially explained by globalisation trends. Globalisation may influence income inequality through technical changes favouring highly educated and skilled workers with bias against unskilled worker, causing wider wage differentials.

Table 4. Regression of income inequality on income, education and globalisation

	GINI	TOP 20%	BOTTOM 40%
Constant	10.56 (12.84)	3.28 (5.26)	16.34 (10.74)
ln Y	13.21 (7.68)	12.63* (7.14)	-4.26 (2.94)
(ln Y) ²	-1.55 (1.17)	-1.13 (0.72)	0.73 (0.58)
ED	-1.72* (0.96)	-2.17** (0.66)	0.98** (0.44)
EDGini	5.94** (2.37)	6.94** (1.13)	-4.76** (1.91)
ln ECONOMIC FREEDOM INDEX	1.73 (2.05)	2.184 (2.12)	-1.31* (0.71)
POLITICAL FREEDOM RATING	-0.15 (0.29)	0.28 (0.63)	-0.09 (0.11)
ln GLOBALISATION INDEX	2.95** (1.13)	3.01** (0.97)	-1.01* (0.54)
N	69	69	69
Adj. R ²	0.445	0.489	0.394

The first entry for each predictor is the coefficient estimate, and the second in parentheses is the standard error of the coefficient estimate. *Indicates significance at the 10% level and ** at the 5% level.

7. Discussion and Conclusion

Education has been a crucial factor in economic and social policies because of education's potential to promote economic and social progress for the individual as well as the country as a whole. Historically, education as human capital investment and its effect on economic growth have been major subjects of concern for scholars as well as policy makers. Finally, the importance of establishing the relationship between education and income and between education and income distribution has gained prominence.

In our paper, we deliver evidence on how the education level and education inequality influence income inequality in the Asian and Pacific areas, based on the panel data of 1990, 2000 and 2010. Results from the panel data analysis indicate that a higher level of schooling of the population has reduced income inequality while a greater dispersion of schooling among the population has increased income inequality. We support the presence of the inverted-U curve when only the income variables are included in the mode as independent variables. Then again, the effect of the income variables becomes weaker and statistically less significant when two additional educational variables, specifically the average years of

schooling and the dispersion of schooling, are incorporated into the model.

We also studied the consequences of freedom and globalisation on income distribution. Our analysis demonstrates that an increasing degree of globalisation results in increasing inequality in income distribution. However, freedom, either political or economic, has only limited impacts on distribution of income. With the adjusted R^2 ranging between 0.4 and 0.5, a substantial part of changes in income inequality across countries still remain unexplained. To identify additional determinants of income inequality, further study is warranted.

This study offers policy implications on how to improve income distribution. The chief finding of this study is that education plays a significant role in reducing income inequality. If a government plans to improve distribution of income, it is suggested that government policy makers focus on education policies that promote educational expansion while affording individuals with equal and greater access to educational opportunities. Educational expansion with less dispersion of schooling is also identified by Park (1998) as a major factor contributing to economic growth. Government policy makers need to monitor the dispersion of educational attainment because education expansion under certain circumstances may produce an increase in education inequality.

At the same time, as changes in educational attainment and dispersion of schooling take longer time, this indirect and long-term education policy needs to be supplemented by a more direct and short-term government policy focusing on progressive income tax structure and transfer benefits to the poor. Some argue that redistributive policies have a tendency to have a negative impact on economic growth. However, equitable distribution may not necessarily be detrimental to economic growth as Japan, Taiwan and Korea represent a few cases of achieving both equity and economic growth with their emphasis on education in their economic development process. Equity and growth can be achieved by an optimal mix of long-term education policies and short-term redistributive government policies.

This study also confirms an important role played by globalisation in determining income inequality. The difficulty in establishing relationships comes from the complexity of globalisation measurements. The globalisation index is comprised numerous elements of globalisation such as movements of goods and service, inward and outward foreign direct investment as well as portfolio capital flows, convergence of domestic and international prices and international travel. To discover which elements, play important roles in determining income inequality, further research on different components of globalisation would be required.

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