The Nexus between International Trade, FDI and Income Inequality*

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Abstract

Purpose – This paper investigated the effect of international trade affects income inequality. It also compares the different effects between developing and developed countries over the period from 2005 to 2014 for 58 countries.

Design/methodology – The econometric estimation was used to identify the relationship between export, import, FDI, GDP, unemployment and income inequality. In this empirical analysis, we utilized a Vector Error Correction (VEC) model using panel data.

Findings – The findings show that there is a close correlated between trade and income inequality. The higher export ratio of GDP tends to have a 1.79 times more income inequality in developing countries than in developed countries. The higher import ratio of GDP tends to have a 2.44 times higher income inequality in developing countries than in developed countries. Further, Increasing FDI tend to have an approximately 1.43 times higher income inequality in developing countries than in developed countries. Korea is in the middle of developed and developing countries' result.

Originality/value – To correct the global income inequality regarding trade, developed countries' proactive trade policies, such as granting preferential tariff benefits to developing countries, are likely to be needed and Income Safety Net in international trade must be taken into account.

1. Introduction

It has been widely recognized that international trade can help to enlarge the size of the market, raises the level of domestic output, eventually leads to an increased efficiency by learning-by-doing, and finally contributes to economic growth. Trade liberalization have brought various effects on trade performance across countries, such as a distribution of benefits and costs of trade liberalization across countries.

However, income inequality across countries and intra-nation has been widening rapidly over the last three decades. Global income inequality has been a long subject of interest to the international economists as the international trade volume has been increased dramatically. It is a common shared belief that the widening of income inequality is majorly attributable to

globalization, which benefits the rich, hurts the poor. It has also been well documented that income bipolarization has occurred in many countries, not only the United States and some European countries but also developing countries because the shares of employment in high-skilled occupations has increased, however, low-skilled occupations does not grow as much as high-skilled one, in the end, middle-wage occupation declines, polarization of earnings and the employment polarization have also been occurred.

There are mixed research results about international trade impact on income inequality. One is that increasing international trade volume appears to have contributed to narrowing the income gap in the developing countries and developed countries. Maasoumi et al. (2015), Jaumotte et al. (2013) and Krieger and Meierrieks (2016). However, there is also growing evidence that international trade negatively impacts income distribution (Alderson and Nielsen, 2002; Barusman and Barusman, 2017). Interestingly, some economists had argued that trade impact on the income gap between developing countries was not clear, because there are many other factors except international trade affecting inequalities, such as labor market conditions, capital market, and technological changes (Beaton, Cebotari and Komaromi, 2017; Green, Dickerson and Arbache, 2001).

Although there are many research papers studying the impact of trade volume on income inequality, this study suggests a simple theory to show that increasing international trade volume can cause income inequality by comparing developing countries and developed ones, and more specific divide trade into export and import, analyze exporting's impact on income inequality and importing's impact on income inequality respectively. It is meaningful to compare the different effects between developing and developed countries by using panel data from the period 2005 to 2014 for 58 countries. Using the empirical results, we suggest some constructive implications for developed and developing countries.

This paper is organized as follows. The second section presents trends of income inequality. The third section performs a review of the literature which identifies a series of indicators. The fourth section describes the research methodology, deals with data, and is followed by a discussion of the results. The fifth section presents the conclusions of this research.

2. Literature Review

2.1. Income Inequality Trend

Recently, income inequality has dramatically risen all over the world, including in wealthy, developing and poor countries. In parallel, many developing countries have seen the emergence of a middle income class that could play a major role in the future development of economies and societies. For a last century, the gap in incomes between the rich and poor is generally thought to have narrowed in an overall perspective. If taking a close look at income database, from in around the 1920 to 1960s, decline in inequality began in USA, Europe and some developing countries. But in the 1970s and 1980s, the pattern began to reverse, and inequality began to rise again. Inequality has also widened in developing economies for many reasons. In recent decades, the economic rise of BRICS (China, Brazil, India, Russia, South Africa) has reshaped the global economy. Emerging of BRICS has relieved huge number of people out of absolute poverty and contributed the emergence of a new middle class. But poverty hasn't gone away. Indeed, in many developing countries, relative poverty is proving stubbornly resistant and inequality, too, is widening.

Fig. 1. The Gini Coefficient in Developing and Developed Countries
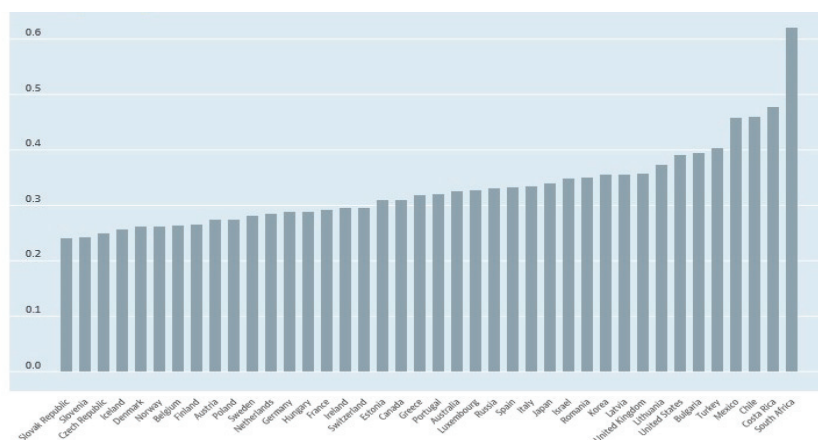
Note: Gini coefficient: 0 = complete equality; 1 = complete inequality.
Source: OECD (n.d.).

Many countries use the Gini coefficient as the index of judging equitable levels of income distribution. The scale of Gini coefficient is between 0 and 1, therefore if Gini coefficient is smaller, the income distribution in their countries will be better. However, if the value of the Gini coefficient is getting bigger, then the income distribution will be worse. The value of 0.4 is usually considered to be the warning line of the income gap between the rich and the poor.

The Fig. 1. shows 58 countries Gini index, composed of 32 developing countries and 26 developed countries. Gini coefficients of developing countries are generally higher than those of developed countries from 2005-2014.

2.2. International Trade and Income Inequality

There have been many studies researched about the relationship between international trade and income inequality. Even though most of them analyze the case in a global base, the approaches are much similar among them. Some studies use Stolper – Samuelson theorem proposed by Stolper and Samuelson (1941) to analyze the effect of international trade on income inequality. This theory suggests that international trade can improve the welfare of the country, but may not be good for everyone. Some people may experience an increase in income while others have an income that has fallen. The Stolper – Samuelson model was used to analyze how the international trade influences income inequality according to Roser and Cuaresma (2016). They demonstrate that there are factors affecting income inequality in industrialized economies and also point out that income inequality was worsened due to increase on imports for developing countries. Lin and Fu (2016) also analyze the relationship between trade expansion and income inequality in small countries. They found that trade increases income inequality in democracies. However, trade has resulted in a significant reduction in autocracies' income inequality. However, this does not necessarily imply that the Stolper – Samuelson model is adequate to analyze the relationship between trade liberalization and income inequality. Several studies use empirical evidence from the following: Alderson and Nielsen (2002), Furusawa and Konishi (2012), Ghose (2004), Jaumotte et al. (2013). Ghose (2004) found that trade liberalization contributed to an increase in the inter-

country inequality and also reduced international inequality. This helped some populous low-income countries to figure out their trade orientation. Franco and Gerussi (2013) empirically tested the effect of trade and inward foreign direct investments (FDI) on income distribution during the period from 1990 to 2006. They found that trade was more relevant than FDI when it occurred in developed countries. In addition, one of the first systematic, cross-national examinations of the role of globalization in the inequality "U-turn" has been inspected by Alderson and Nielsen (2002). They point out that inequality is most affected by 1) the percentage of the labor force in agriculture and 2) the institutional factors union density by globalization affect inequality variation. On the other hand, they analyze longitudinal variation in inequality. It is important that this took place better in many industrial countries better than it did in cross-sectional inequality differences among countries. According to Jaumotte et al. (2013), an analysis was made between the rapid pace of trade and financial globalization and the rise in income inequality. They emphasized that trade globalization is associated with a reduction in inequality. Moreover, they also found that a country with 1) Policies to reduce trade barriers and 2) Expansion of education will increase the trade credit of the country and benefit others globally.

Richardson (1995) analyzes about the nexus between international trade and technology on income inequality. Focusing on developed countries, he revealed that international trade gives a moderate contribution on widening of income inequality, while the most significant contribution on income inequality comes from the information technology development. Gourdon, Maystre and Melo (2008) proved the importance of factor endowments in analyzing the relationship between international trade and income inequality. In Addition, a more international trade is associated with higher inequality in capital abundant country and high-skilled abundant country than labor abundant country. Roser and Cuaresma (2016) argued that international trade could occur between countries with similar factor endowments. For example, the trade between United States and Japan in the last few decades are mainly in the field of technology and cars. Based on this theory, they try to analyze the impact of international trade between developed and developing countries. They used data on the volume of import from developing countries whose production is low-skilled labor intensive and volume of export from developed countries whose production is high-skilled labor intensive. They proved that low-wage import from developing countries increase income inequality in developed countries.

Jaumotte, Lall and Papageorgiou (2013) researched the impact of globalization on income inequality. Globalization is classified into two categories: trade openness and financial openness. They found that globalization brought about a minor effect on income inequality. This is due to its components having offsetting effects: trade openness reduces income inequality, while financial openness exacerbates it. The most important contribution to the increase in income inequality was technological changes. Helpman (2016) argued that globalization is mainly responsible for the huge increase in the inequality of labor compensation has basis in the academic evidence. Further, globalization has impacted the wage gap of different types of workers, it has contributed to an increase in the wages of skilled relative to unskilled workers through technical development. It is also found that these effects explain only a part of the rise in wage inequality in rich and poor countries alike. Pavcnik (2017) focused on low- and middle-income countries, and come to a similar conclusion, and emphasizes that while the impact of trade on inequality is really huge, it is also very sensitive to context-specific factors, such as the mobility of workers and capital across the country. The fact that context-specific factors heavily influence the impact that globalization has on inequality is part of the reason why we observe such different inequality trends between countries.

We also reviewed some studies earlier that help us understand the relationship of international trade to income inequality. They explained why international trade can help to widen a wage gap between top earners and bottoms. The answer can be found in research from Furusawa and Konishi (2012). They provide results that international trade increases the lowest and highest abilities of real wages, but decreases the intermediate abilities of real wages. In a country, international trade increases income inequality in the smaller or talent-scarce nations. On the other hand, it lessens the income inequality in the talent-abundant countries. Some research was published recently by Barusman and Barusman (2017), Beaton, Cebotari and Komaromi (2017), Maasoumi et al. (2015), Hong (2015), Krieger and Meierrieks (2016), Lin and Fu (2016), Zakaria, Junyang and Fida (2016). Krieger and Meierrieks (2016) assess the relationship between income inequality and economic freedom during 1971–2010. They use a panel of 100 countries' data and analyzed the effect of income inequality on economic freedom is negative. In particular, inequality is negatively associated with those components of economic freedom related to international trade. Hong (2015) assesses the link between increased openness to trade and transnational income inequality, and presents the result that the Canada–US Free Trade Agreement benefited Canada.

Very few studies have assessed different locations. Maasoumi et al. (2015) demonstrate the impact of liberalization policies on income inequality in 26 African countries during the years 1996-2010 and find that financial liberalization has a levitated income-redistributive effect with the magnitude of the de jure measure higher than that of the de facto measure (FDI). They also found that exports, trade, and "freedom to trade" have an equality incidence on income distribution, institutional and/or political liberalization has a negative impact. Lastly, they found that economic freedom has a negative income-redistributive effect. To the research of South Asian countries, Zakaria, Junyang and Fida (2016) demonstrates the effects of trade liberalization on undernourishment and income inequality in South Asian countries (SACs). This also points out that after liberalization, the income inequality has increased in the region. Zakaria and Fida (2016) empirically show the effects of trade liberalization on income inequality in China and the South Asian Association for Regional Cooperation countries during the years 1973-2012. They find that the liberal trade policies have increased income inequality. Education, financial development, financial openness, democracy, and government size have a reducing effect on income inequality except per capita income in these countries. In Latin America, Beaton, Cebotari and Komaromi (2017) demonstrates the relationship between international trade, economic growth, and inequality in Latin America and the Caribbean. They adopt a cross-country panel framework and event studies approach to find that trade openness has substantial macroeconomic benefits. However, they do not find that trade has an impact on overall income inequality. On the other hand, Mahesh (2016) demonstrates the relationship between trade openness and income distribution evidence from BRIC countries (Brazil, the Russian Federation, India, and China). It was proven that a percentage of GDP increase in trade caused the worsening of the income distributions in these countries. Meanwhile, Barusman and Barusman (2017) also points out that trade increases income inequality in the United States, and an increase in trade leads to a wider income gap as more income goes to the top 10% wealthiest people.

2.3. FDI and Income Inequality

FDI as a more important tool effects on economic development, meanwhile, its effects on income inequality. Many literatures investigate the relationship between FDI and income inequality from different views. Some of research scholars deemed that FDI can reduce income inequality. Such as Herzer and Nunnenkamp (2013) found inward and outward FDI

reduce inequality in the long run. Im and McLaren (2015) found that FDI inflows have a negative effect on inequality in the host countries because of the potential endogeneity, when FDI inflows are instrumented by a range of variables. McLaren and Yoo (2017) investigated that FDI can be a general anti-poverty strategy in Vietnam. Völlmecke et al. (2016) identified a positive interaction of FDI and human capital in their relation with income growth dynamics. On the other hand, studies found that FDI can increase income inequality. Such as Basu and Guariglia (2007) used a panel data of 119 developing countries and found FDI increase human capital inequality. Hanson (2007) used geographic variation in FDI to analysis FDI effect on income inequality. He found that FDI raise inequality. Zhang and Zhang (2009) found FDI is an important cause of the widening income gap between urban and rural areas in China. In the end, we summarize this studies in Table 1.

Table 1. Summary of Studies that Income Inequality

Factors	Authors	Description
Trade ↓ Income inequality	Ghose (2004)	Trade liberalization ↗, Inequality ↗ in the inter-country. Trade liberalization ↗, International inequality ↘.
	Alderson and Nielsen (2002)	Globalization ↗, Inequality ↗.
	Furusawa and Konishi (2012)	Trade ↗, Income inequality ↗ in the smaller or talent-scarce nations Trade ↗, Income inequality ↘ in the talent-abundant country
	Jaumotte et al. (2013)	Trade globalization ↗, Income inequality ↘.
	Franco and Gerussi (2013)	Export and import ↗, Income inequality ↘, in the long time Export and import ↗, Income inequality ↗, in the short time
	Maasoumi et al. (2015)	Freedom of trade ↗, Income inequality ↘.
	Hong (2015)	Openness to trade ↗, Unequal income ↗.
	Lin and Fu (2016)	Trade↗, Income inequality ↘ in autocracies. Trade↗, Income inequality ↗ in democracies.
	Roser and Cuaresma (2016)	Imports ↗, Income inequality ↗.
	Krieger and Meierrieks (2016)	Income inequality ↗, Economic freedom (related to international trade) ↘.
	Zakaria et al. (2016)	Trade liberalization ↗, Income inequality↗.
	Zakaria and Fida (2016)	Trade liberalization ↗, Income inequality↗.
	Mahesh (2016)	Trade ↗, Income inequality↗.
	Beaton et al. (2017)	Trade ↗, Income distribution (0).
	Barusman and Barusman (2017)	Trade ↗, Income inequality↗.

Table 1. (Continued)

Factors	Authors	Description
FDI ↓ Income inequality	Hanson (2007)	FDI ↗, Income inequality ↗.
	Basu and Guariglia (2007)	FDI ↗, human capital inequality ↗ in developing countries.
	Zhang and Zhang (2009)	FDI ↗, the widening income gap between urban and rural areas ↗ in China.
	Muhammad and Naveed (2008)	FDI ↗, economic benefits ↗ in rural areas than in urban ones.
	Herzer (2013)	outward FDI ↗, Income inequality ↘.
	Im and McLaren (2015)	FDI inflows ↗, inequality ↘ in the host countries.
	Völlmecke et al. (2016)	FDI and human capital ↘, income growth ↗.
	McLaren and Yoo (2017)	FDI ↗, poverty ↘ in Vietnam.

3. Empirical Methodology

3.1. Model

As far as we know, many studies use econometric estimation to test the relationship between international trade and income inequality. The econometric estimation is conducted using a ten-year panel data over the period 2005-2014 for 58 countries. The method used to analyze the data in this study, and the Vector Error Correction Model (VECM) was be used. The empirical results pertaining to inequality and international trade is researched with reference to conditions in the labor markets. Gourdon, Maystre and De Melo (2008) found that initial resource endowments, particularly with respect to skilled labor, materials when assessing the effects of international trade on income inequality. They find that trade liberalization has strong positive effects on income inequality in countries where most labor force has no education. Acar and Dogruel (2012) applied panel data analysis to study wage inequality in selected Middle Eastern and Northern African countries. They found that per-capita GDP and female labor-force participation have positive effects on income inequality while trade openness has negative effects.

Research regarding income inequality have been conducted across countries. Anderson (2005) points out that empirical time series studies show that greater openness increased wage income gap, cross-sectional studies show that greater openness had little effect on income gap. He projects that income inequality associated with increased demand for skilled labor would be offset by other industrial effects. Basu and Guarigliab (2007) found that FDI promotes growth while reducing the agricultural share of total GDP, thus increasing income inequality.

In this study, the variables affecting the income inequality (GINI) were defined considering export volume, import volume, FDI, GDP and unemployment. Therefore, the following equations have been formulated:

$$GINI = f(IMPORT, EXPORT, FDI, GDP, UNEMPLOYMENT) \tag{1}$$

$$\Delta GINI = \propto + \beta_1 \Delta logExport_{it} + \beta_2 \Delta logImport_{it} + \beta_3 \Delta logFDI_{it} + \beta_4 \Delta logGDP_{it} + \beta_5 \Delta Unemployment_{it} + \epsilon_t \tag{2}$$

Where,

GINI: the GINI coefficient of country,

$Export_{it}$: the export volume of country in year t,

$Import_{it}$: the import volume of country in year t,

FDI_{it}: the foreign direct investment of country in year t,

GDP_{it}: the GDP volume of country in year t,

$Unemployment_{it}$: the unemployment of country in year t

$$\Delta Y_t = FY_{t-1} + G(L)\Delta Y_{t-1} + \epsilon_t \tag{3}$$

Where, Y_t is n-dimensional vector of time-series I (1).

$$F = A\ (1), \tag{4}$$

$$G(L) = G_0 + \sum_{i=1}^{m} G_i L^{i-1}, G(L) = -\sum_{h=i+1}^{m} A_h \tag{5}$$

Where, ϵ_t is n x 1 linear prediction error vector with iid(0, Σ_ϵ).

In general, Vector Error Correction (VEC) model is mainly used to learn the causal relationship between the paired time-series variables and to explore common characteristics and the interaction. The VEC model is used if there is co-integration among variables; in this paper, this model will be used for the analysis.

3.2. Data

The World Bank divides the world's economies into four income groups like high, upper-middle, lower-middle, and low. We use this classification on GNI per capita calculated using the Atlas method. The unit for this measure is based on a current US Dollars. These classifications are used to collect data for groups of similar countries. The income-category of a country is not one of the factors used that influence lending decisions. In this study, it is reassigned into two income group. High, upper-middle is assigned into developed countries, lower-middle and low income group is assigned into developing countries. This study uses a ten-year panel data of 58 countries, which consists of 26 developed countries and 32 developing countries over the period from 2005-2014. The developed countries include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherland, Norway, Portugal, South Korea, Spain, Italia, Sweden, Switzerland, United Kingdom, United States, England, and Japan. The developing countries: Armenia, Belarus, Bolivia, Brazil, Bulgaria, China, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Georgia, Honduras, Hungary, Indonesia, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Mexico, Moldova, Panama, Paraguay, Peru, Poland, Romania, Russian Federation, Slovak Republic, Thailand, Turkey, Ukraine, Uruguay, the Czech Republic and Malta.

Furthermore, the independent variables such as GDP, FDI, and unemployment come from the World Bank Database. And the international trade data set uses import and export volume in a country; this data is also collected from the World Bank Database. The key of the dependent variable is economic inequality (GINI) data which comes from the UNU-WIDER World Income Inequality Database (WIID3.4) that was published in January 2017. The descriptive statistics for the variables are shown in Table 2; included are the mean, median, standard deviation, maximum and minimum values as follows:

Table 2. Descriptive Statistics for Variable Measures

Variables	Mean	Median	Max	Min	Std. Dev.	Obs.
IMPORT	24.916	25.107	28.556	20.668	1.822	580
EXPORT	24.969	25.122	28.684	21.056	1.702	580
FDI	22.528	22.693	27.321	15.803	1.953	580
GDP	25.779	25.904	30.487	21.623	1.947	580
UNEMPLOYMENT	7.733	7.029	27.466	0.492	4.193	580
GINI	36.339	33.980	59.510	22.700	8.862	580

3.3. Result

Before doing the VAR estimation firstly, Stationary of time series will be examined by unit root test. If a time series is non-stationary time series data, then there is no relationship between the two variables, so it can cause a spurious or fictional regression in which a highly significant regression is assumed (Hill, Griffiths and Lim, 2012). Thus, the unit root test was inspected for all variables. It is possible to see that all variables present in the unit root are changed into primary difference, then all variables become to have unit root, and the time series data are stable. The unit root test conducted on the level stage to the first difference, and the result of the data stationary as follows:

Table 3. Unit Root Test

Categories	Level		1st Difference	
	Statistics	Prob. value***	Statistics	Prob. value***
GINI				
ADF - Fisher Chi-square	128.632	0.199	219.052	0.000
PP - Fisher Chi-square	158.069	0.005	530.866	0.000
LIMPORT				
ADF - Fisher Chi-square	140.102	0.063	254.034	0.000
PP - Fisher Chi-square	187.858	0.000	433.893	0.000
LEXPORT				
ADF - Fisher Chi-square	123.240	0.937	261.813	0.000
PP - Fisher Chi-square	129.288	0.188	427.991	0.000
LFDI				
ADF - Fisher Chi-square	142.963	0.045	200.092	0.000
PP - Fisher Chi-square	236.018	0.000	463.369	0.000
LGDP				
ADF - Fisher Chi-square	178.529	0.000	225.664	0.000
PP - Fisher Chi-square	-2.189	0.014	256.407	0.000
UNEMPLOYMENT				
ADF - Fisher Chi-square	-10.509	0.000	-14.919	0.000
PP - Fisher Chi-square	-3.142	0.001	-4.442	0.000

Next, the optimum lag test was used to shape a good VAR model, it is able to determine the optimum lag in this model. The six criteria are showed by Sims (1980). Such as Schwarz Information Criterion (SC), Hannan-Quinn Information Criterion (HQ), Akaike Information Criterion (AIC), Final Prediction Error (FPE), the general-to-specific sequential Likelihood Ration test (LR), and a small-sample correction to that test (SLR). Based on Table 4, it is worth highlighting that the smallest point for LR, FPE, AIC, SC and HQ criteria based on lag 1. Therefore, the lag 1 would be used in this research because their criteria recommend the use of lag 1.

Table 4. Optimal Lag Test Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5696.497	NA	49.37427	23.76457	23.82544	23.78849
1	800.2512	12776.94*	1.06e-10*	-3.101047*	-2.614105*	-2.909640*

Note: *Optimal Lag (indicates lag order selected by the criterion).

The co-integration test is to examine whether there is a stable relationship between variables. It showed that even though individual time series has unit root, but hypothetical relationship was untenable between time series. Therefore, the results of regression analysis would be meaning. In this study, the co-integration test and unit root test was performed. The co-integration test result on the 7 variables showed that there is a co-integration relationship among these variables. Compared with VAR model, using VECM with co-integration is a good way to gain the characteristics of variables.

Table 5. Johanssen's Co-integration Test Results (Trace Test)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.664709	1046.700	125.6154	0.0001
At most 1 *	0.519111	730.8933	95.75366	0.0001
At most 2 *	0.475706	519.3110	69.81889	0.0001
At most 3 *	0.341062	332.7029	47.85613	0.0001
At most 4 *	0.306009	212.1536	29.79707	0.0001
At most 5 *	0.271572	106.5830	15.49471	0.0001
At most 6 *	0.050607	15.00839	3.841466	0.0001

Notes: 1. Trace test indicates 7 cointegrating eqn (s) at the 0.05 level.
2. * denotes rejection of the hypothesis at the 0.05 level.
3. ** MacKinnon-Haug-Michelis (1999) p-values.

Table 6. Johanssen's Co-integration Test Results (Max-Eigen Test)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.664709	315.8069	46.23142	0.0000
At most 1 *	0.519111	211.5824	40.07757	0.0001
At most 2 *	0.475706	186.6081	33.87687	0.0001
At most 3 *	0.341062	120.5492	27.58434	0.0000
At most 4 *	0.306009	105.5707	21.13162	0.0001
At most 5 *	0.271572	91.57458	14.26460	0.0000
At most 6 *	0.050607	15.00839	3.841466	0.0001

Notes: 1. Max-Eigen test indicates 7 cointegrating eqn (s) at the 0.05 level.
2. * denotes rejection of the hypothesis at the 0.05 level.
3. **MacKinnon-Haug-Michelis (1999) p-values.

Granger causality test is regression, therefore, the tested variable is required to be stable, and the non-stationary variable is required to be co-integrated to avoid pseudo-regression. Before granger causality test, unit root test and co-integration test for non-stationary variables was conducted. From the grander causality test conducted for causality between variables as shown (See Table 7). It should be noted that it can help predict whether there is a causal relationship between the two variables (Choi, 2016).

Table 7. Grander Causality Test

Null Hypothesis:	F-Statistic	Prob.
D(LFDI) does not Granger Cause D(LIMPORT)	3.52988	0.0304**
D(LGDP) does not Granger Cause D(LFDI)	3.19132	0.0423**
D(LEXPORT) does not Granger Cause D(LGDP)	10.9136	0.0000***
UNEM does not Granger Cause D(LEXPORT)	3.23269	0.0405**
D(LEXPORT) does not Granger Cause UNEM	15.8222	0.0000***
D(LEXPORT) does not Granger Cause D(GINI)	3.31736	0.0372**
D(LGDP) does not Granger Cause D(LIMPORT)	5.47939	0.0045***
D(LIMPORT) does not Granger Cause D(LGDP)	6.87574	0.0012***
UNEM does not Granger Cause D(LIMPORT)	7.88752	0.0004***
D(LIMPORT) does not Granger Cause UNEM	14.6726	0.0000***
D(LIMPORT) does not Granger Cause D(GINI)	3.63528	0.0273**
UNEM does not Granger Cause D(LGDP)	6.06009	0.0026***
D(LGDP) does not Granger Cause UNEM	19.5064	0.0000***
D(LGDP) does not Granger Cause D(GINI)	2.96931	0.0479**
UNEM does not Granger Cause D(GINI)	2.92450	0.0498**

In this section, the regression results quantifying the effect of international trade affect income inequality are shown in full. We made two models and used the Eviews tool to analyze and test our hypotheses. In the first model, we analyzed how international trade affects income inequality. In the second model, we also comparatively analyzed how the international trade affects income inequality in developing and developed countries. The Model I empirical result is that the export variable has more of a positive effect on income inequality (b= 0.026350, t=9.44749). As a result, it shows that a 1% improvement of export increases the income inequality rate by 0.026%. The import variable is significant and presents a positive sign on income inequality (b=0.030446, t=10.2433). It means that a 1% increase of import will increase income inequality by 0.03%. Meanwhile, FDI displays significant and positive coefficients on income inequality (b=0.069105, t=3.02755) for the sample containing all the countries. As a result, a 1% increase of FDI will increase income inequality volume by 0.069%. The GDP variable presents a positive sign on income inequality (b=0.011933, t=5.35262). It shows that a 1% improvement of GDP increases the income inequality rate by 0.012% approximately. The unemployment variable has a negative effect on income inequality (b=-0.052690, t=-1.66889). As a result, it shows that a 1% improvement of unemployment rate lessens the income inequality rate by -0.053% approximately. From Table 6 there is a VECM estimation result shows that the significant variables affecting the income inequality is export, import, FDI, GDP, unemployment. The relation above can be written as follow:

$$D(GINI)=0.026350*D(LEXPORT)+0.030446*D(LIMPORT)+0.069105*D(LFDI)$$
$$+0.011933*D(LGDP)+0.265135*D(UNEM)$$

Table 8. Pool Regression Analysis Result

Error Correction	D(GINI)
CointEq	-0.177978
	[-4.33006]***
D(GINI(-1))	-0.883098
	[-16.8019]***
D(LEXPORT(-1))	0.026350
	[9.44749]***
D(LIMPORT(-1))	0.030446
	[10.2433]***
D(LFDI(-1))	0.069105
	[3.02755]***
D(LGDP(-1))	0.011933
	[5.35262]***
D(UNEM(-1))	0.265135
	[1.62715]
C	0.253740
	[1.56356]
R2	0.615751
F-statistic	31.76755
Sum sq.	1755.591

Notes: 1. Significance levels: *$p<0.1$, **$p<0.05$, ***$p<0.001$.
2. Values in [ ] denotes the T-value.

In keeping with the objective of this research, we analyzed that how the international trade affects income inequality in developing and developed countries (See Table 9). The export volume has more of a significant effect on income inequality in developing countries (b=0.020825, t=7.38049), than in developed countries (b=0.011635, t=2.27388). As a result, it shows that a 1% improvement of export volume increases the income inequality rate by 0.021% in developing countries and by 0.012% in developed countries. Similar to export volume, import volume has a stronger significant effect on income inequality in developing countries (b=0.023970, t=7.90699), than in developed countries (b=0.009822, t=1.68406). It shows that a 1% improvement of import volume increases the income inequality rate by 0.024% approximately in developing countries and by 0.010% approximately in developed countries. It is proven that the impact of exports and imports on income inequality in developing countries is greater than that of developed countries. The FDI variable has more of a significant effect on income inequality in developing countries (b=0.066701, t=3.55737), However, it does not have an effect on income inequality in developed countries (b=0.046615, t=0.68236). It is worth highlighting the fact that a 1% improvement of FDI increase the income inequality rate by 0.068% approximately in developing countries. It shows that FDI increases the country's income distribution gap, that is, FDI increased by different types of workers (non-technical and technical, unskilled and skilled) in developing countries. Mean-while, Wu and Hsu (2012) stated that FDI is widening the gap the income distribution of those host countries with low levels of absorptive capacity (air transport, electric power consumption, telephone main lines and their composite infrastructure, as well as initial GDP). The GDP variable has more of a significant sign on the income inequality in developing countries (b=0.010232, t=4.33085), it does not have an effect on income inequality in

developed countries (b=0.002802, t=0.77500). Meanwhile, a 1% improvement of GDP increase the income inequality rate by 0.010%. It indicates that the economic growth is not perceived by whole society in developing countries. Agusalim and Pohan (2018) found the similar result in the research which analyzed the one percent economic growth increasing, the income inequality will increase by 0.73 points. On the other hand, the unemployment rate variable has no effect on income inequality in developed countries (b=0.033207, t=0.44348) and developing countries (b=-0.033844, t=-1.07061). Therefore, for developed countries, the equation can be written as follow:

$$D(GINI)=0.011635*D(LEXPORT)+0.009822*D(LIMPORT)+0.046615*D(LFDI)$$
$$+0.002802*D(LGDP) +0.033207*D(UNEM)$$

Meanwhile, for developing countries, the equation can be written as follow:

$$D(GINI)=0.020825*D(LEXPORT)+0.023970*D(LIMPORT)+0.066701*D(LFDI)$$
$$+0.010232*D(LGDP) +(-0.033844)*D(UNEM)$$

For Korea, the equation can be written as follow:

$$D(GINI)=0.015725*D(LEXPORT)+0.019370*D(LIMPORT)+0.057400*D(LFDI)$$
$$+0.009342*D(LGDP) +(-0.024654)*D(UNEM)$$

Table 9. All Factors Impact Income Inequality in Developed and Developing Countries

Error Correction	D(GINI)		
	Developed countries	Developing countries	Korea
CointEq	-0.012468	-0.103644	-0.035725
	[-0.75786]	[-2.60131]***	[-2.00731]***
D(GINI(-1))	-0.700212	-0.986651	-0.854231
	[-6.58058]***	[-16.2590]***	[-11.5270]***
D(LEXPORT(-1))	0.011635	0.020825	0.015725
	[2.27388]**	[7.38049]***	[4.48759]***
D(LIMPORT(-1))	0.009822	0.023970	0.019370
	[1.68406]*	[7.90699]***	[4.670909]***
D(LFDI(-1))	0.046615	0.066701	0.057400
	[0.68236]	[3.55737]***	[2.37404]***
D(LGDP(-1))	0.002802	0.010232	0.009342
	[0.77500]	[4.33085]***	[3.84652]***
D(UNEM(-1))	0.033207	-0.033844	-0.024654
	[0.44348]	[-1.07061]	[-0.96564]
C	-0.046425	0.353213	0.297413
	[-0.21144]	[1.51056]	[1.26576]
R2	0.327795	0.655794	0.548497
F-statistic	4.738584	23.60878	19.87568
Sum sq.	447.7512	1281.937	978.379

Notes: 1. Significance levels: *$p<0.1$, **$p<0.05$, ***$p<0.001$.
2. Values in [ ] denotes the T-value.

4. Conclusion

This paper investigated the effect of international trade affects income inequality. The econometric estimation was used to identify the relationship between export, import, FDI, GDP, unemployment and income inequality. We used a ten-year panel data over the period from 2005-2014 for 58 countries and sets up two empirical models to analyze and compare with developing and developed countries. The findings show that there is a close correlated between trade and income inequality. The higher export ratio of GDP tends to have a 1.79 times more income inequality in developing countries than in developed countries. The higher import ratio of GDP tends to have a 2.44 times higher income inequality in developing countries than in developed countries. It can be presumed that the increase of imports and exports has led to a widening income gap across the nations, and international trade has significantly affected the income inequality in developing countries than in developed countries. Further, its result also proves that the widening gap of the income inequality across the globe is negatively related from FDI, regardless of developing or developed countries. It is very interesting that FDI can increase more income inequality in developing countries than in developed countries. More specifically, we found that the FDI tend to increase an approximately 1.43 times higher income gap in developing countries than in developed countries. Korea is in the middle of developed and developing countries' result. To correct the global income inequality regarding trade, developed countries' proactive trade policies, such as granting preferential tariff benefits to developing countries, are likely to be needed and income safety net must be taken into account. Income safety net is an alternative, but it is not clear which firms have gained more through free trade and it is difficult to accurately measure which firms have lost to what extent. Therefore, a detailed review of the income safety net should be performed before practicing.

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