DISSERTATION

THREE ESSAYS ON THE EFFECT OF DOMESTIC INEQUALITY AND GLOBAL INEQUALITY ON ECONOMIC GROWTH

Submitted by

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In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Spring 2021

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ABSTRACT

THREE ESSAYS ON THE EFFECT OF DOMESTIC INEQUALITY AND GLOBAL INEQUALITY ON ECONOMIC GROWTH

In the preface to his *Principles of Political Economy and Taxation* (1817; 1951, p. 5), David Ricardo wrote that the determination of laws of distribution is the principal problem in Political Economy. One of the political economy concerns (normative economics) is the application of economic policies to maintain specific goals based on observation or economic theory describing (positive economics). Ricardo's statement points to the importance of income distribution for economic growth and implies that understanding the relationship between income distribution and economic growth is crucial for policymakers.[1] These three essays aim to contribute to the existing literature on the effects of domestic and global inequality in income distribution on growth.

By developing a theoretical model, the first paper attempts to capture the effect of domestic inequality on economic growth in a closed economy without government. The main novelty is modeling the adjustment between aggregate demand and aggregate supply when there is disequilibrium due to inequality in income distribution: such adjustment occurs via the economy's aggregate saving rate. The saving rate adjustment to disequilibrium results in

[1] Ricardo's contribution comes during the period when there was a debate on the Corn Laws in the early 1800s. The fundamental question of the Corn Laws, clearly perceived by Ricardo, concerned the distribution of income. Higher tariffs would shift the distribution of income in favor of the landlords.

an inverted U-shaped relationship between domestic inequality and growth, which has important implications for growth theory and policy.

The second paper investigates recent global inequality trends by isolating its two components: between- and within-countries inequality and investigating their relationship with globalization. The main finding is that the recent decline in global inequality is mostly due to the decline in between-country inequality due mainly to the growth in income per capita for the most populated countries in the world (especially China & India). Although between-country inequality has decreased, within-country inequality has increased over the sample period. The recent increase in globalization is the main reason for the decrease in inequality between countries and the increased within-country inequality.

By using a large panel dataset comprising almost all the countries globally, the third paper provides a further empirical investigation. First, it confirms the hump-shaped relation between domestic inequality and growth. Second, it finds a negative effect of international inequality on real output and consequently on demand for imports. Third, the latter result has implications on the effect of global inequality on economic growth, thus providing a further evaluation of the export-led growth hypothesis.

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Chapter 1: Inequality, the Saving Rate and Economic Growth

Summary

This paper develops a growth model where there is a role for aggregate demand to account for the effect of inequality in the personal or size of income distribution on growth, even though the neoclassical assumption has been accepted. The main argument is that the deficiency in consumption and aggregate demand resulting from inequality will cause a process of dissaving, which has two critical implications concerning growth theory. On the one hand, the aggregate saving rate in the economy will be affected. On the other hand, there will be an inverted U-shaped relationship between inequality and the saving rate. Previous contributions have argued that inequality leads to an increase in the saving rate. The viewpoint advanced in this paper is that low levels of inequality in income distribution determine an increase in saving rate; however, a high inequality level leads to a decrease in the saving rate through aggregate dissaving in the economy. Given the saving rate's role in determining the long-run growth rate in endogenous growth models, the relationship between inequality in income distribution and growth takes an inverted-U shape.

1-1-Introduction

Recent data (Stockhammer et al., 2009), the IMF (2007, 2014), the European Commission (2007), the Bank for International Settlements (Ellis & Smith, 2007), and OCED have all shown a decline in the labor income share since 1980 in many advanced countries [Figure 1-1].

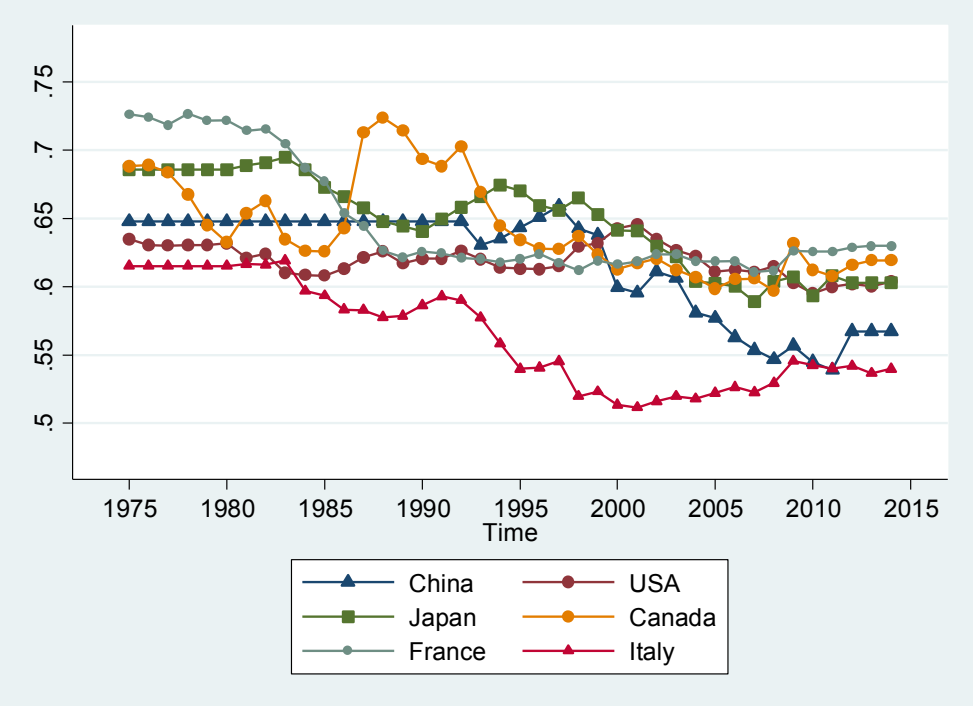

Figure 1-1: *(Source of data: Federal Reserve Bank of St. Louis)*

Also, studies by Piketty (2001, 2003), Piketty and Saez (2003), and Atkinson (2005) highlighted the dramatic changes in income inequality across many different countries since the beginning of the 20th century. Inequality in the personal or size of income measured by the Gini index shows an upward trend for many advanced countries [Figure 1-2].

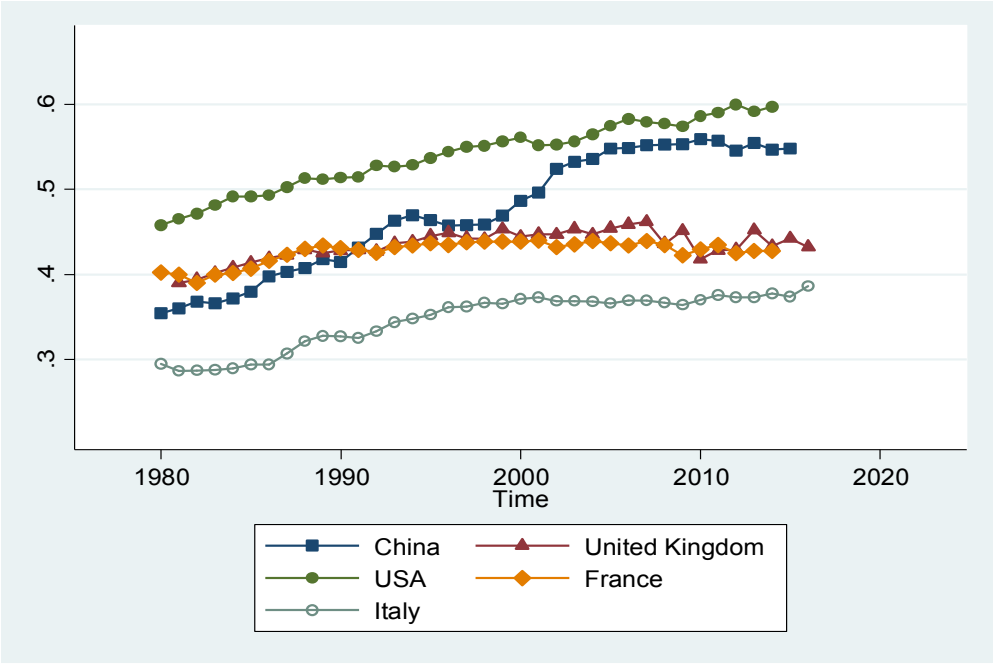

Figure 1-2 :(Source of data: World Inequality Database)

Although the two measures of inequality in income distribution (the personal and functional income distribution) may be correlated, the size distribution of income is a more appropriate way to represent inequality. The Classical Political Economists considered the two measures identical as capitalists' income was solely based on profits, while laborers' income was solely based on wages. Through the twentieth century, the discrepancy between the two-measure become clearer, where according to (Lydall 1968, 2):

"*[…] many employees earn more than capitalists; many property owners work, and many workers own property.*"

Thus, 'workers' might save, thereby owning a portion of capital, while 'capitalists' might also earn wage income. Thus, what matters is the size of income and not the type of income.

The presence of a secular trend in inequality poses important questions for economists and policymakers about the possible effects of inequality on the long-run process of economic growth. Is inequality in income distribution good or bad for economic growth? Is the relation between inequality and growth linear or non-linear? In other words: are low levels of inequality is good for growth, while high levels of inequality are bad for growth?

In the recent economic literature and neoclassical context, many theoretical and empirical studies find that personal income inequality eventually harms the economic growth process. Mostly due to indirect factors associated with inequality and not immediately related to the direct effect of inequality on the growth process. For instance, inequality harms the economic growth process through government intervention (fiscal policy democratic countries through taxation of capital (Alesina and Rodrik, 1994; Persson and Tabellini, 1994). Inequality harms economic growth through low-income people's inability to invest in human capital because of credit-market imperfections (Galor and Zeira, 1993). Inequality could lead to socio-political instability (Benhabib and Rustichini, 1996), which eventually harms economic growth.

However, little has been said about the direct effect of inequality in the personal or size of income distribution on the aggregate saving rate (assuming a closed economy without government), which is the main transmission channel in the neoclassical growth literature (Bourguignon 1981).

Most neo-Kaleckian models and the neo-Keynesian growth models of Lewis (1954), Kaldor (1957) assume individuals have different marginal propensity to save; those with higher incomes have a higher marginal propensity to save. Neoclassical economists usually assume no

minimum consumption requirements[2] concluding that the savings rate equals the marginal propensity to save. Based on the assumption that individuals have different marginal propensity to save and that there does not exist a minimum consumption requirement – or, if it exists, it remains constant – an increase in inequality leads to increased personal or aggregate savings (assuming a closed economy without a government sector). Since saving causes investment, the implication is that higher inequality leads to a higher saving rate. In the neoclassical growth model, this has only a level effect on output per capita. In contrast, in endogenous growth theory (EGT), the increase in the saving rate will have a permanent positive effect on the economy's growth rate. This implies that inequality itself has a positive effect on real output growth in the short and long run.

The viewpoint advanced in this contribution is that assuming no minimum consumption requirement – or its independence from income distribution – is inappropriate and undermines the effect of income distribution on aggregate demand and, consequently, aggregate supply. Individuals have a perceived appropriate standard of living. Besides, we cannot assume the perceived standard of living to be independent of income and income distribution, as indicated by Veblen's (1899, 2007) analysis of conspicuous consumption, Dusenberry (1949) in the second theorem of the relative income hypothesis, and Robert H. Frank (2014) in the case of expenditures cascades.

Under the assumption of different marginal propensities to save and dependence of minimum consumption requirement on income and income distribution, the saving rate will adjust to the deficiency in consumption (increase in savings) resulting from inequality through a process of *dis-saving*. This process provides another way of 'closing' a growth model by allowing the

[2] There are exceptions that is some authors assume existence of minimum consumption requirement, they assume it is constant and will not be affected by income and income distribution presence of minimum consumption (Steger, 2000).

aggregate saving rate to bear the adjustment between aggregate supply and aggregate demand. Since individuals have different marginal propensity to save, and higher income individuals have a higher marginal propensity to save, an increase in inequality leads to an increase in aggregate saving out of income. However, inequality simultaneously leads to an increase in dissaving at low income levels, mostly due to the generated deficiency in consumption. Based on this mechanism, it is expected that the relationship between inequality in income distribution and saving will be non-linear and hump-shaped in particular.

This mechanism provides an alternative way of resolving the conflict between supply-side economists and demand-side economists. Because it will give a role for aggregate demand, in the long run, even the neoclassical assumption that output is constrained by technology and not by aggregate demand has been accepted.

In the neoclassical theory, the saving rate is given exogenously as a parameter (Solow Model), or it is endogenous as in the Ramsey–Cass–Koopmans model, based primarily on the work of Frank P. Ramsey (1929) with significant extensions by David Cass (1965) and Tjalling Koopmans (1965).

In the neoclassical growth models of the kind of the Ramsey growth model, the saving rate is not always constant along the equilibrium path but determined mainly by the rate of return on capital (interest rate), which depends on the production function's characteristics[3]. Barebone neoclassical growth models assume identical consumer representative or homogeneity among individuals, and there is no difference in income or saving behavior among individuals. However,

[3] Accordingly, the saving rate will be either: decreasing along with the transitional dynamics to the balanced growth path of the economy if the intensive production function is concave (for instance, in the Cobb-Douglas case); or constant in case of a constant marginal product of capital, as it would be the case in AK models

some exceptions tried to consider differences in income and wealth among individuals (Stiglitz, 1969; Chatterjee, 1994; Caselli and Ventura, 2000). However, these studies focused on the evolution of income and wealth along the growth process and not on the effect of inequality on saving rate and, consequently, growth.

Serrano and Freitas (2015) provide an alternative closure to analyze the relationships between economic growth, income distribution, capacity utilization, and effective demand in heterodox growth models. The new closure comes from the variability of autonomous expenditures that do not generate the private sector's capacity. This variability allows the marginal propensity to invest in determining the saving ratio without the need for changes in income distribution. However, the Serrano and Freitas model operates in the demand-led growth tradition and ignores the supply side. Furthermore, they assume autonomous expenditures to be independent of income and income distribution.

This research aims to contribute to the existing literature about the inequality in income distribution and the growth process by introducing a new saving function where there is a role for income distribution and aggregate demand in determining the saving rate and, consequently, economic growth. In doing so, all neoclassical assumptions will be accepted, and the personal or the size of the income distribution will be taken as the exogenous variable. The saving rate adjusts to the given income distribution, and therefore all other variables of the system will do so as well.

The second section will be about data analysis of the relationship between inequality in the personal income distribution (measured in Gini Index) and the USA's personal saving rate from 1970 until 2016. The third section will develop a theoretical model for economic growth by introducing a new saving function that considers income distribution's effect on consumer

behavior. Thus, there will be a role for income distribution in determining economic growth via affecting saving rate. The final section will draw some conclusions.

1-2-Data Analysis of the Relation between Personal Savings rate and Income Distribution

Many theoretical and empirical studies suggest a negative relationship between inequality in income distribution and saving rate. From a theoretical standpoint, Duesenberry (1949) studies the relative income hypothesis; Nikiforos (2017) provides a non-behavioral theory of savings; Alvarez□Cuadrado & Mayssun El□Attar Vilalta (2018) study the relationship between inequality and savings; while Frank et al. (2010) provide a theory of `expenditure cascades.' From an empirical standpoint, Li and Zou (2004) found that income inequality harms private savings. Blinder (1975) used aggregate US data and found a negative relationship between income inequality and average propensity to save. Schmidt-Hebbel, K., & Serven, L. (2000) found that the relationship between inequality and saving rate is hump-shaped.

A recent study (Carvalho and Rezai, 2015) presents empirical evidence for the saving rate to decrease significantly from the top quintile of income earners to the bottom quintile. Such study provides evidence that the personal saving rate is related to income distribution inequality.

In Figure [1-3], saving rates for each quintile of income after taxes for the period from 1989 to 2000 were calculated using the same methodology of Carvalho and Rezai (2015) through the formula $s = \frac{Y-C}{Y}$ where s is the saving rate, C is the average annual expenditure, and Y is the average annual income of each quintile.

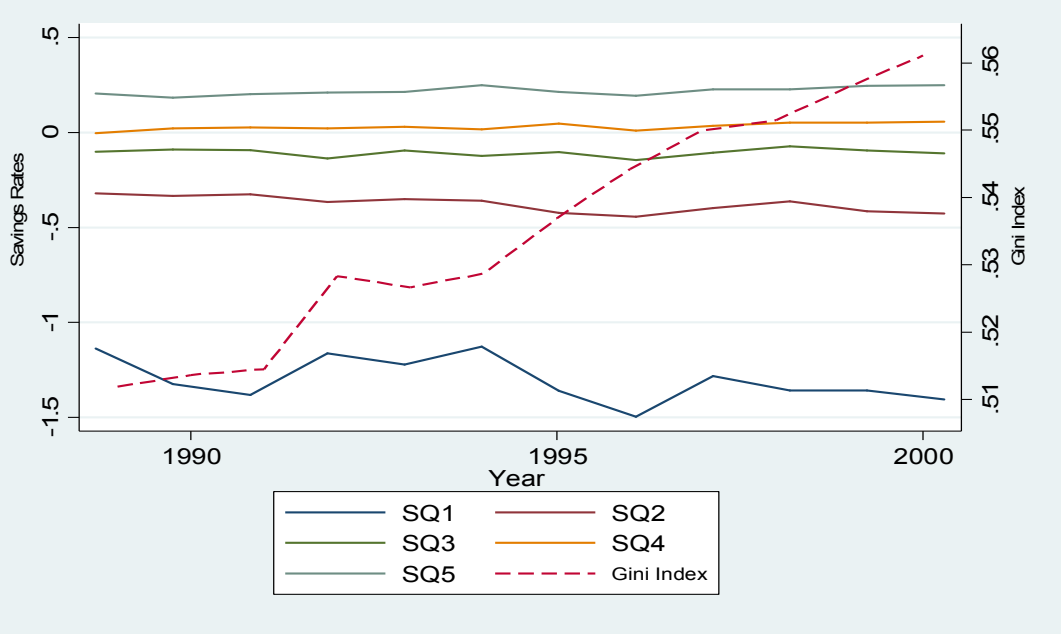

Figure 1-3 :(Source of data: author calculation based on consumer expenditures database)

Saving rates for each quintile are not the same and are increasing with income. The savings rate for the three first quintiles is negative, which indicates that the consumption of these groups is more than their incomes: these households are either borrowing or drawing down their savings. Only high-income groups that are SQ4 and SQ5 have positive saving rates. Comparing the response of savings rates for each group to changes in inequality in the personal income distribution shows that there is an indicator for each group to respond to inequality trends. Savings rates for each group are likely to increase with low inequality levels and decrease at high levels of inequality. The lower the income group considered, the more responsive is the respective saving rate to increases in inequality.

Time series data for the USA from 1970 until 2016 about the personal income distribution (Gini Index, see Figure 1- 4) and the personal saving rate suggest a negative correlation. However, trends in the time series are not enough to establish a causal relation or the

direction of causality. This section will carry a time series exercise through cointegration analysis to answer address the problem with the direction of causality between inequality and the personal saving rate.

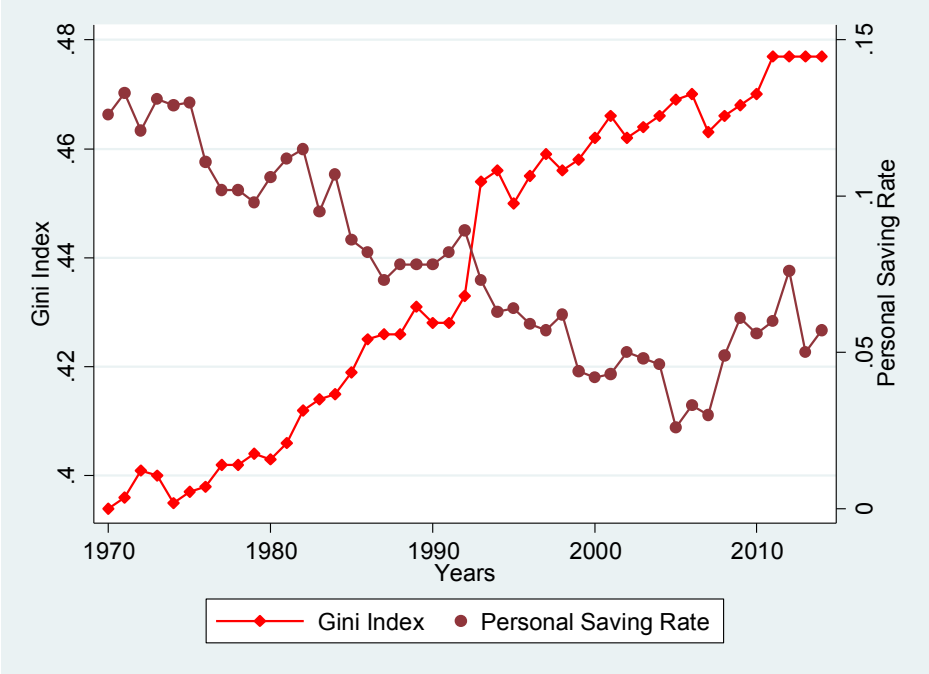

Figure 1-4: (Source of data: Federal Reserve Bank of St. Louis)

Cointegration regression indicates a negative long-run relation between household savings rate and inequality in income distribution as measured by the Gini index [Table 1-1]. Moreover, it appears that the savings rate is the 'clearing' variable, as the adjustment variable for the savings rate (α) is negative and significant, which means that when inequality is high savings rate tends to decline (see table 1).

Table 1-1

	(β) Coefficients.	**z**		**(α) Coefficients**	**z**
log(savings rate)	1	.	D_{log}(savings rate)	-.7382417	-3.85
log(Gini)	-149.39	-6.96	D_{log}(Gini)	.0201053	0.64
$log(Gini)^2$	20.65929	7.13	$D^2_{log(Gini)}$	.1516256	0.66
_cons	267.5589	.			

The most interesting estimation of the long-run relation between savings rate and income distribution by OLS gave almost the same result through estimation by cointegration [Table 1- 2].

Table 1- 2

log(savings rate)				
	Coefficients.	Std. Err.	t	P>t
log(Gini)	146.3355	17.75791	8.24	0.000
$log(Gini)^2$	-20.20235	2.396654	-8.43	0.000
_cons	-262.4891	32.87534	-7.98	0.000

The estimated relation between savings rate and inequality in income distribution indicates that the relationship is non-linear and takes an inverted U-shape as the sign of the Gini Index's square is negative and statistically significant [Table 1-2]. The scatter plot of the saving rate and Gini index [Figure 1-5] also proves that the relation between inequality and the personal saving rate is hump-shaped.

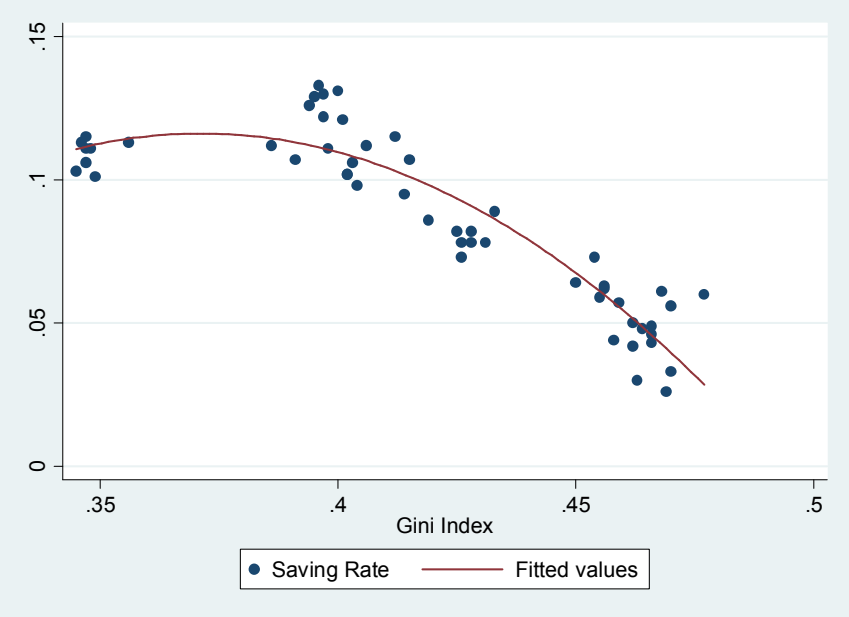

Figure 1-5

The non-linearity of the relationship between inequality and personal saving rate casts doubts on the assumption that an increase in inequality leads to an increase in aggregate savings and, consequently, an increase in saving rate. Most of the literature (with the exceptions already discussed above) involving differentials in marginal propensities to save assumes no minimum consumption requirements, which implies that the marginal propensity to save equals the saving rate. Under the assumptions, individuals have different marginal propensity to save. Those with higher incomes have a higher marginal propensity to save. Furthermore, a consumption floor depends on the perceived standard of living, which varies with income distribution. An increase in inequality leads to an increase in the generated saving out of income at the top of the income distribution and generates forces that lead people to dissave. Thus, it is expected that low levels of inequality lead to an increase in the aggregate saving (since the generated saving out of income is more than the dissaving that results from the deficiency in consumption). It is expected that high levels of inequality lead to a decrease in the aggregate savings and consequently aggregate saving

rate (since the dissaving will outwit the increase of savings out of incomes). Thus, the relation between inequality and saving rate takes the inverted U shape.

1-3- Developing the Theoretical Model

1-3-1-The Theoretical Debate

Most neo-Kaleckian models and the neo-Keynesian growth models of Lewis (1954), Kaldor (1957) assume individuals have different marginal propensity to save; those with higher incomes have a higher marginal propensity to save. Under this assumption, a *ceteris paribus* increase in inequality leads to an increase in aggregate savings out of incomes (a decrease in consumption). The induced increase in aggregate savings will generate the disequilibrium between aggregate savings and investment (aggregate supply and aggregate demand).

According to Kaldor (1955-56, p. 94), when a disequilibrium between savings and investment (and consequently between aggregate demand and aggregate supply) exists, there are two ways to restore equilibrium. The first is to allow for income distribution to change and take the output as given, which implies endogeneity and adjustment of income distribution to the given level of potential output. The second way is to take income distribution as given and allow for changes in potential output.

Adopting the second way of adjustment, the effect of an initial increase in aggregate savings out of incomes on capital accumulation and consequently on the economic growth process is subject to debate between supply-side (Neoclassical) and demand-side (Post-Keynesian) schools of economic thought.

According to Neoclassical economists (for whom the direction of causality is running from saving to investment), an initial increase in aggregate savings while keeping other supply

factors constant (labor and technology) leads to a proportional increase in investment (due mainly to a decrease in interest rate).

$$\uparrow S_t \rightarrow \uparrow I_t$$

As is well known, the neoclassical view presupposes Say's Law: there is no aggregate demand shortage in the economy, no matter the current distribution of income. Since savings causes investment, the implication is that higher inequality leads to a higher aggregate saving rate and investment rate (in equilibrium, the saving rate equals investment rate). In neoclassical growth theory, this increases only in output level if technology improvement is exogenous, and a permanent positive effect on the real output's growth rate in endogenous growth theory (EGT).

Conversely, demand-side economists (and Post-Keynesians in particular) argue that the direction of causality runs from investment to savings, counter that investment instead depends on expected aggregate demand. An increase in aggregate savings lowers aggregate consumption, reducing aggregate demand, and, consequently, decreasing investment. The decrease in investment leads to a decrease in output level and employment until a new equilibrium between current savings and current investment will be maintained but at a level of output (Y_t) below the level of potential output (Y_t^*) which results in being capacity utilization less than one or the normal capacity utilization $(u_t = \frac{Y_t}{Y_t^*} < 1)$.

$$\downarrow I_t \rightarrow S_t(\downarrow u_t)$$

Being capacity utilization less than one implies that although aggregate savings have increased, not all will be invested.[4] The implication is that inequality is harmful to growth because it harms aggregate demand and investment, and consequently the economic growth process.

Neoclassical economists agree that Say's law does not hold in the short run, mostly because of sticky prices (wages and interest rate). Accordingly, there may be insufficient aggregate demand to maintain output at its potential level (Y_t^*) in the short run. Consequently, it is true that in the short run, capacity utilization might be less than one, or whatever the normal capacity utilization rate is. Neoclassical economists argue, however, in the long run, actual output (Y_t) adjusts to potential output through the flexibility of prices. Neoclassical economists argue that capacity utilization should converge to the normal rate in the long-run, and the demand-side argument is valid only in the short run. In the long run. Growth is determined only by growth in the supply factors, and there is no role for aggregate demand.

Many economists (Auerbach and Skott 1988; Committeri, 1986, 1987) and a look at the data (Figure 1-6) suggest that capacity utilization should converge to the normal capacity utilization in the long run. However, recent data shows when actual output is below potential output for a long time, the potential output and actual output tends to decline (Figure 1-6) together. The tendency for potential output to decline (aggregate supply) to decline in the long run casts doubts about the neoclassical synthesis argument even when the idea of convergence of capacity utilization to the normal rate has been accepted.

[4] According to the Keynesian theory equilibrium occurs when current savings equals current investment and during disequilibrium period there will be deaccumulation of not invested savings, or in other words idle resources.

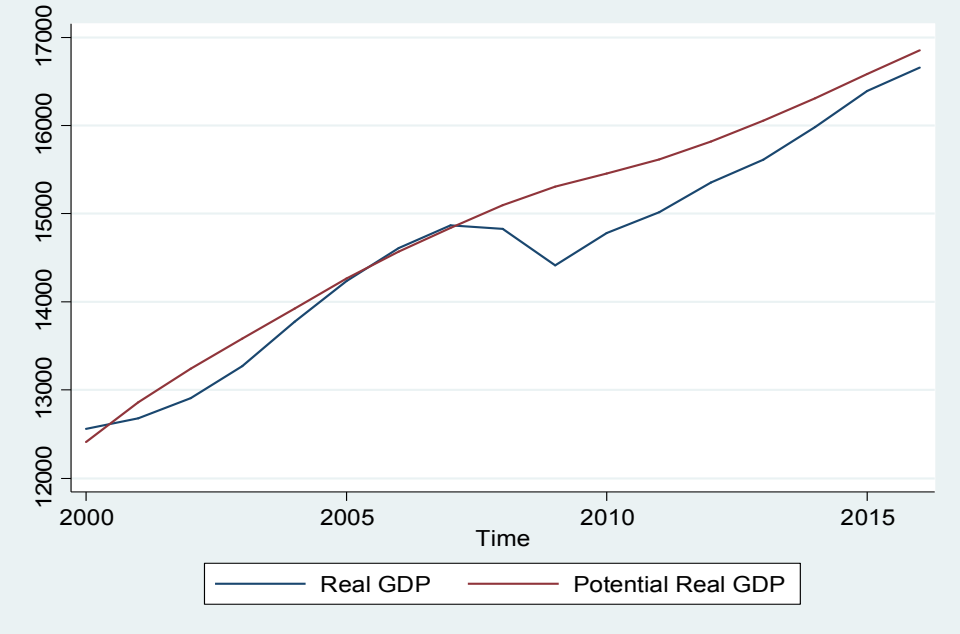

Figure 1-6: (Source of data: Federal Reserve Bank of St. Louis)

Capacity utilization, in the long run, should converge to the normal capacity utilization either by adjustment of actual output to potential output or through adjustment of potential output to actual output, especially if actual output stays below potential output for a long period. In the long run, the final good should be consumed or invested, or in other words, the saving rate should equal the investment rate.

According to Solow (1997), one can be Keynesian in the short run and neoclassical in the long run. Even after the idea about the convergence of capacity utilization is accepted, a question remains about the adjustment process if there is disequilibrium between aggregate demand and aggregate supply in the long run from prolonged high levels of inequality.

Solow (2000) mentions that there is no role for income distribution in his model. Moreover, regarding aggregate demand, he wrote (Solow 1988):

"*I paid too little attention to the problems of effective demand. To put it differently, a theory of equilibrium growth badly needed and still needs a theory of deviations from the equilibrium growth path I can honestly say that I realized the need at the time*". **(**p. 309**)**

In general, what is missing from the benchmark models of both exogenous and endogenous neoclassical growth theory is the role of aggregate demand and income distribution.

The main question addressed in this contribution is the following: if the neoclassical mechanism of adjustment through the flexibility of prices, in the long run, has been accepted and capacity utilization, in the long run, converges to the normal rate, what is the adjustment process if there is disequilibrium between aggregate savings and investment, that can account for deficiency in aggregate demand resulting from inequality in income distribution?

The viewpoint advanced in this contribution is that; the neoclassical assumption of no existence of minimum consumption requirement (or if it exists, but it is constant and independent on income and income distribution) is inappropriate. That is because it leads to failure to consider the effect of income distribution on aggregate demand and aggregate supply.

Individuals have a perceived appropriate standard of living. Besides, we cannot assume the perceived standard of living to be independent of income and income distribution, as indicated by Veblen's (1899, 2007) analysis of conspicuous consumption, Dusenberry (1949) in the second theorem of the relative income hypothesis, and Robert H. Frank (2014) in the case of expenditures cascades.

Under the assumption of different marginal propensities to save and dependence of minimum consumption requirement on income and income distribution, the saving rate will adjust to the deficiency in consumption (increase in savings) resulting from inequality through a process of

dissaving. This mechanism provides an alternative way of resolving the conflict between supply-side economists and demand-side economists. Because it will give a role for aggregate demand, in the long run, even the neoclassical assumption about the flexibility of prices in the long run has been accepted.

It is beyond dispute that in equilibrium, that savings rate must equal the investment rate. To develop a theory for growth in the long run, it should develop a theory for investment rate or a theory for saving rate. A theory for saving rate is equivalent to a theory of investment because what is produced should be consumed or invested in the long run, and nothing lifts.

1-3-2- The Proposed Theoretical Saving Function

If we follow simple logic, any individual in a society will not have any positive savings S_i unless the perceived level of standard of living or consumption norm is covered z_i; otherwise, he/she will have zero or negative savings. Further, any individual will not save or dissave the entire difference between the income and the perceived standard of living, but by amount depends on marginal propensity to save /dissave (φ_i) which depends on income levels (high-income people tend to save dis-save more than low-income people.

$$s_i = \varphi_i[\ y_i - z_i\ ]$$

For the sake of simplicity, assume that we can divide the population in society into two equal groups (low-income group n_1 and high-income group n_2 such that $n_1 = n_2 = n$) based on their incomes. Splitting the population into two groups can be done by first ordering incomes of individuals from low income to the high income and then splitting the population into two groups each group resemble 50% of the population and second taking the average of income of the first n_1 of the population, which resemble the income for low-income group (y_l) and taking the

average income of the second group of the population, which will resemble the income for the high-income group y_h.

Each group marginal propensity to save and the perceived level of standard is the same: $\varphi_{il} = \varphi_l$ and $\varphi_{ih} = \varphi_h$, $z_{il} = z_l$ and $z_{ih} = z_h$.

The marginal propensity to save for high-income people is more than marginal propensity to save for the high-income people because it is expected that as the difference between individual income and their income increase/decrease, the tendency for people to save/dissave will increase/decrease.

$$\varphi_l < \varphi_h$$

For the perceived level of standard of the low-income group is increasing linear function in the income of the group y_l , besides some function $\emptyset(\Omega)$ (where $\frac{\partial \emptyset(\Omega)}{\partial \Omega} > 0$) that resembles the degree that individuals react to the increase in inequality:

$$z_l = y_l \ \emptyset(\Omega)$$

For the perceived level of standard of the high-income group is increasing linear function in the income of the group; besides some function $z(\Omega)$ $(where \ \frac{\partial \emptyset(\Omega)}{\partial \Omega} > 0)$ that resembles the degree that individuals react to the increase in inequality:

$$z_h = y_h \ \emptyset(\Omega)$$

$$Aggregate\ saving = S = \sum_{i}^{N} S_i = \sum_{i=1}^{n_1} S_{il} + \sum_{i=n_1+1}^{n_2} S_{ih}$$

$$S = \sum_{i=1}^{n1} [\varphi_{il}\ y_{il} - \varphi_{il}\, z_{il}] + \sum_{i=n1+1}^{n2} [\ \varphi_{ih}\ y_{ih} - \varphi_{ih}\, z_{ih}]$$

$$S = \sum_{i=1}^{n1} \varphi_{il}\ y_{il} - \sum_{i=1}^{n_1} \varphi_{il}\, z_{il} + \sum_{i=n1+1}^{n2} \varphi_{il}\ y_{il}\ - \sum_{n1+1}^{n2} \varphi_{ih}\, z_{ih}$$

$$S = \sum_{i=1}^{n1} \varphi_{il}\ y_{il} + \sum_{i=n1+1}^{n2} \varphi_{il}\ y_{il}\ - \sum_{i=1}^{n_1} \varphi_{il}\, z_{il} - \sum_{n1+1}^{n2} \varphi_{ih}\, z_{ih}$$

Since $\varphi_{il} = \varphi_l\ ,\ \varphi_{ih} = \varphi_h, z_{il} = z_l\ ,\ z_{ih} = z_h$

$$S = \varphi_l n_l\, y_l + \varphi_h\, n_h\, y_h - \varphi_l\, n_l\, y_l\ \emptyset(\Omega)\ - \varphi_h\, n_h\, y_h\, \emptyset(\Omega)$$

$$S = \varphi_l n_l\, y_l + \varphi_h\, n_h\, y_h - [\ \varphi_l\, n_l\, y_l + \varphi_h\, n_h\, y_h\ ]\, \emptyset(\Omega)$$

$$S = (\varphi_l n_l\, y_l + \varphi_h\, n_h\, y_h)[\ \ 1\ -\ \ \emptyset(\Omega)\ \ ]$$

Multiplying by and dividing on the aggregate income Y

$$S = (\varphi_l n_l\, y_l + \varphi_h\, n_h\, y_h)[\ \ 1\ -\ \ \emptyset(\Omega)\ \ ]\ \frac{Y}{Y}$$

$$S = (\varphi_l \omega + \varphi_h\, \psi\ )[\ \ Y -\ \ Y.\emptyset(\Omega)\ \ ]$$

where $\omega = n_l \frac{y_l}{Y}$ and $\psi = n_h \frac{y_h}{Y}$ are the income shares of the low-income group and the high-income groups. Redistribution of income from the low-income group toward the high-income group leads to an increase in the aggregate marginal propensity to save and level of the aggregate perceived level of standard $Z_t = Y.\ \emptyset(\Omega)$.

Based on these assumptions, the aggregate savings function S_t can be written as follows:

$$S_t = \varphi_t(\Omega_t)[\ Y_t - Y.\emptyset(\Omega)\ ]$$

$$S_t = \varphi_t(\Omega_t)\ Y_t - \varphi_t(\Omega_t)\ Y.\emptyset(\Omega)$$

For any given level of real output, an increase in inequality in income distribution $\uparrow \Omega_t$ has, at the same time, positive and negative effects on the aggregate savings. On one hand increase in inequality will generate an increase in savings out of income $\varphi_t(\uparrow \Omega_t)Y_t$, but simultaneously, inequality generates a deficiency in consumption, which generates a process of dis-saving $\varphi_t(\Omega_t \uparrow)\ Y.\emptyset(\uparrow \Omega)$. The result on aggregate savings and consequently on the investment might be positive, zero, or negative.

$$\varphi_t(\uparrow \Omega_t)Y_t - \varphi_t(\uparrow \Omega_t)\ Y.\emptyset(\uparrow \Omega) \rightarrow \uparrow\downarrow I_t$$

Dissaving does not necessarily mean borrowing. Those with capital will sell some of their assets to cover the gap with the consumption norm, which implies that not all the generated savings out of incomes will be invested but will finance consumption[5]. If borrowing is allowed, those who do not own capital will borrow. In other words, the demand for loanable funds will increase until a new equilibrium is restored.

It is expected that initial inequality will generate more inequality in the long run. That is because the process associated with dissaving at lower ends of the income distribution will further increase inequality. Households whose income lies below their perceived level of living

[5] There is a difference between financial investment and real investment: while real investment generates new capital, the financial investment just leads to change in the ownership of capital and there will be no addition to the exiting capital

standards will sell some of their assets to households with positive savings, leading to a change in capital ownership toward the richer households. The same applies if low-income households borrow to finance the deficiency in consumption because they will have to repay the principal and interest on their loans in the long run.

1-3-3-Equilibrium Condition and Capital Accumulation

The equilibrium condition in a closed economy without a government sector requires aggregate demand equal to aggregate supply. In other words, gross investment equals aggregate savings, which implies the savings rate equals the investment rate:

$$S_t = I_t$$

$$I_t = \Delta K_t + \delta K_t$$

$$S_t = \varphi_t(\Omega_t) Y_t - \varphi_t(\Omega_t)\, Y_t . \emptyset(\Omega)$$

$$\Delta K_t + \delta K_t = \varphi_t(\Omega_t)\, [\, Y_t - Y_t \,. \emptyset(\Omega)\,]$$

Arranging and dividing by K_t , we obtain the capital growth rate g_K :

$$g_K = \frac{\Delta K_t}{K_t} = \frac{1}{B_t}\, \varphi(\Omega)\, [\, 1 - \emptyset(\Omega)\,] - \delta$$

Where $B_t = \frac{K_t}{Y_t}$

$$s_t = \varphi(\Omega)\, [\, 1 - \emptyset(\Omega)\,]$$

$$g_K = \frac{1}{B_t}\, s_t - \delta$$

1-3-4- Capital Accumulation & Growth of Real Output

Since $B_t = \frac{K_t}{Y_t}$, and the growth of real output $g = g_K - g_B$, the growth rate of output depends on the growth of capital and growth of capital-output ratio. Growth of the capital-output ratio depends on the characteristics of the used production function, especially whether the capital's marginal productivity decreases, constant, or even increasing through the growth process. To make the model more general and can account for the three possible cases, the Frankel model (1962) has been adopted where technology A_t has been assumed to be endogenous and depends on capital per capita. Assuming the usual neoclassical assumption of Cobb-Douglas production and assume there is no growth in labor for simplicity. The suggested production will as the following:

$$Y_t = A_t K_t^{\alpha} \, L_t^{1-\alpha}$$

$$A_{\,t} = A_0 \left(\frac{K_t}{L_t}\right)^{\vartheta}$$

$$Y_t = A_0 K_t^{\alpha+\vartheta} \;\; L_t^{1-\alpha+\vartheta}$$

$$\alpha + \vartheta = \theta$$

$$Y_t = A_0 K_t^{\theta} \, L_t^{1-\theta}$$

Where θ might be less than one $\theta < 1$ as the case in Solow model, equal to one $\theta = 1$ (in case of AK model) or even more than one $\theta > 1,$ as in the unlikely case of increasing marginal productivity of capital.

$$g_Y = \theta \;\; g_K$$

$$g_Y = \theta \left[\frac{1}{B_t} \boldsymbol{\varphi}(\Omega) \left[1 - \emptyset(\Omega) \right] - \delta \right]$$

$$k_t = \frac{K_t}{L_t}$$

$$B_t = \frac{K_t}{Y_t}$$

$$B_t = \frac{1}{A_0} \; k_t^{1-\theta}$$

$$g_Y = \theta(\; A_0 \; k_t^{\theta-1} \; \varphi(\Omega) \left[1 - \emptyset(\Omega) \right] \; - \delta \;)$$

$$g_Y = \theta(\; A_0 \; k_t^{\theta-1} \; \varphi(\Omega) \left[1 - \emptyset(\Omega) \right] \; - \delta \;) \qquad (1)$$

Equation (1) can be written as follows:

$$g_Y \; = \sqcap_t \left[s_t \; - \delta \; B_t \right] \qquad (2)$$

$$s_t = \varphi(\Omega) \left[1 - \emptyset(\Omega) \right]$$

$$\sqcap_t = \theta \; A_0 \; k_t^{1-\theta}$$

Equation (2) It is considered a general equation for growth and can generate a variety of growth models as special cases – and in particular the Solow Model and AK Model – depending on the value of θ. For example, if $\theta = 1$, then the model will be reduced to the AK model case.

$$\sqcap_t = \; A_0$$

$$B_t = 1/A_0$$

$$g_Y = \; \varphi(\Omega) \left[1 - \emptyset(\Omega) \right] A_0 \quad - \delta$$

$$g_Y = \; s_t \, A_0 \quad - \delta$$

Empirical data for the USA for the period from 1960- 2017 [Figure 1-7] (on variables that are included in equation (2) after removing the cyclical components) showed that almost all patterns of growth could be explained mainly by the term $[s_t - \delta B_t]$; although the term $\sqcap_t$ shows fluctuations but are in the same direction of the growth rate. All variables of the model can be explained by the aggregate saving rate (investment rate) since the capital-output ratio is fairly constant or moves in the opposite direction of the movement in the aggregate saving rate, and the term $\sqcap_t$ moves in the same direction of the growth rate. Thus, the impact of inequality on growth will be through impacting the saving rate.

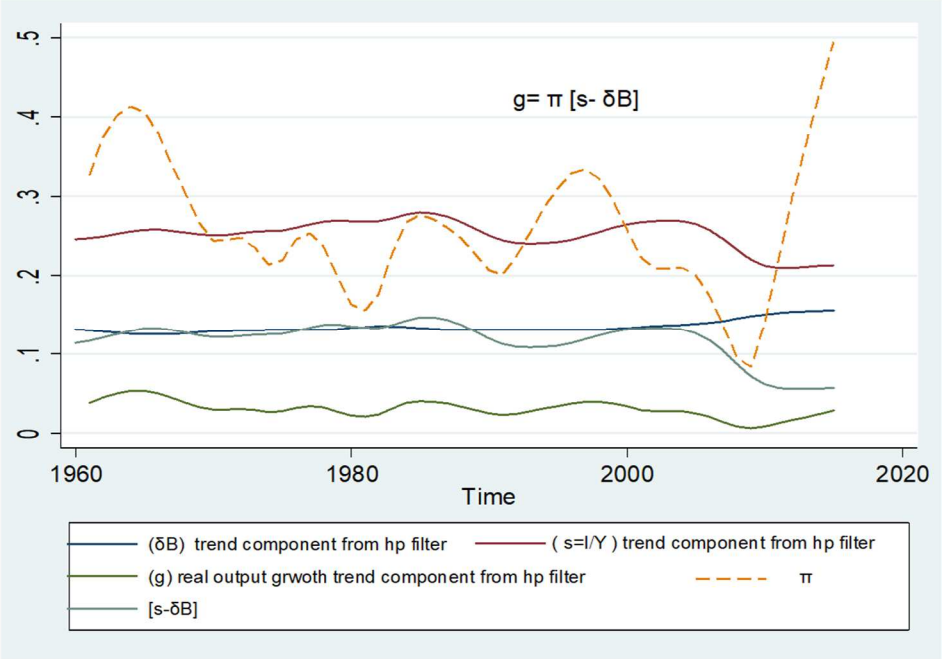

Figure 1-7

1-3-5-Relation between Growth and Income Distribution

For any given level of δ, Y_t *and* k_t, different income distribution scenarios lead to different growth rates through the impact on the saving rate. To derive the relation between growth

and inequality in income distribution holding other variables constant, the partial differentiation of equation (11) has been taken with holding $\delta,\ Y_t\ and\ k_t$ constants.

$$\frac{\partial g_Y}{\partial \Omega} = \sqcap \left[\left(1 - \emptyset(\Omega)\right) \frac{\partial \varphi}{\partial \Omega} - \varphi(\Omega) \frac{\partial \emptyset}{\partial \Omega} \right]$$

$$\frac{\partial \varphi}{\partial \Omega} = \mu$$

$$\frac{\partial \emptyset}{\partial \Omega} = \rho$$

$$\frac{\partial g_Y}{\partial \Omega} = \sqcap \left[\left(1 - \emptyset(\Omega)\right)\mu - \varphi(\Omega)\rho \right]$$

$$\Psi(\Omega) = \left(\emptyset(\Omega)\right)\mu + \varphi(\Omega)\rho)$$

$$\frac{\partial g_Y}{\partial \Omega} = \sqcap [\mu - \Psi(\Omega)]$$

According to equation (3), the slope of the relationship between growth and inequality in income distribution will be positive for the value of $\Psi(\Omega) < \mu$, zero for $\Psi(\Omega) = \mu$, and negative for value of $\Psi(\Omega) > \mu$. Since the term $\Psi(\Omega)$ is an increasing function of income inequality, the relationship between inequality and growth will take an inverted U-shape. Low levels of inequality tend to increase the growth rate, while high-income inequality tends to harm growth.

After a simple calibration of the main equation of growth $g_Y = \sqcap_t [\, s_t - \delta\, B_t]$, assuming $\sqcap_t$ and $\delta\, B_t$ constants ($\sqcap_t$ =.7 and $\delta\, B_t$=.1). The growth rate can be displayed in a 3-dimensional plot. The surface gives all possible growth rates that result from different combinations of points φ [1−∅]. The blue line gives the possible growth paths as a function of inequality [Figure 1-8].

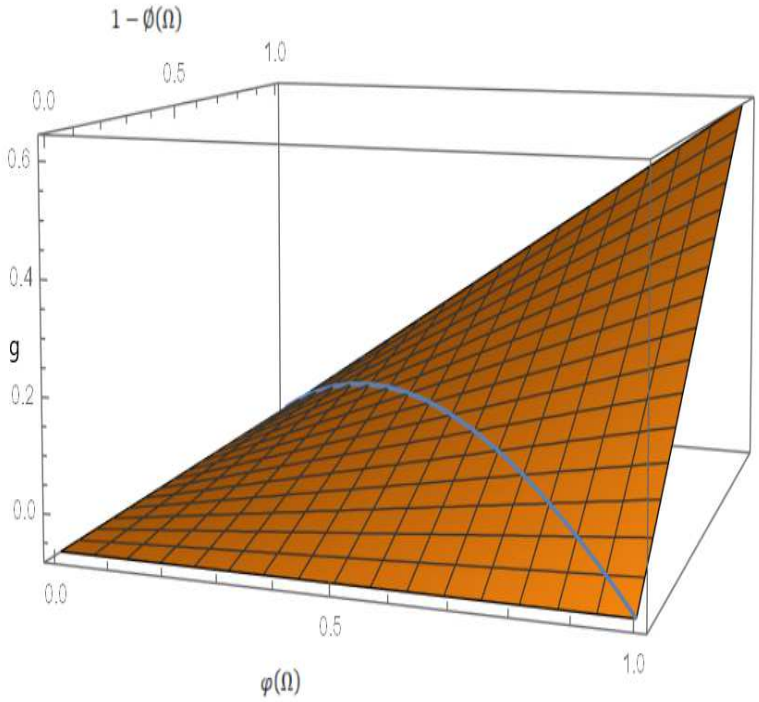

Figure 1-8

1-4- Conclusions

This contribution has advanced the argument that inequality may influence the saving rate differently for households occupying different positions on the income ladder. The resulting aggregate saving rate is hump-shaped in the level of inequality. Low levels of inequality tend to increase aggregate savings and, consequently, the saving rate because the generated savings out of income more than offset the negative effects of dissaving. High levels of inequality tend to decrease the aggregate savings and consequently saving rate because the process of dissaving will outweigh the increase in savings out of high incomes. In exogenous growth models, this will

translate into corresponding non-linear level effects of inequality on capital and income-per-capita; in endogenous growth models, the non-linearity translates into the growth rate.

One implication of the analysis is that autonomous consumption will be the adjusting variable when there is a disequilibrium between aggregate supply and aggregate demand due to inequality. This implication bridges two schools of thought on the growth process (neoclassical and post-Keynesians), providing an attempt at reconciliation by highlighting the role of aggregate demand and aggregate supply forces in determining growth in the long run. Second, and more importantly, the adjustment of saving rate to inequality through the process of dissaving's leads to the conclusion that the presence of initial inequality leads to more inequality in the long run because of the process associated with the dissaving due to inequality. People whose income lies below their perceived level of living standards will sell some of their capital to people who have positive savings, leading to a change in capital ownership toward the rich. The same applies if low-income borrowers can finance the deficiency in consumption because, in the long run, they have to pay both principal and interest, leading to more inequality in the future.

The hump-shaped relation between inequality and savings rate and the conclusion about increasing inequality over time has some interesting policy implications. Policymakers may want to implement redistribution policies at high levels of inequality in order to foster growth.

Chapter 2: Recent Trends in Global Inequality: Between- and Within-Country Inequality, and their Relationship with Globalization

Summary

In the economic literature, many studies have measured and calculated current trends in global inequality, both within and between countries (Berry, Bourguignon and Morrrisson 1983; Schultz 1998; Quah 1999; Chotikapanich, Valenzuela and Rao 1997; Sala-i-Martin, 2002b; Milanovic, 2002; Ortize & Cummins, 2011) and more recently the World Bank (World Bank report, 2018). Further, many studies analyze the relation between global inequality and globalization (Edwards,1997; Majit et al.,2004; Bergh & Nelson ,2011; Zhou et al, 2011). However, the datasets used in previous studies suffer from many limitations. The World Bank Report 2018 provides estimates for world income distribution that measure global inequality more accurately than other data sources. This paper uses the World Inequality Database (WID) to analyze the recent global inequality trends and their within- and between-country components. Moreover, the relationship between global inequality and economic globalization has been investigated using cointegration analysis. This paper's main conclusion is that globalization helped reduce between-country inequality and caused within-country inequality to increase. Prediction of the tree time series for the period spanning 2016 until 2024 shows that globalization, between-country inequality, and within-country inequality are likely to remain stable until 2024.

2-1-Introduction

The concept of global inequality concerns the distribution of income across individuals globally, and it is a relatively recent research topic. Calculating global inequality requires data on income distributions for most countries in the world, or at least for most populous and wealthy countries. Nevertheless, it is only from the early to mid-1980s that such data became available.

In the economic literature (Milanovic 2007), there are three concepts of inequality in the world income distribution. The first concept concerns the distribution of per capita national income across world countries without considering the population's size. The second concept of inequality is the same as the first concept. However, it considers each country's population's size by weighting incomes per capita for each country by its population size. The first and second concepts do not accurately resemble global inequality since they do not consider the income distribution between individuals inside each country (they assume that everyone has the same income per capita). The third concept (referred to as *global inequality* in what follows) in the world income distribution considers inequality in income distribution between individuals worldwide, just like if the world was just a single country. As such, it considers inequality in income distribution both between and within countries of the world.

There are many attempts to measure global inequality in income distribution (Berry, Bourguignon and Morrisson 1983; Schultz 1998; Quah 1999; Chotikapanich, Valenzuela and Rao 1997; Sala-i-Martin 2002b; Milanovic 2002; Ortiz &Cummins 2011) and more recently, the World Bank (World Bank Report, 2018). In general, we can divide these attempts to measure global inequality into the so-called *direct* and *indirect* methods. The direct method measures global inequality by constructing the world income distribution directly from household survey data (Milanovic 2002). The indirect method relies primarily on the estimation of the world income distribution through considering GDP per capita of a particular country as the mean income of that country (assuming lognormality of the distribution of income inside each country); then obtaining a summary inequality statistic within each country—such as the Gini coefficient or the log-standard deviation, or even income shares—to then construct or estimate the distribution of income for each country and then the world income distribution.

An indirect way is an intelligent approach: it is powerful while parsimonious, given relatively minimal information (one or two moments of the distribution and one inequality statistic). However, it requires many assumptions to hold simultaneously (e.g., each country's distribution is lognormal and GDP per capita gives the correct mean income). The drawback is that these assumptions, some of which are somewhat dubious, might drive the results (Milanovic 2006).

The direct method provides direct and accurate data on income distribution within each country without imposing theoretical assumptions that may be unrealistic. However, it also faces substantial criticism. It relies on household surveys, which usually underestimate top income levels and are inconsistent with macroeconomic growth figures. Fortunately, the World Bank (World Bank Report 2018) has attempted to correct for this problem by combining available sources (national accounts, fiscal and wealth data, surveys) through the World Inequality Database project (WID). The World Bank Report 2018 estimates world income distribution from 1980 until 2016 using different income shares ranging from bottom 10% to top 10% and top 1%. Thus, the world bank's database about world income distribution allows measuring global inequality with more accuracy than other data sets.

This paper has two objectives. The first goal is to use the World Inequality Database (WID) of the world income distribution to calculate the Gini and Theil index for global inequality and its two components (within- and between countries). These indices can inform a descriptive analysis of the most recent trends in global inequality. The second objective of this paper is to investigate the relationship between global inequality (and its two components) and globalization.

This paper's organization will be as follows: The next section will be about the recent trends in global inequality, between- and within-country inequality. Section 3 will be about time series

analysis (cointegration between globalization and the two components of global inequality (within and between countries inequality). The last section will draw some conclusions.

2-2-Recent Trends in Global Inequality, Between and Within Countries Inequality

One common way to understand world income distribution changes is to graph the kernel density function[6] of world distribution for some selected years. Doing this allows getting a clear picture of the distribution for each year. Figure 2-1 shows the Kernel density function for world income distribution for some selected years (countries are arranged by their income log).

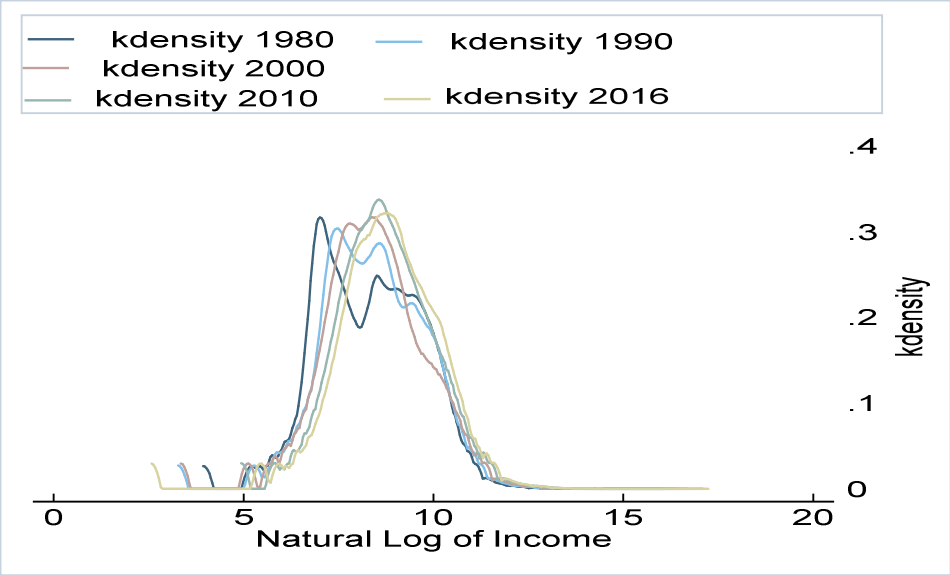

Figure 2-1 :(source: author calculation based on the data set of WID)

Starting in 1980, the Kernel density estimation of world income distribution shows two peaks, which implies polarization. The income distribution was concentrated mainly between two groups: a low-income group and a high-income group. The lower-income group's density area was

[6] The Kernel Density Estimation is a mathematic process of finding an estimate probability density function of a random variable. The estimation attempts to infer characteristics of a population, based on a finite data set. The data smoothing problem often is used in signal processing and data science, as it is a powerful way to estimate probability density.

larger than the higher-income group. The two peaks in the 1990s start to converge, implying that lower-income countries started to converge toward higher-income countries. In 2016, the two peaks nearly had merged, and the distribution of income was concentrated mainly in the middle classes of the income distribution. Thus, changes in income distribution from 1980 until 2016 are consistent with the convergence hypothesis and the rise of a global middle class.

Usually, economists try to express inequality using a single index number. The most popular measure of inequality is the Gini Index.

$$G = \frac{2\sum_{i=1}^{n} iy_i}{ny_i} - \frac{n+1}{n}$$

For population uniform on the values of y_i, i=1 to n , indexed in non-decreasing order ($y_i \leq y_{i+1}$). The Gini index, or Gini coefficient, is a measure of income distribution across a population developed by the Italian statistician Corrado Gini in 1912. It is often used to gauge economic inequality, measuring income distribution or, less commonly, wealth distribution among a population. The coefficient ranges from 0 (or 0%) to 1 (or 100%), with 0 representing perfect equality and 1 representing perfect inequality. Values over 1 are theoretically possible due to negative income or wealth.

The time series of global inequality that was measured in the Gini Index [Figure 2-2] showed that, in general, there is a trend for global inequality to increase until nearly 2002. Then, global inequality starts to decline until 2016.

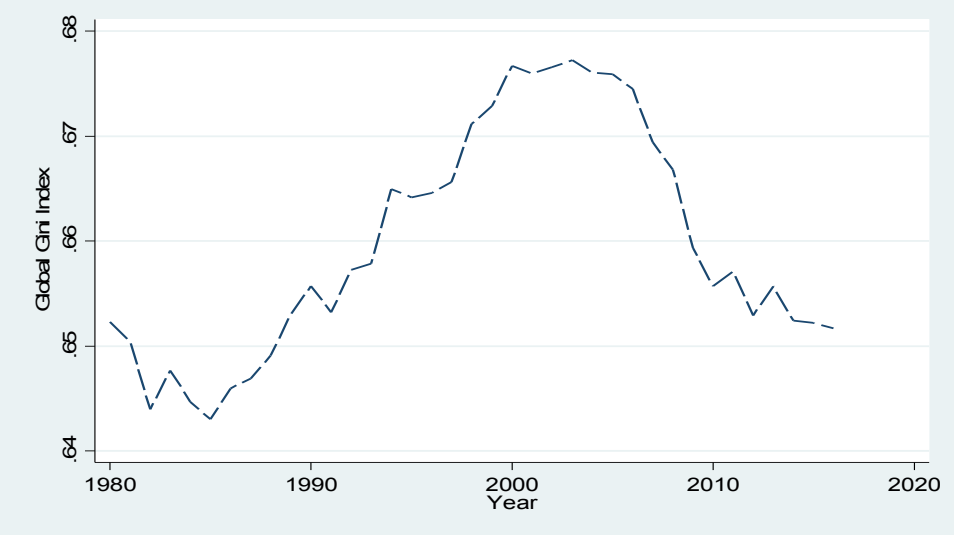

Figure 2-2: Source: WID Database

According to Milanovic (2012), the main reason for this break in the previous trend is the decline of international inequality due to the fast growth of relatively poor and very populous countries, most notably China and India. To get a clearer picture of global inequality changes, we must decompose global inequality into two parts: within- and between-country inequality.

While the Gini coefficient has many desirable properties, such as mean independence or scale independence (if all incomes were doubled, the measure would not change), population size independence (if the population were to change, the measure of inequality should not change, all else equal), symmetry (if any two people swap incomes, there should be no change in the measure of inequality), and Pigou-Dalton Transfer sensitivity (the transfer of income from rich to poor reduces measured inequality, as highlighted in Haughton & Khandker, 2009), it cannot easily be decomposed to the between and within inequality due to presence of the overlapping components (L). Mathematically, global inequality measured by the Gini index can be represented as follows:

$$Global\ Inequality\ (Gini) = \sum_{i=1}^{n} G_i p_i \omega_i + \sum_{i=1}^{n} \sum_{J>i}^{n} \frac{(y_i - y_j)}{y_i}\ p_i \omega_i + L$$

$$\sum_{i=1}^{n} G_i p_i \omega_i = Between\ Countries\ Inequality$$

$$\sum_{i=1}^{n} \sum_{J>i}^{n} \frac{(y_i - y_j)}{y_i}\ p_i \omega_i = Within\ Countries\ Inequality$$

y_i : country i

G_i : Gini coefficient of country i.

p_i: Country i's population share (in total world population).

ω_i : Country i's share of world income.

L: overlapping component

The overlapping component arises when the relative position of a given individual in the subgroup income distribution differs from its position in the total income distribution. Since the Gini index is not precisely decomposable while the Theil Index is exactly decomposable:

$$Global\ Inequality\ (Theil) = \sum_{i=1}^{n} T_i p_i + \sum_{i=1}^{n} \left[\ \frac{y_i}{u}\ p_i\ \right] ln \frac{y_i}{u}$$

$$\sum_{i=1}^{n} T_i p_i = Within\ Countries\ Inequality$$

$$\sum_{i=1}^{n} \left[\ \frac{y_i}{u}\ p_i\ \right] ln \frac{y_i}{u} = Between\ \ Countries\ Inequality$$

y_i : country i

T_i : Gini coefficient of country i.

p_i: Country i's population share (in total world population).

u: Average world income

The decomposition of global inequality measured by the Theil Index into their two components using the Pyatt (1976) decomposition requires knowledge of data countries' income, country population, and data on each country's income distribution globally. Data on income distribution in each country is not available on the WID database. To overcome this problem and decompose global inequality into their two components, I have calculated the between countries inequality and then subtracting it from the global inequality that was measured through the Theil Index, since the information that is needed to calculate inequality between countries of the world or what called international equality is available for almost all countries of the world and a long period. Furthermore, it requires only two variables: mean income, which is approximated by gross domestic income (GDI) per capita, and population size.

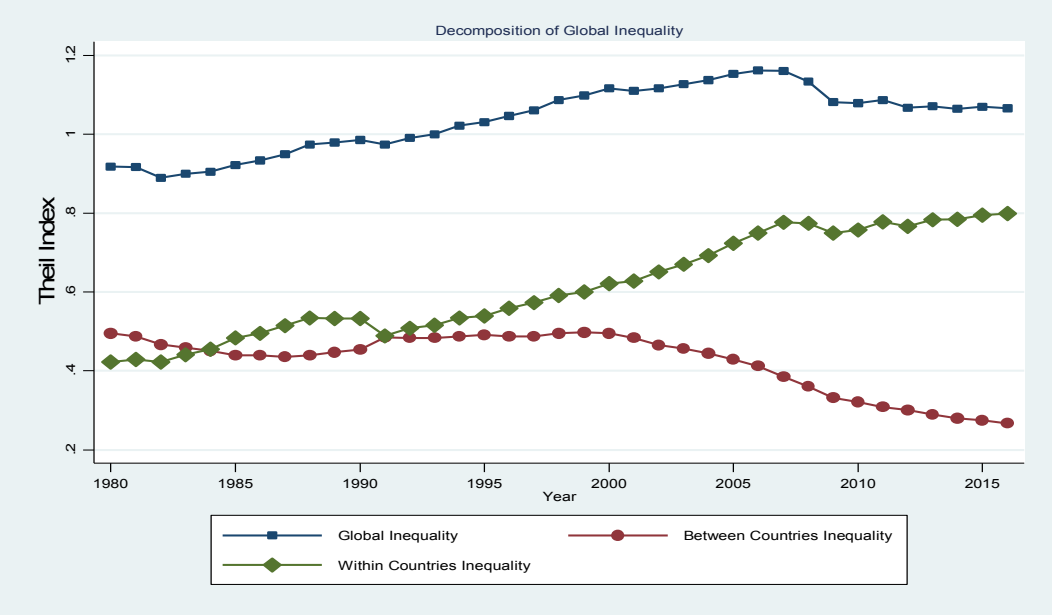

Figure 2-3: Source: Author's calculation based on WID Database

The decomposition of global inequality into its two parts population-weighted international inequality and within-country inequality) as displayed in Figure 2-3 shows that within-country inequality increases starting in the 1980s. In contrast, between-country inequality decreases until the year 1990 when there is a dramatic change in the opposite direction that lasted for just one the year 1990-1991. This reversal may be due to the collapse of the Soviet Union in 1991. Within-country inequality continues to increase while between-inequality continues to decrease, albeit at a different rate of change. From 1991 until 2000, between-country inequality was stable; while it saw a sharp decline from 2000 until 2010, then kept falling but at a slower rate until 2015. The slowdown in the rate of decline in between-country inequality occurs when within-country inequality has reached a high level. The most interesting observation from Figure 2-3 is the opposite behavior of international inequality and within countries inequality. When international inequality tends to decline within countries, inequality tends to increase, and vice versa.

Changes in international inequality are mainly due to changes in income per capita for low-income countries (especially the most populated countries) and income per capita for high-income countries. The graph of the natural logarithm of income per capita for some selected countries (some high-income countries and some low income but high populated countries) to the world income per capita [Figure 2-4] shows increased growth rates in income per capita for China, India, Malaysia, and the declining in the growth rates of income per capita for the most advanced and high-income countries: the United States, Japan, and United Kingdom. It should be noted that although the most populated low-income countries started to catch up with the high-income countries, there still are substantial differences between income per capita between the two groups.

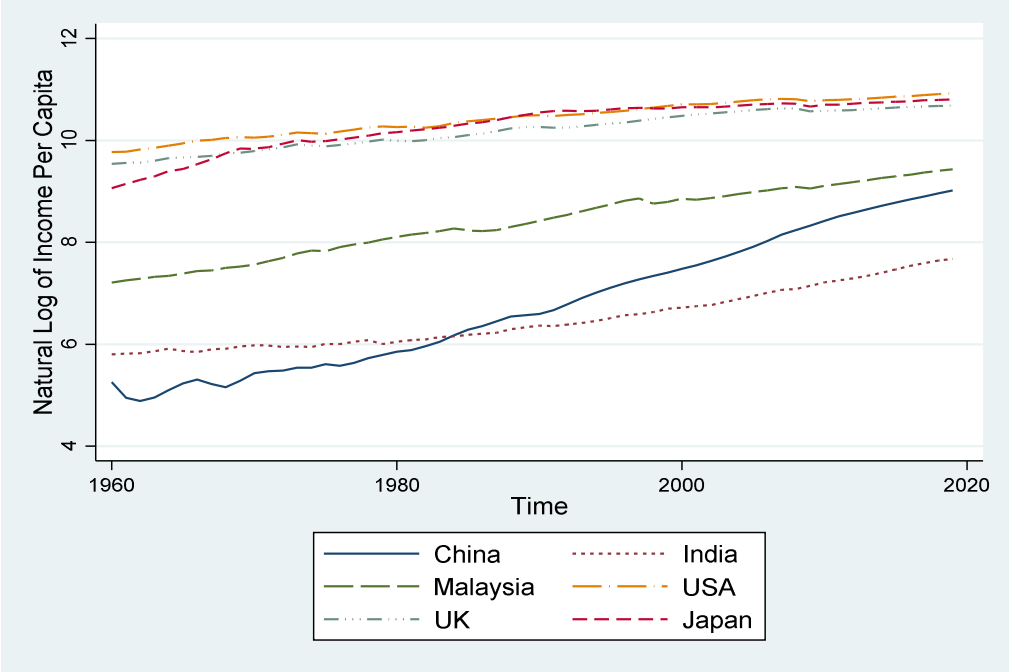

Figure 2-4

The rise of Asian countries can be attributed to many underlying causes. All these countries are highly populated, which means they have a cheaper labor force that provides a good foreign direct investment (Rajan, 2001). These countries also have adopted policies to increase openness to the global economy. The openness of these countries to the world appears to have helped their growth, but at the same time, it appears to have coincided with an increase in their domestic inequality.

2-3- Time series analysis through cointegration

2-3-1-Globalization and Global Inequality

The traditional measure of globalization (trade openness) is the total trade ratio (exports + imports) to GDP. However, this measure does not include capital flows, which are considered

an important aspect of globalization. Thus, the KOF index[7] of globalization was chosen since it includes capital flows and trade openness. The KOF Index of Globalization is an index of the degree of globalization of 122 countries. Dreher introduced the original index (2006), updated by Dreher et al. (2008) and revised by Egbert (2018). The index is based on three principal criteria: economic, political, and the social-economic dimension of globalization. Here, globalization's economic dimension, which includes trade openness and capital flows, will only be considered.

By plotting time-series data of economic globalization measured by the KOF index together with within- and between-country inequality, Figure 2-5 shows that within-country inequality appears to have followed almost the same pattern of economic globalization. Since between and within inequality move in the opposite direction, globalization appears to move inversely with between-country inequality.

[7] The KOF Globalization Index is calculated on a yearly basis from 1970 to 2015. However, not all data are available for all countries and all years. Missing values within a series are imputed using linear interpolation. Missing values at the beginning or the end of a series are substituted by the closest observation available. Specifically, this implies that we carry the last value backward in the case of missing data at the beginning of a series and forward in the case of missing data at the end of a series. Normalizing the data implies that each variable is transformed to an index with a scale from one to one hundred, where 100 is assigned to the maximum value of a specific variable over the whole sample of countries and the entire period. It is the analogue to a transformation of the series according to the percentiles of its original distribution. The procedure is called panel normalization which is different to annual normalization where data points are normalized across all countries in the same year only. The resulting data is well-behaved in terms of sensitivity to outliers, which is a clear advantage over the original series. The downside is that changes in the data in one year affects the ranking of countries in other years

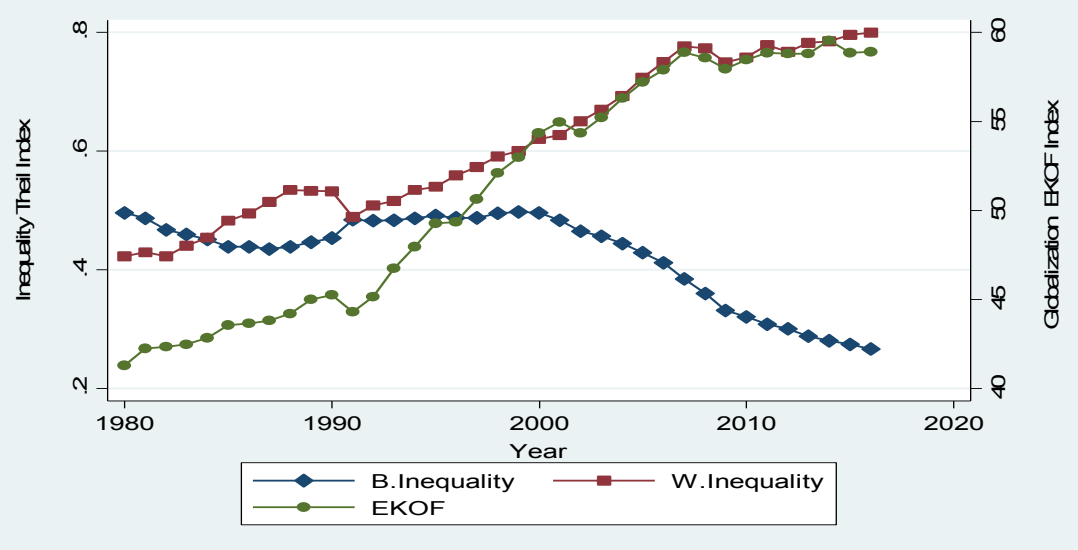

Figure 2-5

Observation of these patterns in the data raises a few important questions. First, is globalization responsible for the increase in within-country inequality and decrease in between-country inequality? Second, is there a negative relation between the within- and between-country inequality? Third, does globalization affect just one or both types of inequality time series?

The economic literature on the relation between globalization and between- and within-country inequality is extensive (for example, see Beck et al., 2007; Dollar and Kraay, 2004; Goldberg and Pavcnik, 2007; International Monetary Fund, 2007a, b). Concerning the question about the relationship between globalization and the two types of inequality (within and between countries inequality), economic theory suggests a link between globalization and global inequality. Since economic globalization consists of trade in goods and services and capital flows, one hand, according to the Stolper–Samuelson theorem derived from the Hecksher–Ohlin (HO) trade model, trade could have reduced inequality in developing countries and increased inequality in the developed countries (although this is not consistent with the observed data on the inequality within

the developed and developing countries since both types of countries witness an increase in domestic inequality). On the other hand, globalization could have reduced between-countries inequality through capital flows from developed to developing countries, and therefore reduced growth rates of developed countries and increased growth rates of the developing countries. Accordingly, globalization could have helped increase growth in low-income countries relative to high-income countries by promoting their export industries (to reduce international inequality). It could have also caused an increase in inequality within countries.

Concerning the question about the possible relation between within-countries and between-countries inequality, there is also a substantial amount of literature on the relationship between domestic inequality and growth—although the direction of causality is unknown: causality may be bi-directional, and the relationship may take an inverted-U shape as per the Kuznets curve. The extensive theoretical and empirical literature on this topic can be divided into two main approaches. The first group, initiated by Kuznets' (1955) seminal research, argues that the causality runs from growth to inequality, and the long-run relation between the two is hill-shaped. The other group instead argues that the direction of causality runs from inequality to growth. The observed opposite behavior of the between- and within-country inequality can be explained through the theoretical relation between domestic inequality and growth rates of real output of countries of the world. It is not related to globalization or trade openness.

Trends in the time series shown in Figure 3 do not seem to provide evidence on the existence of any relation or causality direction. In the next section, and relying on the WID database, I will carry a time series exercise through cointegration analysis on the globalization index, international inequality, and within-country inequality to address the questions above.

2-3-2-Methodology and Estimation Results

It is well known in the econometric literature that a trend in the same direction or the opposite direction for some time series does not mean a positive or negative long-run relationship between the two series unless these time series are stationary. Running regression between these time series will lead to the problem of spurious regression. Udny Yule (1926) is the first to introduce and analyze the concept of spurious regression. Granger and Engle (1987) showed that in order to avoid the problem of spurious regression, the time series must be cointegrated. We say that time-series are cointegrated if one, some, or all of them will return to the long-run equilibrium relation following short-run deviations in any of the time series, which implies that the error term of the long-run relation must be stationary (i.e., must have constant mean and variance). In the econometric literature, several methods to estimate the long-run relation between the time series were developed. The most common approaches are the Engle and Granger 2-step approach and the vector-based vector error-correction model (VECM) using Johansen's (1988, 1991) methods.

The Engle-Granger approach suffers from several weaknesses. Namely, it is restricted to only a single equation with one variable designated as the dependent variable, explained by another variable assumed to be weakly exogenous. It also relies on pre-testing the time series to determine whether variables are I(0) or I(1). These weaknesses can be addressed by using Johansen's (1988) procedure. Its advantages include: (a) that pre-testing is unnecessary; (b) there can be numerous cointegrating relationships; (c) all variables are treated as endogenous, and (d) tests relating to the long-run parameters are possible. The resulting model is known as a vector error correction model (VECM), as it adds error correction features to a multi-factor model known as vector autoregression (VAR). Since we have multiple time series and possible endogeneity (that is, causality might be bi-directional), the best method to test the long-run relation and direction of

causality is estimating VECM by using Johansen's method. Johansen's procedure requires to conduct the following tests first. First, we need to determine whether the time series is stationary or not, and the all-time series should be integrated of the same order. Second, we need to determine the number of lags of the model. Finally, we need to determine the number of cointegration vectors.

The test results of Augmented Dickey-Fuller on the three-time series [Table 2-1**]** data show that all the three-time series are nonstationary at the level of the natural logarithm.

Table 2-1: Dickey-Fuller test for unit root

Variables	Test Statistics	1% critical value	5% critical value	10% critical value	P value
$\boldsymbol{LW.ineq_t}$	1.535	-3.675	-2.969	-2.617	0.9976
$\boldsymbol{LB.ineq_t}$	3.398	-3.675	-2.969	-2.617	1.0000
$\boldsymbol{LEKOF_t}$	-0.940	-3.675	-2.969	-2.617	0.7744

Further tests indicate just the within inequality and globalization time series are stationary at the first difference of the natural logarithm (in the form of growth rates) [Table 2-2]. Therefore, they are integrated of order one, I (1). The time series of the between countries inequality is not stationary even at the first difference of the natural logarithm (that is, growth rate), but stationary when taking the first difference of the growth rates, which imply that the time series of the between countries inequality is integrated of order two I(2), contradicting Johansen's procedure.

Table 2-2: Dickey-Fuller test for unit root

Variable	Test Statistics	1% critical value	5% critical value	10% critical value	P value
$\Delta LW.ineq_t$	-4.596	-3.682	-2.972	-2.618	0.0001
$\Delta LB.ineq_t$	3.398	-3.682	-2.972	-2.618	0.2162
$\Delta LEKOF_t$	-0.940	-3.682	-2.972	-2.618	0.0000

Therefore, the time series of the within countries' inequality and economic globalization will be taken in the natural logarithm. In contrast, the between countries' inequality will be taken the form of growth rate in the regression model for all the time series to be integrated of order one.

Determination of the appropriate lag structure of the VECM by selection order criteria most of the indicators indicate the appropriate lag structure of the model is one-period lag [Table 2-3].

Table 2-3

Selection-order criteria								
Sample: 1985 - 2016					Number of	obs =	32	
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
								-
0	131.764				6.40E-08	-8.04775	-8.0022	7.91033
1	276.614	289.7*	9	0	1.3e-11*	-16.5384*	-16.3562*	15.9888*
2	282.765	12.302	9	0.197	1.60E-11	-16.3603	-16.0415	15.3984
3	288.644	11.757	9	0.227	2.00E-11	-16.1652	-15.7098	14.7911
4	292.377	7.4671	9	0.589	3.10E-11	-15.8361	-15.244	14.0497
Endogenous:	LW.ineq	ΔLB.ineq	LEKOF					

Johansen's (1991) tests for determining cointegration rank indicate that there is at least one cointegration vector [Table 2-4].

Table 2-4

Johansen tests for cointegration						
Trend: constant				Number	of obs=	35
Sample: 1982 - 2016					Lags	1
				5%		
maximum			trace	critical		
rank	parms	LL	eigenvalue	statistic	value	
0	3	267.31538	.	53.9619	29.68	
1	8	290.08054	0.72770	8.4316*	15.41	
2	11	293.63529	0.18383	1.3221	3.76	
3	12	294.29635	0.03707			

However, two integrations vector has been chosen according to the theory of possible existence of two long-run relations between globalization and within countries inequality from one

hand and existence of the long-run relationship between globalization and between countries' inequality from the other hand. The VECM with one period lag and two cointegration vectors can be written in the following form:[8]

$$\Delta \boldsymbol{W_t} = \boldsymbol{W_0} + \boldsymbol{\alpha_{11}}(\boldsymbol{ce.1})_{t-1} + \boldsymbol{\alpha_{12}}(\boldsymbol{ce.2})_{t-1} + \boldsymbol{\gamma_{11}}\Delta \boldsymbol{W_{t-1}} + \boldsymbol{\gamma_{12}}\Delta \boldsymbol{B_{t-1}} + \boldsymbol{\gamma_{13}}\Delta \boldsymbol{G_{t-1}} + \boldsymbol{\mu_{1t}} \quad (\mathbf{1})$$

$$\Delta \boldsymbol{B_t} = \boldsymbol{B_0} + \boldsymbol{\alpha_{21}}(\boldsymbol{ce.1})_{t-1}) + \boldsymbol{\alpha_{22}}(\boldsymbol{ce.2})_{t-1} + \boldsymbol{\gamma_{21}}\Delta \boldsymbol{W_{t-1}} + \boldsymbol{\gamma_{22}}\Delta \boldsymbol{B_{t-1}} + \boldsymbol{\gamma_{23}}\Delta \boldsymbol{G_{t-1}} + \boldsymbol{\mu_{2t}} \quad (\mathbf{2})$$

$$\Delta \boldsymbol{G_t} = \boldsymbol{G_0} + \boldsymbol{\alpha_{31}}(\boldsymbol{ce.1})_{t-1} + \boldsymbol{\alpha_{32}}(\boldsymbol{ce.2})_{t-1} + \boldsymbol{\gamma_{31}}\Delta \boldsymbol{W_{t-1}} + \boldsymbol{\gamma_{32}}\Delta \boldsymbol{B_{t-1}} + \boldsymbol{\gamma_{33}}\Delta \boldsymbol{G_{t-i}} + \boldsymbol{\mu_{3t}} \quad (\mathbf{3})$$

$$(\boldsymbol{ce.1})_t = \boldsymbol{W_t} - \boldsymbol{z_0} - \boldsymbol{\beta_1}(\boldsymbol{G_t}) \quad (\mathbf{4})$$

$$(\boldsymbol{ce.2})_t = \boldsymbol{B_t} - \boldsymbol{m_0} - \boldsymbol{\beta_2}(\boldsymbol{G_t}) \quad (\mathbf{5})$$

Where the notation is as follows:

- W_t: Natural logarithm of Within Countries Inequality time series ($LW.ineq_t$).
- B_t: the growth rate of the Between Countries Inequality ($\Delta LB.ineq_t$).
- G_t: Natural logarithm of Economic Globalization (measured with EKOF index:).
- $(\text{ec. i})_t$: Error Correction term for deviation from the long − run relation.
- μ_{it}: random terms and supposed to be normally distributed with zero means and constant variances.
- β_i: estimated long − run coefficients.
- γ_{ij}: the estimated short-run parameters.
- α_{ij}: Adjustment Parameters.

[8] All variables are in measured in the level of natural logarithm, except the between countries inequality time series which will be the first difference of the natural logarithm (in the growth rate from), in order for all-time series to be integrated of order one.

2-4- Estimation Results

There are three types of parameters of interest in VECM: the parameters in the cointegration equations (β_i), which describe long-run relation; the adjustment coefficients (α_{ij}), which capture the speed and the direction of adjustment, and the short-run coefficients (γ_{ij}). Since the paper is mainly concerned with the long-run relation and direction of causality: therefore, the main parameters of interest are the long-run cointegrating equations 4 & 5 β_i in Table 2-6 and the estimated adjustment coefficients (α_{ij}) in Table 2-5.

Table 2-5: Adjustment Parameters (α_{ij})

	(1)	**(2)**	**(3)**
VARIABLES	ΔW_t	ΔB_t	ΔG_t
$(ce.1)_{t-1}$	-0.2867634 *** (0.0658964)	.0406834 (.0521045)	-0.0983586** (0.0338545)
$(ce.2)_{t-1}$	-0.128512 (0.2181956)	-0.4308695 *** (0.1725282)	0.2047934* (0.1120987)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2-6: Long run Parameters (β_i)

	(1)	**(2)**
VARIABLES	$(ce1)_t$	$(ce2)_t$
W_t	1	(omitted)
B_t	(omitted)	1
G_t	-1.386117 *** (0.1130002)	0.1374644 *** (0 .0359531)
Constant	5.88534 *** (.4458381)	-0.521721*** (0.1418518)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results of the VECM estimator indicate that there is a positive long-run relation between globalization (measured as the KOF index of globalization) and within countries inequality, and there is negative long-run relation between globalization and the between countries inequality as indicated by the statistical significance of the estimated (β_i) coefficients for equations (4) & (5) (Table 7). In particular, we have the following system:

$$ce1_t = W_t + 5.88534^{***} - 1.386117^{***}(G_t) \quad (4)$$

$$ce2_t = B_t - 0.521721^{***} + 0.1374644^{***}(G_t) \quad (5)$$

Both the direction of the long-run causality between the variables and the presence of a long relationship between the within and between countries inequality is determined by the signs and the statistical significance of the adjustment coefficients (α_{ij}) in Table 6.

The estimated adjustment parameters (α_{11} & α_{12}) for equation (1) in Table $(2-6)$ row (1), which measure adjustment of the within inequality to any positive disturbance from the estimated long-run relation (equations 4 and 5), show that only α_{11} is negative and statistically significant. This result indicates a long-run positive relationship between globalization and within-country inequality. It also indicates that the direction of causality runs from economic globalization to within-country inequality. Holding within-country inequality constant in the current period, a decline in economic globalization eventually leads to a decrease in within-country inequality in the next period. On the other hand, the estimated adjustment parameters (α_{12}) is not statistically significant, indicating no response of within-country inequality to changes in the between-country inequality.

$$\uparrow ce1_t = W_t + 5.88534^{***} - 1.386117^{***} \downarrow (G_t)$$
$$\downarrow \Delta WI_{t+1} = (\alpha_{12} = \text{-}0.2867634^{***})(\uparrow ce1)_t$$

The estimated adjustment parameters (α_{21}& α_{22}) for equation (2) in Table (2 − 6) row (2), which measure adjustment of the between inequality to any positive disturbance in the estimated long-run relation (equations 4 and 5), show that only the adjustment parameter α_{22} is negative and statistically significant, indicating a negative long-run relationship between globalization and between-country inequality and indicates that causality runs from globalization towards between-country inequality. Holding between countries' inequality constant in the current period, any increase in economic globalization eventually leads to a decrease in between countries' inequality in the next period. On the other hand, the estimated adjustment parameters (α_{21}) is not statistically significant, which indicates that there is no response for the between countries inequality to changes in the within countries inequality.

$$\uparrow \mathrm{ce2_t} = \mathrm{B_t} - 0.521721^{***} + 0.1374644^{***} (\mathrm{G_t}) \uparrow$$

$$\uparrow \Delta B_{t+1} = -0.0417^{**} (\uparrow ce2)_t$$

The estimated adjustment parameters (α_{31}& α_{32}) for equation (2) in Table (2 − 6) row (2), which measure adjustment of the economic globalization to any positive disturbance from the estimated long-run relation (equations 4 and 5), show that the two adjustment parameters (α_{31}& α_{32}) are both statistically significant and α_{31} has a negative sign, while α_{32} has a positive sign. The adjustment parameter α_{31} indicates a negative long-run causality running from the within inequality towards the economic globalization, while the positive sign of the adjustment parameter α_{32} indicates positive long-run causality running from the between inequality towards economic globalization. In conclusion, we can summarize the sign and direction of causality in the long-run among the three-time series in Figure 2-6.

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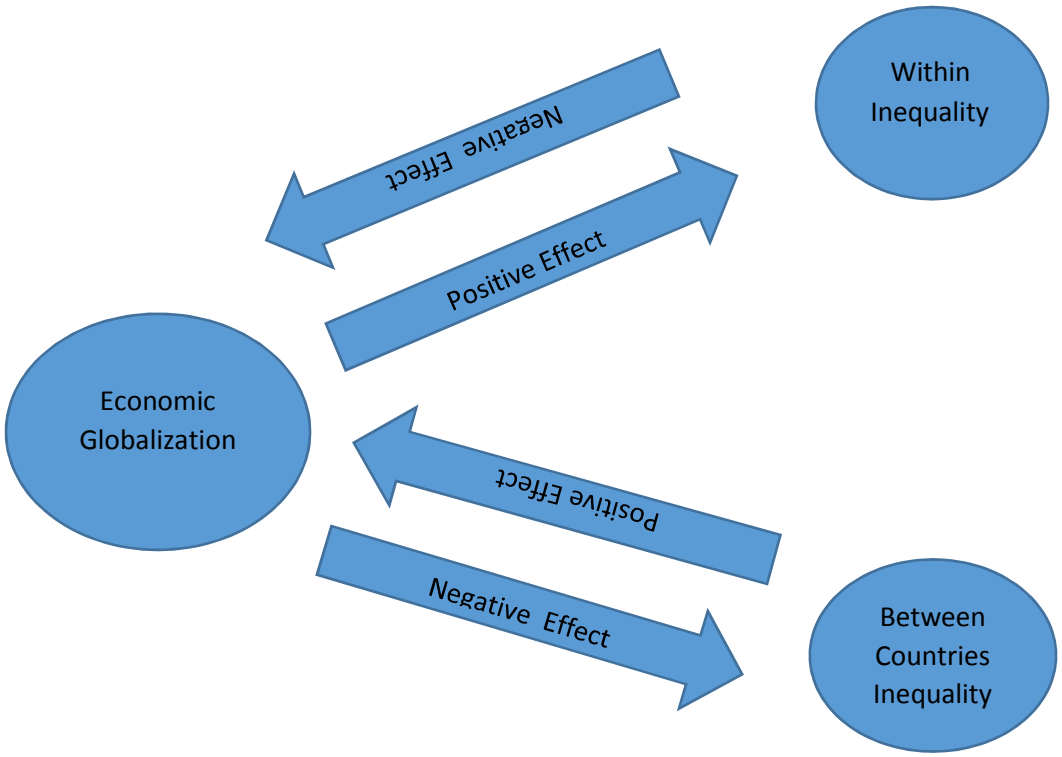

Figure 2-6

The simple impulse response functions graphs, which are a mixture of the short-run and long-run effect of a hypothetical shock to error term of one variable (impulse variable) toward the response variable, indicate that an increase in globalization has a permanent positive effect on the within countries inequality and permanent negative effect on the between countries inequality. Also, it is noted that the pattern of the two impulse function takes the same inverse shape, which corroborates the inverse relationship between the two types of inequality [Figures 2-7 and 2-8].

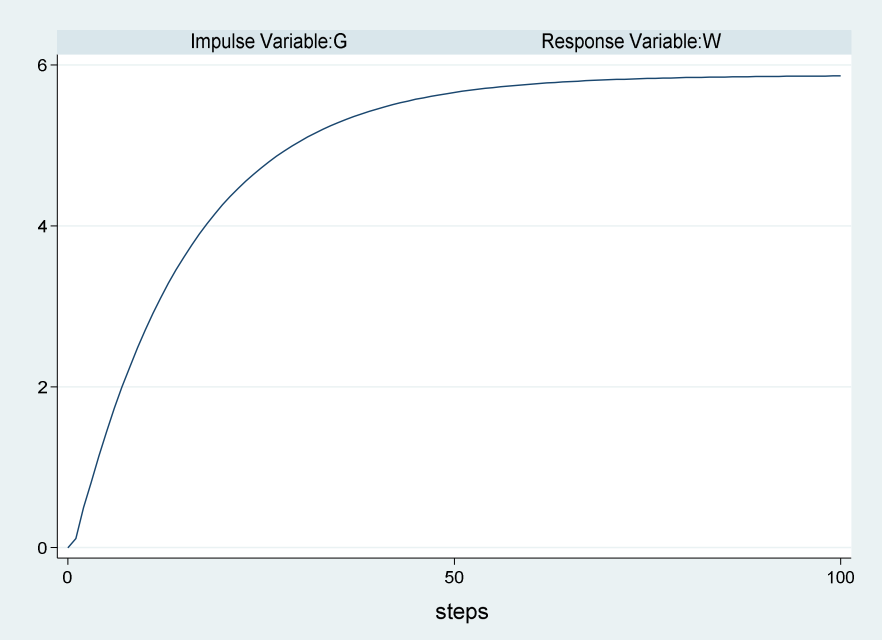

Figure 2-7

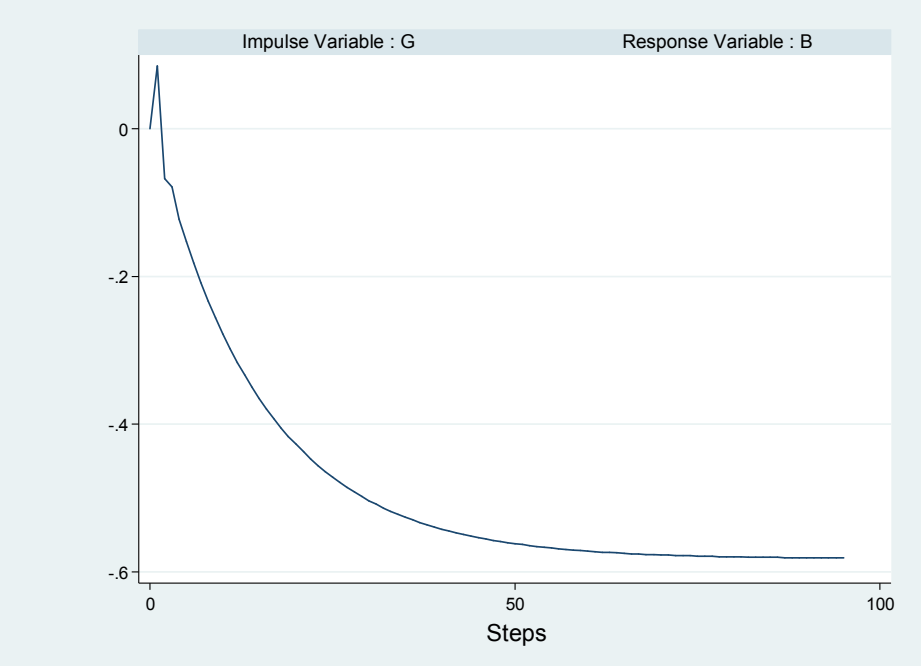

Figure 2-8

The simple impulse response function of a hypothetical shock to the between countries inequality shows a permanents positive impact on economic globalization [Figure 2-9]. The impulse response function of a hypothetical shock to the within countries inequality shows a permanent negative impact on economic globalization [Figure 2-10].

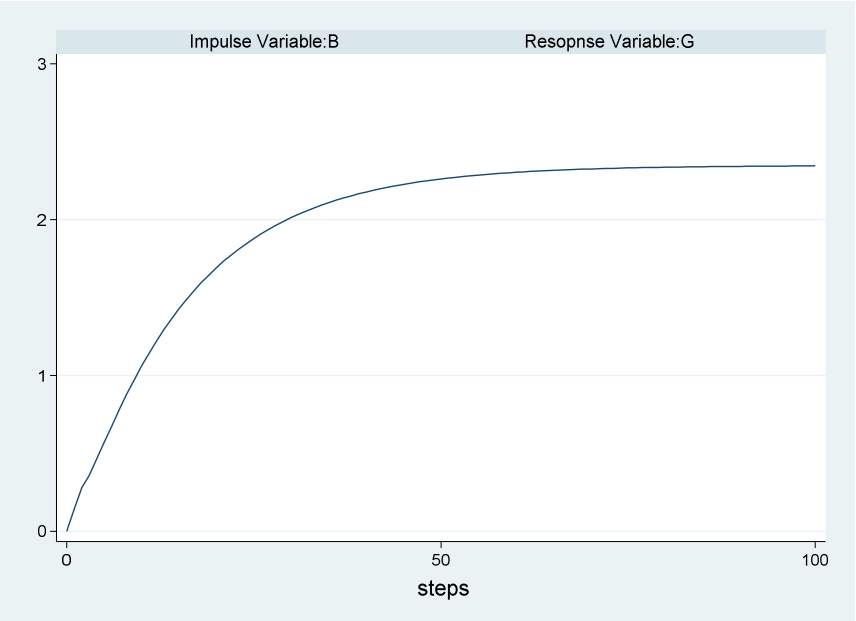

Figure 2-9

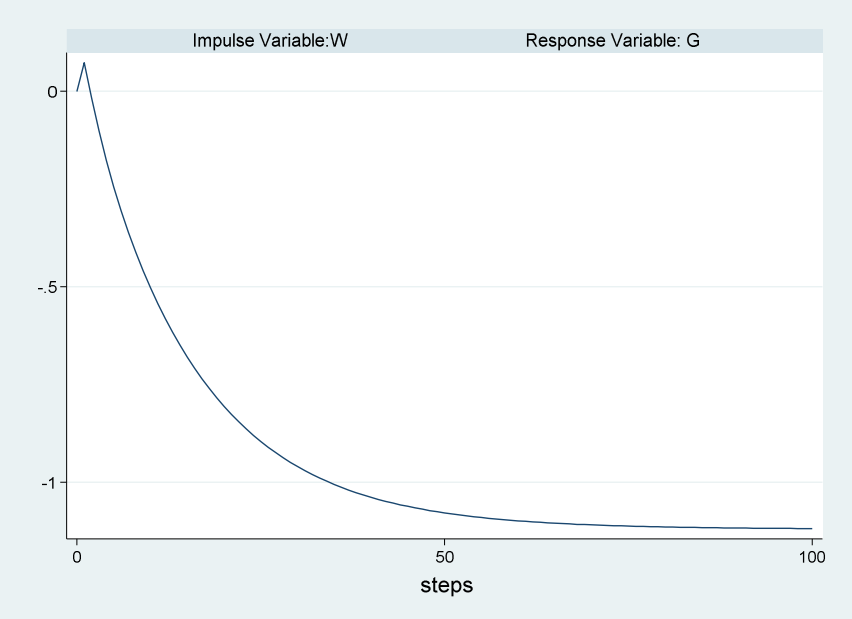

Figure 2-10

Economic globalization reduces inequality between countries and increases within countries inequality; however, there are also adverse impacts from the two types of inequality on economic globalization in the opposite directions, which will moderate the effect of economic globalization on the two types of inequality. Because the adverse effects are smaller than the initial effect of globalization on the two types of inequality, the ultimate effect will be moderating globalization's impact and not canceling or offsetting the initial effect.

Cointegrating VECMs are also used to produce forecasts of the variables in the model. Forecasts of the tree time series from 2016 until 2024 show the within- inequality measure will decline until 2018 and remain stable until 2024 [Figure 2-11]. Between-country inequality will witness some decline until 2019 and then remain stable until 2024 [Figure 2-12]. Finally, economic globalization will stay stable during all periods, witness some decline until 2018, and then remain stable until 2024 (Figure 13).

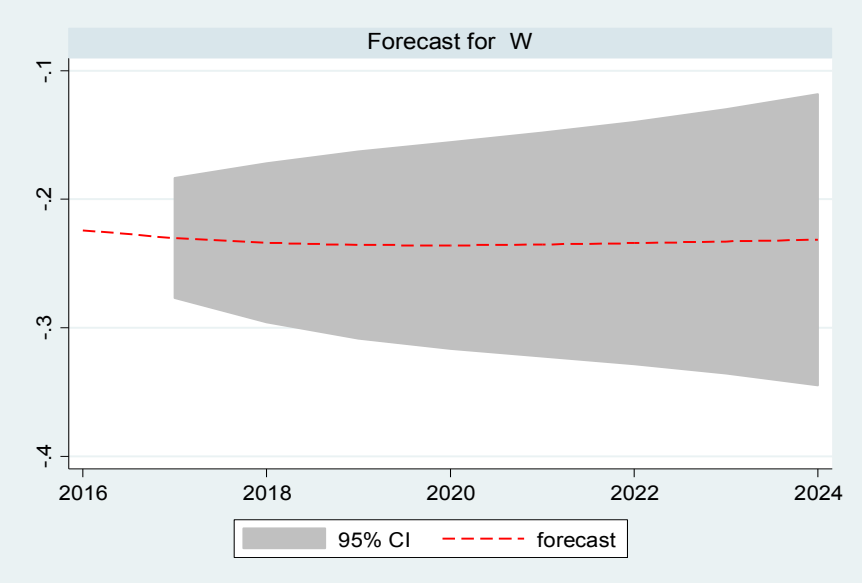

Figure 2-11

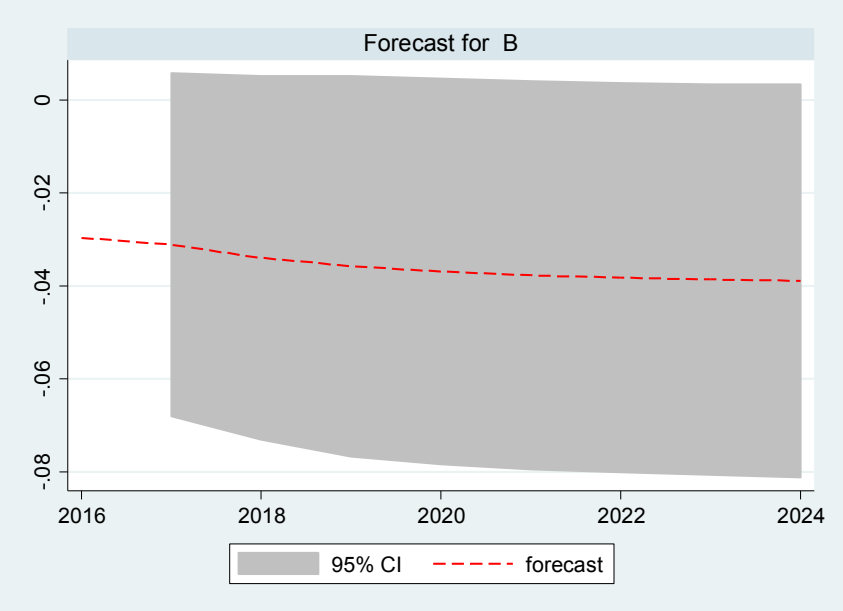

Figure 2-12

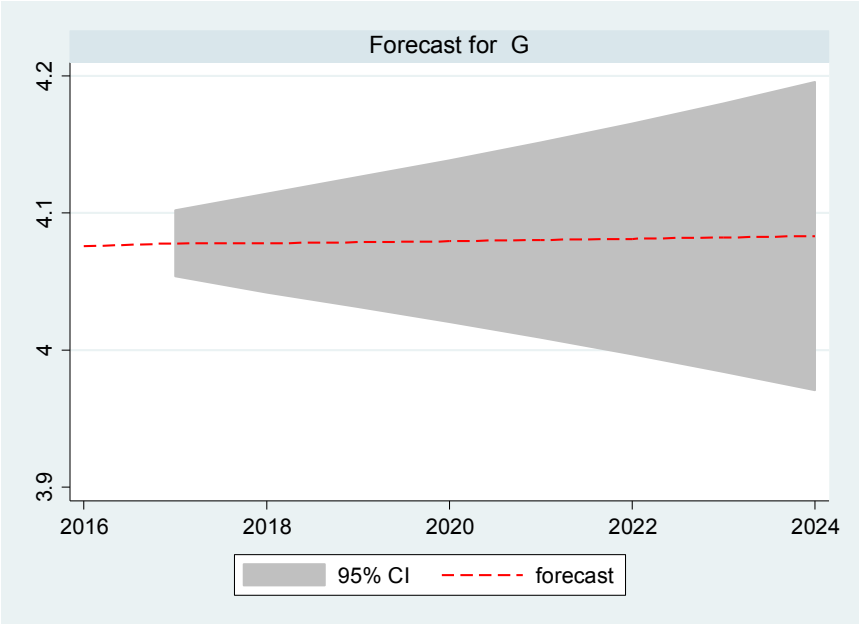

Figure 2-13

2-5- Conclusions

Given the evidence presented using the World Inequality Database, we can conclude our analysis as follows. Although global inequality decreased, due mainly to the decrease in inequality between countries, within-country inequality has increased substantially. The main reason for the decline in international inequality appears to be related to the increase in the world income shares of China, India, and Indonesia (which are also are the most populated countries of the world) and the decline in the world income share for the most advanced and high-income countries such as the United States, Germany, Italy, Japan, and United Kingdom. Almost all the country shares for the rest of the world were stable. A time-series analysis of the relationship between globalization, between countries inequality, and within countries inequality indicates the decrease in the between countries inequality and increase in the within countries' inequality is due

mainly to the rise of economic globalization. Forecasts of the tree time series for the period spanning from 2016 until 2024 shows that it is likely that globalization, between-country inequality, and within-country inequality are likely to remain stable until 2024.

Chapter 3: Global Inequality and World Trade

Summary

In this paper, another dimension to global inequality's significance will be explored: the impact of global inequality on demand for imports, along with this dimension, global inequality, and not just domestic inequality matters. I provide empirical estimates using panel data on almost all countries of the world for the period 1960–2015 to test the effect of domestic and international inequality on real output and consequently on demand for imports.

3-1-Introduction

The concept of global inequality in the distribution of income concerns the distribution of income between populations of the world. In general, it consists of two parts: inequality in income distribution between countries of the world (international inequality: an increase in inequality in income per capita between countries of the world) and inequality within countries of the world (domestic inequality: increase in inequality in income distribution inside countries of the world).

As measured by the Gini Index (Figure 3-1), the time-series on global inequality shows a trend for global inequality to increase until nearly 2002. Then, global inequality starts to decline until 2016. It is also noted that although global inequality through time did change, increasing in some periods and decreasing in others, the changes do not appear to be large. The Gini Index's global inequality ranged from .643 as the minimum value in 1985 to .678 as the maximum value in 2003.

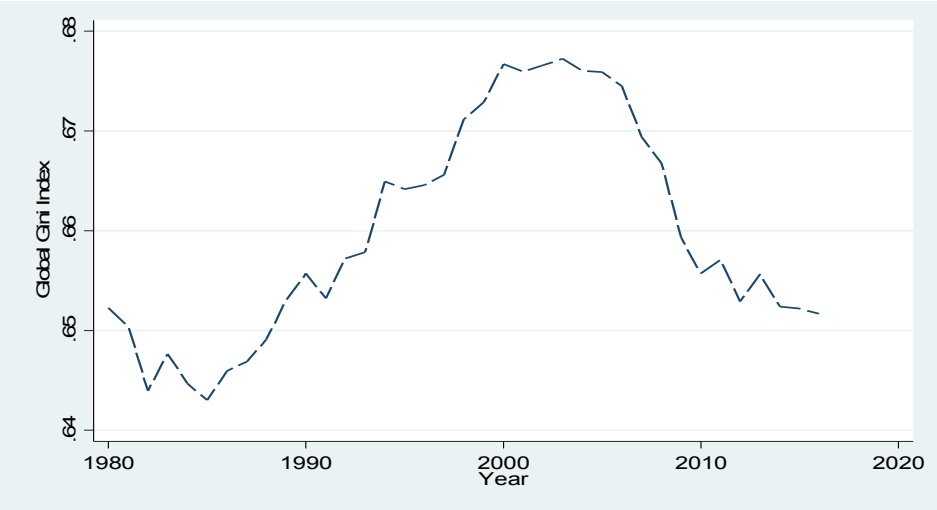

Figure 3-1: Source Database WID

Although global inequality has declined[9] in the past two decades, it is still high. Even without considering the causes of global inequality, there are still important questions that require addressing: (a) does global inequality matter? (b) What are the consequences of global inequality?

According to Bhagwati (2004), even attempting global inequality calculations is 'lunacy' as it is a mere number. There is no 'addressee' to whom this mere number matters because there is no global government, and there is no global civil society and no global polity. Krueger (2002) and Feldstein (1999) argue that inequality matters only regarding absolute income changes only. Accordingly, global inequality does not matter because even global inequality increases, what concerns people in a certain nation is their income level within that nation, not their incomes relative to other nations' citizens. This point of view contrasts with Duesenberry's (1949) theory of relative income. Also, according to Graham and Felton (2005) and Frank (2005), people do not care only about their absolute income, but also about where they stand in the social pyramid, and

[9] Markedly since 2000, following a slower decline during the 1990s and this trend has been due particularly to growth in income per capita for China and India.

also whether they think this position to be fair both with regards to their fellow citizens and the rest of the world. Thus, people in different countries care about their incomes relative to other countries, and this might cause political instability and pressure on civil society. Consequently, global inequality does matter. Kuznets (1965) formulated the following over fifty years ago:

> *"Since it is only through contact that recognition and tension are created, one could argue that the reduction of physical misery associated with low income and consumption levels…permit[s] an increase rather than a diminution of political tensions [because] the political misery of the poor, the tension created by the observation of the much greater wealth of other communities…may have only increased."*

On the other side of the issue, Pogge and Reddy (2002) and Singer (2002) argue that global poverty and global inequality are ethical issues. Rich nations should be concerned about developing nations from an ethical standpoint related to the human nature of concerns and helping others.

In this paper, another dimension to the significance of global inequality will be explored: the impact of global inequality on demand for imports, along with this dimension, global inequality, and not just domestic inequality matters. The export-led growth hypothesis (ELGH) postulates that export growth is one of the critical determinants of economic growth. If global inequality affects the growth of world trade, it will affect each country in the world. Thus, considering the export channel may help explain why global inequality matters and why countries worldwide should care about global inequality besides their domestic inequality.

World trade determines the extent of the markets through which growth and productivity in any country are enhanced. According to Adam Smith (1776), labor productivity

depends on the market's extent and the distribution of products' total value among different social classes. Reading from *The Wealth of Nations*:

> "*As it is the power of exchanging that gives occasion to the division of labor, so the extent of this division must always be limited by the extent of that power, or, in other words, by the extent of the market……, for want of the power to exchange all that surplus part of the produce of his own labor, which is over and above his own consumption, for such parts of the produce of other men's labor as he has occasion for."*

On the one hand, increases in inequality within countries of the world could negatively affect the demand and supply of real output of countries that witnessed domestic inequality. A decrease in real output in a particular country leads to a decrease in its demand for imports since imports are an increasing function in GDP. Thus, if inequality within countries increases globally, this leads to decreases in real output of the world and consequently demand on world imports, which are the world exports. On the other hand, increases in the gap in income per capita between a specific country and the rest of the world might be harmful to that country's real output. Rising inequality between countries of the world could lead to the immigration of skilled workers and political instability in low-income countries, as people in low-income countries compare themselves to living standards in high-income countries.

In the economic literature, some studies attempted to measure global inequality in income distribution (Goldberg and Pavcnic, 2007; Milanovic, 2012); other studies have focused on the impact of international trade on inequality in income distribution between countries, or inequality in income distribution within countries of the world or together (Wood, 1995, 1997, 1999; Ghose, 2004; Kahai and Simmons, 2005; Aradhyula et al., 2007). There are no studies about

the impact of global inequality on world trade, and the economy was found to the best of my knowledge.

In this paper, at the disaggregated level and using panel data on 153 countries at various stages of economic development for the 1960-2015 period, the effect of domestic inequality and international inequality on the real domestic output and, consequently, the effect on demand on imports will be estimated.

The second section of this paper will discuss the possible theoretical effects of domestic inequality on real domestic output and, consequently, the effect of within countries' inequality on world income and world trade. The third section will discuss the possible theoretical effects of an increase in international inequality of a country on its real output and, consequently, the effect of international inequality on world income and world trade. The fourth section will be about the model, data estimation method, and results. The final section presents the conclusion.

3-2-Effect of inequality domestic inequality on real output

In general, economists can be divided into two groups regarding their view on the effect of inequality in the personal income distribution on countries' economic growth. The first group sees that inequality in income distribution affects the supply side. In contrast, the other group sees that the effects of inequality on economic growth will be through the effect of inequality on aggregate demand.

The first group (Neoclassical) sees the effects of inequality in the size of personal income distribution on economic growth that will come through the supply side. In their studies of the effect of inequality in income distribution on economic growth, neoclassical economists see that inequality harms economic growth. They do not relate the negative effect of inequality on the supply side directly to inequality itself (effect of inequality on the economic mechanism), but

instead due to other indirect factors associated with income distribution inequality. Among other factors, one can cite the government's intervention in democratic countries in cases where inequality in income distribution is high (Alesina and Rodrik, 1994; Persson and Tabellini, 1994). In this case, the government would increase taxes on capital through the fiscal policy that has a negative impact on accumulation. The literature has also identified a negative effect of inequality on the accumulation of human capital due to credit-market imperfections (Galor & Zeira, 1993) or due to socio-political instability (Benhabib & Rustichini, 1996). Finally, and without the pretense of being exhaustive, inequality might lead to a financial crisis, especially in advanced countries where inequality in income leads to more borrowing and, therefore, the accumulation of unsustainable household debt (Kumhof & Rancière, 2011). According to these considerations, domestic inequality might be harmful to total production in a particular country through indirect factors.

The second group, mainly composed of Keynesian and post-Keynesian economists, counter that inequality in income distribution impacts economic growth through the effect of inequality on aggregate demand. Post-Keynesian studies showed that the effect of inequality in income distribution on economic growth depends on whether the aggregate demand structure is wage-led (stagnation) or profit-led growth (exhilaration). The economy will stagnate in cases where the negative effect of inequality on consumption more than offsets the positive effect of inequality on investment (that occurs through a reduction in unit labor costs). Conversely, the economy is said to have a profit-led (exhilaration) demand regime in cases where the positive effect on investment more than offsets the negative effect on consumption. Most of these studies are authored by Post-Keynesian economists who adopted the Kaleckian Cambridge equation

(Rowthorn, 1981; Dutt, 1984; Taylor, 1985; Amadeo, 1986; Blecker, 1989; Bhaduri & Marglin, 1990).

3-3-Effect of increase in international inequality of a country on its real output

There is no theory about the effects of inequality in income per capita between countries worldwide on a country's real output in economic literature. Still, at least some economists have mentioned some possible effects of inter-country inequality. According to Held and Kaya (2007), rising inequality between countries of the world might cause an increase in migration of the skilled workers and political instability in low-income countries as people in low-income countries to compare themselves to living standards in the high-income countries. The effects of inter-country inequality on the supply side might occur through various factors such as political instability in low-income countries, deficiency in investment in human capital, and unsustainable external borrowing, leading to a global financial crisis.

3-4-Model Specification and Methodology

The research hypothesis advanced in this paper is that domestic inequality and international inequality may negatively affect the real output. It is well-known in the economic literature (Harberger, 1953; Hinshaw, 1945; Liu, 1954; Vegh, 1941) that demand for imports is increasing function in real domestic output; but the demand for imports in a certain country will affect exports of other countries that engaged in trade with that country. High levels of global inequality (which is calculated as the sum of between-country inequality and within-country inequality) could negatively affect world income, which will affect the demand for individual countries' exports. According to the export-led growth hypothesis, a decline in the demand for exports adversely affects world countries' growth rates. In this paper, by using panel data for different countries of

the world, I will estimate the effect of domestic and international inequality on real domestic output and, consequently, on imports.

3-4-1-Determination of the effect of Domestic and International Inequality on the Real Output and Demand on Imports

According to economic theory, the traditional import demand function (IM_t) that is based on consumer theory (assuming imperfect substitution between domestic and foreign goods) is a function of real output (Y_t) and relative prices (R_t):

$$IM_t = Z_0 Y_t^m R_t^v \, e^{\in_t} \qquad (1)$$

By taking natural logarithms, equation (1) in panel data econometric format:

$$lnIM_{it} = lnZ_0 + \; mlnY_{it} + \; vlnR_{it} \; + \in_{it} \qquad (2)$$

The effects of domestic (D_t) and international inequality(I_t) on demand for imports come from the effects of both types of inequalities on real output (Y_t). Adopting the supply-side approach, the most common control variables that explain variation in the level of real output are physical(K_t), human capital(H_t), labor(L_t), and the stock of technology(A_t).

$$Y_t = \; A_t \; K_t^c \; H_t^v L_t^z \; e^{u_t} \qquad (3)$$

In what follows, we assume that technological progress is endogenous and is a function in physical capital, human capital, and labor. Based on the idea that exports lead to increases in the extent of markets, fostering the division of labor and therefore increasing labor productivity (Adam Smith, 1776), and also borrowing from the literature on productive government spending (Barro, 1990; Aschauer, 1989; Stiroh, 2000; Barro and Sala-i-Martin;1995; Banister and Berechman, 2000), we can also include exports (X_t) and government spending (G_t) as explanatory variables for the stock of technology, which can then be written as:

$$A_t = A_0 \ K_t^q \ H_t^w L_t^i \ G_t^\tau X_t^\theta \qquad (4)$$

$$Y_t = \ A_0 \ \ K_t^\beta \ \ H_t^\pi L_t^r \ G_t^\tau X_t^\theta \ \ e^{u_t} \qquad (5)$$

The effect of domestic (D_t) and international inequality (I_t) on real output will be through the effect of both types of inequality on physical and human capital. Based on this, we assume that both physical and human capital are functions of domestic and international inequality, in addition to the other explanatory variables, and that the other explanatory variables (labor, government spending, and exports) are expected to affect the physical and human capital:

$$K_t = q_0 D_t^m I_t^n \ L_t^q \ \ G_t^m \ X_t^c \qquad (6)$$

$$H_t = j_0 D_t^k I_t^s \ L_t^i \ \ G_t^p \ X_t^f \qquad (7)$$

The reduced-form Cobb-Douglas production function can be written as follows:

$$Y_t = \ B_0 \ D_t^\psi I_t^\Omega \ L_t^\alpha \ \ G_t^\lambda X_t^\zeta \ \ e^{u_t} \qquad (8)$$

The reduced form of Cobb-Douglas production function allows us to avoid many problems in the estimation, since as known in the literature, there are severe problems in the measurement of the physical and human capital (see Escribá-Pérez et al., 2018 for discussion about measuring physical capital and see Stroombergen et al., 2002 for discussion about measurements of human capital), in addition to the problem of multicollinearity between labor and the two types of capital which could seriously affect the estimation results.

According to economic theory increase in inequality at first could lead to an increase in aggregate savings and investment (due to high-income people have a higher marginal propensity to save than low-income people) and consequently higher real output, but high levels of inequality

expected to be harmful to growth because of many of direct and indirect factors like government's intervention in democratic countries in cases where inequality in income distribution is high (Alesina and Rodrik, 1994; Persson and Tabellini, 1994) and political instability (Benhabib & Rustichini, 1996). Also, high inequality leads to a financial crisis, especially in advanced countries where inequality in income leads to more borrowing and, therefore, the accumulation of unsustainable household debt (Kumhof & Rancière, 2011). According to these considerations, low levels of inequality have a positive effect on growth. However, high levels of domestic inequality might be harmful to real output and real output growth.

The effect of domestic inequality on real output might not be constant and may take an inverted-U shape. Thus, the parameter ψ might not be constant and differ according to levels of inequality. In order to take into consideration this possibility, the following function has been assumed:

$$\psi = constant + lnD_{it}$$

By taking the natural logarithm, equation (8) in econometric panel format:

$$lnY_{it} = lnC_0 + \gamma lnD_{it} + \Pi\ lnD_{it}{}^2 + \Omega lnI_{it} + \alpha lnL_{it} + \lambda lnG_{it} + \zeta lnX_{it} + u_{it} \quad (9)$$

Equations (9) and (2) are the proposed equations of estimation. In the econometric literature, there are three standard methods to estimate panel data: pooled OLS, fixed effects, and random-effects models. Determination of which method is the best fit depends on whether countries' time-invariant specific factors are identical across countries or are not. If time-invariant specific factors are common across countries, then one can use pooled OLS assuming no heterogeneity. If time-invariant specific factors are country-specific, but they are correlated with explanatory variables, the best fit method is the fixed effects estimator. If the time-invariant specific factors are country-specific but are not correlated with the explanatory variables, the best

estimation method will be the random-effects model. Since it is understood there are must be heterogeneity between countries of the world, the accurate estimation method should be the FE or RE as indicated by Breusch and Pagan Lagrangian multiplier test. Hausman test was conducted, and results indicated that FE is the most accurate fit for the model. However, in addition to FE, OLS and RE's results will be reported for comparison.

There are also might be there a problem of endogeneity between independent variables and dependent variables (causality might be in the two directions), and in order to overcome this problem, one lag period of independent variables (based on the rule: changes in variables in current time cant cause changes in variables that happen in the past). However, the results of the model with and without one period lag will be reported for comparison.

The sample consists of 153 countries, developing and developed, for the 1960-2015 period. The analysis is based on annual data since there are no higher frequency data for inequality. The sample is unbalanced since they lack data for many countries, especially developing countries (see Appendix 1 for measurement and data sources).

3-4-2-Measurements of the Variables and Source of Data

- **Real Output**: GDP (constant 2010 US$). Source: World Bank national accounts data, and OECD National Accounts data files.
- **Imports**: Imports of goods and services (constant 2010 US$). Source: World Bank national accounts data, and OECD National Accounts data files.
- **Domestic Inequality**: Branko L. Milanovic, All the Ginis Dataset, World Bank Group.

- **International Inequality:** was calculated as the ratio of real GDP per capita of the world to the country's real GDP per capita.

- **Relative Price:** is the ratio of Import value indexes to GDP deflator of the particular country. The import value index is the current value of imports (c.i.f.) converted to U.S. dollars and expressed as a percentage of the base period's average (2000). Source: Import index: United Nations Conference on Trade and Development, Handbook of Statistics and data files, and International Monetary Fund, International Financial Statistics. Source GDP deflator: World Bank national accounts data, and OECD National Accounts data files.

- **Government Spending:** General government final consumption expenditure (constant 2010 US$). Source: World Bank national accounts data, and OECD National Accounts data files.

- **Labor:** I have used the Total population as a proxy for the labor force. Source: World Bank national accounts data,

- **Exports:** Exports of goods and services (constant 2010 US$). Source: World Bank national accounts data, and OECD National Accounts data files.

3-4-3- Estimation Results: Equation (2)

Estimation Results of Equation (2) without one period lag

Dependent variable ($lnIM_{it}$)

	(OLS)	**(RE)**	**(FE)**
VARIABLES			
$\boldsymbol{lnY_{it}}$	0.886***	1.157***	1.282***
	(0.00506)	(0.0113)	(0.0130)
$\boldsymbol{lnR_{it}}$	-0.0684***	-0.0293***	-0.0287***
	(0.00468)	(0.00320)	(0.00309)
$\boldsymbol{lnZ_0}$	1.730***	-4.838***	-7.992***
	(0.124)	(0.278)	(0.318)
Observations	3,600	3,600	3,600
R-squared	0.895	0.892	0.739
Number of ID	152	152	152

Estimation Results of Equation (2) with one period lag

Dependent variable ($lnIM_{it}$)

	(OLS)	**(RE)**	**(FE)**
VARIABLES			
$\boldsymbol{lnY_{it-1}}$	0.885***	1.149***	1.283***
	(0.00514)	(0.0116)	(0.0137)
$\boldsymbol{lnR_{it-1}}$	-0.0741***	-0.0394***	-0.0388***
	(0.00466)	(0.00324)	(0.00312)
$\boldsymbol{lnZ_0}$	1.784***	-4.598***	-7.954***
	(0.126)	(0.286)	(0.334)
Observations	3,494	3,494	3,494
R-squared	0.895	0.89	0.728
Number of ID	152	152	152

Standard errors in parentheses.

All variables in natural logarithm

*** p<0.01, ** p<0.05, * p<0.1

3-4-4- Estimation Results: Equation (9)

Estimation Results of Equation (9) without one period lag

Dependent variable (lnY_{it})

VARIABLES	**(OLS)**	**RE)**	**(FE)**
lnD_{it}	0.551*	1.391***	1.642***
	(0.319)	(0.286)	(0.254)
lnD_{it}^{2}	-0.0637	-0.193***	-0.230***
	(0.0439)	(0.0400)	(0.0358)
lnI_{it}	-0.688***	-0.574***	-0.807***
	(0.00863)	(0.0103)	(0.0162)
lnG_{it}	0.117***	0.163***	0.112***
	(0.00719)	(0.00862)	(0.00989)
lnX_{it}	0.166***	0.236***	0.171***
	(0.00460)	(0.00482)	(0.00551)
lnL_{it}	0.759***	0.706***	1.088***
	(0.00698)	(0.0102)	(0.0228)
lnC_0	4.973***	1.795***	-2.245***
	(0.583)	(0.514)	(0.486)
Observations	1,618	1,618	1,618
R-squared	0.996	0.994	0.974
Number of ID	120	120	120

Standard errors in parentheses.

All variables in natural logarithm

*** p<0.01, ** p<0.05, * p<0.1

Estimation Results of Equation (9) with one period lag

Dependent variable (lnY_{it})

VARIABLES	**(OLS)**	**(RE)**	**(FE)**
$\boldsymbol{lnD_{it-1}}$	0.789**	1.813***	2.057***
	(0.331)	(0.313)	(0.294)
$\boldsymbol{lnD_{it-1}{}^2}$	-0.0957**	-0.250***	-0.287***
	(0.0454)	(0.0438)	(0.0414)
$\boldsymbol{lnI_{it-1}}$	-0.694***	-0.570***	-0.758***
	(0.00894)	(0.0108)	(0.0187)
$\boldsymbol{lnG_{it-1}}$	0.109***	0.153***	0.0978***
	(0.00745)	(0.00923)	(0.0114)
$\boldsymbol{lnX_{it-1}}$	0.165***	0.235***	0.179***
	(0.00477)	(0.00519)	(0.00638)
$\boldsymbol{lnL_{it-1}}$	0.767***	0.707***	1.087***
	(0.00723)	(0.0105)	(0.0264)
$\boldsymbol{lnC_0}$	4.665***	1.277**	-2.821***
	(0.604)	(0.563)	(0.562)
Observations	1,618	1,618	1,618
R-squared	0.995	0.994	0.965
Number of ID	120	120	120

Standard errors in parentheses.

All variables in natural logarithm

*** p<0.01, ** p<0.05, * p<0.1

Results of estimation of equations 2 & 9 with and without one period lag do not differ significantly, concluding that the endogeneity problem is not serious. We can just rely on the estimation of equations without one-period lag**.** The estimation of import demand function based on the FE model (equation 2) indicates a positive relationship between real output and demand on imports (Figure 3-2) and a negative relationship between the demand on imports and relative prices. The estimated parameters are both statistically and economically significant (i.e., of the expected sign). The income elasticity of imports is generally higher than one. It is equal to about 1.28: an increase in the real domestic output by 1% leads to an increase in demand for imports by 1.28 %. Since changes in the country's incomes lead to significant changes in demand for imports by more than the initial changes in income, even small domestic and international inequality changes lead to significant changes in the demand for imports.

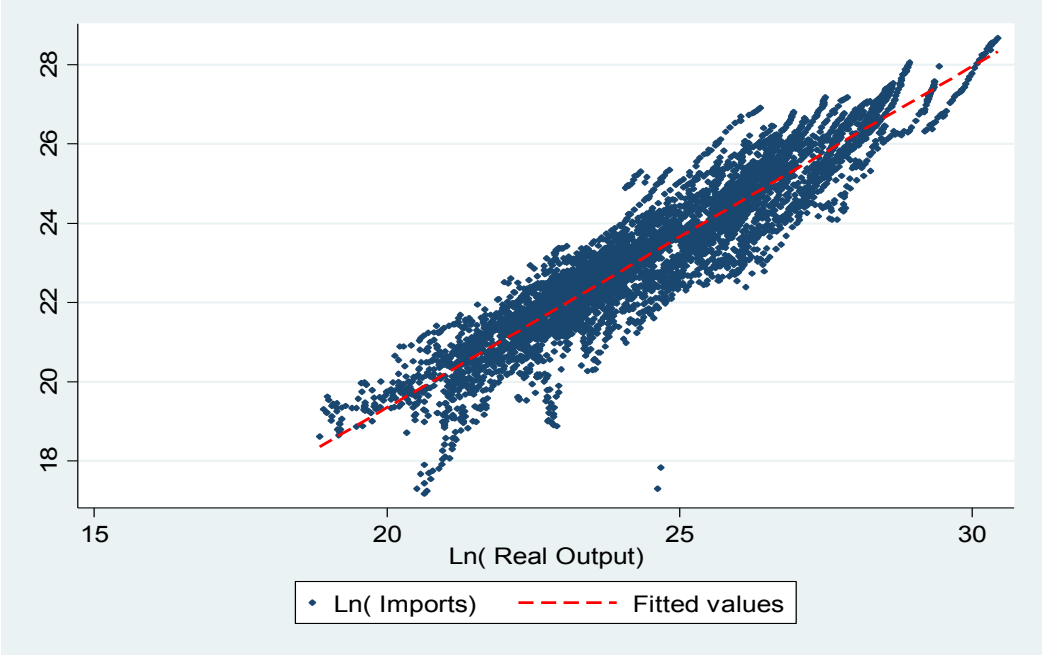

Figure 3-2

The FE estimation of equation (9) shows that the relationship between domestic inequality and real output takes the form of an inverted U; moreover, all other parameters on the explanatory variables are statistically significant and have the expected signs. Thus, based on the results of equation (9), the effect of domestic inequality on real output is nonlinear and a hill-shaped. Further, the hypothesis of no constancy of elasticity of change in real output with respect to domestic inequality change has been confirmed. Low levels of inequality are beneficial to real output, but high domestic inequality levels are harmful to the economy.

$$\frac{\partial \ln(Y)}{\partial \ln(D)} = 1.642 - 0.46 \ln(D)$$

An increase in the Gini Index's natural logarithm by one unit leads to a decrease in the positive effect of elasticity on real output by 0.46 points. Domestic inequality has a turning point at the level of inequality point, nearly about a value of 3.56 of the Gini Index's natural logarithm (calculated as a number between 0 and 100), as shown in Figure (3-3).

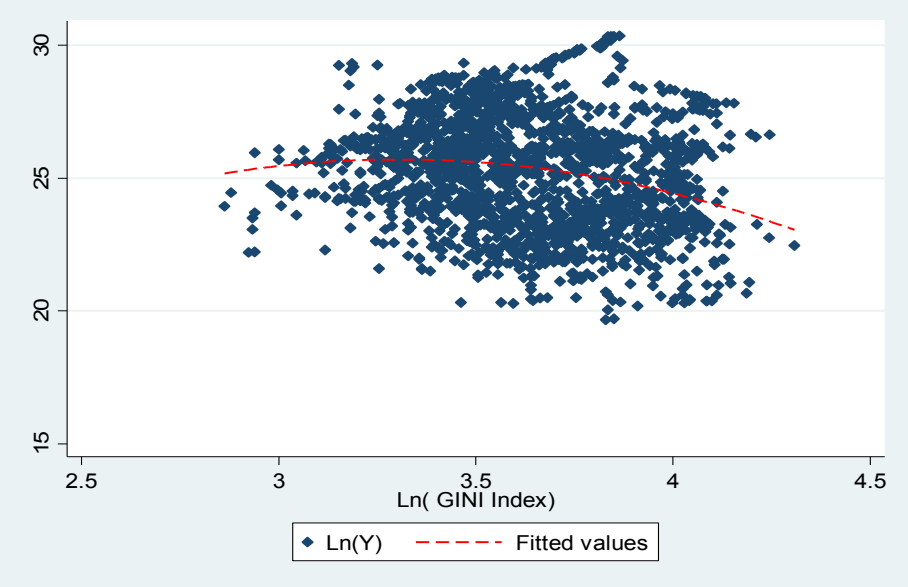

Figure 3-3

Concerning international inequality, the relationship appears to be linear and negative, as shown in Figure (3). An increase in international inequality by 1 % correlates with a decrease in real output by about .807 %.

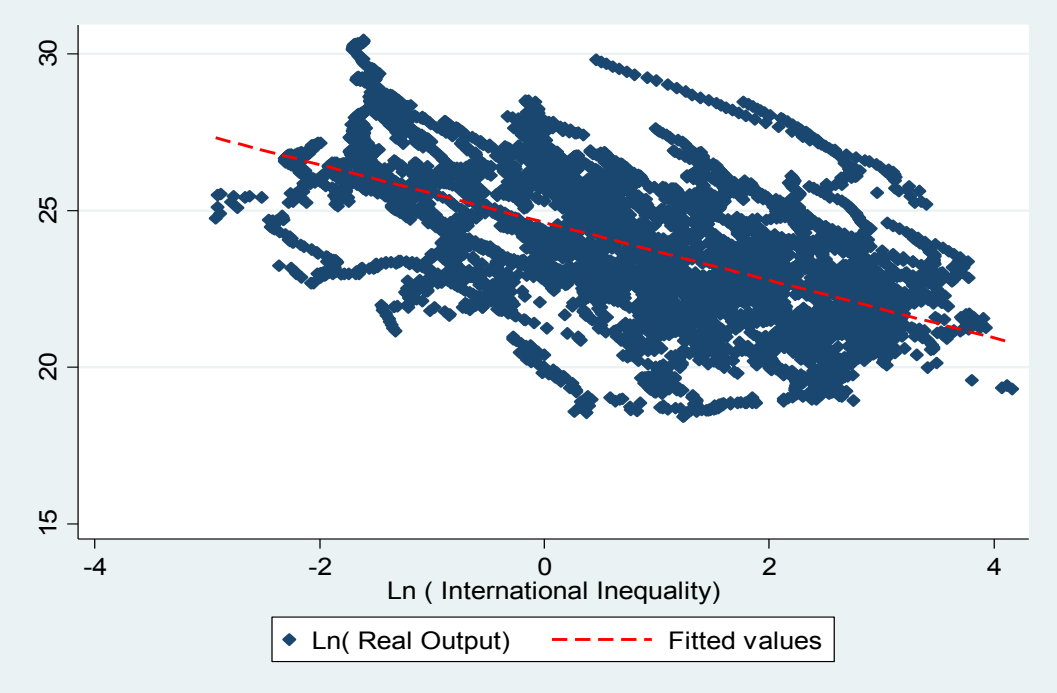

Figure 3-4

For government spending and exports, the results show a clear and positive relationship between government spending, exports, and real output since the estimated parameters are positive and statistically significant at any level of confidence (Figure 3-5 and 3-6)

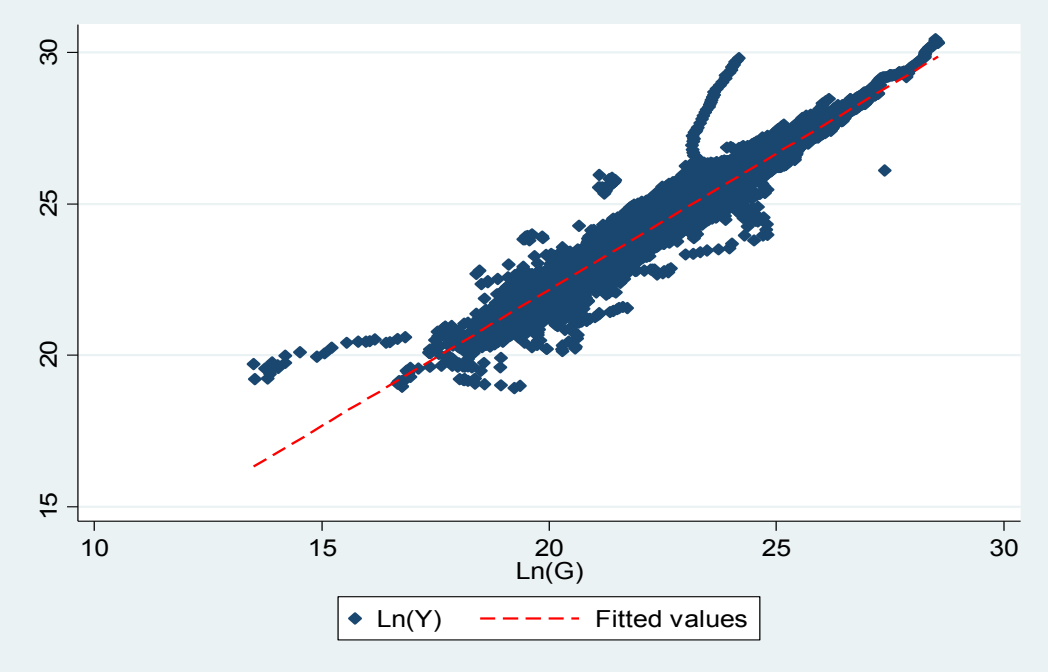

Figure 3-5

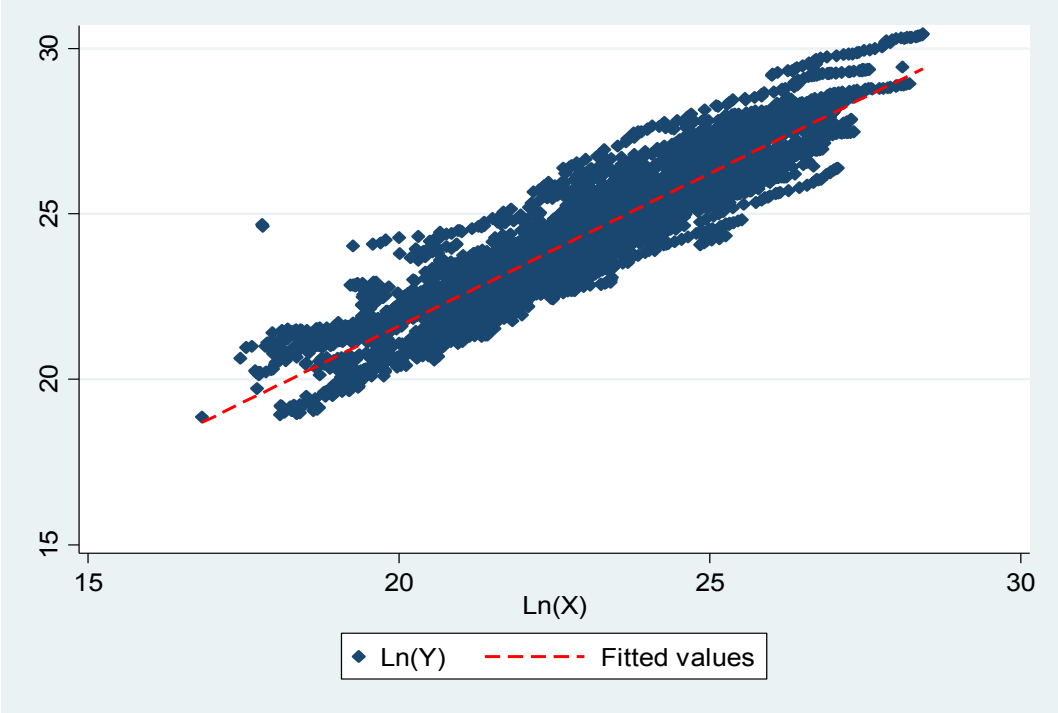

Figure 3-6

3-5-Conclusions

Giving the high (more than one) and positive elasticity of income of the demand for imports and the negative relationship between high levels of domestic inequality and any level of international inequality, an increase in domestic inequality to high levels and increase in the international inequality will negatively affect real output and therefore significantly negatively affect demand on imports for that country. Based on this result, an increase in within inequality to high levels and an increase in the between countries' inequality leads to a decrease on-demand on world imports, which at the same time it is just the world exports. A decrease in the demand for exports will have adverse effects on countries' real output (since exports have a positive effect on real domestic output and are confirmed by estimation results through statistically significant and positive elasticity of real output with respect to the exports). Besides their domestic and international inequality, countries of the world should care about the increase in domestic and international inequality (global inequality) in other countries of the world, especially their partners in the trade.

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