

**ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF ARTS AND
SOCIAL SCIENCES**

**THE IMPACT OF INTEREST ON INCOME INEQUALITY:
AN EMPIRICAL INVESTIGATION**



M.A. THESIS

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Department of Economics

Economics M.A. Programme

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ SOSYAL BİLİMLER ENSTİTÜSÜ

**FAİZİN GELİR EŞİTSİZLİĞİ
ÜZERİNDEKİ ETKİSİ:
AMPİRİK BİR İNCELEME**

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To my parents,





FOREWORD

The subject of this thesis has taken my attention for few years. The main reason of this situation is the unjust nature of interest which has been one of the fundamental dynamics of the contemporary economic system. The presence of a general opinion that interest works as a mechanism which leads resources of the society to flow from the poor and middle income groups to the top ones, drives me to conduct a research on such a topic. This effort started in the times that I was continuing my internship at Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC) as a humble working paper. Praises be to Allah, I could have an opportunity to study this subject as the topic of my Masters' thesis in Istanbul Technical University.

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ABBREVIATIONS

CCEMG	: Common Correlated Effects Mean Group
CLA	: Central and Latin America (region)
CML	: Capital Market Line
CPI	: Consumer Price Index
DSGE	: Dynamic Stochastic General Equilibrium
EU	: Europe (region)
FED	: Federal Reserve
GDP	: Gross Domestic Product
IC	: Inequality Curve
IMF	: International Monetary Fund
LSDV	: Least Squares Dummy Variables
OLS	: Ordinary Least Squares
PC	: Phillips Curve
PDP	: Pigou-Dalton Principle
PIL	: Positive Interest Line
PPC	: Production Possibility Curve
PPP	: Purchasing Power Parity
QRPD	: Quantile Regression for Panel Data
SEDLAC	: Socio-Economic Database for Latin America and Caribbean
UK	: United Kingdom
UMP	: Unconventional Monetary Policies
UNIWIDER	: United Nations University
US	: United States
ZIL	: Zero Interest Line



SYMBOLS

u_i	: Utility of Agent i
u_j	: Utility of Agent j
Ω	: Total endowment in economy
z_N	: Allocation (consisting of bundles)
z_k	: Bundles endowed by Agents k .
z_j	: Bundles endowed by Agents j .
Δ	: Amount of the Transfer
l	: Number of goods in the economy
X	: Consumption set of agents
N	: Number of agents in the economy
x_{it}	: Independent variables
y_{it}	: Dependent variables
β_i	: Country-specific slope on the observable regressors
u_{it}	: Error term that contains the unobservables and the remainder disturbance
ε_{it}	: Remainder disturbance
α_{1i}	: Coefficient that captures time-invariant heterogeneity across groups
f_t	: Unobserved common factor
λ_i	: Heterogeneous factor loadings
λ_t	: Time-effects
v	: Remainder disturbance
Z_μ	: Matrix of individual dummy variables
μ	: Individual dummy variables
Q	: Orthogonal projection of Z_μ
S_Y	: Structural Quantile Function
D	: Policy variables
τ	: Quantile Specified
U_{it}	: Non-seperable disturbance term



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THE IMPACT OF INTEREST ON INCOME INEQUALITY: AN EMPIRICAL INVESTIGATION

SUMMARY

Income inequality is one of the vital problems of contemporary economies, as it has been increasing since last decades. In this study, we try to understand whether interest has an impact on increasing income inequality in recent times. While investigating this question, we argued that interest can affect income inequality by two main channels, namely real interest rate and bond yields.

Firstly, for real interest rates, by referring to Areosa and Areosa (2016) we asserted that increases in real interest rate would decrease aggregate demand, which then slows down the growth and thereby real wages decrease. The ones who affected from decreasing real wages are the lower and middle income groups, as the upper income groups enjoy the increasing return of their financial assets and the consumption of lower and middle classes are mostly depend on their wages. Therefore, increasing real interest rates decreases the income of lower and middle income groups, while it increases the income of the upper income groups. In addition, due to the reason that increasing real interest rates slows down the growth, simultaneous relative falls in the income share of the poorer and relative rises in the income share of the richer implies an income transfer from the poorer to the richer. Thus, this income transfer increases the income inequality at the expense of the lower and middle income groups. As Pigou-Dalton principle indicates that increasing income inequality decreases social welfare, and increasing real interest rates increases income inequality and thereby decreases social welfare.

Secondly, for bond yields, we refer to Fleurbaey and Maniquet (2011) and Tag el-Din (2013). We use Proportional Allocation Transfer which provides that a transfer between two economic agents can be realized on the same basis, as accordingly it removes the problem of interpersonal comparability of utility. Then, by referring to Tag el-Din (2013) and utilizing from his framework in which indicates that positive interests, compared to zero level of interest, lead to increase in consumption of the richer and decrease in of the poorer, we try to analyze this framework with Proportional Allocation Transfer. With the presence of Strong Pareto-Efficiency, Transfer Among The Equals and Unchanged Contour Independence axioms — we claim that increasing interest rates may lead to income transfers from the poorer to the richer agents and decreases social welfare, if all the other things being equal.

To test the above mentioned hypotheses, we use a panel data consists of 26 countries — which mostly comprise of Central and Latin America countries and European countries — and 17 years ranging between 1998 and 2014. The data exhibits fixed-effects characteristics, due to the reason that the sample mainly consists of two main

clusters Central and Latin America countries where the inequality levels are quite higher and the European countries in which there exists a more equal distribution of income. It should be indicated that, within the sample in which there are roughly 442 observations for each variable, there exists heteroscedasticity, autocorrelation and cross-sectional dependence problems while there is no endogeneity which comes from theory. In order to measure the impact of interest on income inequality, we use Gini index and income shares of the income decile groups as dependent variables. As for independent variables, we use real interest rate and the share of interest payments in government expenses which is employed as a proxy for measuring the impact of bond yields on income inequality. For control variables, we use the share of tax revenues in GDP, GDP growth rate and inflation which is calculated on the basis of Consumer Price Index — as it is not correlated with the real interest rate which is calculated by GDP deflator.

For estimation, we use Pesaran's (2006) CCEMG estimator, LSDV estimator with fixed-effects and QRPD estimator which is developed by Powell (2015). As a result, we found out that in general both real interest rate and interest payments lead to an income transfers being done from bottom 80% to top 10%, from bottom 60% to top 10% and from bottom 80% to top 20% with another ones which realizes among the other income deciles in successive regressions, as we try to evaluate these results within the theoretical frameworks mentioned above. from lower and middle income groups to the top ones. We found evidences of income transfers being done from bottom 80% to top 10%, from bottom 60% to top 10% and from bottom 80% to top 20% in successive regressions. In addition, we tried to explain the impact and possible channels of it by using specific countries such as Argentina, Belgium, Bolivia, Indonesia and United Kingdom. We found out that real interest rate increases Gini index and causes an income transfer from the bottom deciles to the top one in Argentina, Bolivia and Indonesia. In that sense Belgium is an exception, in which increases in real interest rates lead to a reverse income transfer from the rich to the poor. However, this impact may stem from its stable and low inequality and interest levels. Moreover, it should be noted that interest payments increases Gini index in Belgium, Bolivia and United Kingdom. Also it should be noted that United Kingdom is an exception in the sense that the transfer of income is being done from the middle income groups to both the top decile and the bottom decile.

Thus, in general, these results verify our hypotheses and showed that both real interest rate and interest payments had increased income inequality in last decades for our sample. Much of this effect may stem from the existence of Central and Latin American countries in the sample, however we have evidences which shows that interest payments increases Gini index and leads to income transfer from lower and middle deciles to the top decile for European countries such as Belgium and United Kingdom. Further studies can be conducted to investigate the possible channels of these impacts in a more precise and detailed way. Nevertheless, it can be explicitly said that these results reveal the unjust nature of interest, which leads to distortions in the income distribution by transferring a certain proportion of income from the bottom and middle income groups to the top ones, thereby increases income inequality and decreases the social welfare.

FAİZİN GELİR EŞİTSİZLİĞİ ÜZERİNDEKİ ETKİSİ: AMPİRİK BİR İNCELEME

ÖZET

Gelir eşitsizliği, son on yıllardan beri artmakta olmakla birlikte çağdaş ekonomilerin hayati sorunlarından birini teşkil etmektedir. Bu çalışmada, faizin gelir eşitsizliğinin artırmasında bir etkisinin olup olmadığını anlamaya çalıştık. Bu soruyu, faizlerin gelir eşitsizliğini etkileyebileceği iki ana kanalı teşkil eden reel faiz oranı ve tahvil getirilerini üzerinden inceledik.

Öncelikle, Areosa ve Areosa'ya (2016) atıfta bulunarak reel faiz oranlarındaki artışın toplam talebi azaltacağını, ardından bunun büyümeyi yavaşlatacağını ve böylece reel ücretlerin düşebileceğini ileri sürdük. Artan faizlerle birlikte yüksek gelir grupları sahip oldukları finansal varlıklardan daha fazla getiri aldığı ve alt ve orta gelir gruplarının tüketimi neredeyse tamamen ücretlere bağlı olduğu için reel ücretin azalmasından etkilenenler daha ziyade alt ve orta gelir gruplarıdır. Bu nedenle, artan faiz oranları, düşük ve orta gelir gruplarının gelirlerini azaltırken, yüksek gelir gruplarınınkini arttıracaktır. Bununla birlikte, artan reel faiz oranları büyümeyi azalatacağı için, eş zamanlı gerçekleşen üst gelir gruplarının gelirlerindeki artış ve alt ve orta gelir gruplarının gelirlerindeki düşüş zenginlere doğru bir gelir transferini ifade edebilir. Dolayısıyla, bu gelir transferi alt ve orta gelir grupları aleyhine gelir eşitsizliğini arttıracaktır. Pigou-Dalton prensibinin belirttiği üzere artan gelir adaletsizliği toplumsal refahı düşüreceğinden ötürü, artan reel faizlerin toplumsal refahı azalttığını söyleyebiliriz.

İkinci olarak, getirileri için Fleurbaey ve Maniquet (2011) ve Tag el-Din (2013) tarafından ortaya konulan çerçevelerden faydalandık. İki iktisadi fail arasındaki transferin aynı düzlemde gerçekleşmesine imkan veren ve böylelikle kişilerarası faydaların karşılaştırılabilirliği probleminin ortadan kalkmasına imkan veren Orantılı Tahsis Transferini esas aldık. Ardından, Tag el-Din (2013) tarafından ortaya konulan ve pozitif faiz oranlarının sıfır faiz oranı ile karşılaştırıldığında birinin tüketimini arttırırken diğerininkini azaltan çerçevesinden istifade ederek, bu çerçeveyi Orantılı Tahsis Transferi ile beraber ele almaya çalıştık. Güçlü Pareto verimlilik, denkler arasında transfer gibi aksiyomların da var olduğu varsayımı altında, diğer değişkenlerin sabit olduğu varsayılarak, artan getiri oranlarının daha fakir olanlardan daha zengin olanlara bir gelir transferi yapabileceğini öne sürdük.

Yukarıda bahsedilen hipotezleri test etmek için, neredeyse tamamı Orta ve Latin Amerika ülkeleri ve Avrupa ülkelerinin 1998-2014 arasındaki gözlemlerinden oluşan, 26 ülke ve 17 yılı kapsayan bir panel veri kullandık. Söz konusu örneklem, hem Orta ve Latin Amerika ülkeleri hem de Avrupa ülkeleri olmak üzere iki temel ülke

kümesinden oluştuğu için sabit etkiler özelliklerini göstermektedir. Her bir değişken için genel olarak 442 gözlemden oluşan bu veri setinin değişen varyans, otokorelasyon ve yatay kesit bağımlılığı gibi problemlere sahipken, teoriden kaynaklanan bir içsellik sorununun olmadığını da belirtmemiz gerekir. Faizin gelir eşitsizliği üzerindeki etkisini ölçmek için, Gini endeksini ve %10'luk gelir gruplarının toplam gelirden aldığı payları bağımlı değişkenler olarak; reel faiz oranı ve hükümet harcamaları içerisindeki faiz ödemelerini payını — tahvil getirilerinin etkisi ölçmek için bu ölçütü tercih ettik — bağımsız değişkenler olarak kullandık. Kontrol değişkenler olarak ise vergi gelirlerinin GSYİH içerisindeki payı, GSYİH büyüme oranı ve enflasyonu — TÜFE ile hesaplanmaktadır ve GSYİH Deflatörü ile hesaplanan reel faiz oranı ile çoklu doğrusallık oluşturmamaktadır — kullandık. Buradan hareketle reel faiz oranları ve faiz ödemelerindeki artışların gelir adaletsizliğini arttırması ve toplumsal refahı düşürmesini beklediğimizi belirtmek gerekir.

Tahmin için, Powell (2015) tarafından geliştirilen ve Panel Kantil Regresyon yöntemini, sabit-etkiler için Kukla Değişkenler En Küçük Kareler yöntemini ve Pesaran (2006) tarafından geliştirilen gözlemlenemez etkileri kesitsel ortalamalarla kontrol eden CCEMG tahmin edicisini kullanmayı tercih ettik. Sonuçta, genel olarak, hem reel faiz oranlarının hem de faiz ödemelerinin alt ve orta gelir gruplarından üst gelir gruplarına gelir transfer edilmesine sebep olduğunu bulduk. Birbirini takip eden regresyon analizleri ile alt %80'den üst %10'a, alt %60'dan üst %10'a ve alt %80'den üst %20'ye ve bunun dışında farklı %10'luk gruplar arasında başka gelir transferinin söz konusu olduğunu dair kanıtlar elde ettik. Ek olarak, Arjantin, Belçika, Bolivya, Endonezya ve İngiltere gibi örneklem içerisinde seçilmiş ülkeler hakkında daha detaylı tahliller yaparak faizin etkilerini ve bu etkinin yansıyabileceği olası kanalları genel hatlarıyla açıklamaya çalıştık. Arjantin, Bolivya ve Endonezya'da reel faiz artışlarının Gini endeksini arttırdığını ve alt ve orta gelir gruplarından üst gelir gruplarına gelir transfer ettiğini gözlemledik. Bu açıdan, reel faiz oranlarındaki artışların tam tersi bir gelir transferine sebep olarak zenginlerden fakirlere kaynak aktardığı Belçika'nın bir istisna olduğunu da belirtmemiz gerekir. Bu etki Belçika'nın sahip olduğu düşük gelir adaletsizliği ve faiz oranlarından kaynaklanıyor olabilir. Ayrıca, faiz ödemelerinin Belçika, Bolivya ve Birleşik Krallık'ta Gini endeksini artırdığı belirtilmelidir.

Özet olarak, bu sonuçlar hipotezimizlerimizi doğrulamakta ve kullandığımız örneklem için son yıllarda hem reel faiz oranlarının hem de faiz ödemelerinin gelir eşitsizliğini artırdığını göstermektedir. Bu etkinin önemli bir kısmı örneklemdeki Orta ve Latin Amerika ülkelerinin varlığından kaynaklanıyor olabilir. Ancak, faiz ödemelerinin Belçika ve İngiltere gibi Avrupa ülkelerinde Gini endeksini artırdığını ve düşük ve orta gelir gruplarının gelirlerini düşürerek gelir transferine yol açtığını gösteren delillere sahip olduğumuzu da belirtmek gerekir. İlerleyen zamanlarda bu etkilerin muhtemel kanallarını daha detaylı şekilde araştırarak çalışmalar yapılması faydalı olabilir. Yine de bu sonuçların, alt ve orta gelir gruplarından üst gelir gruplarına gelir transferine sebep olmak suretiyle gelir adaletsizliğini arttıran ve sosyal refahı düşüren faizin adil olmayan yapısını ortaya koyduğu rahatlıkla söylenebilir.

1. INTRODUCTION

Income inequality has been among the attractive subjects of economic literature. It arises when there exist an unequal distribution of income, wealth and assets within the society. The unequal distribution of income, generally, leads to the division of society, as the lower income groups of the society suffer from this division, while the upper income groups reap the benefits. It varies between societies, different time periods, economic systems.

Income inequality refers to the extent to which income is distributed in an uneven manner among a population. Income is not just the money received through payment, but all the money received from employment (wages, salaries, bonuses etc.), investments, such as interest on savings accounts and dividends from shares of stock, savings, state benefits, pensions (state, personal, company) and rent. When the overall state of income inequality in the world considered, it has recorded that relative global income inequality declined in past 35 years, from a relative Gini coefficient of 0.74 in 1975 to 0.63 in 2010, as it is driven by the extraordinary economic growth in the countries like China and India (UNDP, 2016). However, for absolute income inequality Gini index has increased from 0.65 to 0.72 between 1975 and 2010. Relative income inequality indicates the proportional inequality level, while absolute inequality shows the exact level. Also the ones who reap the benefits of economic growth are mainly the wealthiest ones, as UNDP (2016) report claims that 46% of total increase in income between 1988 and 2011 went to the wealthiest 10%. Even worse, 50% of the increase in world wealth went to the wealthiest 1%, as the poorest 50 % received only 1% of the increase. From 2000 to 2010, wealthiest 1% increased their wealth from 32% to 46% as the world wealth has become more concentrated. In general, it can be said that the world income and wealth inequality have increased over few decades (UNDP, 2016).

Income inequality changes within a wide range across world regions. As reported in the World Inequality Report 2018, the lowest values of inequality have been observed in Europe while the

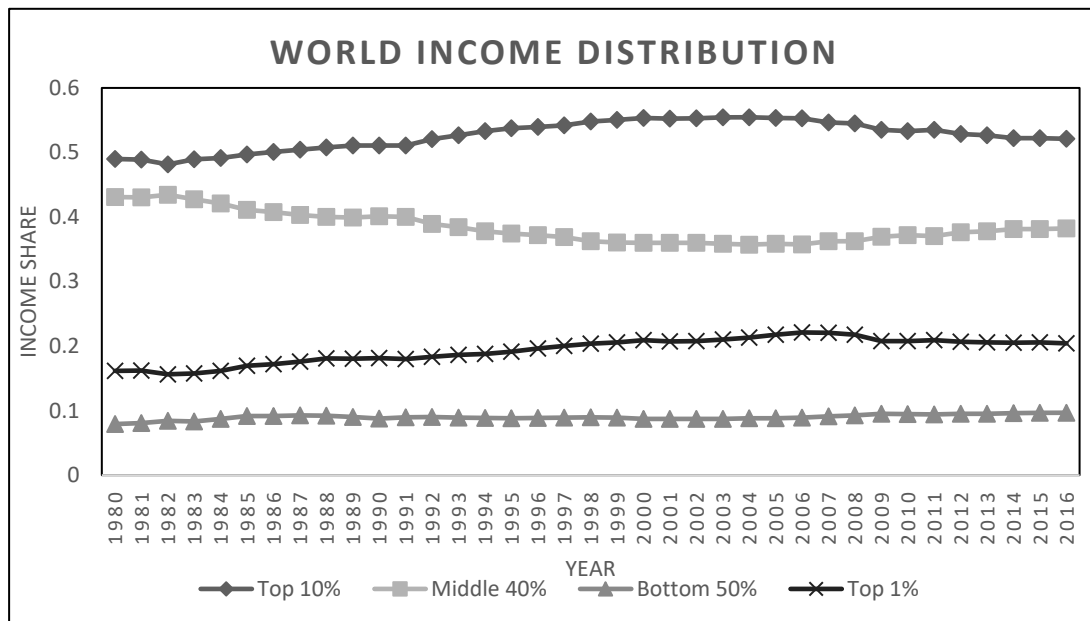


Figure 1.1 : Income Distribution in World Between 1980-2016, calculated from World Inequality Database.

most unequal region is Middle East. There has been a general rise in the world inequality levels in the world since 1980. While the income share of world top 1% increased from 16% in 1980 to 22% in 2000, it had slightly declined to 20% in recent years (Figure 1.1). The income share

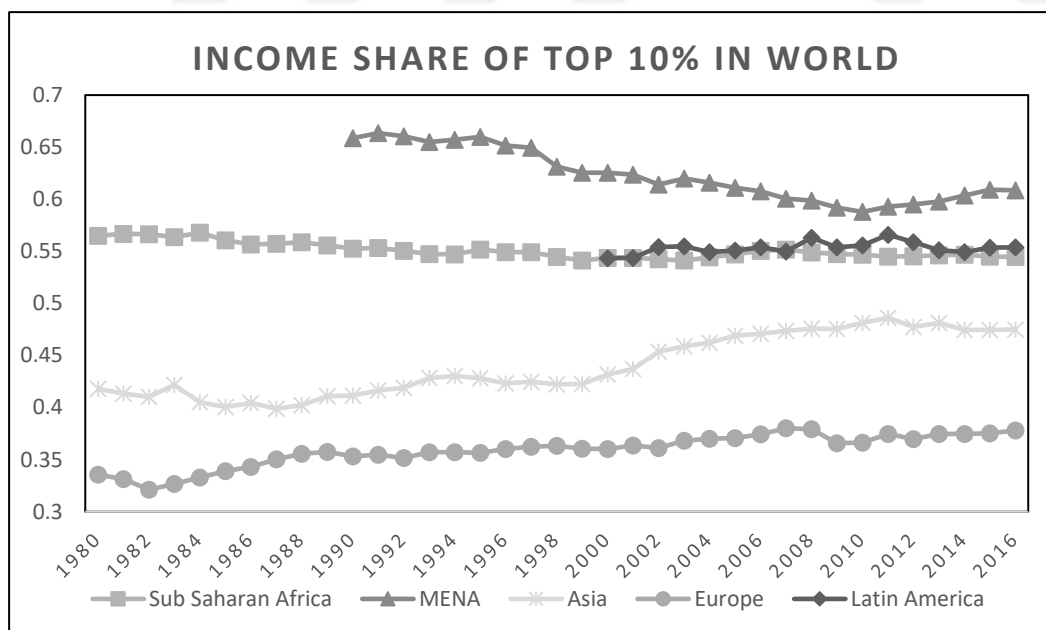


Figure 1.2 : Income Share of Top 10% in World Between 1980-2016, calculated from World Inequality Database.

of the world bottom 50% has been around 9% since 1980, as income share of world middle 40% decreased from 43% in 1980 to 38% in 2016. Also, income share of top 10% increased by 4% in last 25 years. In addition, as it can be clearly seen from Figure 1.1, the patterns of income share groups explicitly indicate that there is a trade-off between the income shares of world top 10% and world bottom 50% between 1980-2016. Moreover, there is an increasing trend in income shares of top 10% across the different regions of world. In Sub-Saharan Africa, Asia, Latin America and Europe, income shares of top 10% has increased between 1980 and 2016 (Figure 1.2). Middle East and North Africa, Latin America and Asia are the most unequal regions, as Europe seems like the most equal one. In addition, it should be noted that due to the high and rising inequality levels within countries, the top 1% richest individuals in the world captured twice as much growth as the bottom 50% individuals since 1980.

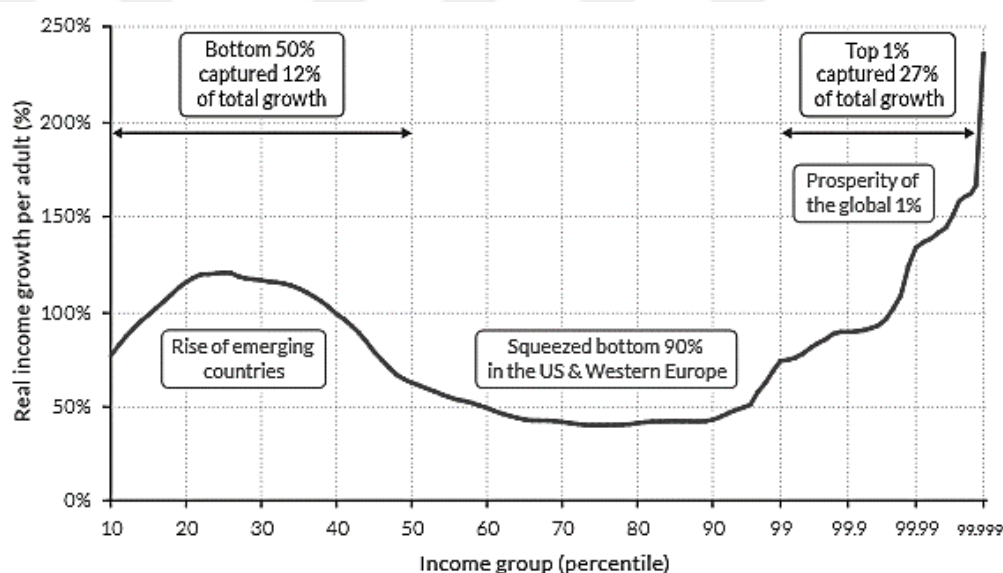


Figure 1.3 : The Elephant Curve of Inequality and Growth Between 1980-2016, adapted from Alvaredo et al. (2017).

When the growth rates or per capita income in accordance with income groups are considered, growth rates of top 1% income is well-ahead compared to the other groups. Especially, the highest growth rates have experienced in the income of top 0.001%. From Figure 1.3, it can be seen that growth rates of the bottom 10% are low because of the low growth in the poorest countries (mostly in sub-Saharan Africa). Between 20%-60%, growth rates are quite high in response to fast growth rates recorded in large

emerging countries such as China and India (Alvaredo et al. pp.4). Finally, growth rates are extremely high among top earners due to the

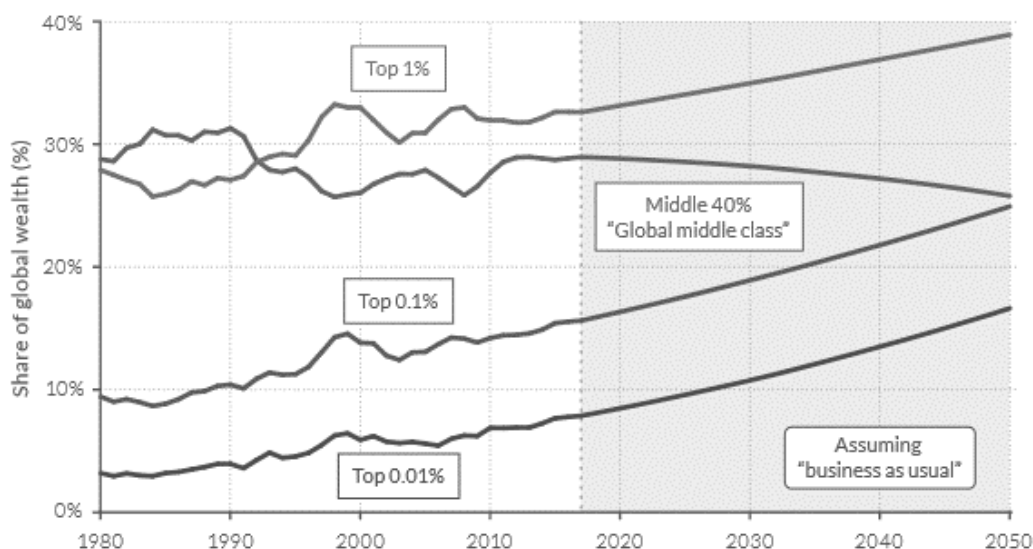


Figure 1.4 : State of global wealth between 1980-2050, adapted from World Inequality Report 2018.

explosive trend of top incomes in many countries. Therefore, this curve is named as elephant because it evokes the shape of an elephant with a long trunk. In addition, Alvaredo et al. (2017) made a projection for the potential inequality levels indicated that if all countries follow their own inequality trend, world top 1% income share would reach up to 25% in 2050, which presently is 20%, as world bottom 50% income share would decrease from 10% to 9% by 2050 (see Figure 1.4). If all the countries follow the US inequality trend, between 2017-2050, income share of top 1% would exceed 28%, while the income share of bottom 50% would decrease to 6% (Alvaredo et al., pp. 10).

Briefly, income inequality has increased in last decades as the ones who reaps the benefits of the growth most are the top income groups. Unfortunately, top income groups has prospered at the expense of the bottom and the middle income groups.

1.1 Purpose of Thesis

In this study, we would like to explore whether there interest has an impact on income inequality, as this impact will be researched through the channels of real interest rate

and bond yields. Our main hypothesis is that interest can lead to increases in income inequality. The reason behind of this hypothesis is that interest may operate as an income transferor, by which a specific amount of income of the poor and middle income groups flows to the richest ones. This assumption implies an unjust nature of interest, according to Naqvi it “..denotes a *social disequilibrium* in the sense that the resources of society flow from the poor to rich” (Naqvi 1994:28). Also, the main motivation of the author is stemming from the prohibition of the interest and discouragement of concentration of the wealth among the riches in Islam.

1.2 Literature Review

The impact of interest on income inequality has been questioned in the literature, as some selected works will be taken into consideration in this paper. In this context, both the channels of monetary policy, factor incomes, expenses, growth and their impact on income distribution and income inequality can be analyzed.

As Saiki and Frost (2014) indicated that “the impact of monetary policy on inequality is new in the academic literature” (Saiki and Frost, p.8), as it has been developing in recent years. Also, for quantitative easing, in which a central bank purchases private sector financial assets to lower interest rates and increase the money supply, the Bank of England (2012) concluded that it benefited the richest 5% of British households, who hold 40% of overall wealth outside pension funds. Moreover, Watkins (2014) provides some illustrations for increasing income and wealth inequality as a result of quantitative easing program of the Fed. Areosa and Areosa (2016) examine optimal monetary policy in the presence of inequality by introducing unskilled agents with no access to the financial system into a DSGE model with sticky prices, as they obtained that a contractionary interest rate shock increases inequality. This study has a special place for its implications and possible channels by which real interest rate influences income inequality, as these channels will be discussed in the following sections. Moreover, as an explanation for possible channels that monetary policy affects income inequality, Doepke and Schneider (2006) indicates that an unexpected increase in interest rates or decrease in inflation will benefit savers and hurt borrowers, thereby generating an increase in inequality. Also, contractionary policy shocks lead to a transfer from borrowers to savers, thereby to widen the inequality as indicated by Coibion et al. (2017). In another study, Davtyan (2017) found out that contractionary monetary policy decreases income inequality. Adversely, Mumtaz and

Theophilopoulou (2017) for UK's quarterly data between 1969 to 2012, found out that contractionary monetary policy shocks lead to an increase in income inequality, as it has worse effects on the low income groups.

In addition, there are some important studies which concentrate on the impact of Unconventional Monetary Policy (UMP) on income inequality. UMP, in addition to quantitative easing, includes zero-interest rate policy, qualitative easing, comprehensive monetary easing and other related unconventional monetary policies. One of these studies conducted by Saiki and Frost (2014) in which they analyzed the relationship between UMP and inequality in the context of Japan, by using household survey data. Their vector autoregression results indicate that UMP increased income inequality after the last quarter of 2008 as the Bank of Japan (BoJ) resumed its zero-interest rate policy and reinstated UMP. They concluded that "this is largely due to the portfolio channel" (Saiki and Frost, p. 3). One of the possible explanations is that asset prices rise disproportionately compared to wages and employment, as higher asset prices benefit primarily upper income households who invests their larger amount of savings in securities (Saiki and Frost, p. 21). Also, they stated that "to the best of our knowledge, this is the first study to empirically analyze the distributional impact of UMP" (Saiki and Frost, p. 3).

For Post-Keynesian models which examine the relationship between interest rates and income distribution, Hein and Schoder (2011) analyzed the effects of interest rate variations on the rates of capacity utilization, capital accumulation and profit in a simple post-Kaleckian distribution and growth model by using the US and Germany data between 1960 – 2007. They found out that "rising real long-term rates of interest cause falling rates of capacity utilisation, capital accumulation and profits, as well as redistribution at the expense of labour income and hence an increasing profit share in US and Germany" (Hein and Schoder, p. 755). Moreover, Rochon and Setterfield (2007) theoretically examine the Smithin, Kansas City and Pasinetti fair rate rules in order to find alternatives to Taylor rule. They found out that "the Smithin rule argues in favor of low real rates (close to zero), whereas the Kansas City rule prefers having nominal rates set at zero as both of these rules therefore propose keeping real or nominal rates close to zero in order to redistribute income away from rentiers" (Rochon and Setterfield, p. 37). For the Pasinetti rule, they claimed that monetary

policy is essentially neutral with respect to the distribution of income (Rochon and Setterfield, p. 38).

Another important study is conducted by Piketty and Zucman (2014), in which they offer an overview of the empirical and theoretical research on the long-run evolution of wealth and inheritance. In their study, over a wide range of models, they concluded that long-run magnitude and concentration of wealth and inheritance are an increasing function of $(r-g)$ where r is the net-of-tax rate of return on wealth and g is the economy's growth rate. Thus, in accordance with their theoretical models, when the interest rate exceeds the growth rate, the concentration of wealth increases. Also, in his well-known book "Capital in the Twenty-First Century" he provides additional evidences which supports this position. Moreover, in Piketty (1997), under the assumption that long-run growth and aggregate investment are positively correlated, the countries in which the real interest rates are low and the capital mobility is high, are likely to grow faster than the countries in which the real interest rates are high and the capital mobility is low. By emphasizing this point, Piketty (1997) indicates that in a steady-state in which real interest rates are high, wealth inequality will be higher, as these economies are willing to grow slower.

One of the most seminal papers is the study of Milanovic (2005) which tries to explain the impact of globalization on income inequality by analyzing different 10% income decile groups. In his study by which he tries to measure the impact of globalization of inequality, he also uses real interest rate as an explanatory variable and concludes that real interest rate is always pro-rich, as he found out that by a percent increase in real interest rate, 0.012% of income has been transferred from the bottom 80% to the top 20%. His results show that only top 20% reap the benefits of it while the income of the bottom 80% income reduces by increasing real interest rates. Even middle-classes lose for the increasing interest rates. In that sense, his paper will be one of the most important references of this study.

Another study belongs to Stiglitz (2015), which found out that low interest rate increases income inequality. He developed a theoretical model which analyzes the relationship between, monetary policy, credit creation and inequality and concluded that in the short run, "lowering real interest rate leads to an increase in the net income of capitalists by a certain amount and a reduction of income of workers by a corresponding amount. It is, in effect, a direct transfer from workers to capitalists"

(Stiglitz 2015, p. 22). In addition to that, the “near-zero level interest” policy of FED has been criticized due to its negative impacts on income inequality, as it increases the prices of stocks —by which the stock owners be more advantageous— and low borrowing costs—by which the large corporations can have an additional capital to boost corporate profits.

For the studies which analyzes the interest and income inequality relationship in the context of Turkish economy, Selim, Günçavdı and Bayar (2014) investigates the impact of functional income sources on inequality between 2002-2011. They applied Shorrocks (1982) variance decomposition methods in order to differentiate the sources of income, and found out that, among different income sources such as labor, agriculture-entrepreneur, entrepreneur, retired, transfer and interest, interest income has the highest inequalizing effect on income distribution, as it increases Relative Inequality Ratio by 6.12 in average, while the others’ effect is about 0.5 in average, except entrepreneur income which is 2.3 in average. The other interesting study was conducted by Çetin and Gün (2014), in which the Shorrocks (1982) variance decomposition method has again been employed. Between 2002-2009 years, they concluded that the interest income is the largest contributor to income inequality.

Furthermore, al-Suwailem (2008), in his agent based simulation model which investigates the impact of three different financing methods on wealth inequality, income and consumption. He takes the interest based financing, mark-up financing as it is widely used by Islamic financial institutions under the name of *murabaha* and the interest-free financing into consideration. He proved that interest-free financing is more equitable than both mark-up/*murabaha* financing and interest-based financing. This study is one of the unique examples in the literature which tries to reveal the impact of interest and wealth inequality in an agent-based simulation framework.

Hence, it can be said that the literature on the relationship between interest and income inequality has mostly been developing for last decades. Much of the literature is linked with the impact of monetary policy and income sources on income inequality.

1.3 Hypothesis

While investigating the impact on interest on income inequality, the main hypothesis of this study is there is a positive relationship between them which denotes that an increase in the interest rate widens the income inequality. We argue that interest can

affect income inequality by two main channels, namely real interest rate and bond yields. In this section, the possible channels by which the interest rates affect income inequality try to be explained.

1.3.1 Real Interest Rate

Firstly, for real interest rate, we refer to the framework in Areosa and Areosa (2016). As it is stated in the literature review section, Areosa and Aresoa (2016) examine optimal monetary policy in the presence of inequality by introducing unskilled agents with no access to the financial system into a Dynamic Stochastic General Equilibrium (DSGE) model with sticky prices. They obtained that a contractionary interest rate shock increases inequality. In that model, income inequality and real interest rate relationship is explained through the fraction of financially included agents whose choices are sensitive to changes in interest, and financially excluded agents whose choices are not affected through interest. For steady state they derived three equations which are IS curve, Phillips Curve (PC) and Inequality evolution curve (IC) which describes the possible dynamics that lead to inequality. IC indicates that Gini index depends on real interest rate and inflation expectation of the next period. They found out that when the slope of IC is positive, rising interest rates increases inequality (Arensa and Areosa, pp. 220).

One of the possible channels of this impact can be realized through intertemporal consumption and labor supply decisions of financially included agents. Changes in interest rate influence the intertemporal consumption and labor supply decisions of financially included agents, as they smooth consumption by trading in asset markets (Arensa and Areosa, pp. 223). This affect the real wage and the demand of the financially excluded variables, because they are highly sensitive to the changes in real wages, as their consumption mostly depends on their wages. If there are fluctuations in real wages, it will lead profits to be fluctuated, thereby will increase the dividend income of financially included agents (Arensa and Areosa, pp. 223).

Hence, by referring to Areosa and Areosa (2016), we assert that increases in real interest rate would decrease aggregate demand, which then slows down the growth. Decreasing growth rate lead nominal wages to decrease due to the reason that firms cut wages or increase them at a slower rate in a less growing economy. In addition,

low growth levels may lead to low inflation. As a result, real wages may either stay constant or decrease depending upon the impact of real interest rate on economic

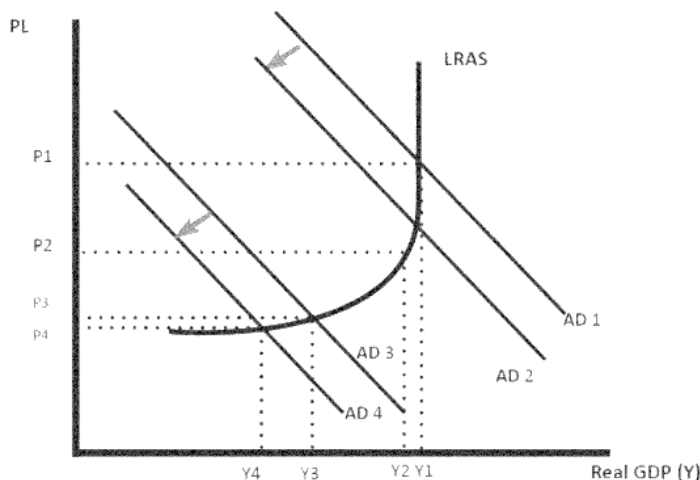


Figure 1.5 : Effects of fall in aggregate demand on inflation and wages

growth and inflation. If the impact is high enough to the extent that it decreases the economic growth much while prices stay almost constant, real wages decrease. In Figure 1.5 shift from AD 3 to AD 4 curve exemplifies this situation. The ones who affected from decreasing real wages are the lower and middle income groups whose consumption pattern is highly dependent on their wages, as the upper income groups enjoy the increasing return of their financial assets. Therefore, increasing real interest rates decreases the lower and middle income groups's income, while it increases the income of the upper income groups. In addition, due to the reason that increasing real interest rates slows down the growth, simultaneous relative falls in the income share of the poorer and relative rises in the income share of the richer implies an income transfer from the poorer to the richer.

1.3.2 Bond Yields

Secondly, for the bond yields, we refer to Pigou (1912), Dalton (1920), Fleurbaey and Maniquet (2011) and Tag el-Din (2013). Dalton (1920) developed the ideas in Pigou (1912) and emphasized an important implication of social welfare function, which is all other things being equal, a social welfare function should prefer more equitable allocations. Pigou (1912) indicates that:

... economic welfare is likely to be augmented by anything that, leaving other things unaltered, renders the distribution of the national dividend less unequal. If we assume all members of the

community to be of similar temperament, and if these members are only two in number, it is easily shown that any transference from the richer to the poorer of the two, since it enables more intense wants to be satisfied at the expense of less intense wants, must increase the aggregate sum of satisfaction (Pigou, pp. 24).

Dalton (1920) extended the arguments of Pigou (1912) and provided some further implications:

... if there are only two income-receivers, and a transfer of income takes place from the richer to the poorer, inequality is diminished. There is, indeed, an obvious limiting condition. For the transfer must not be so large, as more than to reverse the relative positions of the two income-receivers, and it will produce its maximum result, that is to say, create equality, when it is equal to half the difference between the two incomes. And we may safely go further and say that, however great the number of income-receivers and whatever the amount of their incomes, any transfer between any two of them, or, in general, any series of such transfers, subject to the above condition, will diminish inequality (Dalton, pp. 351).

Dalton showed that a transfer from the rich to the poor improves social welfare, if it does not affect their ranking. After Dalton (1920) indicated his further explanations about Pigou's (1912) arguments, this had been converted into a principle, which is called as Pigou-Dalton Principle (PDP). PDP can be expressed by referencing from Moulin (2003). Say that $u_i < u_j$ at profile u and assume that a utility transfer from Agent 2 to the Agent 1, where u_i' and u_j' are the utilities after the transfer such that

$$u_i < u_i', u_j' < u_j \quad \text{and} \quad u_i' + u_j' = u_i + u_j, \text{ where } u_k = u_k' \text{ for all } k \neq i, j.$$

by which the sum of utility of agents is preserved and the inequality gap is reduced (Moulin, pp. 67). Thus, PDP implies that when the income inequality reduces by a certain amount of transfer from the richer agent to the poorer one, therefore social welfare will increase.

As a contribution to the theory of fair allocation, Fleurbaey and Maniquet (2011) deal with orderings so that the idea of the optimality of resource equality must be translated into the betterness of inequality reduction. They formulated different transfer mechanisms by using PDP as a basis. Especially their contributions in terms of equal-split transfer have a significant role in that sense. Equal-split transfer implies to apply PDP to cases in which the relatively rich agent gets a bundle of good — unlike Moulin (2003), Fleurbaey and Maniquet (2011) prefer to use bundle of goods rather than utility — he strictly prefers to an equal split, and the relatively poor agent prefers an equal

split to the bundle he gets. Equal-split transfer mechanism allows us to escape impossibility, because according to this criterion the ranking of the agents cannot be influenced as one moves along indifference curves (Fleurbaey and Maniquet, pp. 28). Say that a transfer of positive quantities of each good is made from agent j to agent k , all other agents being unaffected, and after the transfer j still consumes more than his per capita share while k still consumes less, then the after-transfer allocation is at least as good as the initial allocation. Thus, equal-split transfer can be formulated as follows:

For all $E = (R_N, \Omega) \in D$, and $z_N, z'_N \in X^N$, if there exist $j, k \in N$, and $\Delta \in \mathbb{R}_{++}^l$ such that

$$z_j - \Delta = z'_j \gg \frac{\Omega}{|N|} \gg z'_k = z_k + \Delta \quad (1.1)$$

and for all $i \neq j, k$, $z_i = z'_i$, then $z'_N R(E) z_N$.

In equation (1), Ω represents the total endowment in economy, while z_N represents the allocation, which consists of list of bundles, therefore z_k and z_j implies the bundles that are endowed by agents k and j respectively. In addition, Δ stands for amount of the transfer made, l represents the number of goods in economy, X is the consumption set of agents, and N is the number of agents in economy. Equal-split transfer can be seen in Figure 1.6.

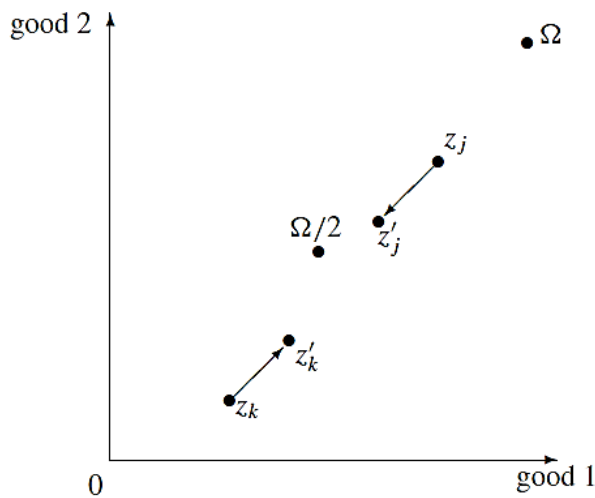


Figure 1.6 : Equal-split transfer, adapted from (Fleurbaey and Maniquet, 2011).

They also defined another transfer axiom, named as Proportional Allocation Transfer. This transfer principle is applied to bundles that are proportional to the social endowment. It is assumed that an allocation $z'_N \in X^N$ is proportional for $E = (R_N, \Omega)$ if for all $i \in N$, $z_i = \lambda_i \Omega$ for some $\lambda_i \in \mathbb{R}_+$. The set of proportional allocations is denoted for E by $\text{Pr}(E)$. An illustration of the proportional allocation transfer can be seen in Figure 1.7. By equal split transfer, “proportional allocations delineate a simple setting in which all interpersonal comparisons, as well as transfers between agents, can be conceived directly in terms of fractions of the social endowment” (Fleurbaey and Maniquet, pp. 29). Thus, problem of interpersonal comparison can be overcome and ordinal preferences can be transformed into cardinal ones. This point is important to conduct an empirical analysis based on the theoretical framework above. Proportional allocation transfer can be defined as follows:

For all $E = (R_N, \Omega) \in D$, and $z_N, z'_N \in X^N$, if there exist $j, k \in N$, and $\Delta \in \mathbb{R}_{++}^l$ such that

$$z_j - \Delta = z'_j \gg z'_k = z_k + \Delta \quad (1.2)$$

and for all $i \neq j, k$, $z_i = z'_i$, then $z'_N \mathbf{R}(E) z_N$.

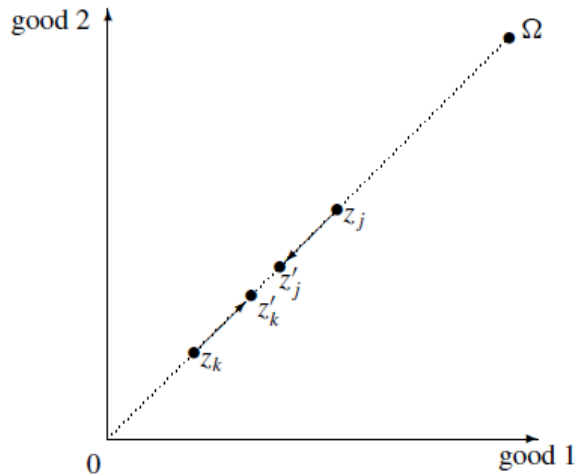


Figure 1.7 : Proportional Allocation Transfer, adapted from (Fleurbaey and Maniquet, 2011).

In addition, the Strong Pareto axiom is important for the efficiency. As Fleurbaey and Maniquet (2011) indicates that “Strong Pareto requires an allocation to be weakly preferred to another whenever all agents weakly prefer it. It also requires strict

preference as soon as at least one agent displays strict preference” (Flaurbaey and Maniquet, pp. 33). It can be defined as:

*For all $E = (R_N, \Omega) \in D$, and $z_N, z'_N \in X^N$, if $z_i R_i z'_i$ for all $i \in N$, then $z'_N \mathbf{R}(E) z_N$;
if in addition $z_i P_i z'_i$ for some $i \in N$, then $z'_N \mathbf{R}(E) z_N$.*

In such a framework, we prefer to measure the social welfare in an egalitarian way, which requires taking the minimum of society as a measure of welfare. Thus, the objective function requires maximizing the minimum of the society. We prefer to take the egalitarian welfare against utilitarian welfare, because utilitarian welfare, which is based on the maximization of the sum of utilities, can be blind to income inequalities. However, egalitarian welfare consider the least privileged in the society.

Until that point, it is emphasized that, all the other things being equal, transfers made from a richer agent to a poorer one, decrease inequality and thereby increase social welfare by using PDP, under the condition of rankings of the agents will be preserved. Then, based on PDP, the equal-split and proportional allocation transfers overcome the problem of interpersonal comparability; thereby ordinal preferences are expressed in cardinal terms, as the after-transfer allocation is at least as good as the initial allocation. Now, this framework can be linked with interest, by utilizing from Tag el-Din (2013). In his seminal work, he provided some insights about how the interest leads to inequality in a capital market framework in which intertemporal consumption and saving choices of different agents taken into consideration. He firstly consider an economy consists of two goods, X and Y and two producers, A and B, as it is assumed that they possess the same production possibility curve (PPC). In addition, it is assumed that both producers possess the same technology and the same natural endowments, as each party is assumed to have heterogeneous preference, represented by their corresponding indifference curves. The framework is explained by capital market theory, which is related to inter-temporal choice of consumption, as it can also be named as the inter-temporal exchange of savings. Then each of the two parties maximizes consumption utility over a two-period life-cycle model, which is subjected to a production possibilities curve and indifference curves, as time preference determines the amount of saving of individuals. Agent A has a negative time preference in the sense of preferring future to present consumption and Part B has a

positive time preference, which means that Agent A has a larger capital stock to finance the production of future output than Agent B has (Tag el-Din, pp.97). Within this framework, by referencing to Fisher (1930), Tag el-Din (2013) defines Zero-Interest Line (ZIL) and Positive Interest Line (PIL) — which is equivalent to Capital Market Line (CML) in Fisher's theory of interest. With the introduction of ZIL, both parties extend the production where the marginal propensity to consume equals to zero. In addition, it leads to a formation of Pareto optimal equilibrium, because Agent B is made better off without making Agent A worse off. Then, PIL is introduced and it has two adverse effects: firstly maximum potential output for both parties decreases and secondly the lender is made better off at the expense of making the borrower worse-off. This point is the most outstanding point of his analysis for this study. Thus, with the introduction to PIL, it can be said that the income inequality increases, as there is an income transfer from Agent B to Agent A. In that sense, by PDP, when the PIL is introduced, the income gap will be widen and social welfare will decrease. In Figure 1.8, an inter-temporal process of savings exchange between lender and borrower can be seen. As Tag el-Din rightly indicates that:

Agent A offers their loan to Agent B subject to reliable collateral, which, in this case, is the future output that Agent B will acquire from their current production activity. The fact that borrowers have to repay their debts from future income sources qualifies future incomes as the best collateral assets for lenders (Tag el-Din, pp. 102).

We would like to explore whether the insights and analytical frameworks indicated in Pigou (1912), Dalton (1920), Fleurbaey and Maniquet (2011) and Tag el-Din (2013) be used in the same framework. This forms the basis of a theoretical background for this study. It is indicated that the Proportional Allocation transfer of Flaurbaey and Maniquet (2011) has already been constructed on the arguments of Pigou (1912) and Dalton (1920). Thus, if a transfer is made from a richer to a poorer agent, under the condition that the ranking is preserved, income inequality decreases and thereby social welfare increases. What if the transfer is made from a poorer agent to a richer one? In order to answer this question, we can define a new concept, which can link the interest with income transfer and social welfare.

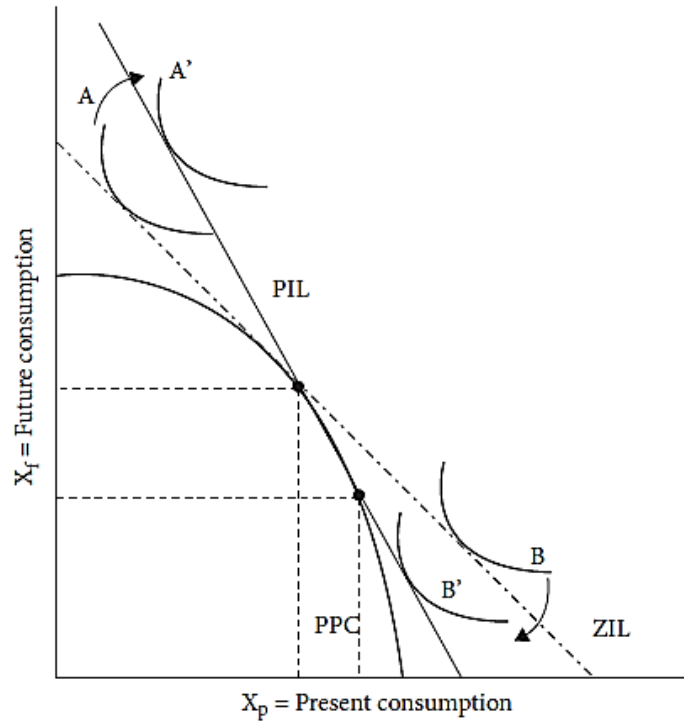


Figure 1.8 : The Zero-Interest Line (ZIL) and the effects of Positive Interest Line (PIL), adapted from (Tag el-Din, 2013).

In the presence of Proportional Allocation Transfer, Strong Pareto axiom and the axioms of Transfer Among Equals and Unchanged Contour Independence¹, interest rate can be included to the framework. This concept can be named as “Positive Interest Equivalent Welfare”. It implies that there is a line, which intercepts with indifference curves of Agent A and Agent B. As positive interest rates lead the slope of this line to become more steeper and income transfers are being done according to the changes in interest rate. Hence, by this way, when the bond yields are positive, a certain share of income can be transferred from the poorer to the richer. Thus, we claim that positive interest rates lead to an income transfer from Agent B to Agent A.

For social welfare, as it is stated above, we prefer to choose the egalitarian welfare approach which takes the minimum of the society as a measurement of welfare. Due to the reason that income inequality increases in the presence of positive interest rates, it can be said that social welfare decreases in the presence of positive interest rates also. Because of the link that positive interest rates may lead the poorer to consume

¹ Transfer Among Equals and Unchanged Contour Independence axioms are technical axioms which should be included to satisfy the technical requirements. Thus, they are not defined, rather they are just referred by name.

less and decreases its welfare, social welfare will further decrease, because we prefer to measure the social welfare in an egalitarian framework. Hence, we assert that, based on egalitarian welfare approach and Pigou-Dalton principle, increasing inequality would decrease the social welfare, thereby it can be said that positive interest rates decrease social welfare.

Thus, for both real interest rate and bond yields, we assert that they transfer a share of income from the poorer to the richer and increases the income inequality, as increasing inequality decreases social welfare. Hence, these are the hypothetical insights which express the main arguments of the study. We would like to explore whether these hypotheses are valid or not by testing them by empirical analysis.





2. DATA AND METHODOLOGY

2.1 Data

The UNI-WIDER's World Income Inequality Database (WIID) version 3.4 is used for the dependent variables, as for the independent variables we used World Bank's World Development Indicators Database. WIID 3.4 data covers 8817 observations from has been collected from various sources. In general, there are many empty observations and time periods are not continuous, thus we try to choose the best among available options. We firstly took the period between 1990-2015 but for eliminating the empty observations and incontinuous time periods, we took the period between 1998 – 2014. In that sense, the regression analysis will be done by using the time period between 1998-2014, however we will also benefit from the time period between 1990-2015 in further interpretations and insights. The data contains observations from 26 countries, most of them consist of Central and Latin America and European countries, some of which are collected from various sources. This could constitute a problem for the results, but we strive to remove probable troubles by using different data sets which are formed for specific country groups such as Eurostat 2016 for European countries, Socio-Economic Database for Latin America and Caribbean (SEDLAC) 2016 for Latin American countries and World Bank 2016 for the other ones, as the others constitute the minority in the sample and mainly contain Asian countries. The country list can be seen in Appendix A.

For the dependent variables, we take Gini Index and the income shares of the deciles into consideration. Gini Index, which is a well-known inequality measurement, measures the inequality among the values of a frequency distribution. It is commonly used for measuring inequality of income or wealth and it had been developed by Gini (1936). Gini coefficient is derived from Lorenz curve, as it shows the level of inequality which increases by the Lorenz curve moves away from the line of equality. However, there are some criticisms against it. One of the criticisms is that it is sensitive to the changes in the middle-income groups rather than the changes in bottom and top

income groups, as Mellor (1989) explains that even the number of people in absolute poverty decreases in a developing country, Gini index may increase due to the increasing inequality at different levels. In order to see the changes in income inequality better, income share of income decile groups are employed, as the shortcomings of Gini Index can be overcome by that way. Income shares of income deciles groups represents the income shares that are acquired by different income decile groups from total income, which are ranked from the bottom to the top. In other words, they represent percentage shares of income or consumption, which are the shares that accrues to subgroups of population indicated by deciles. By referring to Milanovic (2005), we prefer to use this kind of data, because it provides an opportunity to see the changes in income shares of different deciles and to check whether there is an income transfer among the deciles. In addition, for conducting quantile panel data analysis, we also add the logarithmic term of GDP, which is calculated in terms of PPP. It can be seen as an equivalent for income deciles, however by that way we can use a recently developing technique of panel quantile regression analysis.

As for independent variables, real interest rate and interest payments in percentage of government expenses are the ones taken into consideration. Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. The terms and conditions attached to lending rates differ by country, however, limiting their comparability. In general, it is used in various economic theories to explain such phenomena as the capital flight, business cycle and economic bubbles. However, in this study its impact on income inequality will be examined. The other independent variables is interest payments made by government, which include interest payments on government debt — including long-term bonds, long-term loans, and other debt instruments — to domestic and foreign residents. It is given in percentage terms of government expenses. This variable is also important, especially for testing the hypothesis of the study, which also emphasize one of the potential channels that interest affect income inequality, the channel of bond yields. By using interest payments variable, it is aimed to show the lender-borrower relationship. As the borrower, government make interest payments to its lenders, meaning bond-owners. Government may finance its payments from the taxes that it collects from its citizens, which constitute both the lower income, middle income and high income groups. Thus, the impact of this possible channel will be measured by interest payments variable. In

order to understand its impact more accurately, tax revenue in terms of GDP variable will also be used as explanatory variable. Moreover, for control and explanatory variables inflation based on Consumer Price Index (CPI) and GDP growth rate are used. Inflation variable reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed annually in this study. Because of the reason that it is based on CPI, it does not lead to multicollinearity problem with the presence of real interest rate, as real interest rate is calculated in terms of GDP deflator. Relationship between inflation and inequality GDP growth rate variable can be defined as annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates which has been calculated by weighted average method, are based on constant 2010 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Growth is one of the most outstanding factors that influence income distribution, as it can lead to income transfers. A wide literature on the relationship between growth and income inequality exists, as it started with the study of Kuznets (1955) and developed by many researchers, as a specific reference to Barro (2000) can also be made in that sense. They found out that by the increasing level of growth, income inequality increases up to a certain maximum point, after which it starts to decrease with an increasing level of growth. Also, it is an important variable for testing the claims of trickle-down economics, meaning to see whether the benefits or growth are only reaped by the top income owners or the society as a whole also benefits from it. In addition tax revenue in terms of GDP will also be used for explanatory variables, as Tsounta and Osueke (2014) showed that higher tax revenues is one of the main factors behind the decline in inequality levels in Latin America. All of the independent, control and explanatory variables are acquired from World Bank's World Development Indicators Database. In addition, it should be indicated that due to the lack of data, multiple imputation and interpolation methods are applied for some variables. Furthermore, some outlier observations which constitute the minimum 1% and maximum 1% are eliminated from the sample. This is required, otherwise they may distort the real impact, as in some Latin America countries inflation levels can exceed 7500% and real interest rate levels can increase up to 93%.

The summary statistics for the data can be seen from Table 2.1. The data have 442 Gini Index observations ranging from 22% to 60.2% with the mean of 38.70%. Gini index observations are in general ranging from 28.53% – 48.87%. The minimum value of 22% observed in Finland in 1998, while the maximum value of 60.2% recorded in Bolivia in 2000. As it will be indicated in following sections, this fact reflects the differences in the nature of CLA and EU economies.

Table 2.1 : Summary Statistics of Variables

VARIABLES	(1) N	(2) Mean	(3) Std. Dev.	(4) Min	(5) Max
Real Interest Rate (%)	442	6.322	8.472	-11.872	41.716
Interest Payments (% Expenses)	442	8.248	4.491	0.2142	24.358
Inflation (CPI) (%)	440	7.163	12.074	-1.067	93.522
GDP Growth (%)	441	3.139	3.674	-8.269	12.719
Tax Revenue (% GDP)	442	16.93	5.529	1.258	27.676
logGDP (PPP)	442	11.49	0.655	10.298	12.547
Gini Index (%)	442	38.70	10.169	22	60.2
Bottom Decile	442	2.352	1.043	0.3	4.2
Second Decile	442	3.891	1.319	0.9	6.3
Third Decile	442	4.948	1.339	2.2	7.4
Fourth Decile	442	5.956	1.303	3.4	8.3
Fifth Decile	442	7.017	1.227	4.6	9.1
Sixth Decile	442	8.222	1.105	5.8	10
Seventh Decile	442	9.720	0.913	7.0	11
Eighth Decile	442	11.76	0.657	8.7	13
Ninth Decile	442	15.23	1.086	11.64	17.8
Top Decile	442	30.42	7.455	19	46.7

When the distribution of Gini Index between the beginnings of 1990s and mid 2010s is analyzed, Gini Index has decreased from the beginning of the 1990s to the mid of the 2010s (Figure 2.1). There had been a fall in the high levels of Gini Index, as its low levels had risen between these periods. In general, Gini coefficient concentrated around 25% - 50% levels in mid 2010s, compared to its old levels — which is 20% - 55% — in the beginning of 1990s. As it can be seen from Figure 2.2, European (EU) countries especially Norway and Romania had experienced a fall in inequality levels

while in Poland and Germany income inequality has increased between 1995 and 2014. In addition, there has been an outstanding fall in the inequality levels of Central and Latin American (CLA) countries, while income inequality increased in Costa Rica and Paraguay (Figure 2.2). Indonesia is another example where Gini index has increased. In recent years, the most unequal countries are Honduras and Paraguay, while the most equal ones are Norway and Finland. Austria, France, Spain, United Kingdom and Uruguay seem to be the stable countries between the period specified. Moreover, the most successful country in terms of struggle with inequality is Ecuador, in which Gini index decrease by 12.1%. Argentina, Mexico, Panama and Honduras are the other successful instances that follows Ecuador in that sense. It can be also seen that Central and Latin American countries have higher inequality levels — mostly between 40% - 60% — and European countries have lower levels changing between 25% - 35% in approximated terms.

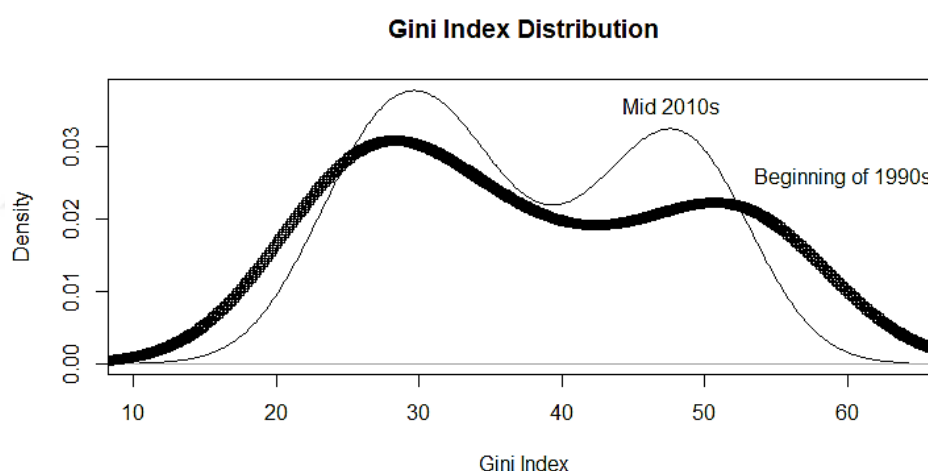


Figure 2.1 : Distribution of Gini Index from Beginning of 1990s to Middle of 2010s.

When the pattern of Gini index in Central and Latin American countries and European countries is comparatively analyzed, the widened gap between these regions can be clearly seen. From Figure 2.3 it can be seen that in CLA countries the mean value of Gini index is 48.42%, while for the EU countries it is 29.87%. In average, Gini index of CLA region is 18.55% higher than Gini index of EU countries. Also, the decreasing trend of Gini index in CLA region can be seen. Notwithstanding there is a decreasing trend of income inequality in the CLA region, there is still a big difference in these

two regions. Thus, these insights are valuable for understanding the dynamics of Gini index in the sample within the specified time interval.

Regarding the income share deciles in the sample, between the beginning of 1990s and mid-2010s, the total income share of bottom 70% had increased while for the income share of eighth 10% rises and falls have almost balanced each other and the income share of top 20% had

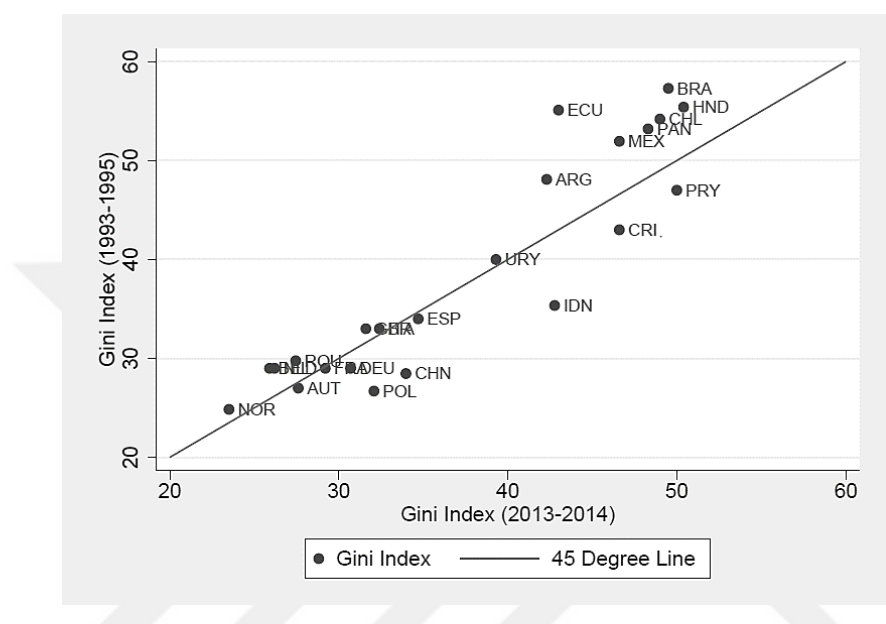


Figure 2.2 : Changes in Gini Index for Different Countries.

decreased (Figure 2.4). As the same case is also valid for Gini Index, these changes may stem from the improving trend in inequality levels which have been experienced in Central and Latin American countries. Also these changes can be evaluated within the relative global income inequality framework rather than the absolute one, as the distinction has been made in above sections. Another remarkable point is the relative share of Central and Latin American countries for the bottom 70%, as their share is lower than European countries, although there has been an improvement in the distribution of income. In that sense Argentina, Ecuador, Honduras, Mexico, Panama and Paraguay acquire the attention on themselves, as the income of bottom 80% had increased while the income of top 10% had fallen. Within the specified period, in some countries especially in Indonesia and Costa Rica, lower and middle income groups had experienced a fall in their income shares, while top income groups gained much more income. The stable positions of Uruguay and United Kingdom can also be observed in

Figure 2.4. In general, these observations are compatible with the evaluations related to Gini index. In order to understand the dynamics of change in the deciles between the specified periods, distributions of the deciles' income shares can also be analyzed. As it is valid for Gini Index, the distribution of income shares of the first eight deciles had experienced an improvement in general terms between the beginning of 1990s and mid-2010s (Figure 2.5). They became more compact in terms of the pattern of distribution, as they had concentrated on the middle values. As it can be seen in the Figure 2.5, the distribution of income shares of the first seven deciles distributed bimodally. Especially for third, fourth and fifth deciles, the peaks have almost had the same height. As it is indicated in Figure 2.5, first peak represents the Central and Latin American countries that have lower share of income and the second peak stands for European countries. The main trigger behind the change is the improvement in income distribution of CLA countries, as it is stated above.

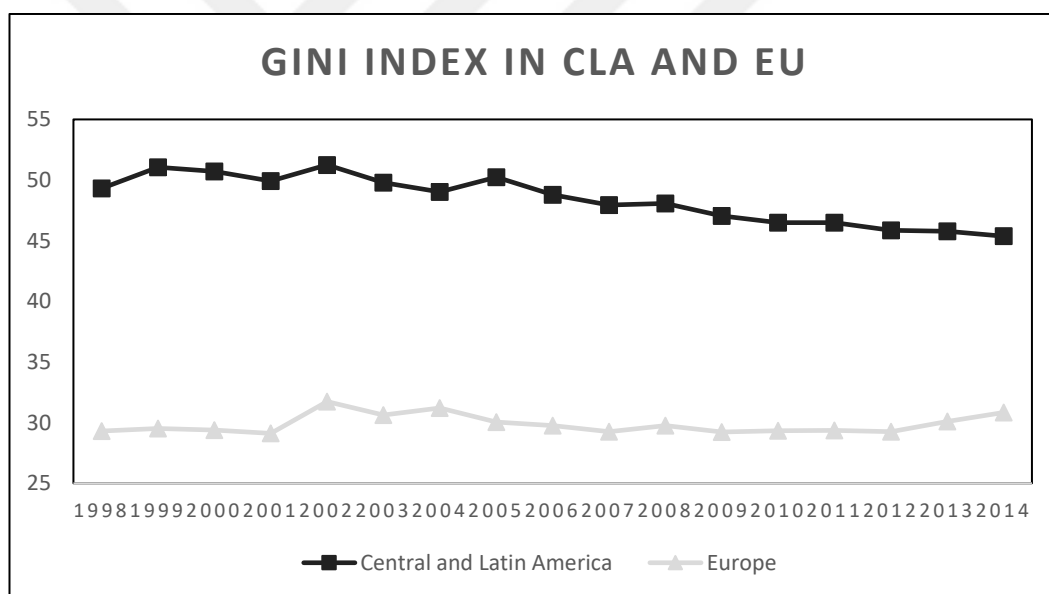


Figure 2.3 : Gini Index in Central and Latin American and European Countries Between 1998-2014

In average the Eighth 10% acquires a quadrapled share compared to the Bottom 10%, while the ratio of Top 10% to the Bottom 10% is 12.93. Also the Ninth 10% takes roughly half an amount of the Top 10%, as the differences among other deciles can be assumed as normal. The extent of inequalities between the means of income share deciles can be seen in Figure 2.6. For mean values, the Top 10% has fourteen times more income than the Bottom 10%, while this proportion equals to roughly four times

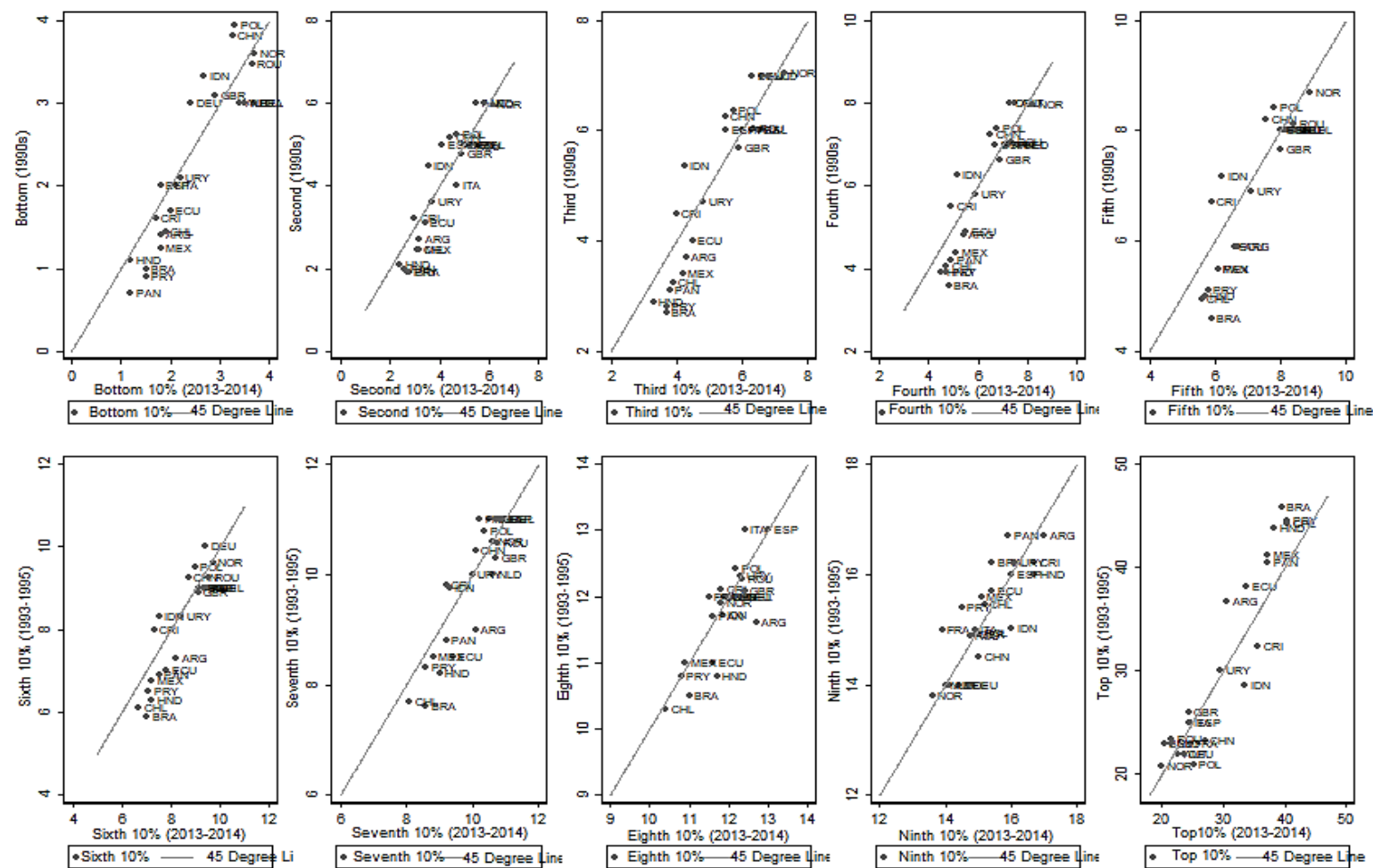


Figure 2.4 : Changes in Income Share Deciles from the Beginning of 1990s to Mid-2010s

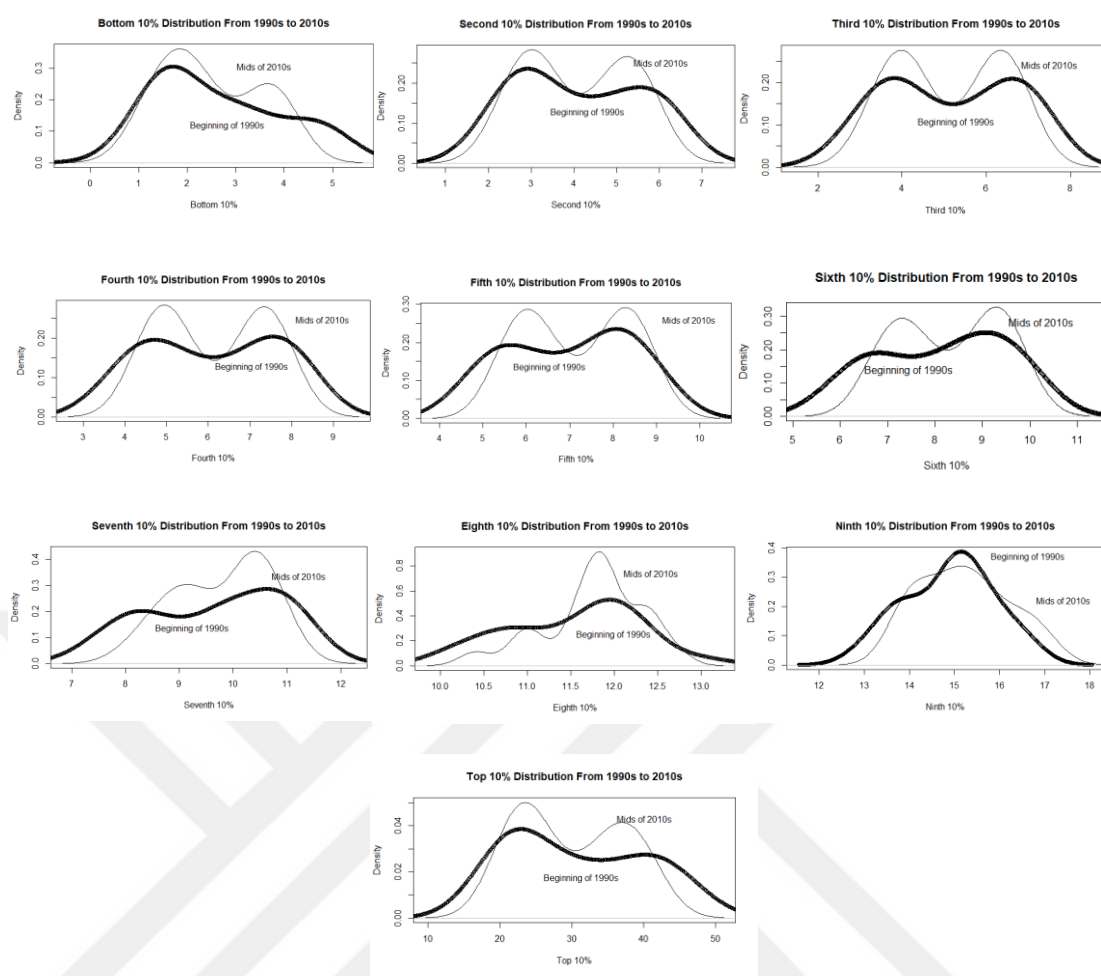


Figure 2.5 : Distribution of Income Shares of the Deciles from the Beginning of 1990s to Middle of 2010s

of the Fifth 10% and double of the Ninth 10%. Moreover, when the income shares of top 10% and bottom 50% are comparatively evaluated between 1998 - 2014, relatively unequal position of CLA countries can be seen again (Figure 2.7). In CLA countries income share of top 10% had ranged between 34% - 40%, while bottom 10% acquires a share of income that has changed between 15% - 22% in approximate terms. In EU countries, there is relatively more equal distribution, as the share of bottom 50% had mostly exceeded the share of top 10% by roughly 5% in the specified time interval. There is an income transfer from bottom 50% to top 10% between 2001 and 2002, however they reverted back to their positions after two years. In addition, it can be seen from Figure 2.7 that there is a trade off between bottom 50% and top 10% in both CLA and EU countries, as rises in income shares of top 10% decreases the income

shares of bottom 50% approximately by the same magnitude for both CLA and EU countries. Also, the improvement in income distribution of CLA countries in last decades can also be observed from the patterns of the income shares of top 10% and bottom 50%.

From now on, CLA countries seemed to have been suffered by high income inequality problem compared to EU countries. In order to understand the overall situation, a further look can be useful. As there is a trade of between top 10% and bottom 50% in CLA countries, a similar and even sharper case is valid for the income shares of top 20% and bottom 80% in these countries (Figure 2.8). As Gasparini et al. (2011) showed that there had been an increasing trend for inequality in early 1900s, late 1990s and early 2000s in the region. Between 1999 and 2004 — 2000 and 2001 years may be accepted as exceptions — the income gap between these two income share groups had been widened. However, by 2004 inequality had been started to decrease and in 2012 income share of bottom 80% exceeded the income share of top 20%. Tsounta and Osueke (2014) found out that the main triggers behind this success are the GDP growth rate backed by the policies like higher education spending, increasing foreign

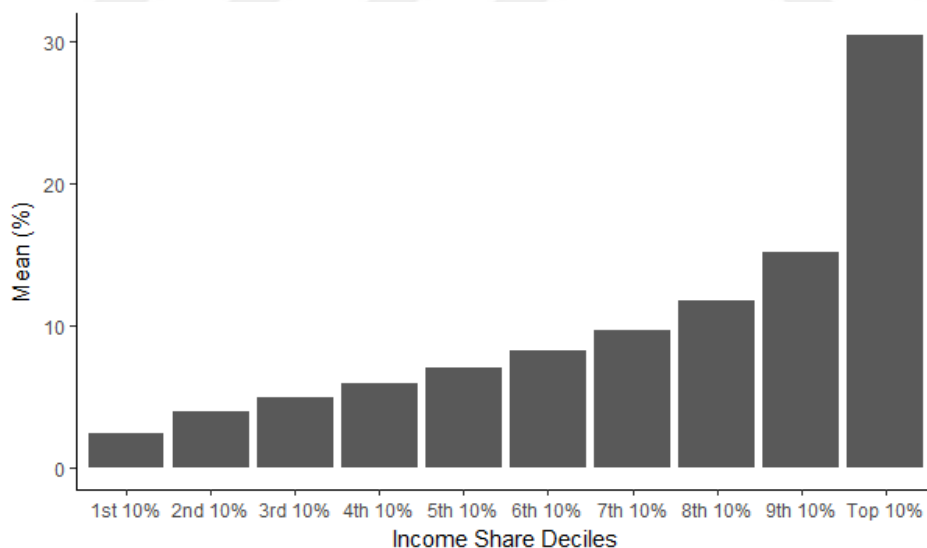


Figure 2.6 : Mean Values for the Income Share of the Decile Groups

direct investments and higher tax revenues. Can another potential factor be interest rates and interest payments? When the pattern of real interest rates and interest payments in CLA countries in last decades are analyzed, both variables have been

observed to decline between specified period (Figure 2.9). Real interest rates, in average, declined by roughly 15% and interest payments reduced by half. This is an important insight for the question of this study that it shows that it can be linked with the income share patterns of top 20% and bottom 80%.

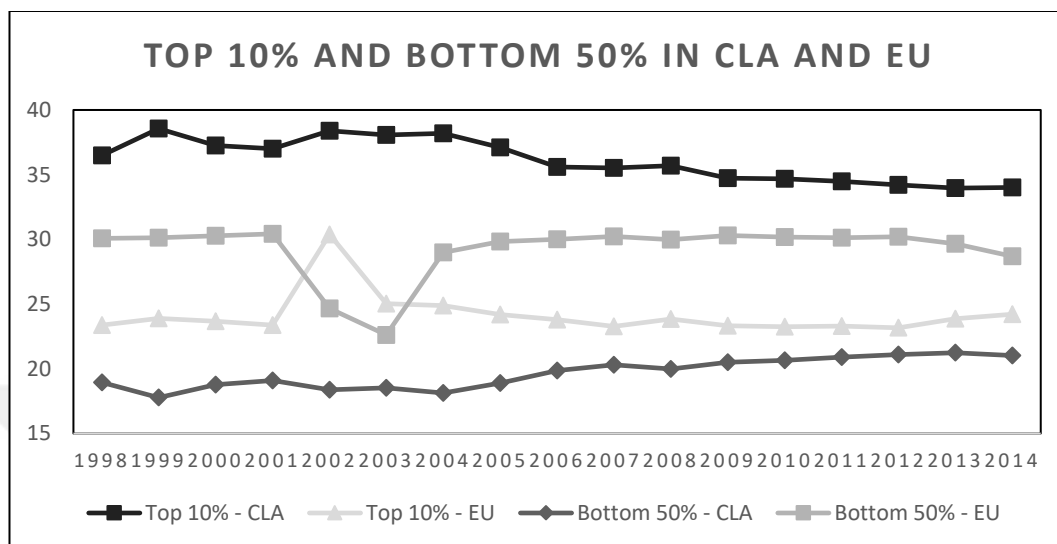


Figure 2.7 : Income Shares of Top 10% and Bottom 50% in Central and Latin American and European Countries.

In order to understand whether there is a potential relationship between interest and income inequality, a further focus can be useful. Figure 2.10 shows the possible the lower levels of Gini Index. In addition, as higher interest rates correspond to lower

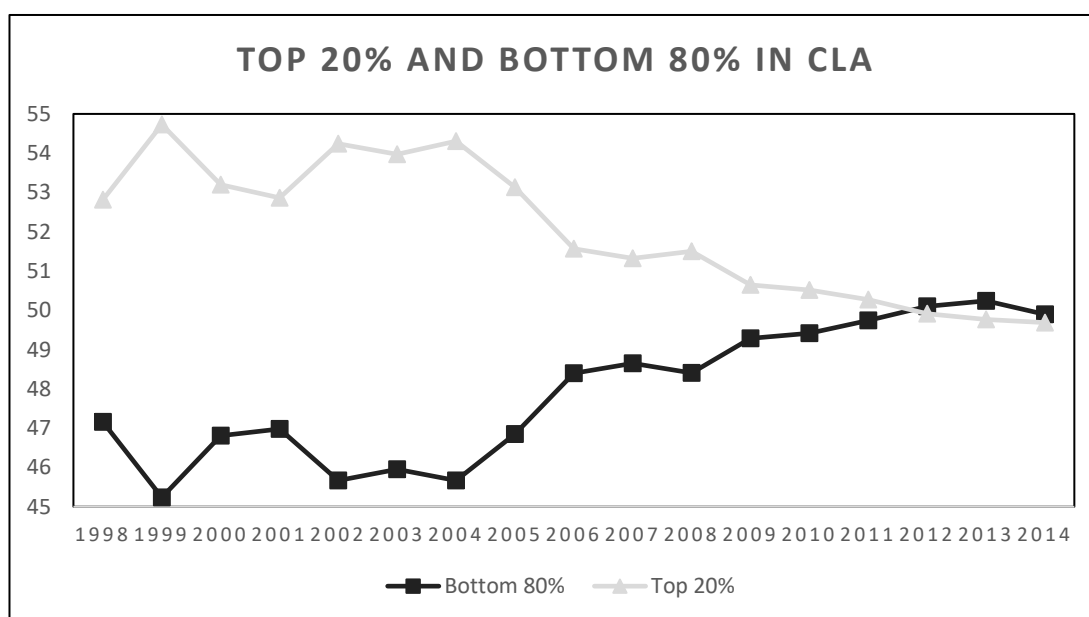


Figure 2.8 : Income Shares of Top 20% and Bottom 80% in Central and Latin American Countries

levels of the income share of bottom 10% and higher income share levels of top 10%. Moreover, for the higher income share levels of top 10%, Gini Index also tends to be higher. Thus, higher values of Gini Index corresponds to higher levels of real interest rates, as in the presence of higher real interest rates Gini Index levels may change between approximately 40% to 60%. Hence, one can infer that increasing real interest rates may have a relationship with increasing inequality levels. A similar pattern can be observed for interest payments from Figure 2.11. For interest payments in government expenses, lower levels of interest payments are seemed to be related with the lower levels Gini Index, where the bottom 10% takes the highest share it can and the top 10% takes the least. However, the reverse situation is valid for the

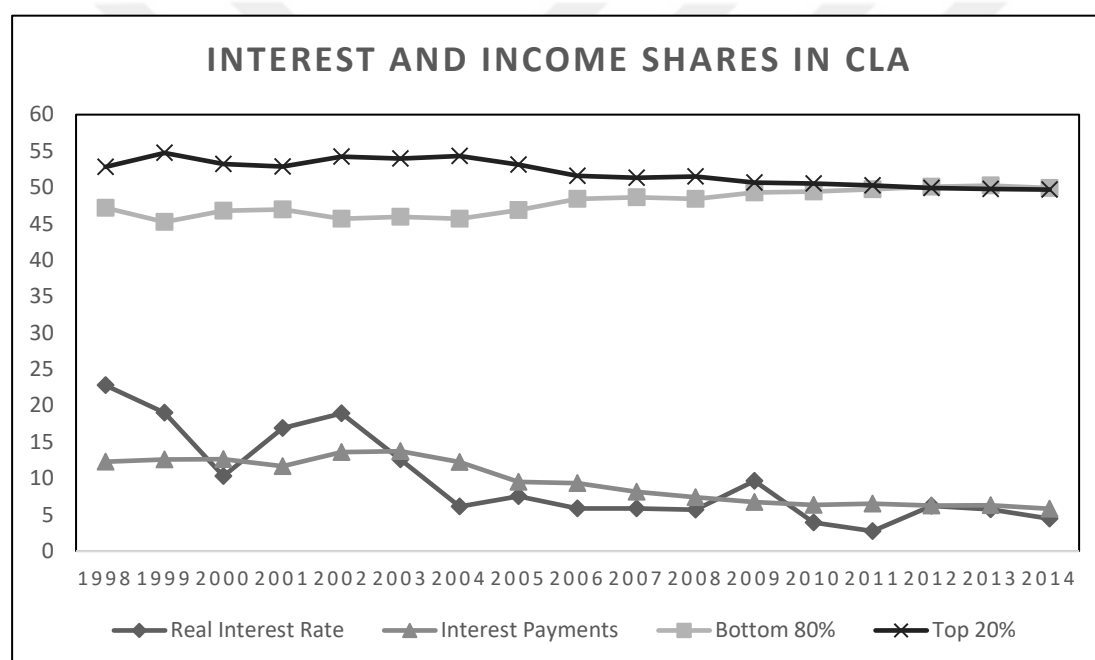


Figure 2.9 : Interest Variables and Income Shares of Top 20% and Bottom 80% in CLA Countries

top decile, as highest shares of top 10% corresponds to relatively higher interest payments. Hence, it can be said that interest payments, income share of top 10% and Gini index seems to have a positive relationship, while it has a negative relationship with the income share of bottom 10%.

Thus, these interactions may explain the changes in the income shares of the deciles, as real interest rate and interest payments may have an impact on these changes. Consequently, these relationships provide important perspectives about the possible

causalities between the variables. We will try to deepen our analysis by examining these relationships empirically.

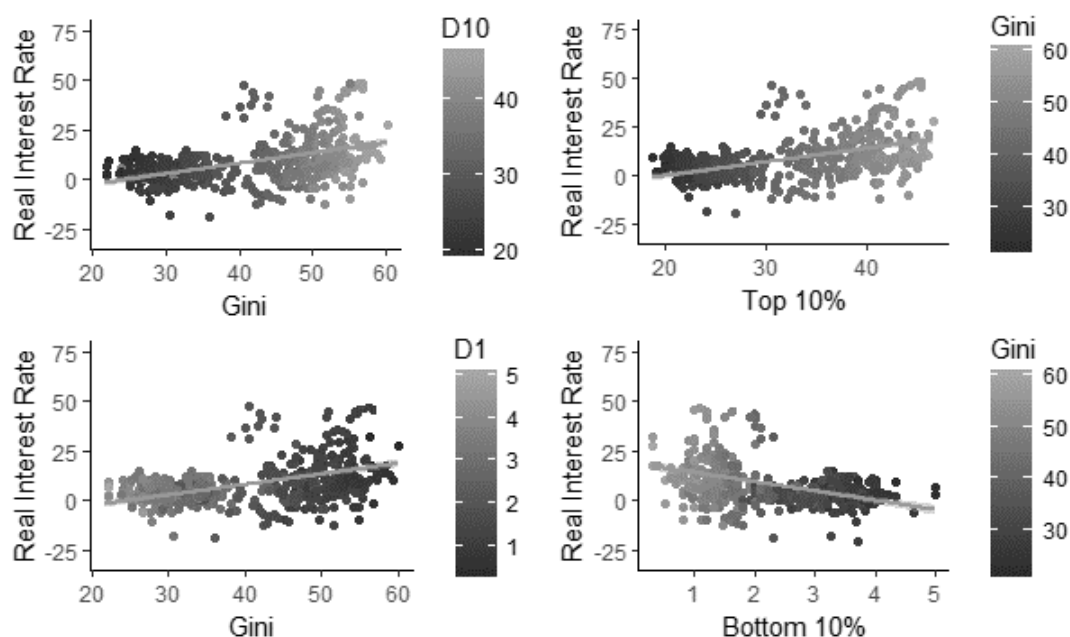


Figure 2.10 : Real interest rates, Gini index and income shares of Top 10% and Bottom 10%

Note: D10 represents the Top 10% and D1 represents the Bottom 10%.

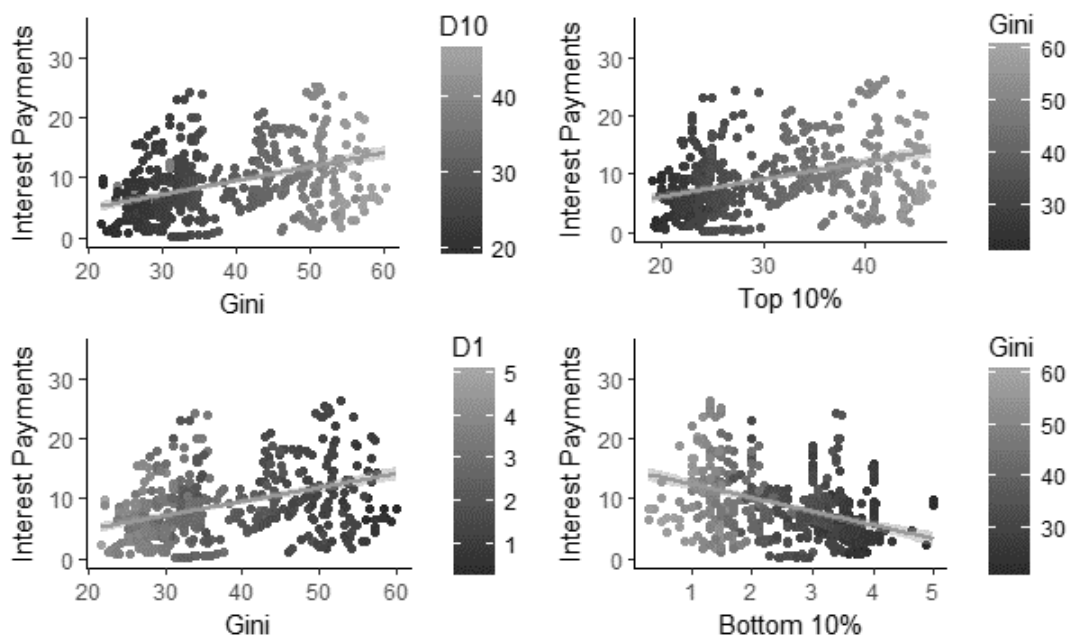


Figure 2.11 : Interest payments, Gini index and income shares of Top 10% and Bottom 10%

Note: D10 represents the Top 10% and D1 represents the Bottom 10%.

2.2 Methodology and Model Specifications

As it is stated above, the data consist of observations from 26 countries — mostly from Central and Latin America and Europe — between 1998-2014. It should be indicated that the data exhibits fixed-effects characteristics. In that section, the tests for autocorrelation, heteroscedasticity, multicollinearity, cross-sectional dependence and the existence of time and individual effects. Then, the estimators used will be specified.

2.2.1 Autocorrelation

In order to understand whether there is an autocorrelation or not, the Wooldridge test for autocorrelation in panel data is applied. Null hypothesis that no first order autocorrelation is rejected and concluded that there is autocorrelation in the sample. For details see Table 2.2.

Table 2.2 : Wooldridge Test for Autocorrelation

Wooldridge test for autocorrelation in panel data		
H0: no first-order autocorrelation		
F(1, 25)	=	51.618
Prob > F	=	0.0000

2.2.2 Heteroscedasticity

For testing whether there is heteroscedasticity or not, we apply Modified Wald test for groupwise heteroskedasticity in fixed effect regression model. Thus, we reject the null hypothesis and concluded that there is heteroscedasticity in the sample. For details see Table 2.3.

Table 2.3 : Modified Wald Test For Groupwise Heteroskedasticity

Modified Wald Test For Groupwise Heteroskedasticity in Fixed-Effects Regression Model		
H0: $\sigma(i)^2 = \sigma^2$ for all i		
chi2 (26)	=	1247.83
Prob>chi2	=	0.0000

2.2.3 Multicollinearity

For testing multicollinearity, we calculated the Variance Inflation Factor (VIF) values of the OLS estimates. As it can be seen from the Table 2.4, all of the VIF values are around 1, thus concluded that there is no multicollinearity.

Table 2.4 : Variance Inflation Factor Values for Multicollinearity

Variable	VIF	1/VIF
Real Interest Rate	1.12	0.890689
Interest Payments	1.06	0.947075
Inflation CPI	1.05	0.950177
GDP Growth Rate	1.04	0.958432
Tax Revenues	1.04	0.963790
Mean VIF	1.06	

2.2.4 Cross-Sectional Dependence

As for checking the existence of cross-sectional dependence, we firstly made a fixed-effects regression and then applied Pesaran's test of cross sectional independence based on the results of this analysis. Then, we concluded that there exists cross sectional dependence problem in the sample (Table 2.5).

Table 2.5 : Pesaran's Test of Cross Sectional Independence

Pesaran's test of cross sectional independence =	Pr = 0.0000
5.905	
Average absolute value of the off-diagonal elements =	0.319

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2.2.5 Individual and Time Effects

Lastly, in order to understand whether there exists any individual or time effects in the sample, we used fixed-effects testing and tested the null hypotheses of “absence of individual and time effects”, “absence of individual effects” and “absence of time effects” successively. We reject the null hypotheses of absence of individual and time effects” and “absence of individual effects”, while we do not reject the null hypothesis of “absence of time effects”. Thus, we concluded that there is individual effects in the sample. The details can be seen from Table 2.6.

Table 2.6 : Fixed Effects Testing for Individual and Time Effects

H01: Absence of individual and time effects	
FH01(40.88461538461538,392.1153846153845)	= 69.89
ProbFH01	= 0.0000
H02: Absence of individual effects	
FH02(25,392.1153846153845)	= 105.56
ProbFH02	= 0.0000
H03: Absence of time effects	
FH03(15.88461538461538,392.1153846153845)	= 1.40
ProbFH03	= 0.1381

2.2.6 Stationarity

For testing the stationarity of variables, we used second generation unit root test due to the presence of cross-sectional dependence in the sample. Thus, we use Pesaran's CADF test for unit root testing. It runs t-test for unit roots in heterogenous panels with cross-section dependence. Hence, we concluded that Gini Index, Real Interest Rate, income share of the Bottom Decile and Top Decile are stationary while the remaining variables are not. For the details, see Table 2.7.

Table 2.7 : Pesaran's CADF Test for Unit Root

Pesaran's CADF test							
Cross-sectional average in first period extracted and extreme t-values truncated							
Variables	Statistics						Conclusion
Gini Index	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Stationary
	-2.883	-2.580	-2.670	-2.830	-2.993	0.001	
Real Interest Rate	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Stationary (Significant in 10%)
	-2.581	-2.580	-2.670	-2.830	-1.469	0.071	
Interest Payments	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-1.788	-2.580	-2.670	-2.830	2.532	0.994	
Inflation CPI	Z[t-bar]	P-value					Non-stationary
	-1.026	0.152					
GDP Growth Rate	Z[t-bar]	P-value					Non-stationary
	-0.318	0.375					
Tax Revenues	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-1.971	-2.580	-2.670	-2.830	1.610	0.946	
Log(GDP) (PPP)	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-2.276	-2.580	-2.670	-2.830	0.068	0.527	
Bottom Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Stationary
	-2.894	-2.580	-2.670	-2.830	-3.047	0.001	
Second Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-2.400	-2.580	-2.670	-2.830	-0.558	0.288	
Third Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-2.113	-2.580	-2.670	-2.830	0.895	0.815	

Table 2.7: Continued

Fourth Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-2.106	-2.580	-2.670	-2.830	0.931	0.824	
Fifth Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-2.222	-2.580	-2.670	-2.830	0.342	0.634	
Sixth Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-2.068	-2.580	-2.670	-2.830	1.119	0.869	
Seventh Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-1.985	-2.580	-2.670	-2.830	1.538	0.938	
Eighth Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-2.349	-2.580	-2.670	-2.830	-0.300	0.382	
Ninth Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Non-stationary
	-1.897	-2.580	-2.670	-2.830	1.985	0.976	
Top Decile	t-bar	cv10	cv5	cv1	Z[t-bar]	P-value	Stationary
	-2.762	-2.580	-2.670	-2.830	-2.385	0.009	

In order to solve the problem of non-stationarity, we take first-difference of the variables. After first-differencing, all of the variables become stationary, as it can be seen in Table 2.8.

Table 2.8 : Pesaran's CADF Test for Unit Root After First-Differencing

Pesaran's CADF test			
Cross-sectional average in first period extracted and extreme t-values truncated			
Variables	Statistics		Conclusion
Gini Index	Z[t-bar]	P-value	Stationary
	-5.296	0.000	
Real Interest Rate	Z[t-bar]	P-value	Stationary
	-3.835	0.000	
Interest Payments	Z[t-bar]	P-value	Stationary(Significant in 10%)
	-1.523	0.064	
Inflation CPI	Z[t-bar]	P-value	Stationary
	-4.486	0.000	
GDP Growth Rate	Z[t-bar]	P-value	Stationary
	-6.399	0.000	
Tax Revenues	Z[t-bar]	P-value	Stationary
	-5.296	0.000	
Log(GDP) (PPP)	Z[t-bar]	P-value	Stationary
	-2.156	0.016	

Table 2.8: Continued

Bottom Decile	Z[t-bar]	P-value	Stationary
	-5.163	0.000	
Second Decile	Z[t-bar]	P-value	Stationary
	-6.018	0.000	
Third Decile	Z[t-bar]	P-value	Stationary
	-3.860	0.000	
Fourth Decile	Z[t-bar]	P-value	Stationary
	-4.475	0.000	
Fifth Decile	Z[t-bar]	P-value	Stationary
	-4.558	0.000	
Sixth Decile	Z[t-bar]	P-value	Stationary
	-3.749	0.000	
Seventh Decile	Z[t-bar]	P-value	Stationary
	-4.505	0.000	
Eighth Decile	Z[t-bar]	P-value	Stationary
	-3.878	0.000	
Ninth Decile	Z[t-bar]	P-value	Stationary
	-2.373	0.009	
Top Decile	Z[t-bar]	P-value	Stationary
	-5.735	0.000	

Also, we assume that there is no endogeneity, due to the reason that there is not any causal relationship between dependent and independent variables which comes from the theory. One can consider that GDP growth rate and income shares of the deciles may lead to endogeneity problem, however it should be noted that income shares of every income decile can be affected from the growth by a different magnitude, as the impact of the growth on some of them can also be insignificant. This is because some deciles are willing to benefit from the GDP growth such as the top income groups, while for the others, GDP growth may have a decreasing impact on their income shares.

2.2.7 Estimators

For a panel data sample which has a fixed-effects nature and consists of 26 countries and 17 years, due to the existence of both individual and time effects, autocorrelation, heteroscedasticity and cross-sectional dependence, we use three different estimators to test whether there is an impact of real interest rate and interest payments on Gini index and income share of the deciles or not. The reason for such a choice stems from the existence of differing methods which focus on capturing the unobservable effects,

existence of nonstationary variables and availability of the purpose of study for employing recently developing techniques like panel quantile regression. Firstly, we use Pesaran (2006) Common Correlated Effects Mean Group (CCMEG) estimator which focuses on to obtain consistent estimates of the parameters related to the observable variables. It assumes that unobserved common effects can be seen in cross-section-averages. The empirical model of CCMEG can be defined by Eberhardt (2012) as:

$$y_{it} = \beta_i x_{it} + u_{it} \quad (2.1)$$

$$u_{it} = \alpha_{1i} + \lambda_i f_t + \varepsilon_{it} \quad (2.2)$$

$$x_{it} = \alpha_{2i} + \lambda_i f_t + \gamma_i g_t + e_{it} \quad (2.3)$$

where x_{it} and y_{it} are observables, β_i is the country-specific slope on the observable regressors and u_{it} contains the unobservables and the error terms ε_{it} . The unobservables in (6) are made up of group fixed effects α_{1i} , which capture time-invariant heterogeneity across groups, as well as an unobserved common factor f_t with heterogeneous factor loadings λ_i , which can capture time-variant heterogeneity and cross-section dependence...The Pesaran (2006) CCEMG estimator allows for the empirical setup as laid out in all three equations above. The empirical setup induces cross-section dependence, time-variant unobservables with heterogeneous impact across panel members, and problems of identification...The focus of the estimator is to obtain consistent estimates of the parameters related to the observable variables. In empirical application, the estimated coefficients on the cross-section-averaged variables as well as their average estimates are not interpretable in a meaningful way; they are merely present to blend out the biasing impact of the unobservable common factor. (Eberhardt, pp. 62-64).

Moreover, according to Eberhardt (2012), “in Monte Carlo simulations CCEMG and Augmented Mean Group (AMG) estimators performed similarly well in terms of bias or root mean squared error (RMSE) in panels with nonstationary variables and multifactor error terms” (Eberhardt 2012, pp. 64). Thus, nonstationary variables do not pose a threat for the validity of the results for the CCEMG estimator.

Secondly, we use Least Squares Dummy Variables (LSDV) estimator with fixed-effects. The reason behind such a choice is that the sample exhibits fixed-effects characteristics, while individual effects are present in the sample. We can capture the impact of the individual effects by adding the countries into the regression equation in the form of dummy variables. In addition, due to the existence of nonstationary variables in the sample, we apply first differencing for both dependent and independent

variables. For the model, fixed-effects model is taken as a basis, then it will be transformed into LSDV by premultiplying the fixed-effects model by the orthogonal projection of the matrix of individual dummies. In matrix form, the model can be expressed as follows:

$$y = \alpha_{INT} + X\beta + Z_{\mu}\mu + v \quad (2.4)$$

where, α_{INT} is constant, X represents independent variables, β are the coefficients, Z is $NT \times (K + 1)$, Z_{μ} is the matrix of individual dummies which is $NT \times N$ and v is the remainder disturbance. From Baltagi (2008), we can obtain the least squares dummy variables (LSDV) estimator from (2.4), by residualizing out the Z_{μ} variables, i.e., by premultiplying the model by Q , the orthogonal projection of Z_{μ} , and performing OLS:

$$Qy = QX\beta + Qv \quad (2.5)$$

Here, the Q matrix wipes out the individual effects (Baltagi 2008, pp. 298). Thus, we will use (2.6) for LSDV estimator:

$$y_{it} = \alpha + \beta_1 RealInt_{it} + \beta_2 IntPayments_{it} + \beta_3 Inflation_{it} + \beta_4 GDPgrowth_{it} + \beta_5 TaxRevenue_{it} + \mu_i + \varepsilon_{it} \quad (2.6)$$

where y_{it} represents the first difference form of Gini Index and income shares of the deciles for $i = 1, \dots, 26$ and $t = 1, \dots, 17$. Also, the all the regressors are in terms of first-differenced variables. μ_i represents the unobserved individual-specific effect which will be controlled with regional dummies, as ε_{it} denotes the remaning disturbance. Time-effects are not taken into consideration, as we could not reject the hypothesis which states that time-effects are present in the sample.

Thirdly, we use recently developed Quantile Regression for Panel Data (QRPD) techniques. It can be said that these methods have been developing since 2004. It is one of the wide-ranging applcation fields of quantile regression methods. We use the model developed by Powell (2015), in which he developed an estimator for nonadditive fixed-effects in quantile regression framework. The model can be described as follows:

$$Y_{it} = \alpha_i + D'_{it}\beta(U_{it}), \quad U_{it} \sim U(0, 1) \quad (2.7)$$

where D represents treatment (policy) variables, Y represents dependent variable, α_i is assumed to be known and U_{it} is the non-separable disturbance term. In such a framework, parameters vary based only on U_{it} . Quantile models with additive fixed-effects provide distribution of $Y_{it} - \alpha_i$ for a given D_{it} (Powell 2015, pp. 6). For non-additive fixed effects, U_{it} can be defined in a way that it includes α_i as well. Let $U^*_{it} = f(\alpha_i, U_{it})$ and $U^*_{it} \sim U(0, 1)$. With the new term U^*_{it} , (2.7) can be defined as:

$$Y_{it} = D'_{it}\beta(U^*_{it}), \quad U^*_{it} \sim U(0, 1) \quad (2.8)$$

In order to specify the quantiles, Structural Quantile Function (SQF) is used. The SQF for (2.8) is:

$$S_Y(\tau|d_{it}) = d'_{it}\beta(\tau), \quad \tau \in (0, 1) \quad (2.9)$$

in which τ represents the quantile concerned. In the estimation process, we use 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80% and 90% for the values of τ . Moreover, it should be noted that the estimation will be done by using Markov Chain Monte Carlo methods with the option of acceptance rate of the algorithm. Acceptance rate of the algorithm for the estimation is taken as 0.5 for all quantiles. Lastly, we apply first-differencing for both dependent variable and regressors in order to overcome the problem of non-stationarity.

Briefly, for the estimation process, Pesaran (2006) CCEMG estimator, LSDV with fixed-effects and QRPD estimator developed by Powell (2015) are used for the estimation. It is expected that real interest rate and interest payments may increase income inequality.

3. ESTIMATION RESULTS AND DISCUSSION

As it is stated in the above section, we used two different estimators which are CCEMG, LSDV and QRPD estimators. Therefore, results will be given for LSDV, QRPD and CCEMG successively.

Firstly, LSDV with fixed-effects, we firstly estimate the impact of real interest rate and interest payments on income shares of the deciles and Gini Index. For unobserved individual effects we added country dummy variables, however in terms of convenience their coefficients are not represented in the results. By excluding Argentina, we avoid dummy variable trap. Also for eliminating possible omitted variable bias we include inflation rate, GDP growth rate and tax revenues. The results can be seen in Table 3.1. With 413 observations, we found out that interest payments have an inequalizing impact on income distribution, as control variables does not affect the level of significance of interest payments. Thus, for this sample, the impact of interest on income inequality does not reflect on either GDP growth rate, tax revenues or inflation rate (CPI), which shows that interest has an increasing impact on inequality by itself. We found out that by a percent increase in interest payments — which mostly consist of the payments regarding the government treasury notes and bonds — income shares of the second, third, fourth, fifth, sixth and seventh deciles (Bottom 60%) falls, as income share of the top decile rises. The bottom 60% loses 0.0645% of its income share in total, while the top 10% gains 0.0903%, which denotes an income transfer from the poor and middle income groups to the richest one. It should be noted that top 10% acquires an income transfer from bottom 60% and gain even 0.0258% more income, in response to a percent increase in interest payments. The impact of such an income transfer can also be seen in the increase in Gini index, as Gini Index increases by 0.114%, in response to an increase in interest payments. In addition, inflation increases the inequality by decreasing the income share of bottom 30% and increasing the share of top 10%, as it can be accepted as an income transfer from bottom groups to the top one. The impact of this transfer can be seen in the increasing impact of

inflation on Gini index also. This may show that the ones who reap the benefits of the inflation is the richer ones. Moreover, GDP growth rate has a significant — significant in 5% — positive impact on the income share of the second decile, as it has an equalizing impact on income distribution.

If we consider that the impact of interest payments on inequality could reflect through the increasing interest rates in bonds which consequently increases the yields of government bonds and securities and thereby income inequality may increase because bonds and securities are generally held by the wealthy, meaning the upper and the top income groups. This insight provides that the interest payments are being done to some specific income groups, mainly to the richest ones who are more likely to buy specific purpose securities and government treasury notes and bonds. While it makes the richer better-off, the poorer ones become worse-off. Hence, these results verify our hypothesis that increases in interest lead to an income transfer from the poorer to the richer and thereby widens income inequality and decreases social welfare. It can be said that the unjust nature of interest reveals itself in our findings.

When the patterns of the income shares of bottom 60% and top 10% in CLA and EU countries are analyzed, it seems to be that there is an explicit trade-off between these income share groups in CLA region (Figure 3.1) while the pattern in EU countries represents a stable situation in which the bottom 60% acquires a two times more income share than the top 10%, in average. If this pattern is considered with the pattern of real interest rates in CLA region, the decreasing trend of interest payments can explain the income transfer between bottom 60% and top 10% in that sense (Figure 3.2).

Secondly, for the estimations done by using QRPD estimator, we firstly analyze the impact of interest variables on the different quantiles of Gini Index. For this purpose, we analyze 20%, 40%, 60%, 80% and 90% quantiles of Gini Index. As it can be seen from Table 3.2, real interest rate, interest payments, inflation and tax revenues have significant impact on the different quantiles of Gini Index. Real interest rate increases the Gini index for all quantiles except 90%. Its highest effects are observed on 40% and 60% quantiles of Gini Index, as we can say that countries which have moderate inequality levels are more tend to be affected by real interest rate increases. Also the ones which have higher levels of inequality, real interest rate has less impact on them. higher levels of inequality are more likely to be influenced by increases in price levels.

Table 3.1 : Regression Results by using LSDV with Fixed-Effects

VARIABLES (First Difference)	Bottom Decile	Second Decile	Third Decile	Fourth Decile	Fifth Decile	Sixth Decile	Seventh Decile	Eighth Decile	Ninth Decile	Top Decile	Gini Index
Real Interest Rate	-0.00379 (0.0049)	-0.00232 (0.00632)	-0.00179 (0.00681)	-0.00081 (0.00724)	-0.00061 (0.00761)	-0.00068 (0.00750)	0.00011 (0.00735)	0.0023 (0.00693)	0.00278 (0.00562)	0.0506 (0.0461)	0.0531 (0.0479)
Interest Payments	-0.00742 (0.00545)	-0.00877* (0.00479)	-0.0120** (0.00523)	-0.0134** (0.00517)	-0.0125** (0.00530)	-0.0126** (0.00574)	-0.014*** (0.00500)	-0.00836 (0.00598)	0.00931 (0.00810)	0.0903** (0.0385)	0.114*** (0.0382)
Inflation CPI	-0.015*** (0.00523)	-0.0116** (0.00457)	-0.0085** (0.00364)	-0.00609 (0.00365)	-0.00412 (0.00405)	-0.00181 (0.00494)	0.00237 (0.00638)	0.00679 (0.00919)	0.0198 (0.0135)	0.130** (0.0626)	0.109* (0.0630)
GDP Growth Rate	0.00484 (0.00336)	0.0106** (0.00471)	0.00794 (0.00473)	0.00795 (0.00577)	0.00636 (0.00611)	0.00497 (0.00688)	0.00881 (0.00664)	0.00750 (0.00651)	0.00543 (0.00667)	-0.0211 (0.0354)	-0.0130 (0.0249)
Tax Revenue	0.0112 (0.0149)	0.0158 (0.0140)	0.0139 (0.0143)	0.0103 (0.0133)	0.00642 (0.0124)	0.00949 (0.0146)	0.00993 (0.0139)	0.00164 (0.0141)	-0.00842 (0.0226)	0.0921 (0.114)	0.0395 (0.112)
Country Effects	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant	0.0184*** (0.00583)	0.0302*** (0.00659)	0.0405*** (0.00755)	0.0468*** (0.00869)	0.0603*** (0.00957)	0.0512*** (0.0101)	0.0487*** (0.0103)	0.041*** (0.0122)	-0.0281* (0.0151)	-0.346*** (0.0672)	-0.356*** (0.0656)
Observations	413	413	413	413	413	413	413	413	413	413	413
R-squared	0.067	0.034	0.022	0.017	0.011	0.009	0.010	0.008	0.026	0.077	0.093

Note: First differencing methods are applied for all of the dependent, independent and control variables.

Robust Standard errors in parentheses

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

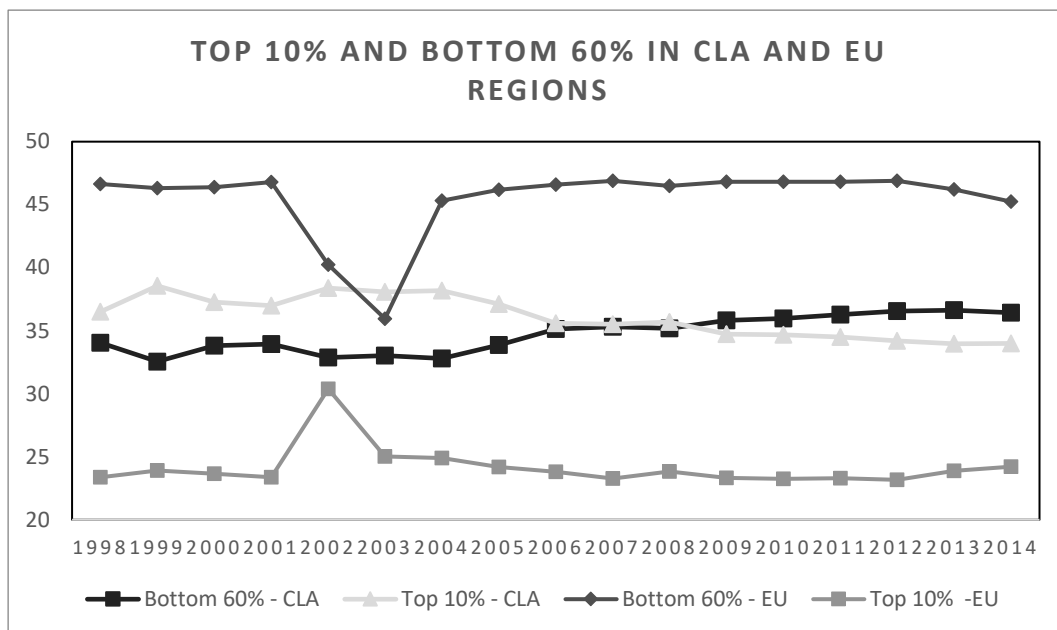


Figure 3.1 : Income Shares of Top 10% and Bottom 60% in Central and Latin America and European Regions

In addition, redistributive effect of the tax revenues shows itself especially in the countries with higher inequality levels, as tax revenues decreases inequality levels in 60%, 80% and 90% quantiles. For interest payments, the most affected ones are the countries which have highest levels of inequality. Interest payments increases Gini index for the quantiles of 20%, 40%, 80% and 90%. In general, the magnitude of the impact of interest payments are higher than of the impact of real interest rate.

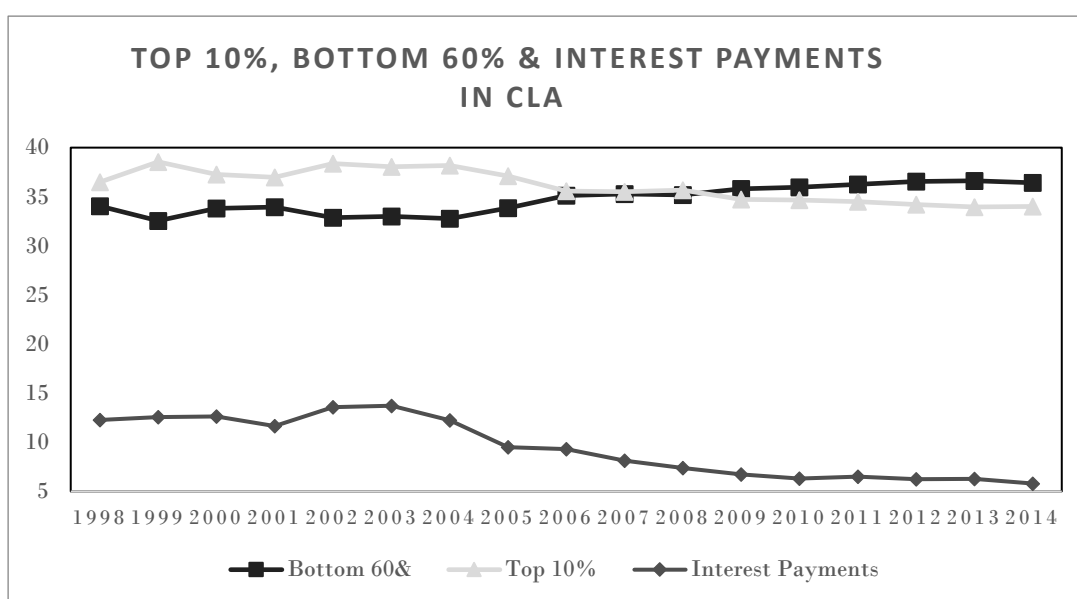


Figure 3.2 : Income Shares of Top 10%, Bottom 60% and Interest Payments in Central and Latin America Region

Table 3.2 : Regression Results by using QRPD (Gini Index)

	(1)	(2)	(3)	(4)	(5)
VARIABLES (First Difference)	Gini Index (20%)	Gini Index (40%)	Gini Index (60%)	Gini Index (80%)	Gini Index (90%)
Real Interest Rate	0.0439*** (0.00787)	0.0447*** (0.00575)	0.0522*** (0.00654)	0.0274** (0.0137)	0.0337 (0.0255)
Interest Payments	0.0584*** (0.0219)	0.0602*** (0.0128)	0.0290 (0.0181)	0.0691*** (0.0249)	0.224*** (0.0248)
Inflation CPI	0.0337*** (0.0127)	0.0492*** (0.00753)	0.0651*** (0.0182)	0.0778*** (0.0163)	0.130*** (0.0153)
GDP Growth Rate	0.000147 (0.00997)	0.0101 (0.00940)	0.00494 (0.0130)	0.0166 (0.0220)	-0.0164 (0.0244)
Tax Revenues	-0.0122 (0.0340)	0.000870 (0.0486)	-0.113** (0.0468)	-0.144** (0.0653)	-0.343*** (0.0274)
Observations	436	436	436	436	436
Number of groups	26	26	26	26	26

Note: First differencing methods are applied for all of the dependent, independent and control variables.

Standard errors in parentheses

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

Another estimation is done by QRPD constitutes an alternative to estimation done by LSDV in terms of the impact on interest variables on different income deciles. For LSDV estimator, we used income shares of different income decile groups as dependent variables. As it can be seen from Table 3.3, for QRPD estimator, we use logarithmic term of GDP which is calculated on the basis of Purchasing Power Parity (PPP). In order to prevent endogeneity, we exclude GDP growth among the explanatory variables for this regression. We found out that a percent increase in real interest rate decreases the total income of third decile by 1.00032 — this is because the dependent variable is expressed in terms of logarithm, as the real impact is $10^{0.000137}$ for the total income (GDP) — while it increases the total income of the ninth decile by 1.00057. *This implies an income transfer from the poor to the rich.* For interest payments, a percent increase in interest payments in government expenses, bottom 80% loses 1.02082 from its total income while ninth decile gains 1.00281. *Thus, this also implies a great income transfer which affects the whole society by transferring an important portion of income from the bottom and middle income groups to the top ones.* Especially this finding can be said to validate our hypothesis regarding bond

Table 3.3 : Regression Results by using QRPD (Logarithmic term of GDP — calculated by PPP)

VARIABLES (First Difference)	Bottom Decile	Second Decile	Third Decile	Fourth Decile	Fifth Decile	Sixth Decile	Seventh Decile	Eighth Decile	Ninth Decile
Real Interest Rate	-8.57e-05 (0.000167)	-8.56e-05 (0.000104)	-0.000137** (6.09e-05)	-8.00e-05 (5.23e-05)	-4.53e-05 (3.87e-05)	5.41e-05 (5.67e-05)	6.13e-06 (5.44e-05)	-1.73e-05 (7.52e-05)	0.000246*** (5.47e-05)
Interest Payments	-0.00219** (0.000857)	-0.00137*** (0.000338)	-0.00140*** (0.000224)	-0.00117*** (0.000265)	-0.00111*** (0.000242)	-0.000668*** (0.000177)	-0.000492* (0.000281)	-0.000550** (0.000223)	0.00122*** (0.000221)
Inflation CPI	-0.000470** (0.000218)	-0.000641*** (0.000104)	-0.000674*** (6.96e-05)	-0.000526*** (9.79e-05)	-0.000493*** (7.22e-05)	-0.000376*** (9.95e-05)	-0.000311*** (0.000103)	-0.000414*** (0.000123)	-0.000413*** (3.88e-05)
Tax Revenue	-0.000321 (0.000704)	0.000863* (0.000492)	0.00101*** (0.000310)	0.000209 (0.000374)	0.000465 (0.000379)	0.000599* (0.000345)	0.00103*** (0.000333)	0.000639 (0.000609)	0.00337*** (0.000220)
Observations	437	437	437	437	437	437	437	437	437
Number of groups	26	26	26	26	26	26	26	26	26

Note: First differencing methods are applied for all of the dependent, independent and control variables.

Standard errors in parentheses

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

yields, as it makes the bottom and middle income groups worse off while making the top income groups better off. In addition, inflation decreases the income of the whole society. However, it decreases the income of bottom 50% more than the others. Hence, we can say that it also increases the inequality. Lastly, for tax revenues, it increases the income of second, third, sixth, seventh and ninth deciles. However it increases the income of upper-middle and top income groups much more than of the bottom and middle income groups. Thus, tax revenues in that case, notwithstanding it has some increasing impact on the income of bottom income groups, have an inequalizing impact on income distribution.

Thirdly, we made estimation by using CCEMG estimator. As stated above, CCEMG estimator tries to capture the unobservable effects by using cross-sectional averages. Thus, regional and time dummies are not included in the following regressions. As it can be seen from Figure 3.3, by using same variables with the same number of observations which is 439, real interest rate, inflation and tax revenue are insignificant for both income shares of the deciles and Gini index. However, interest payments is significant for income shares of the deciles. As a result of a percent increase in interest payments, fifth, sixth and seventh deciles loses 0.637% in total and thereby income inequality increases. Moreover, a percent increase in interest payments leads Gini index to rise by 2.346 points, which represents a great impact. This great impact can stem from the over sensitivity of Gini index to the changes in income shares of the middle income groups. Notwithstanding it seems like there is not any income transferred from a specific decile to another, income inequality increases in response to increasing interest payments. Both middle and upper middle classes are negatively influenced. Also, GDP growth rate decreases the income share of the top decile by 0.263%. In order to understand whether there is a possible impact that can be captured by another dependent variables or not, we formed bottom 80% and top 20% variables, by summing up the income shares of the deciles, due to the presence of trade-off between these two groups which was indicated above sections. *As a result, we found out that increases in interest payments lead to an income transfer from bottom 80% to top 20% (Table 3.4).* In response to a percent increase in interest payments, bottom 80% loses 1.466% and top 20% gains 1.703% in total. Here, again the top income groups gain more than the income transferred from the bottom and middle income groups. The pattern of income shares of top 20% and bottom 80% in CLA countries

can be remembered at this stage (Figure 2.8). GDP growth rate is again significant in 10% for the top decile, as it has a decreasing impact on the income share of the top 10%.

In order to elaborate the discussion, the country-based results for CCEMG estimator can also be evaluated. For this analysis, we take Argentina, Belgium, Bolivia, Indonesia and United Kingdom (UK) into consideration, as Argentina and Bolivia represents the CLA region while Belgium and UK are represents the EU region. For Argentina, when real interest rate increases by one percent, second, third, fourth, fifth, sixth and eighth deciles loses 0.161% of their income shares in total, while the top 10% gains 0.195%, as Gini index increases by 0.213%. Meaning, there is an income transfer from the poor and middle income groups to the top decile. For interest payments, there is not any significant result. Moreover, in order to understand the possible channels that real interest rate influences Gini index, we can use the model developed by Areosa and Aresoa (2016). Our hypothesis regarding real interest rate can explain the income transferred from the bottom 60% to top 10% as Areosa and Aresoa (2016) found out that, regardless of the number of financially excluded and unskilled members, a monetary shock decreases the output gap and increases the Gini index since the interest rate rises much. When the agents' decisions considered, financially included agents postpone their consumption due to the increasing interest rates triggered by the monetary shock (Areosa and Areosa, pp. 225). Market clearing conditions forces firms to decrease their production, thereby the demand for labor and wages also decrease, through which the income of low and middle income groups decreases. Consequently, these mechanisms can constitute the possible channels of income transferred from bottom and middle groups to top 10% in Argentina which is triggered by increasing real interest rate.

As Gasparini and Cruces (2008) indicated, deep macroeconomic crises and periods of sudden and intense economic liberalization conduce to increasing levels of inequality in Argentina. The large macroeconomic crisis of 2001-2002 led to a shift in inequality, however fastly recovering indicators of economy returned income inequalities to pre-crisis levels and large cash transfer programs were implemented (Gasparini and Cruces, pp. 1). In the macroeconomic crisis of 2001-2002 real interest rates were roughly trippled from 9.9% to 29.1%. Gini index increased from 50.4 in 2000 to 52.2 in 2001 and 53.3 in 2002, while the income share of top 10% reached 40.3% from

37.1%. After the crisis economic indicators seemed to be recovered, as decreases in interest rates may lead inequality to decrease. For instance, Gini index decreased from 53.3 in 2002 to 42.3 in 2014, while income share of top 10% fell from 40.3% in 2002 to 30.6% in 2014 as real interest rates decreased from 16.2% in 2002 to -11.9% in 2014. Hence, these insights may explain the income transferred from lower and middle deciles to the top decile in Argentina.

When we come up to other CLA country, Bolivia, both real interest rate and interest payments are significant, as they both lead to income transfer from the lower and middle income groups to the top one. *Real interest rate causes 0.382% of income transfer from bottom 60% to the top 10%.* Again, top 10% has additional income share gain of 0.099%. Also, Gini index increases by 0.44 points in response to a percent increase in real interest. *In addition, interest payments leads to an income transfer of 1.743% from bottom 80% to the top 10%, while 0.368% of income share can be evaluated as welfare loss.* The welfare loss stems from the fact that bottom 80% loses 2.111% of their income share in total, while only 1.743% of it transferred to the top decile. Furthermore, interest payments increases Gini index by 2.178 points. Bolivia is one of the countries in CLA region which gained a success in terms of alleviating income inequality. Vargas and Garriga (2015) found out an evidence which suggests that the reduction of inequality in Bolivia was mainly driven by labor income growth at the bottom income groups. The GDP of Bolivia increased by 80% in real terms during 2000–2014, as a results of commodity boom. Also, the real minimum wage increased by 100% during the same period, with average real labor income also rising by 40% (Vargas and Garriga, pp.25). As Vargas and Garriga (2015) explained that:

Overall, our findings suggest that the reduction of inequality and poverty in Bolivia was driven mainly by labor income growth at the lower end of the income distribution. The contribution of non-labor income (rents, transfers, remittances) was important for certain groups but relatively small. Labor income increases were concentrated in the service and manufacturing sectors, and in the informal sector. These changes reduced the skills premium. Pro-poor labor policies have played a role though, both through marked increases in minimum wages in recent years and transfers to specific population groups: school age kids (Bono Juancito Pinto), elderly people (Renta Dignidad) and, pregnant women and newborns (Bono Juana Azurduy). Renta Dignidad in particular has made a big difference for the elderly poor (Vargas and Garriga, pp.5).

When the patterns of Gini index, income shares of the top decile, real interest rate and interest payments in Bolivia are analyzed, Gini index decreased from 60.2 in 2000 to 48.3 in 2014. Income share of top decile decreases from 62.8% in 2000 to 52.7% in 2014, while real interest rates fell from 27.95% to 7.5% and interest payments in terms of government expenses decreased from 8.43% to 5.94% within the same time interval. For the case of Bolivia, decreasing interest rates could increase the aggregate demand which led economy to grow, as Bolivia economy experienced a 80% growth in real terms in last decades. Increasing demand could force firms to produce more, as Bolivia experienced an commodity boom, consequently firms demanded more labor. This could lead real wages to increase, as real minimum wages increased by 100% in Bolivia. Thus, falling real interest rates caused low income groups to gain more and this decreases income inequality in Bolivia. Hence, if there were increasing real interest rates, a reverse effect might be occurred as we can see from Table 3.5. In addition, for interest payments, our hypothesis may be valid as there is an income transfer from bottom 80% top 10%. Also, government may finance the payments from the taxes collected from the whole society.

For European countries, Belgium and United Kingdom are taken into consideration. It should be noted that both real interest rate and interest payments are significant for Belgium. *As one of the European countries which have the most equal levels of income throughout the world, increases in real interest rate cause an inverse income transfer from top 10% to second, fourth and fifth deciles.* Also a percent increase in real interest rate leads Gini index to raise about 1.161 points. This finding is the only exception among the results of this study, which in general show that interest increases inequality. The reason behind this scene may stem from the stable and low interest rates present in European countries, as well as the low Gini index levels. As Van Rie and Marx (2013) indicated, in terms of economic inequality Belgium is one of the largest and most regulated in OECD countries, as it is included in the most redistributive ones in the European Union and the OECD (Van Rie and Marx, pp.2). Hence, little changes in interest rates may trigger a strong impact on Gini index.

Table 3.4: Regression Results by using CCEMG Estimator for Gini Index and Income Share of the Deciles

VARIABLES	Bottom Decile	Second Decile	Third Decile	Fourth Decile	Fifth Decile	Sixth Decile	Seventh Decile	Eighth Decile	Ninth Decile	Top Decile	Gini Index
Real Interest Rate	0.0171 (0.0161)	0.000491 (0.0199)	0.0128 (0.0201)	0.0130 (0.0171)	0.00247 (0.0216)	0.0151 (0.0154)	0.0187 (0.0144)	0.0198 (0.0164)	-0.00799 (0.0148)	-0.0583 (0.0887)	-0.120 (0.172)
Interest Payments	-0.390 (0.320)	-0.0872 (0.141)	-0.129 (0.139)	-0.159 (0.122)	-0.242* (0.127)	-0.196* (0.116)	-0.199** (0.0882)	-0.103 (0.0999)	0.269 (0.359)	1.165 (0.716)	2.346* (1.200)
Inflation CPI	-0.0226 (0.0240)	0.00650 (0.0158)	0.0123 (0.0162)	0.0150 (0.0217)	0.0155 (0.0236)	0.0102 (0.0214)	0.0174 (0.0213)	-0.0117 (0.0137)	-0.0144 (0.0214)	-0.102 (0.119)	-0.0179 (0.121)
GDP Growth Rate	0.0233 (0.0200)	0.0299 (0.0197)	0.0167 (0.0236)	0.0266 (0.0225)	0.0272 (0.0223)	0.0142 (0.0256)	0.0102 (0.0242)	0.0125 (0.0238)	0.0136 (0.0289)	-0.298** (0.147)	-0.132 (0.169)
Tax Revenue (%GDP)	0.0942 (0.0943)	-0.0309 (0.0717)	-0.0428 (0.0833)	-0.0600 (0.0763)	0.00350 (0.0429)	-0.00983 (0.0513)	-0.0247 (0.0610)	-0.0347 (0.0457)	-0.0816 (0.0589)	0.169 (0.384)	0.354 (0.709)
Real Interest Rate Average	-0.000772 (0.0285)	0.0254 (0.0325)	0.0136 (0.0323)	0.00570 (0.0305)	0.00904 (0.0321)	0.00749 (0.0312)	0.00979 (0.0279)	0.00216 (0.0254)	-0.00423 (0.0389)	0.0505 (0.192)	-0.0227 (0.186)
Interest Payments Average	0.341 (0.307)	0.0245 (0.142)	0.0942 (0.138)	0.111 (0.122)	0.164 (0.113)	0.143 (0.108)	0.131 (0.0854)	0.0413 (0.0871)	-0.301 (0.383)	-1.057 (0.665)	-2.025* (1.119)
Inflation CPI Average	0.00875 (0.0248)	0.00330 (0.0272)	0.00567 (0.0298)	0.00931 (0.0328)	0.0123 (0.0307)	0.0122 (0.0291)	0.0158 (0.0238)	0.000352 (0.0168)	-0.00895 (0.0251)	-0.106 (0.209)	-0.106 (0.221)
GDP Growth Rate Average	-0.0271 (0.0283)	-0.00675 (0.0282)	-0.00497 (0.0322)	-0.00643 (0.0300)	-0.00227 (0.0276)	-0.00531 (0.0315)	-0.00616 (0.0315)	-0.0110 (0.0266)	-0.0349 (0.0442)	0.215 (0.182)	0.00252 (0.214)
Tax Revenue Average	-0.0801 (0.108)	0.0729 (0.0803)	0.0743 (0.0832)	0.0786 (0.0822)	0.0754 (0.0830)	0.0668 (0.0804)	0.0307 (0.0705)	0.0971 (0.0699)	0.155* (0.0889)	-0.0290 (0.471)	0.0985 (0.635)
Bottom Decile Average	0.858** (0.436)										
Second Decile Average		1.010*** (0.331)									
Third Decile Average			1.088*** (0.301)								
Fourth Decile Average				1.010*** (0.336)							

(Continued)

Table 3.4: (Continued)

VARIABLES	Bottom Decile	Second Decile	Third Decile	Fourth Decile	Fifth Decile	Sixth Decile	Seventh Decile	Eighth Decile	Ninth Decile	Top Decile	Gini Index
Fifth Decile Average					1.036*** (0.321)						
Sixth Decile Average						1.090*** (0.298)					
Seventh Decile Average							1.074*** (0.295)				
Eighth Decile Average								1.036*** (0.290)			
Ninth Decile Average									0.936*** (0.260)		
Top Decile Average										0.974*** (0.271)	
Gini Index Average											0.634 (0.443)
Constant	0.397 (2.082)	-1.526 (2.207)	-2.180 (2.385)	-1.491 (2.733)	-1.936 (2.829)	-2.546 (3.104)	-1.785 (3.408)	-2.280 (4.171)	-0.801 (4.730)	4.347 (9.513)	17.02 (14.57)
Observations	439	439	439	439	439	439	439	439	439	439	439
Number of No	26	26	26	26	26	26	26	26	26	26	26

Standard errors in parentheses

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

Table 3.5 : Regression Results using CCEMG Estimator for Bottom 80% and Top 20%.

VARIABLES	(1) Bottom 80%	(2) Top 20%
Real Interest Rate	0.102 (0.111)	-0.0482 (0.0943)
Interest Payments	-1.466** (0.741)	1.703* (0.905)
Inflation CPI	0.109 (0.163)	-0.114 (0.132)
GDP Growth Rate	0.196 (0.167)	-0.247* (0.140)
Tax Revenues	-0.171 (0.404)	0.0546 (0.405)
Real Interest Rate Average	0.0593 (0.225)	-0.00452 (0.162)
Interest Payments Average	1.007 (0.712)	-1.536** (0.774)
Inflation CPI Average	0.0675 (0.202)	-0.104 (0.191)
GDP Growth Rate Average	-0.0849 (0.218)	0.106 (0.181)
Tax Revenues Average	0.488 (0.581)	0.224 (0.471)
Bottom 80% Average	1.075*** (0.317)	
Top 20% Average		0.926*** (0.251)
Constant	-15.14 (22.39)	4.052 (11.93)
Observations	439	439
Number of No	26	26

Standard errors in parentheses

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

However, when it comes to interest payments, a higher amount of income transfer, which is about 2.19%, from the bottom 60% to the top 10% is at issue for Belgium. There is a 1.15% welfare loss stemming from a percent increase in interest payments. Moreover, Gini index increases by 3.201 points. This is an important result which proved that even in the cases in which real interest rate increases inequality, interest payments is usually pro-rich.

As for the other European country, United Kingdom, only the interest payments variable is significant. By a percent increase in interest payments, fifth, sixth and seventh deciles loses 1.698% of their income shares in total, as bottom 10% and top 10% gains 0.469% in total. This result is also unique for our sample, due to the reason that UK is the only country, in which interest payments increases both bottom and top income groups' income share. Hence, as response to increases in interest payments, an income transfer from the middle classes to the top and the bottom ones is valid for UK. This may imply the melting effect of interest on the middle income groups, as the top and the bottom deciles gain at the expense of middle income deciles. Hence, this finding shows that interest payments increases income inequality in UK, as it is compatible with the findings of Mumtaz and Theophilopoulou (2017), who analyze micro level data and found out that contractionary monetary policy shocks increases income, consumption and earning inequalities in UK. They indicate that "households who hold financial assets which experienced price appreciation may have benefited more than poorer households who do not have access to financial markets" (Mumtaz and Theophilopoulou, pp. 422). However, further studies can be conducted to explain the possible channels that bottom 10% gains in response to increasing interest payments.

The last country that we analyze is Indonesia, which can be evaluated as an exception of the sample in the sense that it is located in the Asia region. For Indonesia, with the high level of significance, we found out that increases in real interest rate lead 0.354% of income to transfer from bottom 80% to the top 10%, while the social welfare decreases by 0.062% in total, as Gini index increases by 0.402 points. Indonesia experienced widening inequalities in last decades, as Gini index increased from 33.77 in 1998 to 42.77 in 2014, which means that inequality had been increased by 26.7%. From Figure 3.3 it can be seen that real interest rates also increased from -1.65% to 6.84%. GDP growth rate had been stable around 5% between the period of 2005 and 2014, in which the real interest rates fluctuates and Gini index had increased. Hence, our hypothesis for real interest rate can be valid for this sample too, as rises in interest rates slowed down the growth and aggregate demand, which then forced firms to cut the wages. The ones who are mostly dependent to the real wages are the poorer and middle income groups in general. Thus, their income share fell, while the richest group were not affected from the changes in real wages as they could gain from their financial

Table 3.6: Regression Results using CCEMG Estimator for Selected Countries

VARIABLES	REAL INTEREST RATE										Gini Index
	Bottom Decile	Second Decile	Third Decile	Fourth Decile	Fifth Decile	Sixth Decile	Seventh Decile	Eighth Decile	Ninth Decile	Top Decile	
Argentina	-0.012	-0.025**	-0.027**	-0.035**	-0.028**	-0.028**	-0.021	-0.018**	0.017	0.195***	0.213***
Belgium	0.074	0.234*	0.213	0.249**	0.235**	0.198	0.162	-0.004	-0.146	-0.702**	-1.161*
Bolivia	-0.041	-0.072**	-0.068*	-0.068**	-0.066**	-0.062**	-0.046**	-0.016	0.044	0.481***	0.440***
Indonesia	-0.034***	-0.046***	-0.056***	-0.065***	-0.067***	-0.065***	-0.054***	-0.029*	0.028	0.354***	0.402***
United Kingdom	-0.043	-0.342	-0.310	-0.169	-0.125	-0.149	-0.066	-0.122	-0.316	0.812	-0.816
VARIABLES	INTEREST PAYMENTS										Gini Index
	Bottom Decile	Second Decile	Third Decile	Fourth Decile	Fifth Decile	Sixth Decile	Seventh Decile	Eighth Decile	Ninth Decile	Top Decile	
Argentina	0.002	0.006	0.010	0.007	0.008	-0.001	-0.005	0.008	0.005	-0.022	-0.002
Belgium	-0.124	-0.501**	-0.632**	-0.537***	-0.528***	-0.631***	-0.591***	-0.285	0.185	2.19***	3.201***
Bolivia	-0.174**	-0.297***	-0.281**	-0.304***	-0.310***	-0.316***	-0.293***	-0.136**	-0.126	1.743***	2.178***
Indonesia	-0.010	-0.003	-0.001	0.004	0.005	0.008	0.011	0.013	0.012	0.146	0.025
United Kingdom	0.284*	-0.23	-0.330	-0.523	-0.616*	-0.573**	-0.509***	-0.149	0.185*	0.616	0.474

Note: Only the coefficients of the variables of interest are given. Upper panel indicates the impact of real interest rate on income share of the deciles and Gini index, while lower panel shows the impact of interest payments on the dependent variables. Standard errors are not indicated, as p-values showed by stars (*** p<0.01, ** p<0.05, * p<0.1). Also, the coefficients of control and explanatory variables as well as cross-sectional averages are not given.

assets as a result of the increasing interest rates. However, we cannot verify our hypothesis completely for Indonesia due to the lack of data.

In order to elaborate the discussion, we can refer to Miranti et al. (2013) who analyzed the poverty and inequality trends in Indonesia between 2001 and 2010, when the Indonesian economy had been decentralised. They found out that absolute poverty rates declined during the period of decentralisation, however consumption inequality has increased during the same period (Miranti et al., pp. 6). Notwithstanding there had been a consumption growth on poverty, increasing inequality offsetted the positive benefits of it.

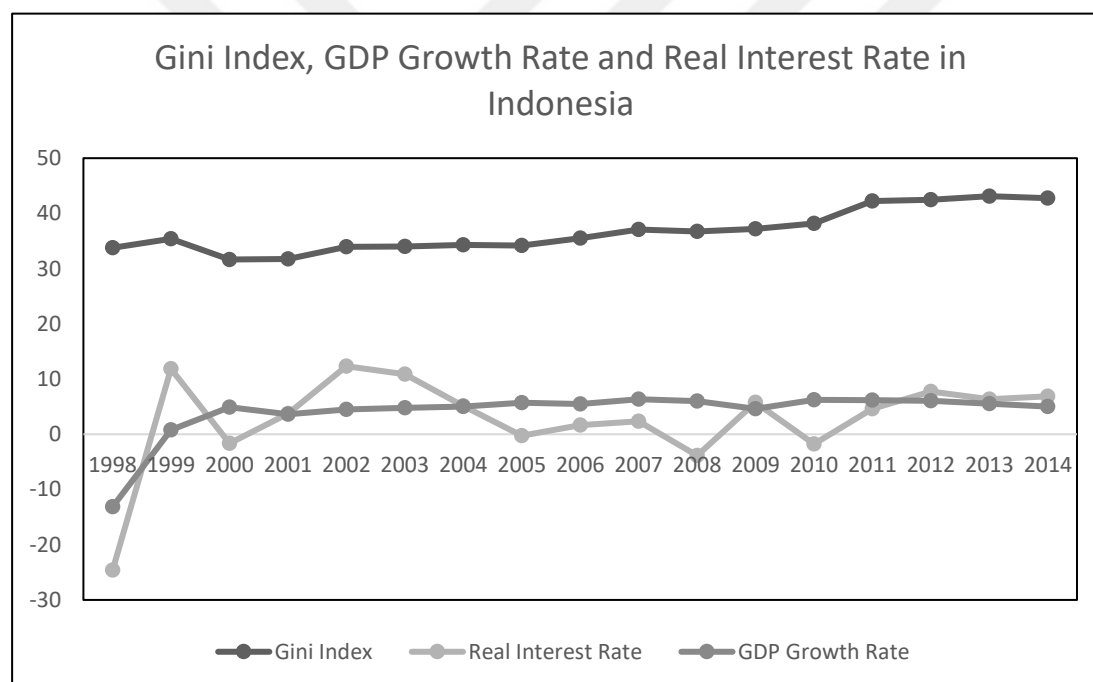


Figure 3.3 : Gini Index, GDP Growth Rate and Real Interest Rate in Indonesia between 1998 – 2014.

Briefly, from the estimation results, we observed that both real interest rate and interest payments lead to income transfer from the bottom and middle income groups to the top decile in general. There are some exceptions, especially European countries like Belgium and UK, in which real interest rate may lead to a reverse transfer while interest payments transfer a portion of income from the bottom and middle income groups to the top one. In addition, Gini index is observed to increase in response to

increases in interest variables in general. Moreover, estimation results reveal that social welfare decreases when interest rates increase. It can be said that social welfare decreases by two channels; the direct channel leads to emergence of welfare loss from the income transferred from bottom and middle income deciles to the top one. Secondly, the indirect channel which implies that social welfare decreases due to the widening income gap between the poorer and the richer agents in the society, which is one of the implications of the Pigou-Dalton principle. These results may reveal the unjust nature of interest mechanism, which increases income inequality and thereby decreases social welfare.





4. CONCLUSION

In this study, we try to understand whether interest has an impact on income inequality in recent times. While investigating this question, we argued that interest can affect income inequality by two main channels, namely real interest rate and bond yields. By referring to Areosa and Areosa (2016), we asserted that increases in real interest rate would decrease aggregate demand, which then slows down the growth and thereby nominal wages decrease. If the impact is high enough to the extent that it decreases the economic growth much, real wages also decrease. The ones who affected from decreasing real wages are the lower and middle income groups, as the upper income groups enjoy the increasing return of their financial assets. Therefore, increasing real interest rates decreases the lower and middle income groups's income, while it increases the income of the upper income groups, as it implies an income transfer from the poorer to the richer. Thus, this income transfer increases the income inequality at the expense of the lower and middle income groups and thereby decreases social welfare. Secondly, for bond yields, we argue that increasing interest rates may lead to income transfers from the poorer to the richer agents and decreases social welfare by referring to Pigou (1912), Dalton (1920), Fleurbaey and Maniquet (2011) and Tag el-Din (2013).

To test the above mentioned hypotheses, we use a panel data consists of 26 countries — which mostly comprise of Central and Latin America countries and European countries — and 17 years ranging between 1998 and 2014. We use Pesaran's CCEMG estimator, LSDV estimator with fixed-effects and QRPD estimator. As a result, we found evidences of income transfers being done from bottom 80% to top 10%, from bottom 60% to top 10% and from bottom 80% to top 20% with another ones which realizes among the other income deciles in successive regressions, as we try to evaluate these results within the theoretical frameworks mentioned above. In addition, we tried to explain the impact and possible channels of it by using specific countries such as Argentina, Belgium, Bolivia, Indonesia and United Kingdom. We found out that real

interest rate increases Gini index and causes an income transfer from the bottom deciles to the top one in Argentina, Bolivia and Indonesia. Moreover, it should be noted that interest payments increases Gini index in Belgium, Bolivia and United Kingdom — as it leads to transfer of income from the middle income groups to both the top decile and the bottom decile in UK, as it is an exception. Our other hypothesis regarding interest payments is also validated on the Belgium, Bolivia and United Kingdom examples, as increasing interest rates lead to income transfers from the poorer to the richer agents and decreases social welfare. In addition, for social welfare, further evidence of welfare loss observed in Belgium and Bolivia in response to increasing interest payments.

Thus, in general, these results verify our hypotheses and showed that both real interest rate and interest payments had increased income inequality in last decades for our sample. Much of this effect may stem from the existence of Central and Latin American countries in the sample, however we have evidences which shows that interest payments increases Gini index and leads to income transfer from lower and middle deciles to the top decile for European countries such as Belgium and United Kingdom. Further studies can be conducted to investigate the possible channels of these impacts in a more a precise and detailed way. Nevertheless, it can be explicitly said that these results reveal the unjust nature of interest, which leads to distortions in the income distribution by transferring a certain proportion of income from the bottom and middle income groups to the top ones, thereby increases income inequality and decreases the social welfare.

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APPENDICES

APPENDIX A

Country List			
Argentina	Finland	Mexico	Romania
Belgium	France	Netherlands	Spain
Bolivia	Germany	Norway	United Kingdom
Colombia	Honduras	Panama	Uruguay
Costa Rica	Hungary	Paraguay	Venezuela
Ecuador	Indonesia	Peru	
Estonia	Italy	Poland	

Figure A.1: Country List



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