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The Impact of Gender Equality on Education Inequality: A Global Analysis Based on GMM Dynamic Panel Estimation

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ABSTRACT

Gender and education inequalities are a widespread phenomenon. This study investigates the impact of gender equality and its sub-indices on education inequality using panel data of 103 countries, over the period 2006–2014. Results reveal, by employing the System Generalize Method of Moment (Sys-GMM) estimation method, gender equality and its sub-indices of gender equality; health and survival, economic participation and opportunity and political empowerment gender equality exert a significant negative effect on education inequality, indicating that higher gender equality between males and females results in lower education inequality. GDP per capita, schooling and democracy have a negative and significant effect on education inequality. Conversely, unemployment, population density and dependency have a positive and significant impact on education distribution. Finally, the result implies that higher gender equality is the primary pathway to lower education inequality or achieving greater fairness in education access.

Keywords: Gender equality, education inequality, GMM panel

JEL Classification: J16, I24, C510

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INTRODUCTION

Equal access to education is one of the basic human rights to which all are entitled. Disparities in education have declined across regions. However, despite some progress the education inequality is still pervasive in many regions. Empirical studies – typically exemplified by Tembon and Fort (2008), Prasartpornsirichoke and Takahashi (2012), Ibourk and Amaghouss (2012) and Agrawal (2014) – show that large inequalities in distribution of education has prevailed across and, importantly, within countries. Figure 1 depicts the education inequality of different regions. Regions, for example, Sub-Sahara Africa, South Asia, the Middle East and North Africa are the most unequally education distributed regions. Whereas Europe and Central Asia followed by East Asia and the Pacific are generally more equally education distributed regions. Similarly, by income, the advanced countries display more equal education distribution. Developing countries, on the other hand, show low education equality. Nevertheless, no region has been fully successful in equal education distribution.

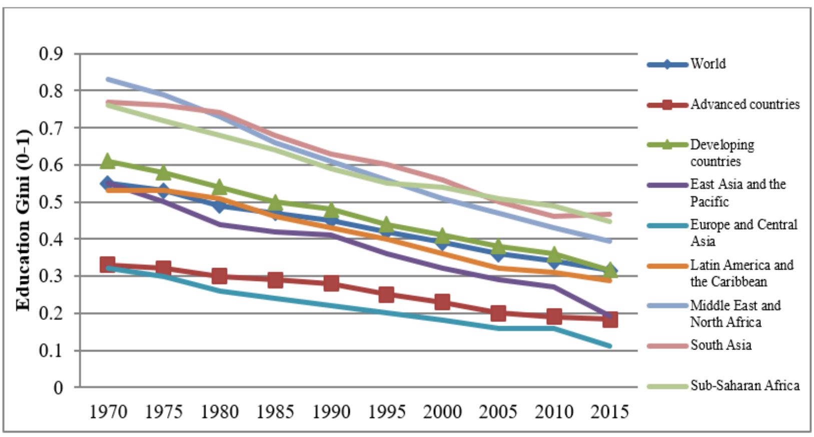

Figure 1. Education Inequality (Gini) by Region (Population Aged 15 and Above) (Source: Author's calculations based on Barro-Lee Data (2015)).

This widened inequality in education in both developed and developing countries has captured the attention of many researchers. In recent years, motivated by the availability of new data sets and fast growing literature concerning education inequality, there has been renewed interest among the academics in understanding the determinants of education distribution. Existing researches recognize the critical role played by gender gap and suggest that gender gap is key determinant of education distribution. The literature for instance Thomas *et al.*, (2001), Zhang and Li (2002), Senadza (2012) and Digdowiseiso (2010) underline that gender gap is one of the major factors affecting the degree of education distribution. The gender gap has narrowed in many developed and developing countries, especially in education and health.[1] However, overall gender disparity persists in many regions.

[1] Enhancing women's education and health does not decipher into empowerment if women do not have gender rights, freedom from domestic violence and domestic unpaid drudgery or lower paid jobs, the same economic opportunities and political rights as men (UN Millennium Project, 2005).

Despite the abundance of research on education inequality, with few exceptions its relationship with gender equality remains underexplored and there is scant literature on relationship of gender equality with education inequality. Gender equality is a multidimensional phenomenon. However, the main limitation of previous literatures regarding gender equality (see e.g. Thomas *et al*., (2001), Zhang and Li (2002), Senadza (2012) and Digdowiseiso (2010)) is that most empirical work on gender equality uses a unidimensional perspective for instance gender equality in education (usually measured by the difference between female illiteracy rate and male illiteracy rate)[2] impact on education inequality, ignoring the other dimensions of gender equality (such as health and survival, economic participation and opportunity, and political empowerment) effects on education inequality. Yet, literacy may not be sufficient measure of the quality and adequacy of the literacy level needed for people working in the community. Because many countries prefer 'basic education' educational attainment as a proxy instead of literacy rate for education level (Terryn 2003). Basic education includes 9 or even 12 years of schooling.[3]

Hence, the effect of gender equality on education inequality is evidently important. Thus this study is motivated by lack of literature on the issues of the impact of gender equality on education inequality and the availability of new data sets, to understand the effect of gender equality on education inequality. This study investigates the effect of gender equality on education inequality focusing on the multidimensional nature of overall gender equality: gender equality in educational attainment, health and survival, economic participation and opportunity, and political empowerment using latest data.

The main contribution of this study over previous empirical literature is in a number of important aspects. This paper studies gender equality as a multidimensional concept. To the best of our knowledge, evidence only exists on the effect of education dimension of gender inequality on education inequality. Unlike the majority of the previous studies, this study covers the four different aspects of gender equality including (a) economic participation and opportunity (b) educational attainment (c) health and survival (d) political empowerment gender equality and their effects on education inequality in order to test the robustness of the results and provide further evidence on the issue. Another contribution of this paper is, in contrast to others, this study measures education gender equality as ratio of female literacy rate, net primary, secondary, and gross tertiary enrolment over male value. Finally, in contrast to the previous studies, this paper contributes to literature using latest data set of gender equality and it its sub-indices.

BRIEF LITERATURE REVIEW

One can argue from the literature review survey previous studies on the impact of gender equality on education inequality that gender education is perhaps the most important determinant of education inequality. The most significant of these were the Thomas, Wang, and Fan (2001) pioneer work that employ the education Gini dataset for population age over

[2] Literacy rate defined as "the percentage of the population who can both read and write with understanding a short simple statement on everyday life" (United Nations, 2003).

[3] See https://www.unicef.org/specialsession/about/sgreport-pdf/sgrep_adapt_part2b_eng.pdf

fifteen, for 85 countries from 1960 to 1990 to survey the correlation between gender gap and education inequality. They find that gender inequality measured by the difference between female illiteracy rate and male illiteracy rate are evidently associated to the inequality of education. The bigger the difference between female illiteracy rate and male illiteracy, the larger the gender inequality and over time and the impact of gender inequality on education inequality have become stronger. The results indicate that while educational inequality has been declining, gender inequality accounts for much of the remaining inequality in education. However, the study fails to consider the other dimensions of gender inequality. Another weakness is that the gender inequality is measured by the difference between female illiteracy rate and male illiteracy rate.

Interestingly enough, the other researches also do not take into account the other dimensions of gender gap other than educational attainment, such as economic participation and opportunity, health and survival, and political empowerment. An empirical analysis of the Rodríguez-Pose and Tselios (2011) provide regional determinants of educational inequality across regions of the EU. Using the European Community Household Panel dataset for 102 regions over the period 1995–2000, the results show a negative relationship between women's access to work and education inequality. Similarly, Senadza (2012) examined the relationship between the gender inequality in education (measured as the difference of average years of schooling of male and female) and the education inequality in Ghana. The results show a positive and statistically significant link between gender inequality and education inequality. However, these results were based upon data of average years of schooling of male and female.

A recently published article by Digdowiseiso (2010) investigate and compare the pattern of Gini coefficient of education among areas and gender, using the educational attainment data from National Social Economic Survey (SUSENAS) of Indonesia between 1999 and 2005 in 23 provinces. The study finds there is a positive association between education inequality and the gender gap (measured as the difference of illiteracy rate of male and female) and over time, the relationship between education inequality and gender gaps becomes stronger. The findings also show that female population has higher education inequality than male population over time and there is a negative correlation between Gini coefficient education and average years of schooling. However, Digdowiseiso analysis does not take account of the primary, secondary and tertiary education data nor does she examine the economic participation and opportunity, health and survival, and political empowerment gender equality effect on education inequality.

Filmer (1999) analysis results revealed that the degree of the female disadvantage in education varies enormously across countries. While gender gaps are large in a subset of countries, wealth gaps are large in almost all the countries studied. The education of adult females has a larger impact on the enrolment of girls than that of boys. Zhang and Li, (2002) find despite the increasing trend in educational attainment, the gap in educational attainment between the developing countries and developed countries and that between males and females increased in the period 1960 to 1990. However, the relative dispersion of educational attainment, as measured by the coefficient of variation, the Gini coefficient, or the standard deviation of log average years of schooling, declined consistently during the period by either development or gender status. Decompositions of the Gini coefficient indicate that the development gap and the gender gap were the main components for world inequality in educational attainment.

In an important research, Tomul (2011) found the level of education of men was higher than that of women. Recently Trabelsi (2013) results show educational inequality is higher for women than for men despite the increase of the educational attainment level. Unlike the articles mentioned above, Harttgen, *et al*. (2010) result reveal that the level of access to education and of educational outcomes are considerably higher for boys than for girls. Ozturk (2001) point out that the distribution of education matters. Educating girls and women help women work outside the home. It creates a multitude of positive remunerations for families including better family health and nutrition, improved birth spacing, lower infant and child mortality, and enhanced educational attainment of children, health and nutrition.

It has also been argued that the greater degree of gender gaps increases fertility rates and higher fertility rates do worsen material wellbeing, education, and health outcomes. Higher fertility will result in lower labour productivity and these do worsen material wellbeing, education, and health outcomes (Fielding and Torres, 2009). Lee and Mason (2010) argue countries with lower fertility are spending more on human capital per child. The decline in fertility may also have beneficial effects though allowing greater investment in child health and education (Bloom, *et al*. 2009). On another note, a study by Tabassum, Rahman and Jahan (2011), revealed that there exist a significant gender inequality in quality of work life among workers in Bangladesh. Such inequality could affect workers in terms of performance and productivity.

On the other hand Stephan Klasen (2000) analysis shows that gender inequality in education and access to resources prevents progress in reducing fertility. Monstad, Propper, and Salvanes (2008) conclude that declining fertility is attributed to the increased education of women. Female education may well contribute to per capita income growth by reducing fertility and hence population growth (Klasen, 2002). The decline in fertility associated with greater gender equality can have profound economic impacts (Ward, *et al*. 2010).

Despite the abundance of research on this topic, its relationship with gender equality remains underexplored and there is scant literature on the relationship between multidirectional gender equality and education inequality. A more comprehensive study would include all the dimensions of gender equality. Thus, the present study takes a step toward filling this gap and attempt to understand and explain by exploring the effect gender equality on education inequality focusing on the multidimensional nature of gender equality.

METHODOLOGY

Econometric model

To estimate the effect gender equality on education inequality the estimation model takes the following form:

$$Educineq_{it} = \alpha Educineq_{it-1} + \beta_1 Gen_{it} + \beta_2 LSch_{it} + \beta_3 LGDPC_{it} + \beta_4 LFer_{it} + \beta_5 Unemp_{it} + \beta_6 LPop_{it} + \beta_7 LDep_{it} + \beta_8 LDem_{it} + \mu_i + u_{it}$$

$$i = 1, \ldots, 103 \text{ and } t = 1, \ldots, 9 \qquad (1)$$

where subscript *i* and *t* are the country and time index, respectively, Educineq is the educational inequality, $Educineq_{i,t-1}$ is the lag of educational inequality; Gen is gender equality index; Sch is average years of schooling; GDPC the GDP per capita; Fer is fertility rate; Unemp is the unemployment rate; Pop is population density; Dep is dependency ratio and Dem is democracy index. μ_i is unobserved country-specific effect term and u_{it} is the error term, while α and β are the parameters to be estimated. The variables GDP per capita, schooling, fertility rate, population density, dependency ratio and democracy are transformed into natural logarithms.

Variable selection

Based on the standard empirical literatures and education inequality models the determinants of education inequality are included in our model. The model includes education inequality, gender equality index, GDP per capita, average years of schooling, fertility rate, unemployment rate, population density, dependency ratio and democracy.

Following previous literature for example Thomas *et al*., (2001), we use education inequality (measured as the education Gini coefficient), calculated based on the distribution of the years of schooling of persons aged 15 years and above.

Education inequality (Gini coefficient) has been computed in different ways, however, this study follows Castello and Domenech, (2002) data to compute education inequality (Gini coefficient) using Barro and Lee data set of average schooling years and attainment levels. Barro and Lee data set provides four levels of education such as no education, primary, secondary and higher education. Castello and Domenech, (2002) proposed the following formula to compute education inequality (Gini coefficient) as:

$$G^h = \frac{1}{2\overline{H}} \sum_{i=0}^{3} \sum_{j=0}^{3} \left| \hat{x}_i - \hat{x}_j \right| n_i n_j \quad \text{(i)}$$

where H denotes average schooling years of the population aged 15 years and above, i and j represent the different levels of education, ni and nj are the shares of population with a given level of education, and $\hat{x}_i$ and $\hat{x}_j$ are the cumulative average schooling years of each educational level such as follows:

$$\hat{x}_0 = x_0 = 0, \quad \hat{x}1 = x_1, \quad \hat{x}_2 = x_1 + x_2, \quad \hat{x}_3 = x_1 + x_2 + x_3 \quad \text{(ii)}$$

From equation (i) and (ii) the education inequality Gini coefficient can be expressed as follows:

$$G^h = n_0 \frac{n_1 x_2 (n_2 + n_3) + n_3 x_3 (n_1 + n_2)}{n_1 x_1 + n_2 (x_1 + x2) + n_3 (x_1 + x_2 + x_3)} \quad \text{(iii)}$$

Where

$x_0 = 0$,

x_1 = average years of primary schooling in the total population divided by the percentage of the population with at least primary education,

x_2 = average years of secondary schooling in the total population divided by the percentage of the population with at least secondary education,

x_3 = average years of higher schooling in the total population divided by the percentage of the population with at least higher,

n_0 = the percentage population with no education,

n_1 = the percentage in the population with primary education,

n_2 = measures the percentage in the population with secondary education, and

n_3 = the percentage in the population with higher education.

The constructed the education inequality Gini index data are obtained from Barro and Lee (2013) data set.[4]

Several gender-related indices have been proposed to measure the gender inequalities. [5]his study uses global gender gap index proposed by Lopez-claros and Zahidi (2005) of World Economic Forum. This study utilises the global gender gap index data due to the availability of annual data since 2006 and the coverage of countries. It is based on fourteen different variables that relate to four fundamental dimensions: educational attainment, health and survival, economic participation and opportunity and political empowerment. Educational attainment gender equality index is the composite female-to-male ratio for education levels, including literacy rate, primary, secondary and tertiary education enrolment rates. Health and survival gender equality index is measured as the female-to-male ratio at birth and healthy life expectancy. Economic participation and opportunity gender equality index is measured as the composite female-to-male ratio for labour force participation, wage for similar work, estimated earned income, legislators, senior officials and managers, professional and technical workers. Lastly, political empowerment gender equality index is the composite female-to-male ratio of seats in parliament, at ministerial level and number of years of head of state (last 50 years). The global gender gap index also ranges from 0, which indicates that women and men are unequal, to 1, which indicates that women and men are equal in all measured dimensions. This dataset has been widely used in literature.[6]

Economic development is one of the key control variables of education inequality. We also include control variables in the estimation. Several studies confirmed that increases in per capita income reduce education inequality therefore; we include the GDP per capita in our model to account for the impact of income and development on education inequality.

Schooling has been frequently used in the literature as a determinant of education inequality. Following Thomas *et al*., (2001), schooling is measured as the average year of education attainment.

One of the control variables is fertility rate. A strong positive relationship exists between the education inequality and fertility rates (Bloom *et al*., 2004; Lin, 2007). In contrast, Checchi

[4] Education inequality Gini coefficient ranges from 0 (complete equality) to 1(complete inequality).

[5] The Gender-Related Development Index (GDI) and the Gender Empowerment Measure (GEM) were the first global gender indices introduced in UNDP Human Development Report 1995 (UNDP, 1995) and in more recently proposed Gender Inequality Index (GII). GII measures three dimensions of gender inequality including labour market (labour force participation), empowerment (educational attainment and national parliamentary representation) and reproductive health (maternal mortality ratio and adolescent fertility rates). It ranges from 0 (no inequality in the included dimensions) to 1 (complete inequality) (UNDP, 2010). Another gender indices to measure the gender equality proposed by Social Watch (2005) Gender Equity Index (GEI), combining three dimensions of gender equality: empowerment, education and economic activity . Branisa et al. (2014) proposed Social Institutions and Gender Index (SIGI), using the Organisation for Economic Co-operation and Development (OECD) Centre's Gender, Institutions and Development (GID) Database. SIGI is new measures of social institutions related to gender inequality, and a related composite index. The SIGI is composed of five dimensions that are measured by five sub-indices: family code, civil liberties, physical integrity, son preference, and ownership rights.

[6] The global gender gap index data has been described and used in a series of papers, including (Jütting *et al*., 2006, 2008, Branisa, Klasen and Ziegler, 2010, 2013; Klasen and Schüler, 2011; Permanyer, 2013; Wyndow, Li and Mattes, 2013; Branisa *et al*., 2014; Samarakoon and Parinduri, 2015; Baloch *et al*., 2016).

(2006) argue fertility rate is negatively associated to educational inequality. Bigger number of family member increase better education distribution due to supportive effect among family members. Fertility rate is measured as the fertility rate, total (births per woman).

Population density is also associated to education distribution. Higher population density tends to increases the number of schools, opening the possibility for individuals to reach higher educational levels (Boucekkine, Peeters, and Croix, 2007). Conversely, high population density can certainly have negative effects on education through increased population pressures on scarce resources. Therefore, the effect of population density is ambiguous. Population density is high in urban areas and it perpetuates urbanization and it is highly correlated with urbanization. It may therefore be proxy for both density and urbanization variables. Population density is measures as people living in per sq. km of land area.

We control for unemployment rates that tend to be usually inversely related to education (Becker, 1993) and positively associated with educational inequality. Increases in unemployment and inactivity aggravate the relative position of low income and low-educated groups (Rodríguez-Pose and Tselios, 2011). Unemployment is measured as total unemployment share of total labour force. Another control variable used is democracy. Democracy variable has been frequently used in the education inequality literatures and has been found to effect education inequality (Eicher, García-Pẽalosa, and Ypersele, 2009; Rodríguez-Pose and Tselios, 2011).

Dependency increases with high aging population and fertility rate. Increasing aging population and presence of young children, and the number of children, who rely more on income of their families, increase the dependency burden on working age group. Higher dependency ratio lead to an increased burden on those of working age to provide for the social expenditure required by the children (aged under 15) and the older (aged 65+) persons for a range of related services. Dependency is measured as age dependency ratio share of working-age population.

Data

This study assesses the issue for 103 developed and developing countries, over the period of 2006–2014, on the basis of data availability. The data offers good coverage of the geographic regions. The list of countries included in the analyses is provided in appendix A. The data used in the study was obtained from various sources. Education inequality and schooling data are obtained from the Barro and Lee (2013) data set. Gender equality index and its sub-indices date collected World Economic Forum (WEF). The data for democracy polity IV data set Polity IV Data Set of (Marshall, Gurr and Jaggers, 2015). The rest of the variables data are drawn from the World Development Indicators (WDI) of World Bank.

Empirical methodology

To capture the impact of gender equality on education inequality, this study employs the System Generalized Method of Moments (system-GMM) panel estimators developed for dynamic models designed to short, and wide panel data, proposed by Arellano and Bover, (1995) and Blundell and Bond, (1998). System-GMM is the extension of difference GMM proposed by Hansen, (1982) and Holtz-Eakin, Newey, and Rosen, (1988) and later extended by Arellano and Bond, (1991). System GMM estimator is an efficient estimator of the coefficient in empirical panel data which allows obtaining robust and consistent results.

Consider the following model:

$$y_{it} = \delta y_{i,t-1} + \beta x'_{it} + u_{it} \tag{2}$$

$$u_{it} = \mu_i + v_{it} \tag{3}$$

Where δ is scalar, x'_{it} is 1 x K and β is K x 1. The u_{it} is white noise random disturbance. The error term u_{it} is decomposed into μ_i and v_{it} where μ_i is the individual-specific effect (that captures the individual heterogeneity) and v_{it} is the disturbance and μ_i and v_{it} are not correlated.

Arellano and Bond (1991) propose transforming Eq. (2) into first-differences to eliminate country-specific effects as follows:

$$y_{it} - y_{i,t-1} = \delta(y_{t-1} - y_{i,t-2}) + \beta(x_{it} - x_{i,t-1})' + (v_{it} - v_{i,t-1}) \tag{4}$$

The unobserved effect, μ_i, has been "differenced away."

The transformed specification recommends an instrumental factors approach. Toward this end they assume that $y_{i,t-2}$ is correlated with $y_{i,t-1} - y_{i,t-2}$, but not with $\Delta v_{it} = v_{it} - v_{i,t-1}$ under the assumption of no autocorrelation in the level residuals.

$$E[y_{i,t}\, v_{it}) = 0 \qquad t = 2, \ldots, T,\ i = 1, \ldots, N \tag{5}$$

Arellano and Bond (1991) suggest the following extended list of instruments for the first-differenced equations that are available as instruments.

$$E[y_{i,t-s}\, \Delta v_{it}) = 0 \qquad t = 3, \ldots, T,\ i = 1, \ldots, N \text{ and } s \geq 2, \tag{6}$$

The regressor, on account of multivariate analysis, can be used as additional instruments. For strictly exogenous variables $x_{i,t}$, past as well as future values are valid instruments. On account of reverse causality, $x_{i,t}$ is weakly exogenous or predetermined. At that point the lagged values of $x_{i,t}$ are appropriate as valid instruments. This offers the following moment conditions. In the case that x_it's are strictly exogenous the moment conditions are:

$$E[x_{i,t-s}\, \Delta v_{it})=0 \qquad t = 3, \ldots, T,\ i = 1, \ldots, N \text{ and all } s \tag{7}$$

and if the explanatory variables, x_(i,t), are predetermined the moment conditions are:

$$E[x_{i,t-s}\, \Delta v_{it} = 0 \qquad t = 3, \ldots, T,\ i = 1, \ldots, N \text{ and } s \geq 2, \tag{8}$$

Blundell and Bond (1998) proposed System GMM estimator, an alternative to the first-differenced GMM estimator of Arellano and Bond, (1991) to eliminate the shortcoming of the standard GMM estimator. Blundell and Bond (1998) show that the GMM estimator proposed by Arellano and Bond, (1991) is inefficient when instruments are weak and in autoregressive models first-differenced GMM estimator may be subject to a large downward finite sample bias.

Blundell and Bond (1998) showed that the lagged differences of the dependent variable, in addition to the lagged differences of the explanatory variables, are proper instruments for the regression in the level equation as long as the initial conditions, $y_{i.1}$, satisfy the stationary restriction, $E(\Delta y_{i.2}\, v_i) = 0$. Thus, when both $\Delta x_{i.t}$ and $\Delta y_{i.t}$ are uncorrelated with v_i, both lagged differences of explanatory variables, $\Delta x_{i.t-r}$ and lagged differences of dependent variable, $\Delta y i.t-r$, are valid instruments for the equations in levels. Furthermore, Blundell and Bond (1998) show that the moment conditions defined for the first-differenced equation can be combined with the moment conditions defined for the level equation to estimate a system GMM. When the explanatory variable is treated as endogenous, the GMM system estimator utilises the following moment conditions:

$$E[(y_{i,t-s} .(v_{i,t} + v_{i,t-1})] = 0 \qquad E[(x_{i,t-s} .(v_{i,t} + v_{i,t-1}] = 0 \tag{9}$$

Where s ≥ 2; and t= 3, …, T,

Moment conditions for the levels are set as follows:

$$E[(y_{i,t-s} - y_{i,t-s-1})(\mu_i + v_{it}) = 0 \,; \qquad E[(x_{i,t-s} - x_{i,t-s-1})(\mu_i + v_{it}) = 0 \tag{10}$$

Where s ≥1 ; and t =3, …, T.

This estimator combines the T −2 equations in differences with the T −2 equations in levels into a single system. It uses the lagged levels of dependent and independent variables as instruments for the difference equation and the lagged differences of dependent and independent variables as instruments for the level equation.

System GMM estimator is designed to control for unobserved country-specific effects and account for the potential endogeneity of explanatory variables. The empirical results suggest that gender equality, schooling, GDP per capita, democracy, fertility rate and unemployment are likely to be endogenous as higher education inequality may affect gender equality, education, GDP per capita, democracy, fertility rate and employment and current education distribution is dynamically related to past education inequality (see e.g., Dollar and Gatti, 1999; Hill and King, 1995; Jung and Sunde, 2014; Shin, 2012; Thomas *et al*., 2001).The GMM estimate controls for endogeneity by using the lagged values of the levels of the endogenous and the predetermined variables as instruments. System GMM estimator avoids poor instruments problem by introducing additional moment conditions. Another advantage that system-GMM theoretically has is that it is less biased in small samples. Further, we consider two-step system-GMM method because the two-step estimation procedure leads to more accurate inference with finite sample variance. Windmeijer (2005) finds that the errors of the two-step efficient system-GMM estimator are downward biased, which requires a correction. In the same vein two-step estimation is more efficient under the general conditions with lower bias coefficients and standard errors.

EMPIRICAL RESULTS

This section presents the empirical results of the impact of gender equality on education inequality. The overall gender equality (Gen) represents four different dimensions of gender equality; that serves as independent variable therefore, this study analyses the model into two-step: first the impact of overall gender equality (Gen) impact on education inequality is analysed and in the second step the effect of each sub-index of gender equality (Gen); educational attainment, health and survival, economic participation and opportunity, and political empowerment, impact on education inequality are analysed separately. The motivation is to show whether the sub-indices of gender equality yields qualitatively similar results to that of the overall gender equality. There are statistical limitations to use all sub-indices of gender equality in a single regression model as the strong correlation among sub-indices may create a risk of multicollinearity. Thus we use the sub-indices of gender equality separately and Gen in Eq. (1) alternates with the four sub-indices of gender equality in the second step.

The descriptive statistics and correlation coefficients matrix for the variables are presented in Table 1. Table 1 provides the means, standard deviations, minimum and maximum values and observations and correlation coefficients matrix. All of the variables are negatively correlated with the education inequality except GDP per capita, fertility rate and dependency ratio. The correlation between overall gender equality and sub-indices of overall gender equality are positive and high except health and survival gender equality, suggesting that the educational attainment, economic participation and opportunity, and political empowerment are more important for gender equality. Other than fertility rate, population density and dependency ratio all variables are positively correlated with gender equality and its indices, however, GDP per capita is negatively correlated with health and survival gender equality and political empowerment is positively correlated with population density and negatively correlated with unemployment. GDP per capita and schooling display a positive correlation with all variables other than fertility rate and dependency ratio. Finally, schooling ranks highest correlation with education inequality.

Table 2 reports the result of overall gender equality on the education inequality. The lagged dependent variable ("education inequality" $_{t-1}$) is statistically significant at 1 percent, suggesting that the dynamic system GMM is an appropriate estimator. The empirical results indicate that overall gender equality exert a significant and negative effect on education inequality, suggesting that equality between male and female results a lower education inequality. In terms of other control variables, the schooling has a negative and significant impact on education inequality. While the unemployment rate, population density and dependency ratio have positive and significant effect on education inequality. However, GDP per capita, fertility rate and democracy have statistically insignificant coefficients.

We found diagnostic tests for the validity of instrumental variables, the Hansen over-identifying restrictions tests and difference-in-Hansen C tests are not statistically significant at the 5 percent level, which suggest that instruments used in the model are appropriate and the estimated models are adequately specified. The Arellano and Bond (1991) first order (AR(1)) and second order (AR(2)) serial autocorrelation tests reveals absence of second order serial autocorrelation. Thus, diagnostics test confirmed that the estimated models are valid, adequately specified and consistent.

Table 1 Summary statistics and correlation (annual data: 2006–2014; N=103; total observations (723))

Variable		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Mean		0.132	0.684	0.959	0.972	0.630	0.172	8.546	2.138	0.843	7.951	4.266	3.976	1.941
Std. Dev.		0.138	0.060	0.074	0.009	0.119	0.126	1.544	0.318	0.443	5.508	1.448	0.268	0.572
Min		0.001	0.451	0.513	0.926	0.195	0.008	5.162	0.611	0.116	0.1	0.498	2.792	0
Max		0.732	0.873	1	0.98	0.878	0.754	11.143	2.580	1.944	37.6	8.953	4.683	2.302
Observations		927	925	925	925	925	925	912	927	924	927	927	927	822
Number of countries (N)		103	103	103	103	103	103	102	103	103	103	103	103	96
Number of time periods (T)		9	8.980	8.980	8.980	8.980	8.980	8.941	9	8	9	9	9	8.562
Education inequality	(1)	1.000												
Over all gender equality	(2)	-0.223	1.000											
Education attainment gender equality	(3)	-0.255	0.689	1.000										
Health and survival gender equality	(4)	-0.183	0.298	0.374	1.000									
Economic participation and opportunity gender equality	(5)	-0.160	0.785	0.451	0.243	1.000								
Political empowerment gender equality	(6)	-0.103	0.735	0.234	0.035	0.284	1.000							
GDP per capita	(7)	0.026	0.204	0.188	-0.016	0.152	0.133	1.000						
Schooling	(8)	-0.910	0.252	0.203	0.076	0.187	0.177	0.029	1.000					
Fertility	(9)	0.033	-0.191	-0.245	-0.059	-0.195	-0.026	-0.647	-0.059	1.000				
Unemployment	(10)	-0.133	0.056	0.152	0.025	0.017	-0.008	0.019	0.081	-0.072	1.000			
Population density	(11)	-0.176	-0.125	-0.096	-0.166	-0.193	0.009	0.066	0.188	-0.151	-0.211	1.000		
Dependency	(12)	0.227	-0.341	-0.602	-0.222	-0.185	-0.076	-0.222	-0.248	0.324	0.025	-0.118	1.000	
Democracy	(13)	-0.233	0.452	0.449	0.120	0.334	0.263	0.282	0.235	-0.282	0.075	-0.058	-0.420	1.000

Table 2 Results of dynamic panel System GMM estimations. Dependent variable: education inequality

Variables	Coeff.	S.e
Constant	0.490***	0.178
"education inequality" $_{t-1}$	0.351***	0.0338
Overall gender equality	-0.117**	0.0543
GDP per capita	-0.0134	0.0196
Schooling	-0.311***	0.0234
Fertility rate	0.0303	0.0265
Unemployment rate	0.00498***	0.0012
Population density	0.0177**	0.0089
Dependency	0.0813**	0.0378
Democracy	-0.0025	0.0105
AR(1) test (p-value)		0.004
AR(2) test (p-value)		0.409
Hansen J. Test (p-value)		0.161
Diff-in-Hansen test (p-value)		0.660
Observations		635
Instruments		20
Countries		103
Time period		2006-14

Note: S.e. indicates standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3 list the results of the impact of sub-indices of gender equality; educational attainment model (1), health and survival model (2), economic participation and opportunity model (3), and political empowerment model (4) on education inequality. The results in all models (Table 3) show that the of lagged dependent variable significance level at 1 percent, confirm the dynamic GMM is an appropriate estimator. Our specification in model (3) show that gender equality in economic participation and opportunity exert a significant negative effect on education inequality, suggesting that by narrowing gender equality in economic participation and opportunity results a lower education inequality. However, other sub-indices of gender equality; educational attainment (model 1), health and survival (model 2) and political empowerment gender equality (model 4) have negative insignificant effects on education inequality.

Schooling has negative and significant effect on education inequality in all models. GDP per capita and democracy have negative and insignificant coefficients. Fertility (except in model (4)), unemployment, population density and dependency (except in model (1)) have positive and significant effect on education inequality. Suggesting that higher rate of fertility rate, unemployment, population density and dependency lead to higher rate of education inequality.

The Hansen over-identifying restrictions tests and difference-in-Hansen C tests appear to suggest that instruments used in all models are appropriate and the estimated models are adequately specified. The Arellano and Bond (1991) first order (AR(1)) and second order (AR(2)) serial autocorrelation tests results also confirm absence of second order serial autocorrelation.

Table 3 Results of dynamic panel System GMM estimations.

Dependent variable: education inequality				
Variables	Model (1)	Model (2)	Model (3)	Model (4)
Constant	0.460*	0.841	0.328**	0.331**
	(0.276)	(0.787)	(0.152)	(0.168)
"*education inequality*" $_{t-1}$	0.331***	0.307***	0.354***	0.336***
	(0.0348)	(0.0402)	(0.0323)	(0.0383)
Education attainment gender equality	-0.0985			
	(0.0979)			
Health and survival gender equality		-0.579		
		(0.706)		
Economic participation and opportunity gender equality			-0.0506**	
			(0.0223)	
Political empowerment gender equality				-0.0126
				(0.0233)
GDP per capita	-0.00698	-0.0241	-0.0177	-0.00454
	(0.0233)	(0.0259)	(0.0191)	(0.0206)
Schooling	-0.306***	-0.311***	-0.287***	-0.312***
	(0.0260)	(0.0303)	(0.0237)	(0.0235)
Fertility rate	0.0660**	0.0624*	0.0483*	0.0342
	(0.0281)	(0.0323)	(0.0263)	(0.0344)
Unemployment rate	0.00385***	0.00393***	0.00423***	0.00357***
	(0.000989)	(0.000983)	(0.000970)	(0.00113)
Population density	0.0185*	0.0225**	0.0201**	0.0162*
	(0.0105)	(0.0103)	(0.00904)	(0.00958)
Dependency	0.0728	0.132***	0.101***	0.0922**
	(0.0622)	(0.0455)	(0.0375)	(0.0401)
Democracy	-0.00980	-0.0112	-0.00336	-0.0135
	(0.00933)	(0.0100)	(0.00894)	(0.0106)
AR(1) test (p-value)	0.001	0.001	0.001	0.001
AR(2) test (p-value)	0.121	0.081	0.236	0.082
Hansen J. Test (p-value)	0.082	0.083	0.150	0.065
Diff-in-Hansen test (p-value)	0.368	0.300	0.607	0.311
Observations	635	635	635	635
Instruments	20	19	20	20
Countries	103	103	103	103
Time period	2006-14	2006-14	2006-14	2006-14

Note: Figures in parentheses are standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Robust test

We perform outliers test for robustness checks to test whether our results are robust. We performed the outliers test to identify outliers and influential points based on the DFITS proposed by Belsley, Kuh, and Welsch (1980). Belsley *et al*., (1980) point out that if the absolute DFITS statistic is greater than $2\sqrt{k/n}$, (where k is the number of independent variables and n the number of countries) the observation is considered as an outlier of countries. The DFITS test identified Benin, Guatemala, Malawi, Morocco, Uganda, Yemen and Pakistan as extreme outlier[7] . Since the tests suggest that these countries are extreme outlier in our data, therefore, we exclude extreme outliers (or observations), and proceed to the regression analysis.

Table 4 reports the main results of the regression without Benin, Guatemala, Malawi, Morocco, Uganda, Yemen and Pakistan. The results in each models (1) to (5) in Table 4 show that overall gender equality and its sub-indices, health and survival, economic participation and opportunity and political empowerment gender equality coefficient become highly significant, however, educational attainment gender equality coefficient remain insignificant.

The relationship between explanatory variables and education inequality are very similar to the base model, however, dependency ratio lost its significance level in models (1) and (3) and democracy become significant in columns (3) and (5). In model (5) the GDP per capita and fertility also coefficients turned significant. The diagnostic tests of the Hansen over-identifying restrictions tests and difference-in-Hansen C tests are not statistically significant at the 5 percent level for all models, which suggest that instruments used in all models are appropriate and the estimated models are adequately specified. The Arellano and Bond (1991) first order (AR(1)) serial autocorrelation cannot be rejected based on the negative and significant 1 percent p-values in all models. While as required, the insignificant p-value for the second order AR(2) serial autocorrelation test, fails to reject the null hypothesis of no autocorrelation, that reveals absence of second order serial autocorrelation. Accordingly, diagnostics test confirmed that the estimated models are valid, adequately specified and consistent. Thus the exclusion of the extreme observations (outliers) improves our regression results, suggesting that outliers are concern in the base model.

Table 4 Robust analysis, outlier removal.

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
"education inequality" $_{t-1}$	0.352***	0.348***	0.144**	0.348***	0.489***
	(0.0305)	(0.0368)	(0.0704)	(0.0362)	(0.0337)
Overall gender equality	-0.156**				
	(0.0773)				
Education attainment gender equality		-0.0867			
		(0.122)			
Health and survival gender equality			-1.991*		
			(1.153)		
Economic participation and opportunity gender equality				-0.0648**	
				(0.0286)	

[7] The result and graphical illustration of this test are available upon request from the authors.

Table 4 (Cont.)

Political empowerment gender equality					-0.0533***
					(0.0184)
GDP per capita	-0.0104	-0.0201	0.0319	-0.0208	-0.0259***
	(0.0234)	(0.0314)	(0.0357)	(0.0198)	(0.00915)
Schooling	-0.312***	-0.293***	-0.338***	-0.281***	-0.237***
	(0.0333)	(0.0362)	(0.0372)	(0.0280)	(0.0269)
Fertility rate	0.0360	0.0756**	0.159***	0.0572*	0.0552**
	(0.0383)	(0.0322)	(0.0614)	(0.0300)	(0.0219)
Unemployment rate	0.00536***	0.00432***	0.00278**	0.00463***	0.00381***
	(0.00120)	(0.00106)	(0.00126)	(0.00106)	(0.000930)
Population density	0.0168	0.0242*	0.00513	0.0225**	0.0229***
	(0.0126)	(0.0145)	(0.0201)	(0.00994)	(0.00597)
Dependency	0.0727	0.0966	0.0712	0.109***	0.103***
	(0.0571)	(0.0869)	(0.0653)	(0.0407)	(0.0243)
Democracy	-0.00141	-0.00415	-0.0322**	-0.00138	0.00711**
	(0.00925)	(0.0107)	(0.0132)	(0.00798)	(0.00359)
Constant	0.522**	0.391	2.106*	0.297*	0.216
	(0.265)	(0.372)	(1.142)	(0.169)	(0.134)
AR(1) test (p-value)	0.004	0.001	0.001	0.002	0.002
AR(2) test (p-value)	0.611	0.184	0.008	0.384	0.110
Hansen J. Test (p-value)	0.230	0.102	0.190	0.230	0.068
Diff-in-Hansen test (p-value)	0.752	0.698	0.496	0.791	0.398
Observations	19	19	16	20	21
Instruments	614	614	614	614	614
Countries	97	97	97	97	97
Time period	2006-14	2006-14	2006-14	2006-14	2006-14

Note: Figures in parentheses are standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively. Benin, Guatemala, Malawi, Morocco, Uganda, Yemen and Pakistan were identified as extreme outliers and re-moved using the DFITS test.

It is motivating to compare the developing countries with the global sample. Table 5 reports the impact of overall gender equality on education inequality for developing (middle and low income) countries sample. Benin, Guatemala, Malawi, Morocco, Uganda, Yemen and Pakistan were identified as extreme outliers and re-moved using the DFITS test. The results in all columns in of Table 5 show that the lagged dependent variable (*education inequality*$_{t-1}$) is statistically significant which suggests that the dynamic GMM is an appropriate estimator.

The results show that overall gender equality and its sub-indices, education attainment gender equality and economic participation and opportunity gender equality are negatively associated with education inequality. For developing (low and middle income) countries the correlation between gender equality and education inequality is quite strong: the coefficients of the overall gender equality and its sub-indices, education attainment gender equality and economic participation and opportunity gender equality are negative and statically significant, while health and survival gender equality and political empowerment gender equality coefficient are statistically insignificant. GDP per capita has a negative in all estimated models, however, in models (1) and (5) coefficients are statistically insignificant. Schooling has negative and significant effect on education inequality in all models. Similarly fertility rate has negative but insignificant effect on education inequality in all models. Conversely unemployment and population density have positive and significant effect on education inequality in all regressions. Democracy has negative and significant effect on education inequality in models (2) and (3). On the contrary dependency depicts statistically significant coefficients but with mix signs in models (2) and (3). These results suggest that gender equality, higher income, schooling and democracy reduce education inequality in developing countries. In contrast unemployment, population density and dependency lead to higher rate of education inequality. Diagnostics for the estimations are satisfying.

Table 5 Results of dynamic panel System GMM estimations in developing countries.

Dependent variable: education inequality					
Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
"education inequality" $_{t-1}$	0.392***	0.253***	0.356***	0.400***	0.449***
	(0.116)	(0.0766)	(0.0674)	(0.104)	(0.103)
Overall gender equality	-0.616***				
	(0.189)				
Education attainment gender equality		-0.616***			
		(0.100)			
Health and survival gender equality			-1.131		
			(1.020)		
Economic participation and opportunity gender equality				-0.198***	
				(0.0675)	
Political empowerment gender equality					-0.126
					(0.0804)
GDP per capita	-0.00188	-0.0124***	-0.0160***	-0.00994*	-0.00555
	(0.00692)	(0.00385)	(0.00515)	(0.00542)	(0.00758)
Schooling	-0.250***	-0.346***	-0.297***	-0.239***	-0.235***
	(0.0568)	(0.0347)	(0.0345)	(0.0497)	(0.0431)
Fertility rate	-0.107	-0.0605	-0.0790	-0.106	-0.0703
	(0.0763)	(0.0451)	(0.0514)	(0.0693)	(0.0615)
Unemployment rate	0.00812**	0.00785***	0.00603*	0.00679**	0.00822**
	(0.00379)	(0.00254)	(0.00364)	(0.00330)	(0.00380)
Population density	0.0214**	0.0273***	0.0204*	0.0158*	0.0305***
	(0.00880)	(0.00478)	(0.0118)	(0.00880)	(0.00939)
Dependency	-0.0383	-0.111**	0.107**	0.0344	0.0869
	(0.0652)	(0.0508)	(0.0421)	(0.0450)	(0.0555)

Table 5 (Cont.)

Democracy	-0.00352	-0.0234***	-0.0276***	-0.0134	-0.0159
	(0.0126)	(0.00838)	(0.0104)	(0.00957)	(0.0142)
Constant	1.139***	1.875***	1.494	0.646**	0.172
	(0.426)	(0.333)	(1.159)	(0.315)	(0.249)
AR(1) test (p-value)	0.846	0.312	0.354	0.808	0.901
AR(2) test (p-value)	0.251	0.164	0.150	0.276	0.973
Hansen J. Test (p-value)	0.497	0.362	0.153	0.326	0.104
Diff-in-Hansen test (p-value)	0.922	0.637	0.455	0.923	0.621
Observations	19	19	19	20	19
Instruments	326	326	326	326	326
Countries	50	50	50	50	50
Time period	2006-14	2006-14	2006-14	2006-14	2006-14

Note: Figures in parentheses are standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Interestingly, a number of other studies confirm gender gaps are intuitively evident factor that affects educational inequality. Thomas *et al*., (2001) find that gender gaps are clearly related to the education inequality. The bigger the difference of the two illiteracy rates, the larger the gender inequality and over time and the impact of gender inequality on inequality has become stronger. The results indicate that while educational inequality has been declining, gender inequality accounts for much of the remaining inequality in education. Senadza (2012) the paper obtains a positive and statistically significant correlation between education inequality and the gender gap. Digdowiseiso (2010) study find there is a positive association between education inequality and the gender inequality. Women and girls lack basic education compare to men and boys, have unequal access to health and are far less likely to be employed than their male counterparts that affect their ability to participate fully in education and are more likely to live in poverty. Therefore, the higher gender gap leads to higher education inequality.

Schooling has negative effect on education inequality. This results are consistent with the results of Thomas *et al*., (2001) who found education inequality is negatively associated with the average years of schooling. Digdowiseiso (2010) study also finds a negative correlation between Gini coefficient education and average years of schooling. A similar point was made by Gregorio and Lee (2002) that higher educational attainment leads to more equal distribution of education.

GDP per capita and democracy have negative coefficients. Prasartpornsirichoke and Takahashi, (2012) suggested that real income per capita is a significant disequalizer of educational inequality. Rodríguez-Pose and Tselios (2011) advocated that the higher the individual income, the higher the expenditure on education for all strata. A rise in per capita income can be a major factor in reducing the extent of education inequality. Gilbert, (2008) was of the view that education brings higher lifetime income; higher incomes enable parents to live in neighborhoods with excellent public schools or to send their children to private schools; and well-educated children are favorably positioned to repeat the cycle.

Fertility, unemployment rate, population density and dependency ratio have positive effect on education inequality. Suggesting that higher rate of fertility, unemployment, population density and dependency lead to higher rate of education inequality. Our fertility results are consistence with Lin, (2007) results. Fielding and Torres, (2009) also found higher fertility is bad for education and health, and so bad for material wellbeing overall. The results of unemployment on education inequality are in the line with Rodríguez-Pose and Tselios, (2011) results, who found unemployment positively associated with educational inequality. Increases in unemployment and inactivity aggravate the relative position of low income and low-educated groups. Unemployment rates tend to be usually positively related to education inequality (Becker, 1993). Schlicht-Schmaelzle and Moeller, (2012) argue that unemployment create a more competitive and exclusive environment in the education system in which individuals from less privileged societal and cultural backgrounds suffer most. One possible explanation for positive the unemployment–education relationship is that the most children absorb money from their parents for their education, unemployment often causes economic hardship and put extraordinary pressures on families and parents may decide to stop sending children to school. Young girls are more vulnerable and they may be are stop going to pursuing education. Hannum and Buchmann, (2005) results also indicate a positive relationship between education and democracy. We found that dependency lead to higher rate of education inequality and this is consistence with results of Rodríguez-Pose and Tselios (2011) who find that the population ageing has a positive effect on educational inequality in the long run.

CONCLUSION

The study attempted to identify the impact of gender equality on education inequality for sample of 103 countries over the period of 9 years (2006–2014). Specifically, we also use four sub-indices of gender equality other than overall gender equality. These include gender equality in educational attainment, health and survival, economic participation and opportunity, and political empowerment. Based on dynamic panel system GMM estimations the results showed that overall gender equality and its sub-indices; health and survival, economic participation and opportunity and political empowerment gender equality have negative and significant effects on education inequality. This implies that by narrowing gender inequality or equality between male and female results a lower education inequality. The control variables, GDP per capita, schooling and democracy have negative effect on education inequality. While fertility rate, unemployment, population density and dependency have positive effect on education inequality.

The empirical results of developing countries sample also demonstrated a significant result, which revealed that overall gender equality and its sub-indices, education attainment gender equality and economic participation and opportunity gender equality are negatively associated with education inequality, while health and survival gender equality and political empowerment gender equality coefficient are statistically insignificant.

These results imply that the propagation of not only gender equality in education attainment but also health and survival, economic participation and opportunity, and political empowerment gender equality would be the effective way to expand equality in education in the world. The study emphasizes that considerable economic policies are required to achieve education and gender equality. The study also suggests that policy makers should also consider and implement policy measures related to the all aspects of gender equality such as gender equality in educational attainment, health and survival, economic participation and opportunity and political empowerment.

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APPENDIX A

List of Countries Included in the Analyses

Country	Code	Country	Code	Country	Code	Country	Code
Albania	ALB	El Salvador	SLV	Lithuania	LTU	Russian Federation	RUS
Algeria	DZA	Estonia	EST	Luxembourg	LUX	Saudi Arabia	SAU
Argentina	ARG	Finland	FIN	Malawi***	MWI	Singapore	SGP
Australia	AUS	France	FRA	Malaysia	MYS	Slovak Republic	SVK
Austria	AUT	Germany	DEU	Mali	MLI	Slovenia	SVN
Bahrain	BHR	Ghana	GHA	Malta	MLT	South Africa	ZAF
Bangladesh	BGD	Greece	GRC	Mauritania	MRT	Spain	ESP
Belgium	BEL	Guatemala***	GTM	Mauritius	MUS	Sri Lanka	LKA
Benin***	BEN	Honduras	HND	Mexico	MEX	Sweden	SWE
Bolivia	BOL	Hungary	HUN	Moldova	MDA	Switzerland	CHE
Botswana	BWA	Iceland	ISL	Mongolia	MNG	Tanzania	TZA
Brazil	BRA	India	IND	Morocco***	MAR	Thailand	THA
Bulgaria	BGR	Indonesia	IDN	Namibia	NAM	Trinidad and Tobago	TTO
Cambodia	KHM	Iran, Islamic Rep.	IRN	Nepal	NPL	Turkey	TUR
Cameroon	CMR	Ireland	IRL	Netherlands	NLD	Uganda***	UGA
Canada	CAN	Israel	ISR	New Zealand	NZL	Ukraine	UKR
Chile	CHL	Italy	ITA	Nicaragua	NIC	United Arab Emirates	UAE
China	CHN	Jamaica	JAM	Norway	NOR	United Kingdom	UK
Colombia	COL	Japan	JPN	Pakistan***	PAK	United States	USA
Costa Rica	CRI	Jordan	JOR	Panama	PAN	Uruguay	URY
Croatia	HRV	Kazakhstan	KAZ	Paraguay	PRY	Venezuela	VEN
Cyprus	CYP	Kenya	KEN	Peru	PER	Yemen***	YEM
Czech Republic	CZE	Korea, Rep.	KOR	Philippines	PHL	Zambia	ZMB
Denmark	DNK	Kuwait	KWT	Poland	POL		
Dominican Republic	DOM	Kyrgyz Republic	KGZ	Portugal	PRT		
Ecuador	ECU	Latvia	LVA	Romania	ROM		
Egypt	EGY	Lesotho	LSO				

Note: *** shows the countries excluded as the outliers.