The Effect of the Gender Equality on Income Inequality: A Dynamic Panel Approach

(Kesan Kesaksamaan Jantina Kepada Ketidaksaamaan Pendapatan: Pendekatan Panel Dinamik)

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ABSTRACT

This study investigates the effects of gender equality on income inequality along with several dimensions of gender equality using panel data of 103 countries for the period of 2006-13. We use the dynamic econometric method system Generalized Method of Moments (Sys-GMM) to explore the link between these two variables. The empirical evidence shows a negative and significant impact of gender equality and its sub-indices on income distribution, suggesting that by increasing equality between males and females will result in lower income inequality. GDP per capita has nonlinear effect income inequality. Education attainment has a negative effect on income distribution, while higher inflation rate increases income inequality. This analysis implies that by narrowing the gender gap or increasing equality between males and females will effectively contributes to expanding equality in income.

Keywords: Income inequality; gender equality; GMM

ABSTRAK

Kajian ini menyiasat kesan kesaksamaan jantina terhadap ketidaksamaan pendapatan disamping beberapa dimensi kesetaraan gender menggunakan data panel 103 negara untuk tempoh 2006-13. Kami menggunakan kaedah sistem ekonometrik Kaedah- dinamik Umum Masa (Sys-GMM) untuk meneroka hubungan antara kedua-dua pemboleh ubah ini. Bukti empirikal menunjukkan kesan negatif dan signifikan kesamaan jantina dan sub-indeksnya ke atas pengagihan pendapatan, menunjukkan bahawa dengan meningkatkan kesaksamaan antara lelaki dan perempuan akan mengakibatkan ketidaksamaan pendapatan yang lebih rendah. KDNK per kapita mempunyai kesan ketidaksamaan pendapatan tidak linear. Pencapaian pendidikan mempunyai kesan negatif terhadap pengagihan pendapatan, sementara kadar inflasi yang tinggi meningkatkan ketidaksamaan pendapatan. Analisis ini membayangkan bahawa dengan merapatkan jurang jantina atau meningkatkan kesaksamaan antara lelaki dan perempuan akan menyumbang secara efektif untuk memperluaskan kesaksamaan dalam pendapatan.

Kata kunci: Ketidakseimbangan pendapatan; kesaksamaan jantina; GMM

INTRODUCTION

Income inequality has been presented to be a persistent phenomenon in both developed and developing countries, even in the presence of sustained macroeconomic growth. It has increased in most advanced and many developing countries over recent decades (Bastagli et al. 2012; IMF 2014). The income inequality has received a wide attention from the academic researchers and has been subject to extensive debate. There is consensus in the literature that increasing income inequality is harmful and destructive to growth and poverty reduction, furthermore,

it has significant political, social and economic costs and it is morally questionable (Berg & Ostry 2013; Mankiw 2013; Stiglitz 2012; Tan & Law 2012).

Academic researchers and economists have provided broad empirical and theoretical evidence of the factors that are attributed to higher income inequality such as globalization, technological progress, skills biasedness, wage inequality, financial deepening, access to finance, fiscal spending, inequality of opportunity etc. Chamlou (2016) argues that the link between gender gap and income equality have been omitted in the income equality literature. In fact, few prior empirical studies have delved

deeper into the effects of gender gap on income inequality. The these existing literature establishes a negative association between gender equality (inequality) and income inequality (equality) (Costa et al. 2009; Davies & Joshi 1998; Gonzales et al. 2015; Popova 2002).

Gonzales et al. (2015) argue that gender inequality affects income inequality through a number of channels. Firstly, wage inequality between men and women directly contributes to higher income inequality. Moreover, higher gender inequality in labour force participation rates results gender inequality in earnings, thus creating and worsening income inequality. Costa et al. (2009) discuss that gender equality reduces the poverty and inequality and concluded that the eradication of gender inequalities, particularly an increase in women's access of labour market would result in a rise in household income and a decline in poverty and income inequality. Wide gender inequality of wages and education indicates an unequal distribution of income and resources (Seguino 2002).

Gender inequality effects income distribution by preventing the reduction of fertility rate and as well as reduces the education gains of the next generation. The impact of diminishing returns of higher levels of male education would lower the average level of human capital and thus income (Abu-Ghaida & Klasen 2004). Rising fertility can reduce investment in children's education and health. Moreover, educational inequality can contribute to women's unequal household bargaining power, affecting the distribution of household resources (Blumberg 2004). Gender inequality in education produces economic inefficiency is that the exclusion of women from educational achievements limits the supply of skilled people (Costa et al. 2009), that result in higher unemployment and lower wages which are the sources of inequality. Similarly, higher gender inequality in employment associated lower income for women. Less income for women and more for men, in general, translates into income inequality.

Gender inequality also effects income distribution by discouraging women workers from entering to the job market to which they are best suited, thereby lowering the value of output. Furthermore, gender inequality affect the competitiveness of countries by lowering female wages (Busse & Spielmann 2006), thereby influencing income distribution. Gender inequalities restrict women's participation in productive employment and thereby lower the potential economic growth dividend (Buvinic et al. 2009). Unequal pay weakens economic bargaining power of women with the other members of her family and prevents investment in their education and skill formation, therefore, they work in low-skilled services sector and agriculture which are low paid (Roy et al. 2008). Gender inequalities such as gender wage gaps influence aggregate demand, employment, and output in the short run. The gender division of labour influence the transmission mechanisms by which gender affects growth (Berik et al. 2009).

Gender gap is a multidimensional phenomenon which implies that females will be less well educated and have lower health status, higher fertility rate and lower labour and political participation. However, most empirical work on gender gap uses a one-dimensional perspective, which may not be adequate because gender gaps are multidimensional and accordingly the impacts on income inequality may vary. Besides, the focus has been either for individual countries or regions. There remains considerable puzzle of what the several aspects of gender equality contribute to income inequality in both the developed and developing economies. Yet very little is known for sure about the impact of gender inequality on income inequality. Therefore, growing interest in this topic should not come as a surprise. Hence further analysis is required to understand the effects of gender equality on income equality and what the various aspects of gender equality contribute to income inequality.

Thus, this study is motivated to investigate the effects of gender equality on income inequality focusing on the multidimensional nature of overall gender equality. In contrast to other studies that focus on the unidimensional effect of gender in/equality on income inequality in a particular region[1], this study is unique because it focuses on the multidimensional nature of overall gender equality: gender equality in educational attainment, health and survival, economic participation and opportunity, and political empowerment and uses a large panel of advanced and developing countries. This paper uses the latest data set of the World Economic Forum gender gap index for gender equality, measured by Lopez-claros and Zahidi (2005) for the period (2006-2013) focusing on the multidimensional nature of gender equality. We also employ the dynamic econometric technique the System Generalized Method of Moments (Sys-GMM) proposed by Blundell and Bond (1998).

The rest of paper is ordered as follows. Section 2 describes the literature review. Section 3 presents the empirical specification and methodology. Section 4 registers empirical analysis and reports the regression results. Section 5 concludes.

LITERATURE REVIEW

This paper draws from recent literature that highlighted the importance of gender in the income distribution. Gonzales et al. (2015) find a decline in gender inequality is associated with lower income inequality. They argue that income inequality and gender gaps are relate through gender wage gaps and labour force participation rates, education, and health gender gap that likely to exacerbate income inequality and impede more equal income distribution. Costa et al. (2009) analyse the impact of four different aspects of gender inequalities on income distribution in Latin America including labour market participation differences occupational status differences,

wage discrimination and characteristics differences. The result shows that gender equality reduces the poverty and inequality and concluded the eradication of gender inequality, particularly an increase in women's access of labour market would result in a rise in household income and a decline in poverty and income inequality. Popova (2002) results also show that gender inequality contributes to overall inequality and poverty in Bulgaria, Romania, Hungary and Poland and Russia.

A more recent study by López-calva and Lustig (2010) find inequality in Latin America is the result of state capture by elites, capital market imperfections, inequality of opportunity in particular, of access to good-quality education, labour market segmentation, and discrimination against women and non-whites. Declines in labour income inequality appear to be associated with the educational upgrading of the labour force, which resulted in a more equal distribution of schooling attainment in Brazil, Mexico, and Peru. Calderón and Chong (2009) find equal male-female remuneration, the right of collective bargaining, and the equality of opportunity or conditions of employment based on race, religion, sex, political opinion or social origin influence the distribution of income. Similarly Davies and Joshi (1998) find that women's participation and earnings reduce poverty and inequality in UK. Increased in women participation, increased share of family income came from women's labour market income over the period.

This study relies on certain channels to explain how gender gap influences income inequality. One of the explained arguments is that gender gaps effect income inequality through the channel of human capital. Education and health are important elements of human capital (Fielding & Torres 2009). Higher gender inequality means lower human capital level. Increase in gender gap lower the average quality of human capital (Baliamoune-Lutz & McGillivray 2009; Stephan Klasen 2000). Gender equality influences education, distribution of human capital and health outcomes and opportunities (Baldacci & Clements 2004; Seguino 2000).

Various researchers argue that human capital, such as education, which is considered the engine of economic growth, reduce income inequality (Barro 2000; Beck et al. 2007; Calderón & Chong 2009; Castelló-Climent & Domenech 2014; Hoeller et al. 2014; Kremer & Chen 2002; Law et al. 2014; López-calva & Lustig 2010). Stiglitz (2012) debates growing inequality of opportunity, particularly, educational opportunity is one of the reasons increase in income inequality. Thorbecke and Charumilind (2002) suggest that large-scale exclusion from educational opportunities results in lower economic growth and persistent income inequality. Similarly, Kremer and Chen (2002) find that increase in access to education opportunities permanently reduce income inequality. Human capital or education tends to reduce the income gap (Beck et al. 2007; Calderón & Chong

2009; Law et al. 2014). Farooq (2010) results indicate that education and schooling do affect the distribution of income in favour of the people with more education.

Mirowsky and Ross (2005) and Ross and Mirowsky (2010) explain that education influences employment, work, earnings, and income, acting as a key to position in the stratification system. Education may interact with fertility, mortality, health, and other aspects of development that affect income distribution. Jaumotte et al. (2013) argue that an increase in the average years of education reduces inequality. Greater access to education would be expected to reduce income inequality by allowing a greater share of the population to be engaged in high-skill activities.

Education is frequently seen as preparation for the labour force, as training for employment. The more education one has invested in, the more skills one has and the better job one can expect once working. The higher the income one expects, the greater incentive to be in the labour force (Cotter et al. 2004). Checchi (2006) explain education promotes labour market participation and employability, irrespective of gender. Countries with higher educational achievements could result better employment opportunities and lower long-term inequality.

Gender equality effects health indicators (Baldacci & Clements 2004; Baliamoune-Lutz & McGillivray 2009; Klasen 2000; Osmani & Sen 2003) which is another important indicator of human capital. Health is associated with income inequality that is evident in the literatures. McGillivray et al. (2011) for instance, argue that health is highly correlated with income with the implication that health inequality may yield very little additional information to income inequality. A highly unequal distribution of health will imply a higher inequality in terms of opportunity as well. Chakraborty and Das (2005) show health inequality can be a key factor in explaining the observed persistence wealth and income inequality across households. Further, gender gaps have an impact on the income inequality through the channel of fertility. Gender equality in education reduced fertility in developing countries (Abu-Ghaida & Klasen 2004; Blackden et al. 2006; Branisa et al. 2013; Stephan Klasen 2000).

Gender gap in labour force participation influence income inequality. Labour force participation gap is generally cited as the main source or cause of the rising inequality. Costa et al. (2009) as cited earlier, find decreasing gender gap in labour participation would lead to significant reduction in income inequality and poverty. On the other hand, applying an original decomposition method based on micro-simulation techniques analysis, Bourguignon et al. (2001) identified increases in the female labour force had an inequality-increasing effect in Taiwan during the period of 1979–94.

Using micro-data for seventeen OECD countries Harkness (2010) results show a negative association between female employment and income distribution.

Despite of large employment inequality between high and low educated women in all countries, female earnings exert a positive effect on the income distribution. Reducing employment gap between women and raising female employment would have a significant effect on reducing household income inequality, and a far higher impact than reducing the inequality of gender pay for all countries.

McNabb and Moss (1990) have considered the determinants of family income inequality in Australia and in particular the impact of the employment status of wives on family income distribution. Their results indicate that where women are in full-time employment the distribution of income is more even. Moreover, the inequality in family income varies over the life cycle reflecting the labour supply behaviour of married women. The most important determinant of inequality is the variations in the hourly of wage rate faced by husbands and thus in husbands' earnings. Karoly and Burtless (1995) find female employment rates and earnings have risen between 1959 and 1989 in America, but the growth in women's earnings in the most recent decade was concentrated particularly among women in high income families, and thus contributed to the sharp rise in inequality. Trends in the distribution of unearned income have also played a role in raising inequality: increases in income from capital assets and from public and private pensions were especially common in families with a high rank in the income distribution.

Ding et al. (2009) apply the technique of decomposing the coefficient of variation to examine the impact of changes in married women's employment and earnings on income inequality among Chinese urban households. Using the Chinese Household Income Surveys from 1988, 1995, and 2002, they explore the differences between two phases of economic transition: the gradualist reform period (1988–1995) and the radical reform period (1995–2002). The analysis results show that the public sector labour retrenchment of the late 1990s has led to a drastic decline in the employment rates of women, especially those married to low-earning husbands, and the change in women's employment was a major force driving income inequality in post-restructuring urban China.

Ferreira and Ravallion (2008) reveal that the entry of relatively skilled women into the labour force reduced earnings inequality in Taiwan, it contributed to an increase in the dispersion of household incomes. In Brazil, too, between 1976 and 1996, a substantial increase in extreme poverty was associated primarily with an increase in unemployment, informality, and underemployment. In Indonesia, a large share of the overall increase in inequality was associated with large movements of labour away from wage employment (in agriculture) toward (predominantly urban) self-employment.

Gender wage inequality is positively related to income inequality (Seguino 2000). Stiglitz (2012) argues that for most people, wages are the most important source of income and higher unemployment and lower wages for ordinary citizens are a major source of inequality. Ferreira and Ravallion (2008) indicate that greater earnings inequality often led to higher inequality in household incomes. Bastagli et al. (2012) demonstrates that the women's lower labour income and shorter working hours leads to income inequality. Improved women's wage rates can lead to a more equal distribution of income (Ward, Lee et al. 2010). Karoly and Burtless (1995) find that the rise in wage inequality is reflected directly in growing inequality in the distribution of family incomes. Increase women employment rates leads to raise their labour income that could reduce overall inequality.

Previous researches have clearly showed that income inequality persists across regions overtime, however, academic researchers have ignored empirical research to address multidimensional gender equality impact on income inequality and it remain relatively scarce. Thus, the present study takes a step towards filling this gap and attempt to understand and explain by exploring the impact of gender equality on income inequality.

THE EMPIRICAL MODEL AND ECONOMETRIC METHODOLOGY

In order to test the effects of gender equality on income inequality the empirical specification is as follows:

$$LGini_{it} = \alpha LGini_{i,t-1} + \beta_1 Gen_{it} + \beta_2 LEducAtt_{it} + \beta_3 LGDPC_{it} + \beta_4 LGDPC\_sq_{it} + \beta_5 INF_{it} + \beta_6 LGlob_{it} + \beta_7 LDemoc_{it} + \mu_i + \varepsilon_{it}$$

$$i = 1, \ldots, 110 \text{ and } t = 1, \ldots, 9 \qquad (1)$$

where subscript i and t are the country and time index, respectively, all variables are in natural logarithm except gender gap, globalisation and democracy, *Gini* is income inequality, $Gini_{it}$ is lagged value of income inequality, *Gen* is the measure of gender gap, *GDPC and GDP_sq* are *GDP per capita* and its square, *EducAtt* is education attainment, *INF is* inflation rate, *Glob* is globalisation, and *Democ* is democracy, μ_i is unobserved country-specific effect term and ε_{it} is the error term, while α and β are the parameters to be estimated.

To estimate Eq. (1) this study employs the system Generalized Method of Moments (Sys-GMM) panel estimators developed for dynamic models of panel data due to the potential endogeneity of the variables. Arellano and Bover, (1995) and Blundell and Bond (1998), proposed Sys-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) showed that this new Sys-GMM estimator in which the level and difference equations are combined, results consistent and efficient parameter estimates and has better asymptotic and finite sample properties. Sys-GMM estimator, one of the most

widely used econometric estimation methods in finance and economics, is an efficient estimator of the coefficient in empirical panel data which allows obtaining robust and consistent results. Sys-GMM estimator addresses potential endogeneity and serial correlation problems that may arise from the dynamic specification of the models. Endogeneity refers to the condition in which an independent variable (is endogenous, e.g., education, GDP per capita, and democracy) correlates with the error term, or if two error terms correlate when dealing with structural equation modelling. The empirical results suggest that education, GDP per capita, and democracy are likely to be endogenous in Eq. 1 as higher income inequality may negatively affect education, GDP per capita and democracy and current income distribution is dynamically related to past income inequality.

Following Windmeijer (2005) this study uses two-step Sys-GMM estimation procedure. The two-step Sys-GMM estimation procedure is attributed to more efficient under the general conditions. Windmeijer (2005) suggest that qualifies with lower bias and standard errors. Two-step Sys-GMM estimator leads to more accurate inference with finite sample variance. Therefore, this study considers two-step Sys-GMM estimation method.

This study employs Hansen J-test of over-identifying restrictions proposed by Hansen (1982) to test the validity of instrumental variables whether lagged values of the explanatory variables are valid instruments in the regression model. The consistency of GMM estimates also depends whether the error term is not serially correlated. The Hansen J-test address these issues as suggested by Arellano and Bond, (1991). A failure to rejection of the null hypothesis validates the model. The Hansen J-test is for the validity of instruments and the test for the serial correlation of residuals to confirm the dynamic GMM provides consistent estimates of the parameters. The null hypothesis is that all instruments are valid. If the computed chi-square exceeds the critical chi-square value, we reject the null hypothesis, which means that at least one instrument is correlated with the error term.

With respect to the serial correlation test, this study employs test statistic AR(1) and AR(2) test for presence of serial correlation in the first-differenced residuals of first- and second-order, respectively; they are asymptotically normally distributed under the null of no serial correlation (Arellano & Bond 1991). First order autocorrelation AR(1) is expected to be negative significant but according to the second-order autocorrelation AR(2) test there is no significant which is the crucial point with respect to the validity of the instruments.

THE DATA

This study assesses the issue for 103 countries in the global sample a subsample of 42 developed and 61 developing countries, over the period 2006–2013.[2]

Based on the standard empirical literatures and income inequality models the determinants of income inequality are included in our model. For the measure of income inequality, we use Gini coefficient, the most frequent and standard measure used in literatures. The coefficient varies between 0 (complete equality) and 100 (complete inequality). The primary source for the Gini index data used in our model is the PovcalNet database created by (Milanovic 2014). PovcalNet data are not available (largely for advanced economies), following Jaumotte et al. (2013) to increase the coverage, the data from the Standardized World Income Inequality Database (SWIID) Version 5.1, created by (Solt, 2016) and UNU-WIDER United Nations University's World Income Inequality Database (WIID3.0b) were used.

This study utilises the global gender gap index data introduced by Lopez-claros and Zahidi, (2005) of World Economic Forum.[3] The global gender gap index measures the gender gap in four main dimensions: educational attainment, health and survival, economic participation and opportunity, and political empowerment. This datasets has been widely used in the literature.[4] The overall gender gap index (Gen) represents four different dimensions of gender gap; that serves as independent variable therefore, this study analyses the model into two-step: first the impact of overall gender equality impact on income inequality will be analysed and in the second step the effect of each dimension of gender equality; educational attainment, health and survival, economic participation and opportunity, and political empowerment, will be analysed separately. Thus Gen in Eq. (1) alternates with the four dimensions of gender gap index in the second step.

The relationship between income inequality and economic development has been extensively debated in the literatures.[5] We include GDP per capita and its square in our model to capture the possible presence of a Kuznets-curve "inverted-U" hypothesis effect. Kuznets (1955) "inverted-U" hypothesis suggest that inequality rises in the early stages of industrialization, however after reaching some level of income, inequality declines. GDP per capita (constant 2005 US$) has been included into the model as a measure of economic development. The data are obtained from WDI.

Education attainment variables have been frequently used in the income inequality literatures and has been found to effect income inequality (José De Gregorio and Lee, 2002; Beck et al. 2007; Jaumotte et al. 2013; Law et al. 2014). We use the number of adults with at least completed secondary education in the Barro–Lee dataset as a proxy for education attainment.[6] The education attainment data are obtained from the Barro and Lee (2013) data set. Further our study uses globalisation as another important control variable following (Jalil 2012). We use the KOF index of globalisation data, developed by Dreher et al. (2008) and Dreher (2006). Following Beck et al. (2007), Ang (2010) and Jalil, (2012)

inflation is also used as a control variable to capture the macroeconomic environment, which is expected to affect income distribution.[7] Following Clarke et al. (2006) we use inflation rate, log difference of consumer price index. The inflation data are obtained from WDI. Finally, we also use democracy in our model to capture the effects of domestic political regime. We use the democracy index published in Polity IV developed by Marshall, Gurr, and Jaggers (2015).

EMPIRICAL RESULTS

Table 1 reports the impact of gender equality and sub-indices of gender equality on the income inequality.[8] Table 1 list the impact of overall gender equality column (1) and each dimension of gender equality; educational attainment column (2), health and survival column (3), economic participation and opportunity column (4), and political empowerment column (5) on income inequality for global sample countries. The results in all columns in Table 1 show that the lagged dependent variable (income inequality$_{t-1}$) is statistically significant at 1 percent, which suggests that the dynamic system GMM is an appropriate estimator. The results in each column (1) to (5) show that overall gender equality and its sub-indices, educational attainment and political empowerment gender equality generally exert a significant negative effect on income inequality, suggesting that by higher gender equality or equality between male and female results a lower income inequality. Although the coefficient magnitudes differ substantially between the overall gender equality and its sub-indices, educational attainment and political empowerment gender equality, the effect is uniformly negative and generally significant. The coefficient of overall gender equality is –0.73, this indicates that 1 unit change in overall gender equality leads to 0.73 % change in income inequality. Similarly, the coefficients of education attainment gender equality and political empowerment gender equality are –1.15 and –0.38 respectively, suggesting that if gender equality in education attainment and political empowerment were to increase by one unit, then income inequality would decrease by 1.15 % and 0.38%. However, health and survival column (3) and economic participation and opportunity gender equality column (4) has insignificant coefficient.

This implies that the higher gender equality provides equal opportunities for women in education and health which in turn reduce income inequality. Gender equality also increase in women's access of labour market would result in a rise in household income and a decline income inequality. Higher gender equality leads to higher wages for women in the marketplace that leads to improve income equality. Costa et al. (2009) analyses also provide similar evidence that gender equality reduces

the poverty and inequality in Latin America. Similarly Popova (2002) results also show that gender inequality contributes to overall inequality and poverty in Bulgaria, Romania, Hungary and Poland and Russia. Harkness (2010) find an inverse relationship between female employment and income inequality. Bastagli et al. (2012) argue women's lower labour income and shorter working hours, leads to income inequality. A study by Davies and Joshi (1998) and Calderón and Chong (2009) identify that women's earnings and remuneration reduce poverty and inequality.

Similarly, education attainment and inflation have negative and significant effect on income inequality in all models; however, inflation is insignificant in column (2). These education attainment results are consistence with the results of Beck et al. (2007); Law et al. (2014); Jaumotte et al. (2013); José De Gregorio and Lee (2002) and inflation results are consistent with the results of Clarke et al. (2006), Ang (2010) and Jalil (2012). GDP per capita and democracy have positive and GDP per capita (square) and globalisation have negative but jointly insignificant coefficients in all models. Finally, all models passed the diagnostic checks and appear to be adequately specified. Overall, the results in Table 1 show a large effect of gender equality on income distribution.

In Tables 1, we found 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. We report the Arellano and Bond (1991) first order (AR(1)) and second-order (AR(2)) serial autocorrelation tests for the Sys-GMM (Tables 1). The first order 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 autocorrelation AR(2) test, fails to reject the null hypothesis of no autocorrelation, that reveals absence of second-order serial autocorrelation. Thus, diagnostics test confirmed the estimated models are valid, adequately specified and consistent.

ROBUSTNESS TESTS

We perform outliers test for robustness checks to test whether our results are robust. Outliers may lead us to distorted and misleading findings and usually exert disproportionate influence on substantive conclusions on relationships among variables. In some cases, the existence of a few outliers, even one, can seriously jeopardize the results and conclusions of the regression analysis (Cohen et al. 2003). We performed the outliers test to identify outliers and influential points based on the DFITS proposed by Belsley et al. (1980), that assesses the influence of an observation on the regression results as a whole. Belsley et al. (1980) point out that if the absolute DFITS statistic is greater than $2\sqrt{k}/n$, (where k is

TABLE 1. Impact of Gender equality on Income Inequality Dependent variable: income inequality (in log)

Variables	(1)	(2)	(3)	(4)	(5)
Income inequality$_{(t-1)}$	0.525***	0.540***	0.605***	0.583***	0.535***
	(0.0774)	(0.0859)	(0.0777)	(0.0880)	(0.0739)
Over all gender equality	−0.726**				
	(0.358)				
Education attainment gender equality		−1.146***			
		(0.391)			
Health and survival gender equality			−1.478		
			(1.494)		
Economic participation and opportunity gender equality				−0.0436	
				(0.251)	
Political empowerment gender equality					−0.383**
					(0.151)
GDP per capita (log)	0.225	0.230	0.0464	0.0622	0.274
	(0.207)	(0.176)	(0.154)	(0.181)	(0.222)
GDP per capita (Square) (log)	−0.0131	−0.0136	−0.0042	−0.0055	−0.0152
	(0.0114)	(0.0099)	(0.0089)	(0.0100)	(0.0123)
Education attainment(log)	−0.103***	−0.0825***	−0.0792***	−0.0729***	−0.112***
	(0.0244)	(0.0190)	(0.0185)	(0.0252)	(0.0254)
Inflation	−0.204***	−0.0541	−0.162***	−0.184**	−0.160***
	(0.0416)	(0.0873)	(0.0446)	(0.0751)	(0.0442)
Globalisation	−0.0008	−0.0004	−0.0003	−0.0004	−0.0003
	(0.0017)	(0.0016)	(0.0014)	(0.0017)	(0.0017)
Democracy	0.0017	0.0001	0.0014	0.0014	0.0020
	(0.0026)	(0.0028)	(0.0034)	(0.0026)	(0.0025)
Constant	1.538	2.033**	2.956*	1.575**	0.789
	(0.944)	(0.827)	(1.748)	(0.798)	(1.046)
AR(1) test (p-value)	0.001	0.002	0.002	0.001	0.000
AR(2) test (p-value)	0.451	0.673	0.572	0.506	0.411
Hansen J-test (p-value)	0.593	0.751	0.612	0.570	0.650
Diff-in-Hansen test (p-value)	0.696	0.946	0.518	0.368	0.355
Instruments	29	29	29	29	29
Observations/Country	346/103	346/103	346/103	346/103	346/103

Note: Figures in parentheses are standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively. Gender equality and its sub-indices are on a scale from 0 to 1, where a higher score means more gender equality. Income inequality and globalisation are on a scale from 1 to 100, with a higher score indicating higher income inequality and globalisation. Democracy is on a scale from 0 to 10, with a higher score indicating more democracy. Regressions are with regions and culture dummies. See Appendix Table B for more detailed variable definitions and sources.

the number of independent variables and n the number of countries) the observation is considered as an outlier of countries.

The results of DFITS test identified Albania, Malaysia, Mongolia, Singapore and South Africa as potential extreme outliers.[9] The tests suggests Albania, Malaysia, Mongolia, Singapore and South Africa are outlier since the DFITS statistic of these countries are greater than the threshold $2\sqrt{k}/n$. Since the tests suggest that these countries are extreme outlier in our data, therefore, we exclude extreme outliers (or observations).

Table 2 reports the main results of the regression without Albania, Malaysia, Mongolia, Singapore and South Africa for global sample. The results in each

column (1) to (5) in Table 2 show that overall gender equality and its sub-indices, educational attainment health and survival, economic participation and opportunity and political empowerment gender equality impact on income inequality yield the same results in Table 1. The relationship between explanatory variables and income distribution are very similar to the base model. The results do not change with the exclusion of the extreme observations; our results still hold, thus, outliers are not a major concern.

It is motivating to compare the developed and developing countries across regions with the global sample. Table 3 reports the impact of overall gender equality on income inequality for developed (high

TABLE 2. Robust analysis: Outlier removal Dependent variable: income inequality (in log)

Variables	(1)	(2)	(3)	(4)	(5)
Income inequality$_{(t-1)}$	0.540***	0.606***	0.599***	0.564***	0.523***
	(0.0753)	(0.0761)	(0.0808)	(0.0769)	(0.0801)
Over all gender equality	−0.587*				
	(0.331)				
Education attainment gender equality		−0.834**			
		(0.347)			
Health and survival gender equality			−1.047		
			(1.265)		
Economic participation and opportunity gender equality				−0.116	
				(0.189)	
Political empowerment gender equality					−0.381**
					(0.183)
GDP per capita (log)	0.189	0.0913	0.0961	0.108	0.254
	(0.245)	(0.217)	(0.207)	(0.222)	(0.258)
GDP per capita (Square) (log)	−0.0114	−0.0063	−0.0070	−0.0079	−0.0144
	(0.0135)	(0.0121)	(0.0115)	(0.0123)	(0.0142)
Education attainment	−0.0998***	−0.0722**	−0.0836***	−0.0783**	−0.114***
	(0.0369)	(0.0333)	(0.0322)	(0.0359)	(0.0392)
Inflation	−0.221***	−0.0888	−0.192***	−0.233***	−0.179***
	(0.0405)	(0.0814)	(0.0377)	(0.0574)	(0.0466)
Globalisation	−0.0004	−0.0003	−0.0002	−0.0005	0.0002
	(0.0016)	(0.0015)	(0.0014)	(0.0016)	(0.0017)
Democracy	0.00165	0.0005	0.0018	0.0019	0.0016
	(0.0021)	(0.0023)	(0.0026)	(0.0020)	(0.0020)
Constant	1.543	2.094*	2.342	1.500	0.915
	(1.166)	(1.097)	(1.587)	(1.032)	(1.184)
AR(1) test (p-value)	0.000	0.001	0.001	0.000	0.001
AR(2) test (p-value)	0.377	0.598	0.404	0.192	0.556
Hansen J-test (p-value)	0.592	0.755	0.599	0.556	0.669
Diff-in-Hansen test (p-value)	0.795	0.755	0.566	0.410	0.372
Instruments	29	29	29	29	29
Observations/ countries	338/98	338/98	338/98	338/98	338/98

Note: Figures in parentheses are standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively. Albania, Malaysia, Mongolia, Singapore and South Africa were identified as potential extreme outliers and re-moved using the DFITS test.

TABLE 3. Impact of gender equality on income inequality in developed countries Dependent variable: income inequality (in log)

Variables	(1)	(2)	(3)	(4)	(5)
Income inequality$_{(t-1)}$	0.849***	0.813***	0.726***	0.870***	0.807***
	(0.0807)	(0.0446)	(0.0707)	(0.0669)	(0.0809)
Over all gender equality	−0.129				
	(0.311)				
Education attainment gender equality		−2.413***			
		(0.267)			
Health and survival gender equality			−6.008***		
			(1.370)		
Economic participation and opportunity gender equality				0.0938	
				(0.108)	
Political empowerment gender equality					−0.166
					(0.144)

TABLE 3. (*Cont.*)

GDP per capita (log)	0.0250	0.149*	–0.132	0.0642	–0.145
	(0.0778)	(0.0796)	(0.116)	(0.0742)	(0.1000)
GDP per capita (Square) (log)	–0.0012	–0.0073*	0.0059	–0.0039	0.0076
	(0.0039)	(0.0039)	(0.0059)	(0.0036)	(0.0051)
Education attainment	–0.0282	–0.0315**	0.0136	–0.0204	–0.0014
	(0.0200)	(0.0140)	(0.0318)	(0.0155)	(0.0221)
Inflation	0.155**	0.119***	0.129***	0.152**	0.0961
	(0.0715)	(0.0415)	(0.0358)	(0.0605)	(0.0622)
Globalisation	–0.0006	–0.0016	0.0018	0.0019	–0.0001
	(0.0017)	(0.0016)	(0.0014)	(0.0021)	(0.0015)
Democracy	–0.0099	–0.0085	–0.0425***	–0.0167	–0.0048
	(0.0112)	(0.0109)	(0.0129)	(0.0108)	(0.0121)
Constant	0.688	2.601***	7.736***	0.182	1.423**
	(0.704)	(0.522)	(1.250)	(0.582)	(0.641)
AR(1) test (p-value)	0.027	0.031	0.025	0.025	0.026
AR(2) test (p-value)	0.991	0.964	0.839	0.973	0.929
Hansen J-test (p-value)	0.807	0.747	0.654	0.833	0.693
Diff-in-Hansen test (p-value)	0.664	0.980	0.816	0.778	0.905
Instruments	29	29	29	29	29
Observations/ countries	205/41	205/41	205/41	205/41	205/41

Note: All regressions are estimated using the Sys-GMM estimator (Blundell and Bond, 1998). Figures in parentheses are standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

income) countries sample. The results show that educational attainment and health and survival gender equality in columns (2) and (3) are negatively associated with income inequality, respectively. The magnitude of estimated coefficient for gender equality in education attainment is –2.41 and significant at 1% significance level. This implies that one unit change in gender equality in education attainment brings 2.41% negative effect on income inequality. Similarly, the coefficients of health gender equality s -6.0, suggesting that 1-unit change in gender equality in health leads to 6% decrease in income inequality in developed countries. However, overall gender equality, economic participation and opportunity gender equality and political empowerment gender equality have insignificant coefficients. GDP per capita has positive and significant coefficient and GDP per capita (Square) and education attainment have negative and significant coefficients in only column (2) estimated model. On the other hand, inflation has a positive and significant effect on income inequality in all models except column (5). Similarly, the estimated coefficient of the globalisation and democracy are insignificant in all models, except the column (3) where the coefficient of democracy is negative and significant. Finally, all models passed the diagnostic checks and appear to be adequately specified.

Table 4 reports the impact of overall gender equality on income inequality for developing (middle and low income) countries sample. The results show that overall gender equality, economic participation and opportunity gender equality and political empowerment gender equality in each model are negatively associated with income inequality. For developing (low and middle income) countries the correlation between gender equality and income distribution is strong: the coefficient of the overall gender equality and political empowerment gender equality is negative and statically significant at 1 percent, while economic participation and opportunity gender equality coefficient is weak, statistically significant at 10 percent. The results suggest that one-unit increase in overall gender equality is associated 1.02% decline in income inequality. In the same way, one-unit increase in gender equality in economic participation and opportunity and political empowerment leads to 0.37% and 0.53% respectively. This implies that the political gender equality in developing countries is greater and brings higher impact. However, educational attainment and health and survival gender equality have insignificant coefficients. GDP per capita has positively strong and statistically significant coefficients in all estimated models. On the other hand, GDP per capita (Square) and education attainment have a negative and significant coefficient all regressions, which indicate that GDP per capita (Square), education attainment and inflation significantly affects income distribution. Similarly, the estimate of the coefficient for the globalisation and democracy are insignificant. Diagnostic for the estimation is satisfying. In total, the main findings of our results show a large and robust effect of gender equality and its sub-indices on income distribution. Clearly, this finding supports the conventional wisdom that gender equality in all aspect is essential for income equality.

TABLE 4. Impact of gender equality on income inequality in developing countries Dependent variable: income inequality (in log)

Variables	(1)	(2)	(3)	(4)	(5)
Income inequality$_{(t-1)}$	0.537***	0.550***	0.484***	0.534***	0.499***
	(0.0227)	(0.0234)	(0.0276)	(0.0294)	(0.0210)
Over all gender equality	−1.017***				
	(0.329)				
Education attainment gender equality		−0.0128			
		(0.176)			
Health and survival gender equality			1.717		
			(1.570)		
Economic participation and opportunity gender equality				−0.371*	
				(0.204)	
Political empowerment gender equality					−0.525***
					(0.150)
GDP per capita (log)	0.444***	0.409***	0.481***	0.444***	0.385***
	(0.123)	(0.105)	(0.126)	(0.129)	(0.129)
GDP per capita (Square) (log)	−0.0267***	−0.0246***	−0.0285***	−0.0269***	−0.0225***
	(0.0079)	(0.0067)	(0.0080)	(0.0083)	(0.0083)
Education attainment	−0.139***	−0.108***	−0.126***	−0.139***	−0.145***
	(0.0225)	(0.0200)	(0.0269)	(0.0222)	(0.0240)
Inflation	−0.122***	−0.0998**	−0.139***	−0.184***	−0.129***
	(0.0250)	(0.0400)	(0.0203)	(0.0320)	(0.0238)
Globalisation	0.0009	0.0001	−0.0013	0.0010	−0.0006
	(0.0019)	(0.0018)	(0.0022)	(0.0020)	(0.0020)
Democracy	−0.0010	−0.0005	0.0011	0.0002	0.0015
	(0.0015)	(0.0020)	(0.0015)	(0.0014)	(0.0013)
Constant	0.816	0.204	−1.447	0.369	0.606
	(0.634)	(0.495)	(1.416)	(0.630)	(0.625)
AR(1) test (p-value)	0.001	0.007	0.023	0.013	0.059
AR(2) test (p-value)	0.804	0.929	0.419	0.723	0.582
Hansen J-test (p-value)	0.817	0.394	0.378	0.434	0.831
Diff-in-Hansen test (p-value)	0.806	0.718	0.645	0.526	0.493
Instruments	25	25	25	25	25
Observations/ countries	137/57	137/57	137/57	137/57	137/57

Note: All regressions are estimated using the Sys-GMM estimator (Blundell and Bond, 1998). Figures in parentheses are standard errors. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

CONCLUSIONS

This study set out to determine the effect of gender equality on income distribution. This study analysed the estimation models using dynamic econometric method the system GMM for the period of 2006–2013. The empirical results show significant effects of gender equality and its sub-indices on income distribution using panel data of 103 countries. The results show negative impacts of gender equality and its sub-indices on income distribution, suggesting that by increasing equality between males and females will result in lower income inequality. GDP per capita has nonlinear effect income inequality. Education attainment has a negative effect on income distribution, while higher inflation rate increases income inequality.

We performed an outliers test to ensure robustness and to test whether our results still hold. The results show that gender equality impact on income inequality yield the same results. For further robustness, we compared the developed and developing countries with the global sample. The results indicated that educational attainment and health and survival gender equality are negatively associated with income inequality in developed (high income) countries. However, overall gender equality, economic participation and opportunity gender equality and political empowerment gap index have insignificant coefficients. In developing (middle and low income) countries the results showed that overall gender equality, economic participation and opportunity gender equality and political empowerment gender equality are negatively associated with income inequality. However, educational

attainment and health and survival gender equality have insignificant coefficients. Finally, all models passed the diagnostic checks and appear to be adequately specified. This study can conclude that gender equality demonstrated a negative relationship on income inequality.

The study contributes to existing empirical literature is in a number of important aspects. *First,* this study bridges the gaps in the existing literature. *Second*, gender equality is a multidimensional phenomenon. Therefore, this study covers 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 income inequality, education inequality and institutional quality effects on different aspects of gender equality. Finally, this study also uses the latest data set of the World Economic Forum gender gap index for gender equality, measured by Lopez-claros and Zahidi (2005).

Thus, this analysis has implications that the higher gender equality would contribute more to the higher income equality and suggesting that the propagation of gender equality would also be the effective way to expand equality in income. Higher gender equality in education, health, economics participation and political empowerment translate into economic equality.

The results also suggest that implementing equality promotion policies are reasonable course of policy action to offset persistent inequalities in income and gender. Equality does not just happen but requires effort and affirmative measures to bring it about and also requires implementation measures. Greater efforts are needed to ensure gender equality in each dimension. The governments need to promote political, social and economic equality, through policies of redistribution and positive actions, in order to reach de facto equality.

NOTES

[1] See Costa et al. (2009)

[2] Appendix C lists all these countries

[3] Gender gap index ranges from 0 (indicates perfect inequality) to 1 (indicates perfect equality).

[4] The global gender gap index data has been described in a series of papers, including (Branisa, Klasen, & Ziegler, 2010; Branisa et al. 2013; Branisa, Klasen, Ziegler, Drechsler, & Jütting, 2014; Jütting, Morrisson, Dayton-johnson, & Drechsler, 2006; Jütting, Morrisson, Dayton-Johnson, & Drechsler, 2008; Klasen & Schüler, 2011; Permanyer, 2013; Samarakoon & Parinduri, 2015; Wyndow, Li, & Mattes, 2013)

[5] The relationship between income inequality and economic growth is inconclusive. For example Forbes (2000) and Frank (2009) have shown that there is a positive association between income inequality and economic growth. conversely Aghion, Caroli and García-Peñalosa (1999), Glomm and Kaganovich (2008) and Cornia (2012, 2014) points out a negative relationship between income inequality and economic growth.

[6] (see Cornia 2012)

[7] The literature remains inconclusive about the relationship between inflation and income inequality. There are two alternative views about the effect of inflation on the income inequality. For instance, Clarke, Xu and Zou (2006), Ang (2010) and Jalil (2012) point out that the inflation has negatively effect on income inequality. In contrast, Chong and Calderón (2000), Beck et al. (2007), Gourdon, Maystre, and de Melo (2008) Meschi and Vivarelli (2009) find inflation is positively associated with the growth of income inequality and higher inflation is associated with a worsening of income distribution.

[8] Appendix A reports the descriptive statistics and correlation coefficients matrix for the variables. The table provides the means, standard deviations, minimum and maximum values and observations and correlation coefficients matrix.

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

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APPENDIX A. Summary statistics and correlations

Variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mean		3.574	0.680	0.947	0.972	0.631	0.169	8.464	74.111	1.743	0.053	64.657	6.752
Std. Dev.		0.258	0.060	0.094	0.009	0.110	0.124	1.572	26.660	1.203	0.051	15.421	6.453
Min		3.113	0.451	0.467	0.922	0.195	0.008	5.162	26.649	0.121	−0.189	35.791	0
Max		4.245	0.873	1	0.98	0.878	0.754	11.363	129.131	3.518	0.367	92.371	10
Observations		517	824	824	824	824	824	816	816	783	709	824	808
Number of countries (N)		103	103	103	103	103	103	102	102	98	102	103	98
Number of time periods (T)		5.019	8	8	8	8	8	8	8	7.989	7.950	8	7.704
Income inequality (log)	(1)	1.000											
Overall gender equality	(2)	−0.243	1.000										
Education attainment gender equality	(3)	−0.076	0.613	1.000									
Health and survival gender equality	(4)	−0.062	0.222	0.321	1.000								
Economic participation and opportunity gender equality	(5)	−0.221	0.792	0.487	0.194	1.000							
Political empowerment gender equality	(6)	−0.203	0.797	0.204	0.0203	0.339	1.000						
GDP per capita (log)	(7)	−0.241	0.276	0.107	−0.119	0.187	0.284	1.000					
GDP per capita (Square) (log)	(8)	−0.175	0.274	0.063	−0.164	0.175	0.312	0.942	1.000				
Education attainment (log)	(9)	−0.319	0.316	0.315	0.185	0.325	0.132	0.094	0.043	1.000			
Inflation	(10)	−0.076	0.268	0.145	−0.008	0.247	0.199	0.117	0.079	0.061	1.000		
Globalisation	(11)	−0.588	0.514	0.461	0.208	0.380	0.362	0.358	0.228	0.549	0.136	1.000	
Democracy	(12)	−0.125	0.238	0.214	0.083	0.146	0.192	0.107	0.101	0.148	0.036	0.376	1.000

Total observations (474)

APPENDIX B. Definition and description of gender equality index

Variables	Description
Gender Equality (Gen)	Measures the Gender Equality
Economic Participation and Opportunity (GEP)	Ratio of female labour force participation over male value Wage equality between women and men for similar work (converted to female-over-male ratio) Ratio of female estimated earned income over male value Ratio of female legislators, senior officials and managers over male value Ratio of female professional and technical workers over male value
Educational Attainment (GE)	Ratio of female literacy rate over male value Ratio of female net primary enrolment rate over male value Ratio of female net secondary enrolment rate over male value Ratio of female gross tertiary enrolment ratio over male value
Health and Survival (GH)	Ratio at birth (converted to female-over-male ratio) Ratio of female healthy life expectancy over male value
Political Empowerment (GP)	Ratio of females with seats in parliament over male value Ratio of females at ministerial level over male value Ratio of number of years of a female head of state (last 50 years) over male value

APPENDIX C. List of countries included in the analyses

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