

Determinants of Human Capital Inequality: Generalized Method of Moments (GMM)

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Abstract: This paper examine determinants of human capital inequality in developed and developing Countries using Gini coefficient as a proxy to human capital inequality. This paper use a few variables such as average years of education, public expenditure on education, life expectancy, fertility rate and emigration rate by difference skill using dynamic panel data two-Step System Generalized Method of Moment (GMM) for 92countries over the period of 1965-2015. The empirical results show that, the past of human capital inequality, average years of education have a significance effect on human capital inequality in the world, developing and developed at 1 and 5 percent level. However, the public expenditure on education, total emigration rate, emigration by medium skill only significant in the world. For emigration rate by high skill only significant in developed countries. For life expectancy, only developed and developing countries have a significance effect on human capital inequality at 10 percent level. Other variable such as life expectancy is insignificant on human capital inequality at any level in the world, developing and developed countries.

Key words: Human capital inequality • Generalized Method of Moments

INTRODUCTION

The persistent and increasing income inequalities in most of developing and developed countries since 1980's until now have been giving negative effect to the economy. Theoretically, the relationship between human capital inequality and income inequality are positively correlated [1,2]. In examining the ability of the human capital inequality to explain the differences of income inequality across countries will naturally raise questions on the determinants of human capital inequality. Equalizing human capital through education is widely recognized as the main way for social advancement and better life chances. In a perspective of equality of opportunity, human capital should be equally distributed in the population. Thus, the reducing in human capital is an important to achieve equality of distribution in human capital and indirectly reduce income inequality. This is also parallel with Millennium Development Goal (MDG) to reduce human capital

inequality on a global scale and provide a benchmark for educational standard (MDG, 2009). In addition, most of developing and developed countries try to achieve equality in human capital in 21st century. But, in the literature, a large body of empirical research points to the persistence of inequality in human capital across countries [3,4].

There are many determinants lead to inequality in human capital as reported by researcher in previous studies¹. In part of determinants two sided driving forces influencing human capital inequality. One side is describing the household behaviour (average of education and the past inequality) in education as the demand of education and other side is government provision for education and skilled of migration in the labour market as a supply of education. For demand of education, average years of education and past human capital inequality is proxy past educational inequality one of the factors influencing distribution in human capital inequality. Most of previous studies found negative

¹ For example gender inequality (Stromquist; [5], Buchmann *et.al*; [6] and UNESCO; [7] disability Carrier [8], Peters [9] social class [10], Jonsson *et.al*. [11], Persell [12] and Stromquist [13]. Other studies have reported other factors which influenced human capital inequality such as the effect of political economy, natural disasters, poverty, privatization, race or ethnicity, religion, language, corruption, trade and globalization.

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relationship between average years of education with its inequality and positive relationship between the past human capital inequality with its inequality. In discussing the supply side of education, nowadays increased the flows of migration from developing to developed countries have attracted of researchers in investigating the effect of migration on growth, development as well as inequality. Beine *et al.* [14] and Vidal, [15] found that migration prospects have a positive and significant impact on human capital formation especially for countries with low initial GDP per capita levels in cross-section of 37 and 57 developing countries. However, the study of the effect migration on inequality in term of human capital inequality is less given attention by researcher. In Mexico, McKenzie and Rapoport [5] investigated how migration affects human capital inequality. The results show that migration reduces human capital inequality. This is an important issue, as the literature on inequality has gone beyond looking at the distribution of outcomes. It is also supported by Massey *et al* [5], migration is the latter 'crucial determinants of outcomes' such as income, wealth and human capital. It is also important issue because inequality is an outcome of interest in its own right and the effects of migration on human capital inequality should be addressed to achieve equality in human capital as well as reduce income inequality in the future. Besides that, the effectiveness of allocation resources by government provision for public expenditure education should be also addressed in affecting human capital inequality across countries. This is one of important factors in supply side must be investigated. This issue need to be addressed because the equality of opportunity is a key development in achieve equality of human capital and there is also lack of studies about the effectiveness public expenditure in reducing human capital inequality in literature. From this issue, we can conclude that, can demand of education and supply of education as we discussed in this section affecting in inequality in human capital for most countries especially developed and developing countries?

The objective of this paper is to examine the determinants of human capital inequality in developing and developed countries such as the past of human capital inequality, average years of education, migration by skill and education, public expenditure and other significant control variables such as life expectancy and fertility rate. The importance of detecting the significant determinants of human capital inequality is to achieve equality in human capital and reduce income inequality. It

is because human capital inequality has been a positive effect to income inequality. If human capital inequality can be reduced this will indirectly lead to decrease in income inequality. The main contribution of this paper over previous empirical literature is in a number of important aspects. First, this paper computed and extended data set of human capital inequality for two periods (2005-2010) using Human capital Gini for developing and developed countries based on the latest dataset from Barro and Lee (updated in 2010). Recently, Castello and Domenech [16] computed the human capital Gini for the period 1960 to 2000, using Thomas *et al* model [17] and Barro and Lee dataset (2000). Thus, this paper produce the results of the study from larger sample and longer periods. Second, this paper employs the Generalized Method of Moments (GMM) using system GMM two-step as proposed by Arrelano and Bond [18] for broad panel data in developing and developed countries which is different from previous studies that used OLS estimator, SUR Technique and others methods.

The rest of the paper is organized as follows. Section 2 reviews the related literatures. Section 3 explains the empirical model, method estimation and data used in the analysis, while Section 4 reports and discusses the econometric results. The final section concludes and synthesizes the whole study.

A Brief Literature Review: In previous studies, many researchers have identified factors which lead to inequalities in human capital. In Stromquist [13], Buchmann *et al.* [19] and UNESCO [13] they found inequality in gender as one of the main factors in contributing to human capital inequality, where gender referring to inequality between males and females in relation to educational attainment, access to higher education and compounded with the disparities of minority ethnic status. While Carrier [9] and Peters (2003) reported the disability has influenced in human capital inequality. It can be defined as a term that encompasses physical, mental, emotional and spiritual disadvantages. Jonsson *et.al.* [20], Persell (1977) and Stromquist [17] all find that social class also influenced human capital inequality. In Rambla (2006) social class inequality is underpinned by several heterogeneous factors. Social inequality emerges from the unequal distribution of resources, which is biased against groups of individuals. This type of inequality is much more difficult to dislodge if the groups of individuals cannot develop their basic capabilities due to their disadvantaged position [12].

Other studies have reported that, there are other factors which could influenced human capital inequality such as the effect of globalization and political economy (Stronguist; 2005, Hawkins; 2007) natural disasters (Gitter and Barham2007; Skoufias 2003), neoliberalism (Apple 2001, 2005; Colclough 1996; Hershock *et al*, 2007), poverty (Narayan 2000; Reimers 2000), privatization (Belfield and Levin 2002; Geo-JaJa 2004; Torche2005), race or ethnicity (Ogbu 1988; Persell, *et al*, 2004; Phalet, *et al*, 2007), religion (Driessen 2002; Mehrotra & Panchamukhi2006) and language [12,13]. Besides the determinants as described above, the public provision of education has been commonly perceived as egalitarian and viewed as a vehicle to achieve equity goals in the economy. The relationship between public spending on education and inequality has been examined in a number of research studies, most of which have focused on primary, secondary, or all levels of educational spending, rather than spending on higher education specifically. Sylwester [21] studied in the cross-sectional the role of public expenditure on education to inequality. He found that public educational spending and income inequality are positively related. Checchi [22] found that government expenditures on education were positively associated with income inequality in the most developed countries such as the United States. Besides examining the effect of public expenditure on education, McKenzie and Rapoport, [5] examined the effect of migration on human capital inequality in rural Mexico. The results showed that migration reduced human capital inequality especially for girls, by perversely reducing schooling at the top of the human capital distribution. As a conclusion is that no single factor can ultimately explain the local, regional, or national disparities associated with the inequalities of education. Besides that, this study also includes the effect of emigration by skill (low, medium high) workers, fertility rate and life expectancy on human capital inequality. The results shown that, these effects are negatively with human capital inequality [16,23].

Empirical Model for Determinants of Human Capital Inequality: To analyse the determinant of human capital inequality in the world, developed and developing countries, this study use a few variables such as average years of education, previous of human capital inequality, emigration rate by skill, public expenditure on education and included life expectancy and fertility rate as control variables. The data set will use unbalanced panel data which is dynamic panel data System GMM set of 92

countries from 1965 to 2010. The empirical model can be specified as follows:

$$\ln HCgini_{j,t} = \beta_0 + \beta_1 \ln HCgini_{j,t-1} + \beta_2 \ln Pub_{j,t} + \beta_3 \ln Ayrs_{j,t} + \beta_4 \ln Expect_{j,t} + \beta_5 \ln Fert_{j,t} + \beta_6 \ln Tot_emig_{j,t} + \beta_7 \ln Low_emig_{j,t} + \beta_8 \ln Medium_emig_{j,t} + \beta_9 \ln High_emig_{j,t} + \beta_{10} Dummy_{j,t} + \epsilon_{j,t}$$

where HCgini is human capital inequality using gini coefficient (human capital Gini), Ayrs is average years of education for the population of 25 age and over, pub is public expenditure on education, Expect is life expectancy, Fert is fertility rate, Tot_emig is referred to total of emigration rate, Low_emig is emigration rate by low skill, Medium_emigration rate by medium skill and high_emig is emigration rate by high skill. Lastly $\epsilon_{j,t}$ is Error term and j, i represents index countries and periods.

Methods of Estimation: To estimate the model specification for determinants of human capital inequality in 92 countries with T=11, this paper uses dynamic panel data procedure Generalized Method of Moments (GMM). The reason of using GMM is to allow the identification of country-specific effects, control the unobserved effects by first-difference data and control the potential endogeneity of all the explanatory variables and controls for a simultaneity bias caused by the possibility that some of the explanatory variables may be endogenous. To consistency of the GMM estimator, this paper also test the validity of the moment conditions by using the conventional test of over identifying restrictions proposed by Sargan [24] and Hansen [25] and testing the null hypothesis that the error term is not second order serially correlated of the difference in equation. Furthermore, we test the validity of the additional moment conditions associated with the level equation with the difference Hansen test. Besides that, AR (1) and AR (2) are tested to evaluate the validity of appropriate instrumentation (Arellano and Bond, [18], Blundell and Bond, [26]). The purpose to test AR is to determine the error term serial correlation, as far as the assumption of nonexistence serial correlation of $\epsilon_{j,t}$. It is important for the consistency for the estimators. If $\epsilon_{j,t}$ is not serially correlated, there should exist negative series correlation (AR (1)) for the first stage and there is no proof of serial correlation in the second stage (AR (2)).

Data Description and Sources: This paper used several main variables and control variables as control variables to the problem of omitted variables. This paper used

Human capital Gini coefficient as a dependent variable using from two sources. For periods 2005 and 2010, we extended and computed human capital Gini based on average years of education of the population aged 25-64. The average year of education is taken from Barro and Lee data set updated in 2010 and we used model suggested by Thomas *et al.* [17]. However, for periods 1970-2000, we used Castello and Domenech dataset [16]. They were used in the computed human capital Gini used Barro and Lee Dataset (2000) and computed using the same model from Thomas *et al.* [17]. This paper also included the effect of emigration rate by skill (low, medium and high skill). The emigration data is extracted in Docquier and Marfouk (2010). This paper also included public expenditure on education and average years of education. These data are taken from UNESCO (2009) and World Development Indicator [27]. One of the control variables is life expectancy. The fertility rate was obtained from World Bank [27] and another control variable used in the analysis is life expectancy. This data is taken from UNESCO [27]. All variables covering 10 periods starting years 1965-2010.

Empirical Result: STATA 13.0 software is used to estimate the determinants of human capital inequality in developed and developing countries for periods 1965-2015 using system Generalized Method of Moment (GMM) with twosteps. Table 1 contained results of regressions for most countries in the world, developing and developed countries. We found a strong significant effect of one-year lagged human capital inequality ($\ln HC_{gini,t-1}$) on the current human capital inequality in the world, developing and developed countries at 1 percent level with coefficient is 0.839, 0.792 and 0.838 respectively. For average years of education ($\ln yrs$), we found a constant negative relationship between average years of education and human capital inequality ($\ln HC_{gini}$) and statistically significant at 1 percent in the world (-0.272), 5 percent in developed and developing countries with coefficient -0.450 and -0.173. Considering others factors on the demand side education fertility rate ($\ln fertility$) there is an insignificant on human capital inequality at any level in most countries in the world, developed and developing countries. For life expectancy, only developed and developing countries have a significance effect on human capital inequality at 10 percent level.

On the supply side of education, we found negative and significant relationship between public spending on education ($\ln pubspen$) and human capital inequality only in the world with coefficient -0.122 at 5 per cent level.

Table 1: Determinants of human capital inequality on income inequality in the world Developed and developing countries (1965-2015).

	World	Developed	Developing
Dependent Variable ($\ln HC_{gini}$)			
$\ln HC_{gini}$	0.839*** (0.0498)	0.792*** (0.117)	0.838*** (0.0460)
$\ln yrs$	-0.272*** (0.0477)	-0.450* (0.209)	-0.173* (0.0862)
$\ln pub$	-0.122* (0.0540)	0.0729 (0.162)	0.0469 (0.0616)
$\ln lifeexpect$	0.0126 (0.00981)	0.0114** (0.00358)	0.00648** (0.00232)
$\ln fertility$	0.0281 (0.0231)	-0.0435 (0.0613)	0.00777 (0.0127)
$\ln tot_emig$	0.308*** (0.0619)	0.275* (0.131)	0.0541** (0.0614)
$\ln low_emig$	-0.157*** (0.0333)	-0.112* (0.0497)	-1.221 (1.151)
$\ln medium_emig$	-0.0595* (0.0260)	-0.0524 (0.0653)	-0.00820 (0.0330)
$\ln high_emig$	-0.102*** (0.0261)	-0.113* (0.0443)	-0.0347** (0.0127)
_cons	0.124 (0.154)	0.495* (0.226)	0.0936 (0.300)
N	724	215	521
No of countr	92	27	66
AR(1)	0.001	0.003	0.000
AR(2)	0.155	0.334	0.577
Sargan Test	0.000	0.035	0.061
Hansen Test	0.487	1.000	0.071

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

For emigration rate effect, we found the total of emigration rate ($\ln tot_emig$) are influencing human capital inequality with positive sign at 1 percent significant level in the world with coefficient 0.308, 5 per cent level in developed (0.275) and 10 percent in developing countries (0.0541) in Table 1. After including the effect of emigration rate by skill level, we only found emigration rate by low skill ($\ln low_emig$) affecting human capital inequality in the world and developed countries with 1 per cent and 5 per cent level significant. However, we also found emigration rate by high skill ($\ln high_emig$) is significant in most countries, developed and developing countries at 1 per cent, 5 percent and 10 percent level significant respectively. For emigration rate by medium skill ($\ln medium_emig$), we only found significant effect in the world on human capital inequality. Finally, based on the AR (2) in table 1, the result found that no error term serial correlation in the second stage, while Hansen Test proves that the instrument used in this model is a valid instrument. Both tests AR (2) and Hansen Test do not reject the null hypothesis for full sample (world), developed and developing countries.

CONCLUSION

Based on results as discussed in this paper, the successful policies to address inequality in human capital have approached both supply side and demand side should be taken and considered. From the empirical results, we found negative relationship between average years of education with human capital inequality in case of developed and developing countries, an increase of educational attainment (average years of education) in the current generation will persuade higher educational attainment in future generation. At the same time, a reduction in the degree of inequality in human capital in the current generation will boost greater equality in educational attainment in the next generation. Hence it is important to increase educational attainment (average years of education and decrease the level of inequality in human capital due to a long-lasting impact on future generation. Enhancing higher educational attainment (average number of years of schooling) will influence greater equality in educational attainment (human capital). So government of developing countries should be abating the population without education and enhancing population with primary education is the first stage for increasing equality attainment. In a case of developed countries, reducing population with primary education and inducing people with secondary and tertiary education will improve greater equality in educational attainment. The allocation and effectiveness the public expenditure one of important part if each country to equalize the distribution of human capital. As we know, many previous studies have been providing ample evidence that such bias is ultimately a political decision. Hence, to achieve equalizing in human capital around the world the issue of political should be avoided and the public provision of education must be accessed at all national level in a country by agencies and donors. It is because concentrating public spending on primary and lower secondary education at all level around the world will improve the distribution of human capital in a country. By improving public expenditure on education, it will lead to influence human well-being and economic growth and reduce inequality in the world.

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