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ECONOMICS PROGRAMME

The Effects of Income Inequality and Redistribution on the Economic Growth in Selected OECD Countries

MA Thesis

Muna MOHAMUD JAMA

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Abstract

This study examines the effect of income inequality and redistribution of income on economic growth in selected OECD countries by using annual data from OECD Statistics and Standardized World Income Inequality Database (SWIID) for the years between 2001 and 2017. In this context, the effect of income inequality by using the Gini after tax and transfers and the effect of redistribution by using both absolute and relative redistribution measures on the per capita GDP growth are investigated by using a fixed effect model for 15 OECD countries. At the first stage of the analysis, baseline growth model that includes GDP per capita income, population growth, gross fixed capital formation as an indicator of physical capital and secondary school enrolment as an indicator of human capital is estimated. As the two following stages, redistribution and income inequality measures are added to the model. At the last stage, control variables regarding the human development, namely life expectancy, fertility rate, index of democracy and index of the rule of law are included in the model. This set of models are estimated for absolute and relative distribution separately. The effect of absolute and relative redistribution on the economic growth are found to be significantly negative along with the significantly negative effect of income inequality. In the extended model, absolute and relative redistribution has no significant effect on economic growth.

Key words: Absolute redistribution, relative redistribution, income inequality, economic growth, OECD.

Öz

Bu çalışma gelir eşitsizliği ve gelirin yeniden dağıtımının seçilmiş OECD ülkelerindeki iktisadi büyüme üzerindeki etkisini, 2001 ve 2007 yılları arasında OECD ve Standartlaştırılmış Dünya Gelir Eşitsizliği Veritabanı'dan elde edilen yıllık verilerle araştırmayı amaçlamaktadır. Bu bağlamda gelir eşitsizliği harcalanabilir gelir ile hesaplanan Gini katsayısı ile, gelirin yeniden dağıtımı ise sırasıyla mutlak yeniden dağıtım ve nispi yeniden dağıtım olmak üzere iki değişken ile ölçülerek gayri safi milli hasıla (GSYH) büyümesi üzerindeki etkileri sabit etkiler modeli kullanılarak 15 OECD ülkesi için incelenmiştir. Çalışmanın ilk aşamasında kişi başı GSYH, nüfus büyümesi, fiziksi sermaye değişkeni olarak gayri sabit sermaye oluşumu, beşeri sermaye değişkeni olarak orta dereceli okul kayıt sayısı değişkenlerinin kişi başı GSYM büyümesini tahmin etmek için kullanıldığı temel büyüme modeli tahmin edilmiştir. Takip eden iki aşamada, sırasıyla yeniden dağıtım ve eşitsizlik değişkenleri sırasıyla modele eklenmiştir. Dördüncü ve son aşamada ise insani gelişmişliğe dair kontrol değişkenleri olan beklenen yaşam süresi, doğurganlık hızı, demokrasi indeksi ve hukuk üstünlüğü indeksi değişkenleri modele eklenmiştir. Bu dört model mutlak yeniden dağıtım ve nispiy eniden dağıtım değişkenleriyle ayrı ayrı tahmin edilmiştir. Çalışma sonucunda mutlak yeniden dağıtım ve nispi yeniden dağıtımın iktisadi büyüme üzerinde istatistiksel olarak anlamlı negatif etkileri, gelir eşitsizliğinin istatistiksel olarak anlamlı ve negative etkisiyle birlikte tespit edilmiştir. İnsani gelişmişlik değişkenlerinin bulunduğu genişletilmiş modelde ise mutlak ve nispi yeniden dağıtım değişkenlerinin iktisadi büyüme üzerinde anlamlı bir etkisi bulunmamaktadır.

Anahtar Kelimeler: mutlak yeniden dağıtım, nispi yeniden dağıtım, gelir eştsizliği, iktisadi büyüme, OECD

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Table of Contents

List of Tables

List of Figures

LIST OF ABBREVIATIONS

OECD:	Organization for Economic Co-operation and Development
GDP:	Gross Domestic Product
WB:	World Bank
EIU:	Economist Intelligence Unit
SWIID:	Standardized World Income Inequality Database
GCF:	Gross Capital Formation
OLS:	Ordinary Least Square

1. Introduction

Main social and economic objectives of the welfare system are controlling income inequality, economic progress, and attainment of prosperity. The objective of decreasing income inequality is much linked with philosophical views of justice, humanitarianism, and equality. Rawls (1971) stresses that economies need to encourage each resident to accomplish their own goals by ensuring the rational egalitarianism of opportunities. Also, the aim of reducing economic inequality may be associated with the provision of a specific state-assured degree of income security.

Social researchers have been discussing how economic inequality is occurred and how it accumulates over time. As explained by Kuznets (1955) the progress that an economy undergoes through a structural change leading to income inequalities, the interrelationship between economic growth and income dispersion, and income redistribution came to the attention of scholars. He suggested that income inequality first raises and then subsequently goes down when employees move from low-productivity crops to high-productive production. For achieving higher levels of economic growth, primary production should not cost too much; public expenditure in the form of transfers should not negatively impact incentives for growth. decreasing economic disparity needs government policies that would be considerably more beneficial to the poor in the longer term. (OECD 2012). Okun (1975) claimed that income inequality encourages economic growth, and the tax and transfers are the tools for public redistribution, which Okun compared with "leaking bucket" with money lost as taking transfer and tax from the rich to the poor.

There have been several studies on the relationship between inequality, redistribution, and economic growth, although the mechanism between them seems to be far from being straightforward. In the literature, it is stated that there is positive impact of income inequality on economic growth through work incentives and saving (Castelló-climent 2007; Arjona et al 2003; Gerhart 2013). On the other hand, negative impact of uneven income distribution on economic growth is identified through credit market imperfection, endogenous fertility, sociopolitical unrest and endogenous fiscal policy (Keefer and Knack 2002; Galor and Moav 2004; Alesina et al 1994; Leoni et al 2006).

Income redistribution, on the other hand, has economic growth inducing effect through giving financial resources to the poor people, so they can achieve their aims (Trau 2012; Boadway and Keen 1999) It is also stated that, income redistribution has negative impacts on economic growth through discouraging physical or human capital accumulation by decreasing returns on investment (Klaus Gründler and Scheuermeyer 2015).

Despite the wide literature on the relationship between the income inequality and economic growth and income redistribution and economic growth separately, there are not many studies in literature that examine the interconnections between economic growth, income disparity and redistribution at the same time. Some studies have highlighted the effect on economic growth of income inequality, ignoring the redistribution of income and their effects on economic growth. On the other hand, certain studies have shown how the distribution of income is related to economic growth, and the consequences of redistributive policies on economic growth are not taken into account. This study will examine the impact of income inequality and income redistribution on economic growth in selected OECD countries by using data from World Bank, SWIID, OECD database and EIU, and contribute to the literature by exploring the association between economic growth and income inequality and income redistribution in the same model. The results of the thesis can help policymakers to create and implement effective growth policies in the presence of income inequality and also the redistribution policies that can increase the economic growth.

The structure of the thesis will be as follows. In chapter 2, the theoretical link between income inequality, redistribution, and economic growth will be examined. Chapter 3 will review the literature on the relationship between income inequality, redistribution, and economic growth. Chapter 4 explains the methodology and data used in the study. Chapter 5 will present the estimation result and chapter 6 will present the conclusion.

2.Theoretical Link Between Inequality, Redistribution, and Economic Growth

This section aims to investigate the theoretical explanation of the impact of income inequality and income redistribution on economic growth.

2.1.Income Inequality and Economic Growth

Incentives and saving are the main channels through which income inequality may encourage the economic growth. Working hard involves a cost (mental or physical exertion effort, work time, etc.). A rational person will make an effort only if he obtains pay equal with his efforts. Suppose there is an employer and a large number of employees, and that the success of a project is based on the effort made by the project participants. The employer cannot examine the employees' efforts but can evaluate the final outcome of their work. Nobody will be given an incentive to work hard, if the company offers a fixed salary for everyone regardless of the individual effort. On the other hand, if a greater variable payment is made for those who achieve good results and payments are reduced for those who underperform, employees are encouraged to do their best. Consequently, if when unequal reward is paid, productivity and production levels are increased. Adding this argument to the entire economy indicates that incentives can encourage higher income levels (Arjona et al 2003; Gerhart 2013).

The theory that concentration of income and wealth supports an increase in savings is based on the assumption that the rich saves more than the poor. The transfer of income from the poor to the rich would therefore lead to higher economic growth. Indeed, the actual causal impact between inequality and savings is far from the evident. There are a number of alternative theoretical proposals on that, suggesting that these two variables are related positively, negatively or neutrally (Gerhart 2013).

Castelló-climent (2007) claimed that saving rate increases with wealth and income. Inequality raises the income of the wealthier population, which has greater savings rates, so that inequality promotes the capital accumulation and, as a result, the economic growth. Positive impacts of income inequality on saving are the main reasons why income inequality might have impact on economic growth positively in case of high income classes are more likely to save marginally and saving and investment rates are positively linked.

There are two possible explanations on why income inequality may decrease the economic growth. Firstly, as explained by Leoni et al (2006), income inequality raises societal discontent and fosters social unrest; the latter has a negative impact on investment and hence decreases growth through increased likelihood of coups, revolutions, mass violence or, more broadly, increased political instability and damaged property rights. Keefer and Knack (2002) claimed that more unequal societies may be less socio-political stable, because inequality reduces costs to participate political affairs. Unequal countries are witnessing increasingly violent manifestations, ethnic conflict and political division that might affect the safety of property and contract rights.

Secondly, human capital stock is accepted as another channel that may have negative impact on economic growth, and income distribution. Credit market imperfection prohibits people who lack financial funds from realizing their potential, that decreases investment in human capital knowledge, reduces economic growth by reducing human capital stock, so inequality has a economic growth decreasing impact. As the economic impact of schooling has increased in today's knowledge economies, it's possible that the deteriorating impacts of income inequality on accumulation of human capital will be more observed (Galor and Moav 2004).

2.2. Redistribution and Economic Growth

Not just the income dispersion level can influence growth, but also the policies that are implemented to provide an evenly distributed income by taking tax and transfer from high income earners to finance public expenditure and labor market policy tools such as unemployment pay and minimum wage (Wang et al 2012).

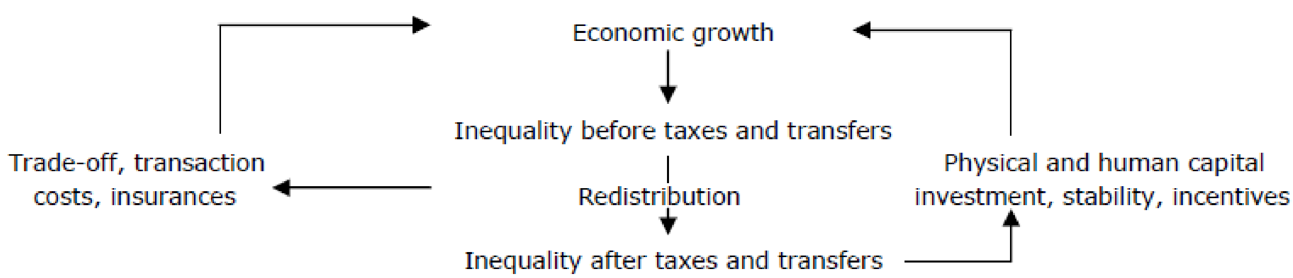
Trau (2012) indicated that redistribution can influence trade union's bargaining power on labor markets, reduce income disparities through progressive taxation, and provide financial resources for individuals who are unable to engage in market activities or require assistance on low market incomes. The dynamics between income redistribution and economic growth is not straightforward. Public policies that may have redistributive impacts that can foster economic growth, through a public insurance plan that markets cannot efficiently cover for risks like unemployment, disability and old age (Boadway and Keen 1999).

The economic mechanism on the negative redistribution incentive effects focuses on the fact that redistributive taxes discourage physical or human capital accumulation by decreasing returns on investment. In addition, a welfare system discourages wealthy to work, so it decreases economic growth. Indirect redistribution needs to be engaged by the government through providing free public goods, this can result in increased social mobility and equalization of market income that are not covered in typical redistributive mechanisms like taxes and transfers (Gründler and Scheuermeyer 2015).

2.3. Income Inequality, Redistribution and Economic Growth

Figure 1 indicates the mechanism between economic growth, income inequality, and redistribution. As explained by Thewissen (2012), income inequality effects negatively economic growth in short-run, and to eliminate that effect, the government needs to have redistribution policy to equalize the income among the individuals. Redistribution also has negative effect on economic growth, but it reduces income inequality by taking tax and transfer from the persons who have high income, this causes decrease in investment because people become discouraged by the tax, and it lowers the incentives to work. On the other hand, the poor people or individuals with low income acquire the financial resource to finance their education and healthy expenditures. The stability in the economy which may gained from these developments can benefit to decreasing crimes and protests in the society.

Figure 1. The Hypotheses of Income Inequality, Redistribution and Growth



Sources: Thewissen (2012, 4)

3. LITERATURE REVIEW

In this chapter, the existing literature regarding the relationship between income inequality, redistribution and economic growth will be presented.

3.1. Income Inequality, Redistribution, and Economic Growth

There are several of studies that discuss the impact of inequality and redistribution on the economic growth.

Adams (2003) aimed to examine the effect of economic growth on poverty and income dispersions in 50 developed countries by using data between 1980 and 1999 from the World Development Indicator. Using descriptive statistics, he showed a weak correlation between economic growth and poverty reduction as calculated by survey mean income.

Knowles (2005) explained the empirical relationship between inequality and economic growth in 27 countries by employing annual data between 1960 and 1970 obtained from Penn World Tables and World Income Inequality Database. Using cross-country growth regression, the study indicated that economic growth and income inequality have a negative relationship for the after redistribution case.

Akhmad et al (2010) explained the relationship between economic growth, income disparities and poverty in 33 regions in Indonesia by using panel data between 2009 and 2015 obtained from the Indonesian Ministry of National Development Planning and Indonesian Central Bureau of Statistics. By using descriptive and multiple linear regression methods, the study showed that Indonesia's poverty rate has decreased in tandem with the country's improving economic conditions, measured by the annual average economic growth which was more than 5%. The regression analysis results revealed that the Gini index has a substantial and significant impact on the rise of poverty. Human development index has a significant decreasing impact on poverty. Meanwhile, the Gross Regional Domestic Product (PDRB) has a negative but insignificant impact on poverty reduction.

Thewissen (2012) aimed to investigate the dynamics between income inequality and redistribution and economic growth by using data 30 OECD countries between 1975 and 2005 obtained from the OECD Database for panel design. By employing General Method of Moments, the study showed that there is no significant association between income inequality and economic growth, and income redistribution reduces the economic growth.

Ncube et al (2014) explained the relationship between economic growth and income inequality in the Midlle East and North Africa (MENU) region by using data between 1985 and 2009. By using cross-sectional time series data, they discovered that high dispersion in income levels decreases the economic growth and raises poverty. Economic growth, exchange rate, initial per capita GDP, CPI, and primary education are found to have a significant negative impact on economic growth. Domestic investment levels, urbanization, infrastructure production, and mineral rent (% of GDP), on the other hand, are variables that are positively and substantially correlated with MENUs economic growth. Apart from income inequality, foreign direct investment, population growth, inflation rate, and primary education are all variables that contribute the poverty.

Dabús et al (2014) explained the relationship between income inequality and economic growth in 112 developing countries using data between 1980 and 2014 obtained from World Bank Database. By using dynamic panel estimation, the study found that income inequality positively effects economic growth in the countries with higher GDP.

Rabnawaz (2015) aimed to reveal the association between corruption, income inequality and economic growth. Findings of the study showed that corruption and income inequality are inversely proportional to economic growth. Increased corruption results in monetary disparities, which disrupts civil order through street violence and a lack of confidence in society. Inequality often has a detrimental impact on economic growth, and it effects individuals' attitudes owing to inequality of opportunities and financial purchases. Furthermore, corruption and inequality affect the social system's supply and demand, restricting economic growth.

Gründler and Scheuermeyer (2015) aimed to reveal association between income inequality, redistribution and economic growth by using all available data in the SWIID, the study found that the negative direct growth impacts is combined with the indirect positive effect of lower inequality, so the aggregate impact of redistribution is negligible. Although advanced economies primarily drive this outcome, redistribution helps underdeveloped and developing countries to grow the size of their economies.

Asghar et al (2016) explained the relationship among income inequality, redistribution and economic growth in twelve Asian countries by using data between 1996 and 2013 obtained from SWIID, World Development Indicator and Quality of Government Basic Data. The paper showed that income inequality has a negative impact on economic growth, while redistribution has a positive impact, also it is revealed that redistribution and economic growth have a unidirectional causality with the direction from redistribution to economic growth. For economic stability, the study indicates that better redistribution policies for reducing inequality and boosting economic growth should be formulated and enforced in these countries.

Wanyangathi (2016) aimed to investigate how income inequality influences economic growth in Kenya using data between 1950 and 2006 obtained from Kenya National Bureau of Statistics, World Bank Database and the Penny World Table. By using a series of OLS regression, they found that income inequality has a destructive effect on economic growth and productivity. Income dispersion is large due to fact that wealth is held by a few in the country.

Kandek et al (2017) aimed to investigate the relationship between regional income disparity and local economic growth in 357 American metropolitan cities by using data between 2010 and 2015 obtained from mainly United States Census Bureau. By using a series of OLS regression, they showed that income dispersion effects GDP per capita growth positively and impact of GDP per capita was found to be insignificant.

Biswas et al (2017) aimed to show the impact of income inequality and tax policy on economic growth in 49 US states by using data between 1980 and 2009 obtained from U.S. Department of Commerce Bureau of Economics Analysis (BEA). Using OLS regression, it is presented that lower income dispersion between low and median-income families foster the economic growth.

Lahouij (2017) explained the relationship between income inequality and other potential determinants on the economic growth of a group of oil-importing MENU countries using panel data from 1980 to 2007 obtained from World Development Indicator and Penn World Table. Using fixed and random effect model, dynamic panel model and Genelized Method of Moments, the study revealted that income dispersion reduces the economic growth.

Pollan (2017) explained the relationship between income inequality and economic growth in India using data between 1948 and 1972. Using cross-sectional data, the paper found that there is significant positive effect of income inequality on economic growth, which is quite opposite to the modern viewpoint.

Adinde (2017) aimed to study the relationship between income inequality and economic growth by using data between 1984 and 2005 by using data from World Bank Database, the National Bureau of Statistics, and a statistical website called KNOEMA. By using granger causality test, and multiple regression analysis for examining the relationship between the Gini coefficient and GDP, the findings show that GDP, CPI, population growth, and schooling are essential factors determining Nigeria's income inequality. According to the study results, as Nigeria's economy grows, income inequality worsens.

Papadimitriou et al (2019) aimed to examine how redistribution help to build a more stable economy in US economy's current state by using data between 2007 and 2019 obtained from Federal Reserve and World Inequality Database. The found that a redistribution of income toward middle- and low-income families have a strong positive macroeconomic impact in the form of an increase in consumer spending.

Vo et al (2019) explained the relationship between income dispersion and economic growth in developing countries by using data between 1960-2014 taken from SWIID, World Development Indicator and Penn World Trade. Using granger causality test and general method of moments, they found a casual relationship between economic growth and income inequality, and the negative impact of income inequality on economic growth.

Çepni et al (2020) examined the impact of income inequality on economic growth in 48 contiguous US states by using data between 1948 and 2014 obtained from Federal Reserve Bank and Bureau of Economic Analysis. Using linear regression analysis, they found that there is significant positive impact of income dispersion on economic growth at lower levels of development. At higher level of development, income inequality has a significantly negative impact on economic growth.

Topolewski (2020) aimed to evaluate the nature of the dynamics between income inequality and economic growth, as well as the direction of the impact of income inequality on growth by using data between 2001-2018 obtained from Eurostat and the World Bank databases. By using dynamic panel models, they found a negative association between income inequality and economic growth.

Seo et al (2020) showed the effect of income inequality on economic growth in 77 countries by using data between 1982 and 2011 obtained from WIID, SWIID and Luxembourg Income Inequality. Using nonlinear regression model, they estimated that the nonlinear relationship exists between inequality and growth, It seems as if there is a value in the Gini coefficient and that an increase follows the decrease in inequality in the degree of economic growth if inequality exceeds the threshold.

Weisstanner (2020) explained the impacts of relative and absolute redistribution in 20 advanced economies by using data between 1985 and 2019 obtained from OECD income distribution database and Luxembourg income study. Using OLS regression, the paper found that income increase promotes redistribution preferences. Individuals who have seen less or more real income growth over the last five years are more likely to demand less or more redistribution.

3.2. Population Growth and Economic Growth

Akinwande et al (2012) explained the relationship between population growth and economic growth in some developing (Mexico, Bangladesh, Indonesia, Ethiopia, and Nigeria) and developed (Germany and United States) countries by using data between 1980 and 2010 obtained from World Development Indicator. They found that excluding Mexico of the upper middle income group, the actual economic growth is greater in developed nations (the United States and Germany) with high population sizes compared to the world's selected developing countries.

Peterson (2017) explained how population growth and economic growth have been correlated over the last 200 years using historical data. The study found that low increase in population in high-income countries has a potential to create social and economic issues, while rapid growth in population in underdeveloped countries has the potential to reduce the economic growth.

Mahmoudinia et al (2020) aimed to explore the long-term and short-term link between population growth, GDP growth and capital stocks in Organization of Islamic Cooperation (OIC) countries using data between 1980 and 2018 obtained from World Development Indicator. Using OLS regression and Granger casuality test, they showed that, taking GDP growth and capital stock as dependent variables, in long-run, the population growth has a positive and statistically significant impact on economic growth. In addition, for the OIC countries the bidirectional relationship of population and short-term economic growth has been revealed.

Mamingi and Perch (2013) investigated the nature of the association between population growth and economic growth and development in Barbados using data between 1980 and 2010 obtained from World Bank Development Indicators and Central Bank of Barbados. Using autoregressive distributed lag method, the paper found that the relationship between population density and population growth is significantly positive, population growth is affected by economic growth negatively; economic growth has a negative and significant impact on population growth and net international migration has a significantly distorting effect on population growth.

Kuhe (2013) aimed to analyze the association between population growth and economic growth in Nigeria employing annual between 1960 and 2015 obtained from Tilasto database. Using generalized least squares unit root test, error correction model, and VAR Granger causality tests, the paper showed that there is a long-run link between population increase and economic growth in Nigeria. In the long run, urban, rural, and overall population growth are all found to have positive and significant influence on Nigerian economic growth, but the impact of population growth on economic growth is found in the short run.

Maestas et al (2016) aimed to evaluate the economic impact of population aging on state output per capita among US states using data between 1980 and 2010 obtained from Census Integrated Public Use Microdata Series (IPUMS) and American Community Surveys. Using ordinary least square, they found that a 10% rise in the proportion of the population aged 60 and up reduces GDP per capita growth by 5.5 percent. Slower growth in labor productivity throughout the age accounts for two-thirds of , while slower labor force growth accounts for one-third. Due to population aging, the findings suggest that annual economic growth will decrease by 1.2 % in this decade and 0.6 % in the next decade.

Peter and Bakari (2018) aimed to show the effects of population growth and fertility on the economic growth in African countries using panel data between 1980 and 2015 obtained from World Development Indicators database. Using a dynamic panel model of difference and system GMM, the paper suggested that population growth has positive impact on economic growth while fertility effecting economic growth negatively in Africa.

Thuku et al (2016) aimed to examine the relationship between economic growth and population growth in Kenya using annual time series data between 1963 and 2009 obtained from Statistical Abstract and Economic Survey of Kenya and National Bureau of Statistics Database of Kenya. Using VAR method, the paper indicated that population growth and economic growth have positive relationship and that an increase in population will positively effect the country's economic growth.

3.3. Human capital and economic growth

Gumus and Kayhan (2012) studied the association between GDP per capita and primary, secondary and tertiary school enrolment in Turkey by using data between 1980 and 2008 obtained from OECD Library Database and National Education Statistics. Using Granger casuality test, they revealed that the relationship between GDP per capita and the primary school enrolment rate are bi-directionally statistically significant. The study also showed a substantial correlation between secondary level education and GDP per capita but this was only significant in one direction: from per capita GDP to secondary education enrolment rate.

Abugamea (2017) aimed to show the relationship between education and economic growth in Palestinian by using data between 1990 and 2014 obtained from Palestinian Central Bureau of Statistics and Palestinian Ministry of Education. Using OLS regression model, the study found that significantly increasing growth of the number of the high school graduates and technical colleges contributes economic growth negatively, due the weakness of the economic sectors in Palestine.

Cooray (2010) examined the impact of education on economic growth in low and middle income countries by using data between 1999 and 2005 from UNESCO and World Bank. By using GMM and OLS, the study found that education, as measured by enrolment ratios, explicitly influences economic growth. Government spending indirectly effects economic growth since it improves educational quality.

Nowak and Dahal (2016) investigated the relationship between education and economic growth in the long-run in Nepal using data between 1995 and 2013 obtained World Development Indicator, International Monetary Fund and United Nation Development Program. Using the Johansen Cointegration technique and OLS, they revealed that secondary and higher education contribute significantly to Nepal's economic growth. Elementary education has an insignificant positive impact on economic growth. The findings of the cointegration test indicated that there is a long-run relationship between education (a well-educated human capital) and economic growth.

Maneejuk and Yamaka (2021) examined the impacts of education on economic growth in Thailand, Indonesia, Malaysia, Singapore, and the Philippines using data between 2000 and 2018 obtained from International Labour Organization and World Development Indicator. By using OLS, the paper showed that there is nonlinear effects of the government expenditure per tertiary student on economic growth, Secondly, it is found that an increase in the number of the highly educated workers can have a beneficial or negative impact on economic growth, requiring the implementation of appropriate policies to mitigate the negative effects, Finally, secondary and higher education enrolment rates can contribute the economic growth of 5 ASEAN-countries(both the individual and regional levels).

3.4. Fixed capital formation and economic growth

Pavelescu (2000) examined the relationship between the gross capital formation and economic growth for the European Union countries using data between 1999 and 2006 obtained from UNECE Statistical Database. The study found that gross fixed capital formation contribute the economic growth.

Akindele (2010) conducted a study to investigate the relationship between capital formation and economic growth in Nigeria using data between 1981 and 2009 obtained from Central Bank of Nigeria, National Account of Nigeria and National Bureau of Statistics. Using johansen co-integration technique, error correction model and Granger causality test, the study showed that gross capital formation has a positive impact on economic growth both in the short and long run, as the relationship was significant.

Lach and AGH (2013) examined the relationship between gross fixed capital formation and economic growth in Poland using data between 2000 and 2009 obtained from Census and Economic Information Center. Using granger casuality test, the results of this research showed that fixed capital in Poland remains below its maximizing level of growth.

Tvaronavičius and Tvaronavičiene (2008) examined the impact of fixed capital formation on economic growth in Lithuania using data between 176 and 2006 obtained from Eurostat Database.

The paper showed that there is positive significant effect of fixed capital formation on economic growth.

Onyinye et al (2017) explained the relationship between capital formation and Nigerian economic development using data between 1981 and 2009 obtained from Central Bank of Nigeria and Nigerian Stock Exchange. Using multiple regression, granger causality test, co-integration and vector error correction model, they showed that gross capital formation has an insignificant positive impact on real GDP both in short and long run. The causality test revealed the negative association between government capital expenditure and real gross domestic product in both the short and long run.

Ali (2017) aimed to investigate the relationship between fixed capital formation and economic growth in Pakistan using annual time series data between 1981 and 2014 obtained from International Financial Statistics, Federal Bureau of Statistics, State Bank of Pakistan, and World Development Report. Using Johansen Co-integration approach, the paper found that the relationship between the fixed capital formation and economic growth is significant and fixed capital formation has a long-run relationship with the economic growth.

Dritsakis et al (2006) explored the relationship between gross capital formation, export, foreign direct investment and economic growth in Greece using data between 1960 and 2002 obtained from International Monetary Fund (IMF). By using a multivariate autoregressive Var model and granger casuality tests, the paper revealed a unidirectional causal relationship between gross capital formation on economic growth.

Meyer and Sanusi (2019) examined the relationship between gross domestic investment and economic growth in South Africa by using quarterly data between 1995Q1 to 2016Q4 obtained from South African Reserve Bank. By using VECM and Johansen Cointegration approaches, the paper showed that economic growth, gross domestic investment, and employment have a long-run association. The findings also showed that investment has a long-term positive influence on employment.

3.5. Human Development and Economic Growth

Zaremba and Smoleński (2000) explained the political economic argument for the reverse relationship between democratic levels and economic performance in democratic countries by using data between 1975 and 1997 obtained from World Bank Development Indicator. Using OLS regression, they found that increased democracy tends to enhance per capita income growth rates.

Heshmati and Kim (2017) aimed to investigate the relationship between democracy and economic growth in 144 countries using data between 1980 and 2014 obtined from World Development Indicator and Penny World Table. Using panel data, they showed that the effect of democracy on economic growth is quite positive. The guarantee of credit is one of the major positive links between economic and democratic prosperity. In democratic countries, the marginal effects of credit guarantee and foreign direct inflows of investment are greater than in non-democratic countries.

Doucouliagos and Ulubasoglu (2017) investigated the relationship between democracy level and economic growth by using a meta analysis on developing countries. Using traditional meta regression analysis and fixed and random effect model, they concluded that there is direct effect of democracy on economic growth. However, the impact of democracy and economic growth is significant positive through human capital, lower inflation, lower political instability, and increased economic freedom.

Wittry (2013) aimed to examine the relation between rule of law and economic growth in 134 countries using data between 1984 and 2019 obtained from World Economic Outlook Database, International Monetary Fund and Worldwide Governance Indicators. The study showed that rule of law has a substantial positive relationship with GDP per capita which is strengthening with time, and compatible with alternative rule of law measurements. These results show the relevance of the rule of law in economic growth and income disparity reduction.

Ozpolat et al (2016) examined the relationship between the rule of law and economic growth in underdeveloped, developing, and developed countries by using panel data between 2002 and 2015 obtained from Worldwide Governance Indicators and World Development Indicators. Using Generalized Method of Moments (GMM) and OLS regression, they found that GDP in high-income nations is strongly associated with the rule of law index, corruption index control, voice, and accountability index. On the other hand, the results are not statistically significant for developing and underdeveloped countries.

Boucekkine and Diene (2007) explained the relationship between life expectancy and economic growth in 18 nations using data between 1820 and 2005 obtained data from World Economic Data and Historical Statistics OECD Development Centre. The study revealed that there is a strong and concave relationship between life expectancy and economic growth.

Cervellati et al (2009) examined the impact of life expectancy on economic growth by explicity taking the role of population transition into consideration using data between 1940 and 2000 obtained from UN Demographic yearbook. Using 0LS regression, they suggested that advances in life expectancy mainly increase the population before the demographic shift. However, improvements in life expectancy restrict population growth and encourage the accumulation of human capital after the demographic transition has begun, but before and after demographic transition, that life expectancy does not affect population, human capital and income per capita.

Mahumud et al (2013) aimed to show the effect of life expectancy on economic growth and expenses in healthcare and explore gender-base difference in trend of life expectancy in Bangladesh using data between 1995 and 2011 obtained from World Development Indicator. Using OLS regression, they concluded that the rise in life expectancy has a direct effect on increasing real per capita income and increased spending on health, population planning, and health equity that are crucial for life expectancy.

Prettner et al (2012) aimed to show the relationship between fertility rate, labor supply and economic growth in 118 countries by using data between 1980 and 2005 obtained from World Development Indicator and Global Development Finance. Using random effect and OLS regression, they indicated that a decrease in fertility leads to increase education and health in investment, decreasing fertility rate negatively impact on effective of labor supply and economic growth.

Fox et al (2015) explained the relationship between fertility rate and economic growth in 20 European countries and sub- national regions by using data between 1990 and 2012 obtained from UK data archive, Statistics Romania, and Eurostat. They found that, in many countries, the negative relationship between fertility rate and economic development is weakening, while in others, the positive relationship is strengthening.

4. DATA AND METHODOLOGY

In this chapter, the data and methodology employed in this study are explained in detail. Basic growth model is used as the baseline setting in order to build an extended model to examine the impacts of the redistribution, inequality on economic growth along with control variables. For acquiring the extended model, stepwise inclusion of the redistribution, inequality and human development variables in the baseline model was used as the model building strategy. For predicting the models in a setting of different countries with time series data, panel data analysis method, specifically the fixed effect model is employed with respect to its empirical suitability to the model which is proven by the diagnostics test.

4.1 Panel Data Analysis

Regression and time-series analysis are combined in longitudinal data analysis. Like many regression datasets, longitudinal data is made up of various subjects. With the exception of regression data, longitudinal data enables evaluating individuals over time. Unlike time-series data, longitudinal data allows observing a large number of subjects. It allows the research of both dynamic and cross-sectional dimensions of a problem by observing many subjects over time(Larsen, 2006). Panel data tracks the same people or objects over time and measures any quantity about them Brooks (2008).

Brooks (2008) explained some advantages of the panel data analysis as follows:

● First and most important, panel data allows everyone to solve a larger variety of issues and solve more complex problems than pure time-series or cross-sectional data alone.

● Second, it is commonly interesting to look at how variables, or their interactions, change dynamically (over time). With pure time-series data, a long run of data is often needed to get sufficient observations to perform any useful hypothesis tests. Using the information on the complex behavior of many individuals simultaneously, one can increase the number of degrees of freedom and thus the power of the test by integrating cross-sectional and time-series data. The extra variation added by integrating the data will also help reduce multicollinearity issues that can occur when time series are modeled individually.

● Third, properly structuring the model will eliminate the effect of some types of excluded variables bias in regression outcomes.

This thesis discusses the fixed effects model and the random effects model as two basic models for panel data analysis, as well as consistent estimators for these two models.

4.1.1. Fixed Effect Model

A fixed effect model investigates the interaction between predictor and outcome variables (country, person, company, etc.). Specific features of each person can or may not affect the predictor variables. (For instance, males and females may different attitudes toward a specific issue; a country's political structure may influence trade or GDP, or a company's trading decisions may effect its stock price). The fixed-effect model also assumes that specific time-invariant characteristics are unique to the individual and should not be compared with other individual characteristics. Since each entity is unique, the entity's error term and constant (which captures individual elements) should not be associated Torres-Reyna (2007). The fixed effect equation can be shown as the following equation:

$$y_{ti} = a_i + \beta' X_{it} + u_{it} \tag{1}$$

where a_i (i=1…...n) the unknown intercept for each entity (n entity for specific intercepts), y_{it} is (DV) dependent variable where i= entity and t= time, x_{it} is the vector represent the set of the independent variables (IV), β is vector of the parameters for the independent variables (IV) and u_{it} is the error term.

4.1.2. Random Effect Model

Since the entity's error term is independent from the predictors, time-invariant variables can be used as independent variables in random-effects models. Individual attributes that may or may not affect the predictor variables must be defined in random-effects models. This is because certain variables might not be available, resulting in model bias due to omitted variable bias(Torres-Reyna, 2007). The key difference between fixed and random effects is whether the unobserved heterogeneity effect contains elements associated with the model's regressors (Greene, 2012). Random effect model can be shown as follows:

$$y_{ti} = \beta' X_{it} + a + u_{it} + e_{it} \quad (2)$$

where a is the unknown intercept, y_{it} is (DV) dependent variable where i= entity and t= time, x_{it} is the vector represent the set of the independent variables (IV), β is vector of the parameters for the independent variables (IV), u_{it} is the error term between the entity and e_{it} is error term within entity.

4.1.3 Hausman Test

In the panel data analysis, Hausman test is the commonly used methodology that is employed for choosing between random and fixed effect model. The null hypothesis of the test indicates the random effect model while the alternative hypothesis indicates the fixed effect model. Hausman test methodology simply relies on the testing whether the unique error or characteristics are correlated with the regressors (Upudhyaya, 2016). If the p-value of the Hausman test is more than 0.05, null hypothesis is accepted, and the random model is chosen. If the p-value of the Hausman test is less than 0.05, alternative hypothesis is accepted, and the fixed effect model is chosen.

4.2 Data

This chapter explains the data employed in this study, data resources and variable construction. The annual data covers the period between 2001 and 2017. Based on baseline growth model, log GDP per capita income growth is used as the dependent variable, while the independent variables are log GDP per capita income, population growth, secondary school enrolment as the proxy for human capital and gross fixed capital formation as the proxy for physical capital. The redistribution and inequality variables are added to the model step by step. As the second step, redistribution measures (absolute or relative) are included in the baseline model. After this step, inequality measures which is Gini after tax and transfer is added to the model. As the last step, a set of human development measures namely, the democracy index, rule law index, life expectancy and fertility rate are included in the model as the control variables. Details about the measurement units and resources of each variable can be seen in the Table 1. The study covers 15 OECD countries, namely

Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Germany, Netherlands, Norway, Sweden, Turkey, United Kingdom, and United States. Data set is strongly balanced, and the main sources are the Organization for Economic Co-operation and Development Database (OECD), Standardized World Income Inequality Database (SWIID) and World Development Indicators (World Bank) and Economist Intelligence Unit (EIU). The results of the analysis were obtained using the Stata 15 software.

Table 1. Variables Measurement and Sources

Variables	Unit of measurement\construction	Sources
GDP per capita income	GDP per capita (Current US$)	World Development Indicator
GDP Growth	Gross domestic product (Current US$)	
Population Growth	Population, total	World Development Indicator
Secondary School Enrolment	Number of children enrolled in secondary school	World Development Indicator
Gross fixed capital formation	Gross fixed capital formation, total GDP (current US$)	World Development Indicator
Absolute Redistribution	(Gini before tax and transfer- Gini after tax and transfer)	(SWIID)
Relative Redistribution	(Gini before tax and transfer - Gini after tax and transfer / Gini before tax and transfer *100)	(SWIID)
Democracy	Freedom house index	(EIU)
Rule of Law	Judicial framework independence	(EIU)
Life Expectancy	Expected years of living at birth	(OECD)
Fertility Rate	Birth rate	(OECD)

The variables used in the study, their unit of measurement and sources can be seen in Table 1. GDP per capita is measured as total GDP divided by population in the country. Log transformation is undertaken for the GDP per capita variable. Economic growth is calculated by using log GDP per capita variable.

Total population is a measure of the total number of people who live in a country. World Bank uses each country's individual estimates for compiling this data. For population estimates, details can be taken from the country's most recently available records and updated by the sources of population change generated since the last statistics. The growth of the population is calculated by using population data.

Human capital is an essential determinant of economic growth since it boosts individual's inventive capability. In the model, secondary school enrolment compiled by World Bank is employed as a proxy for human capital.

Another determinant of the growth model is physical capital which covers all the physical equipments and inputs in the production process. Gross fixed capital formation is added in the model as a proxy for physical capital. Gross fixed capital formation is a form of investment that is defined as the acquisition of produced assets.

Income redistribution is the transfer of income from one individual to another through a social process such as taxes, charity, or welfare. The concept usually applies to redistribution across the entire economy rather than amongst specific individuals. To address the effect on redistribution on economic growth, two redistribution measures are employed in the study, namely absolute redistribution and relative redistribution. Absolute redistribution is measured as the differences between market and disposable income inequality. In order to gain the relative redistribution, absolute redistribution is divided by the market income inequality and multiplied by 100.

As market and disposable income inequality measures, Gini before taxes and transfers and Gini after taxes and transfers are used respectively. The Gini coefficient measures the inequality in frequency distribution values (levels of income). A Gini coefficient of 0 denotes complete income equality in which each individual has the same income, while a Gini coefficient of 1 denotes the greatest income inequality in which only one individual possesses all income in the society and the rest of the society has no income.

In order to extend the growth model employed in the study, some human development indicators are included in the model as well. Human development is defined as the process of improving people's prosperity, freedom and opportunities and it is a crucial factor in increasing society's wellbeing along with the economic growth. Some of the most important indicators which are democracy and rule of law indexes (calculated by EIU), life expectancy and fertility rate are added to do model in order to extend it. Life expectancy is measured as the average number of years that an individual is expected to live at birth if mortality rates remain constant over the future and it is calculated by the OECD. The fertility rate is the measured of the number of live births that every 1000 women between 15 to 49 years per, it how many children can women between 15 to 49 years old give birth, and it is also reported by the OECD.

By using these variables, a four steps equation system is estimated by using fixed effects models. In the first step, income level measured by log GDP per capita income (GDPpcg), population growth (POg), secondary school enrolment (SSE) for human capital, and log gross fixed capital formation (GFCF) for physical capital are employed to estimate the log growth of per capita income (GDPpcg):

$$LNGDP_{pcgit} = \beta_1 LNGDP_{PCit} + \beta_2 PO_{git} + \beta_3 SSEit + \beta_4 LNGFCFit + uit \qquad (3)$$

A redistribution measure (RED) which is absolute redistribution for the first set of estimates and relative distribution for the second set of estimates is introduced to the model in the second step:

$$LNGDP_{pcgit} = \beta_1 LNGDP_{PCit} + \beta_2 PO_g it + \beta_3 \text{SSEit} + \beta_4 LN\text{GFCFit} + \beta_5 REDit + uit \qquad (4)$$

In the third step, Gini for disposable income (GA) is introduced in the model:

$$LNGDP_{pcgit} = \beta_1 LNGDP_{PCit} + \beta_2 PO_g it + \beta_3 \text{SSEit} + \beta_4 LN\text{GFCFit} + \beta_5 REDit + \beta_6 GAit + uit \qquad (5)$$

In the final step, four human development control variables, namely log life expectancy (LE), log fertility rate (FR), democracy index (D), and rule of law index (RL), are employed in the model:

$$LNGDP_{pcgit} = \beta_1 LNGDP_{PCit} + \beta_2 PO_g it + \beta_3 \text{SSEit} + \beta_4 LN\text{GFCFit} + \beta_5 REDit + \beta_6 GAit + \beta_7 LNLEit + GAituit + \beta_8 LNFRit + \beta_9 Dit + + \beta_9 RLit + uit \qquad (6)$$

(6)

Stepwise estimation of these models makes it possible to control the impact of each variable group on the economic growth and to see their interaction with the target variables which are redistribution and inequality.

5. Analysis Results and Discussions

This chapter presents the analysis and the result regarding the relationship between income redistribution, income inequality, and economic growth for selected OECD countries.

Table 2 displays descriptive statistics for GDP per capita growth as a dependent variable and population growth, secondary school enrolment, gross fixed capital formation, absolute redistribution, relative redistribution, the rule of law, Gini after-tax and transfer, democracy, life expectancy, and infertility rate as independent variables.

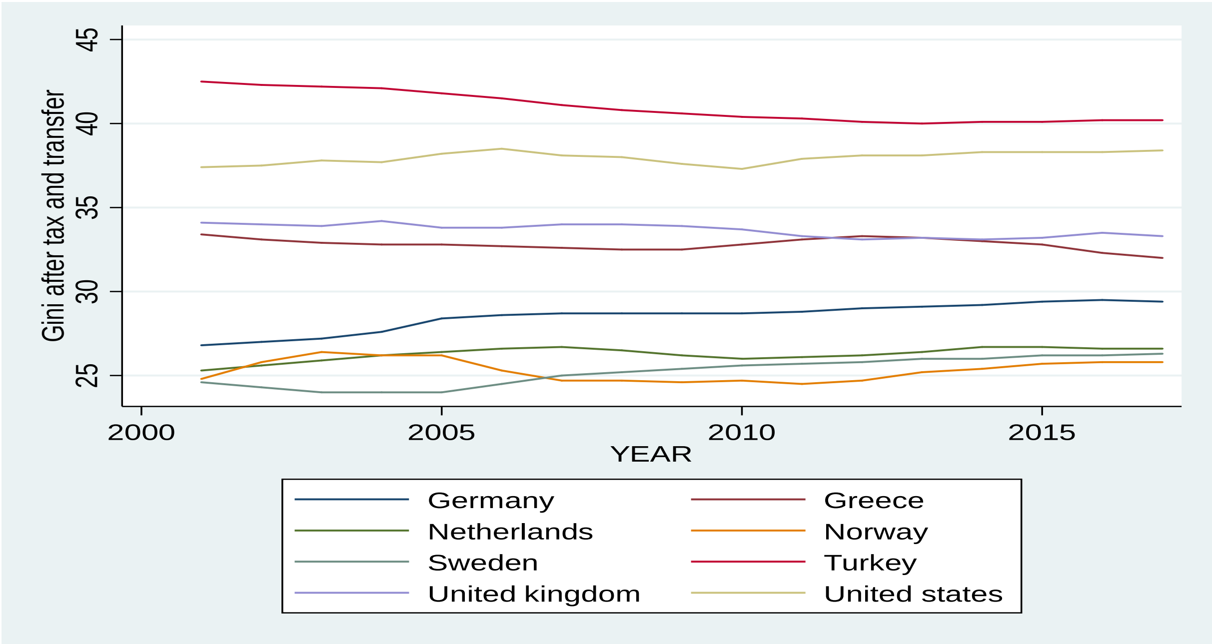
Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Kurtosis	Skewness	Observation
Ln GDP capita growth	0.036	0.0983	-0.3170	0.269	3.519	0.469	N = 255
		0.009	0.021	0.058			n = 15
		0.097	-0.339	0.279			T = 17
GDP per capita income	52318	45063	707.983	24067	7.942	1.756	N = 255
		45124	2149.346	20538			n = 15
		11082	11777.82	87608			T = 17
Population growth	0.006	0.004	-0.018	0.020	5.395	0.288	N = 255
		0.004	-0.000	0.014			n = 15
		0.002	-0.011	0.015			T = 17
Secondary enrolment	112.918	19.506	80.040	163.935	3.369	1.113	N = 232
		19.772	91.321	158.562			n = 15
		8.715	90.154	146.036			T = 15
Gross fixed capital	1.440	5.790	-4.200	2.900	4.685	-0.613	N = 240
		2.470	-4.650	1.010			n = 15
		5.270	-5.060	2.040			T = 16
Absolute redistribution	18.536	5.123	2.5	24.8	5.942	-1.732	N = 255
		5.249	3.052	24.205			n = 15
		0.658	15.989	20.489			T = 17
Relative redistribution	38.223	10.524	5.555	50	2.907	0.892	N = 255
		10.830	6.947	48.979			n = 15
		0.918	34.410	41.085			T = 17
Gini after tax	29.816	4.830	22.8	42.5	6.154	-1.775	N = 255
		4.951	24.547	40.958			n = 15
		0.595	28.069	31.469			T = 17
Democracy	0.818	0.126	0.375	0.965	7.405	-1.812	N = 255
		0.121	0.440	0.926			n = 15
		0.046	0.608	0.936			T = 17
Life expectancy	79.952	2.006	71.5	82.8	2.530	-0.484	N = 255
		1.688	74.717	81.482			n = 15
		1.164	76.734	83.334			T = 17
Fertility rate	1.742	0.229	1.3	2.4	6.039	-1.942	N = 255
		0.219	1.364	2.141			n = 15
		0.084	1.477	2.001			T = 17
Rule of law	0.882	0.123	0.5	1	5.597	-1.680	N = 255
		0.124	0.514	0.983			n = 15
		0.026	0.781	0.937			T = 17

Source: Computed by the researcher using data from SWIID, World Bank, and OECD

Table 2 indicates that the average log GDP per capita growth for selected countries is (0.036) unit, its standard deviation is (0.0983), the maximum GDP growth is (0.269). These values indicate a significant variation in growth rates of selected countries. For the case of GDP per capita growth, the skewness (-0.469) and kurtosis (3.519) values show that its distribution is skewed and peaked. The average GDP per capita income (current US $) is (52318.7), its standard deviation is (45063.9), and the maximum GDP per capita income rate is (24067). The average population growth is (.006), its standard deviation is (0.004), and the maximum population growth is (0.020). The mean of secondary school attainment is (112.9), its standard deviation is (19.5), and the maximum secondary school attainment is (163.9). The average of fixed capital formation (current US $) is (1.440), its standard deviation is (5.790), and the maximum rate of fixed capital formation is (2.900). The mean of absolute redistribution is (18.5), its standard deviation is (5.12), and the maximum rate of absolute redistribution is (24.8). The average relative redistribution is (38.2), its standard deviation is (10.5), and the increasing rate of relative redistribution is (50). The average Gini after tax is (29.81), its standard deviation is (4.83), and the maximum rate of Gini after tax is (42.5). The average life expectancy is (79.95), its standard deviation is (2.066), and the increasing rate of life expectancy is (82.8). The mean fertility rate is (1.742), its standard deviation is (0.229), and the increasing rate is (2.4). The average index of democracy is (0.81), its standard deviation is (0.12), and the maximum value is (0.965). The average index of the rule of law is (0.882), its standard deviation is (0.123), and the rising value is (1).

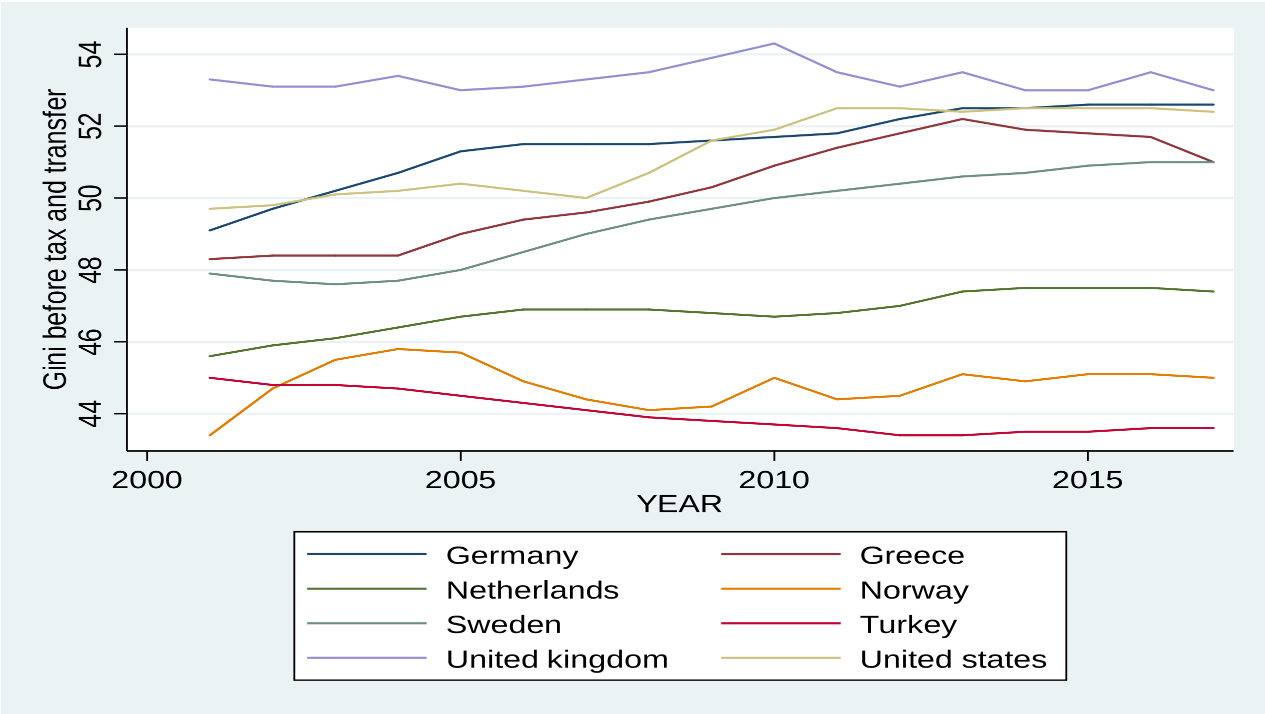
Figure. 2 Gini After-Tax and Transfer Across Selected OECD Countries.



Sources: Prepared by the researcher by using data from SWIID

Figure 1 shows the Gini after tax and transfer values between the years 2001 and 2017 for only a limited number of the selected countries that show variation in disposable Gini values. This figure indicates that Turkey and the United States have the highest Gini after-tax and transfer values that implies relatively higher disposable income inequality for these countries. On the other hand, Norway, Netherland, and Sweden have the lowest disposable income inequality.

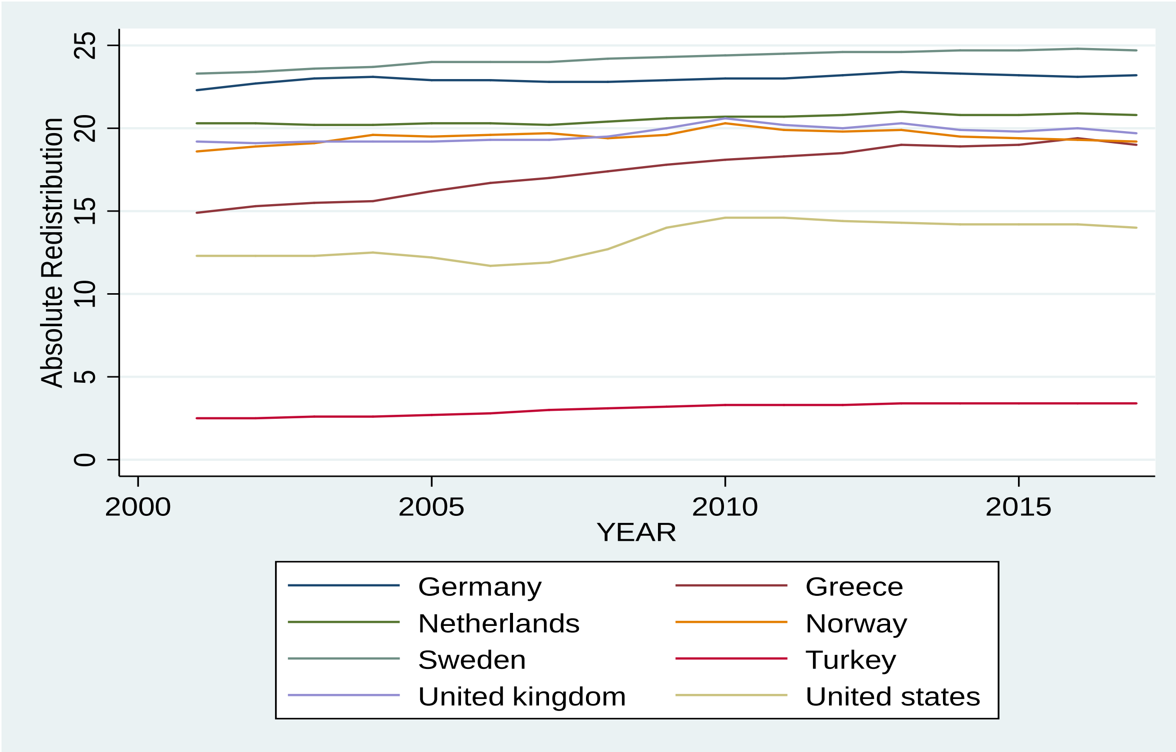
Figure. 3 Gini Before Tax and Transfer Across OECD Countries.



Sources: Prepared by the researcher by using data from SWIID

Figure 2 shows that the Gini before tax and transfer values between the years 2001 and 2017 for only a limited number of the selected countries that show variations in market Gini values. Figure 2 indicates that United Kingdom, Germany, and the United States have the highest Gini before tax and transfer values while Turkey, Netherlands, and Norway have the lowest Gini before tax and transfer values. For the case of Turkey, the difference between before and after-tax Gini ratios deserves more attention. This behavior may imply the inequality increasing effect of redistribution in Turkey.

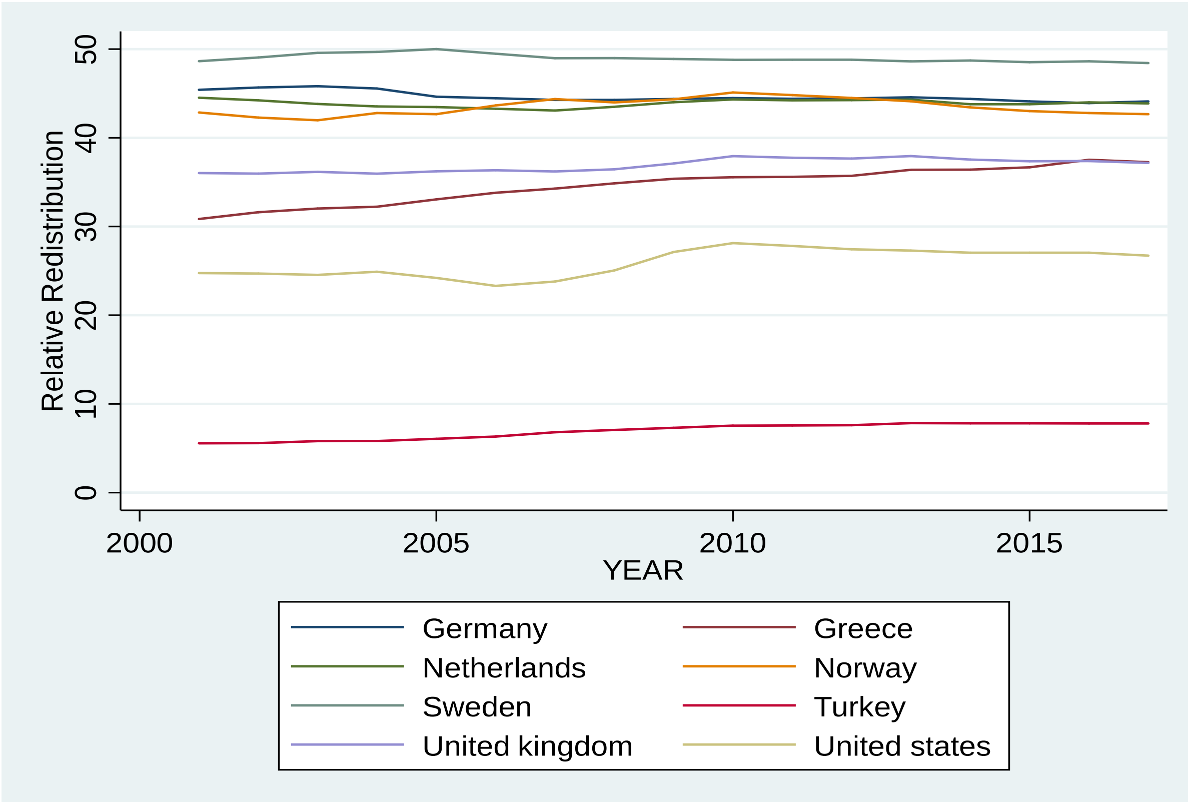
Figure.4 Absolute Redistribution Across OECD Countries



Sources: Prepared by the researcher by using data (SWIID)

Figure 3 indicates that Sweden, Germany, and the Netherlands have the highest absolute redistribution. United States, Greece, and Norway have a relatively low level of absolute redistribution, while Turkey has the lowest absolute redistribution compared to the rest of the country sample.

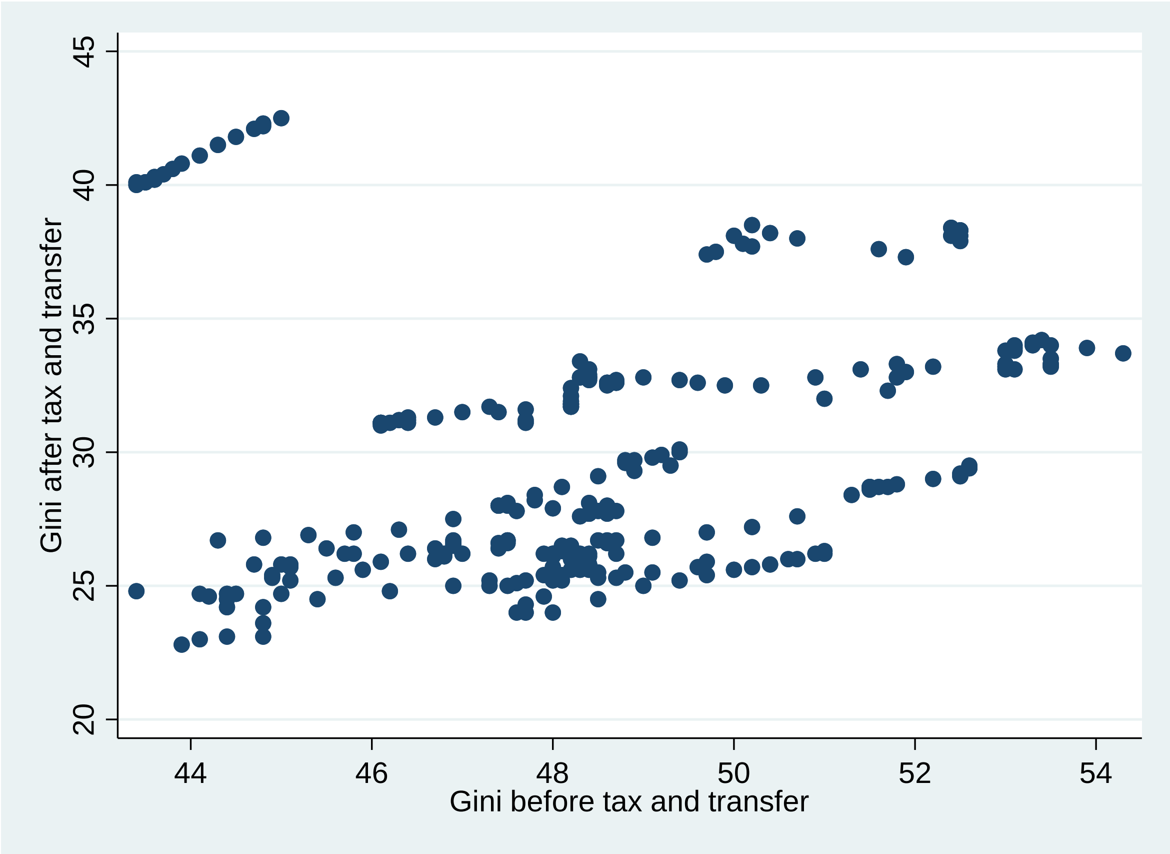
Figure.5 Relative Redistribution Across Selected OECD Countries



Sources: Prepared by the researcher by using data from SWIID

As shown in figure 4, relative redistribution shows the same behavior with absolute redistribution for the selected countries.

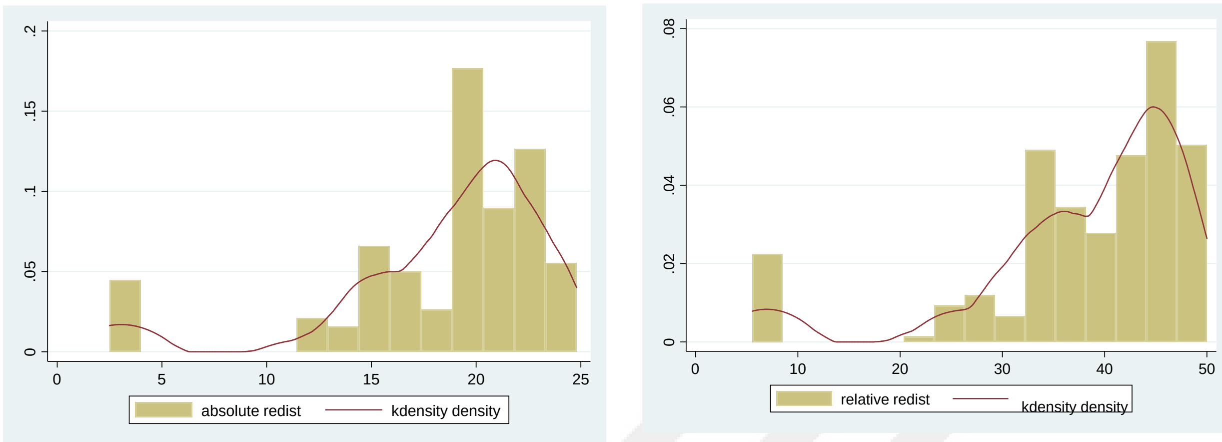
Figure 6. Relationship Between Gini Before Tax and Transfer And Gini After-Tax And Transfer



Sources: Prepared by the researcher using data from SWIID

The relationship between the Gini before and after-tax and transfer can be seen in Figure 5. This figure indicates a positive but not very strong relationship between Gini before and after-tax and transfers with a 0.455 correlation coefficient which is statistically significant. As shown in the figure, some outliers cases correspond to high Gini after-tax and transfer and relative low Gini before tax and transfer exits in the sample.

Figure.7 Absolute Redistribution and Relative Redistribution Across Countries



Sources: prepared by the researcher using data from SWIID Absolute REDIST: N= 255, standard deviation= 5.12, Skewness= -1.73239, kurtosis= 5.942. Relative REDIST: N= 255, standard deviation= 10.52442, skewness= -1.680313, kurtosis= 5.597519.

Figure (6) shows kernel distribution of absolute and relative redistribution of 17-year average for all countries. Both distributions show a right-skewed behavior. The mean value of absolute redistribution is (18.53) points, with a standard deviation of (5.12). In the case of absolute redistribution, Sweden has the highest mean (24.20), while Turkey has the lowest (3.052) mean. Greece has the highest standard deviation (1.50), while France has the lowest standard deviation (.167).

The mean value of relative redistribution is 38.2 points, with a standard deviation of (10.52), which shows variation in relative levels of redistribution across countries. In the case of relative redistribution, Sweden has the highest mean (48.97). while, Turkey has the lowest mean among the OECD countries. Greece has the highest standard deviation (2.07), while Belgium has the lowest standard deviation (.385) among the OECD countries.

In order to see the effect of absolute and relative redistribution on economic growth, a four-step specification is followed for each redistribution measure as indicated above. For the baseline growth model, income level measured by GDP per capita income, population growth, secondary school enrolment as an indicator of human capital, and gross fixed capital as an indicator of physical capital are employed in the first step as shown in the equation 3. As the second and third steps, redistribution and income inequality measures are included in the model respectively. In the last step, some control variables regarding human development, namely, life expectancy, fertility rate, democracy index, and the rule of law index, are included in the model. For choosing the correct model specification method in terms of panel data analysis, The Hausman specification test that aims to see the individual effects in the model is employed. Based on the Hausman test result, fixed effect regression is chosen for all models, which can be seen in detail in the Appendix 1 and 2. Table 3 shows the results of these 4 models with the absolute redistribution as the redistribution measure included in the models.

Table 3. The Effect of Absolute Redistribution On Growth With Fixed Effect Model

Dependent variable: log GDP per capita growth				
Variables	1	2	3	4
lnGDP per capita income	*-0.309* *(0.005)******	-0.019 (0.114)	-0.017 (0.14)	0.060 (0.003)***
Population growth	-1.328 (0.171)	-1.483 (0.125)	-1.311 (0.172)	-1.720 (0.08)*
Secondary school enrolment	-0.000 (0.013)**	-0.000 (0.052)*	-0.000 (0.04)**	-0.000 (0.9)
lnGross fixed capital formation	0.702 (0.000)***	0.691 (0.000)***	0.689 (0.00)****	0.655 (0.000)***
Absolute Redis		-0.009 (0.033)**	-0.008 (0.05)**	-0.003 (0.4)
Gini after tax			-0.008 (0.03)**	-0.006 (0.09)*
Democracy				-0.126 (0.06)*
lnLife expectancy				-1.450 (0.000)***
lnFertility rate				0.000 (0.9)
Rule of law				0.113 (0.2)
constant	0.442 (0.00)***	0.456 (0.000)***	0.680 (0.00)***	5.993 (0.00)***
Observation	232	232	232	232
Countries	15	15	15	15
R-squared	0.85(0.00)***	0.86(0.00)***	0.86(0.00)***	0.87(0.00)***
F test	319.99(0.00)***	261.22 (0.00)***	222.08 (0.00)***	151.49 (0.00)***

Sources: author's calculation using data from the World Bank, OECD database, SWIID, and the Economist Intelligence Unit (EIU) *p<0.1, **p<0.05, ***p<0.01

The fixed-effect models fits the data well with respect to significant R-square and F test values. Column (1) indicates that in the case of log zero GDP per capita income, zero population growth, zero years of schooling, log zero gross fixed capital formation, log GDP per capita growth is expected to increase (0.442) units ($p<0.01$). For 1% increase in log GDP per capita income, the log GDP per capita growth is expected to decrease (*-0.309*) %, holding all other variables constant ($p<0.01$). log GDP per capita income and secondary school enrolment seem to have a negative and significant impact while log gross fixed capital formation effects GDP per capita income growth positively and siginificantly. Population growth is found to be statistically insignificant. Stepwise inclusion of the absolute redistribution and Gini coefficient in the model (2) and (3) respectively does not change the signs and the powers of these explanatory variables initially belonged in the baseline growth model. In model (3), one unit increase in absolute redistribution decreases GDP per capita growth by about *0.8 %*, and GDP per capita growth decreases by 0.8% for one unit increase in Gini after tax and transfer. In model (4), 1 unit increase in Gini after tax and transfer decreases GDP per capita growth by 0.6%. Model (2) shows the negative and statistically significant impact of absolute redistribution on the GDP per capita growth while in model (3), absolute redistribution and Gini after taxes and transfers seem to have significant and negative effects on GDP per capita growth. With the inclusion of the human development indicators in the model (4), population growth has a significantly significant negative impact on GDP per capital income growth and the secondary school enrolment becomes statistically insignificant. In the extended model (4), absolute redistribution becomes statistically insignificant while the Gini coefficient still have a decreasing effect on economic growth, but the magnitude of the coefficient decreases slightly. In model (4), democracy index and life expectancy have statistically significant negative impacts on GDP per capital income growth, fertility rate and rule of law index have no statistically significant impacts on the depended variable. Therefore, absolute income redistribution has negative impact on GDP per capita income growth alone itself and together with the income inequality with the exception of the extended model with human development variables.

Table 4. The Effect of Relative Redistribution on Growth with Fixed Effect Model

Dependent variable: lnGDP per capita growth				
Variables	1	2	3	4
lnGDP per capita income	*-0.309 (0.005)****	-0.030 (0.008)***	-0.020 (0.076)*	0.060 (0.003)***
Population growth	-1.328 (0.171)	-1.355 (0.166)	-1.296 (0.178)	-1.730 (0.07)*
Secondary school enrolment	-.0007 (0.013)**	-0.000 (0.016)**	-0.000 (0.03)**	-0.000 (0.97)
lnGross fixed capital formation	0.702 (0.000)***	0.701 (0.000)***	0.691 (0.00)***	0.654 (0.00)***
Relative Redis		-0.000 (0.803)	-0.005 (0.09)*	-0.002 (0.4)
Gini after tax			-0.013 (0.004)***	-0.008 (0.06)*
Democracy				-0.126 (0.06)*
lnLife expectancy				-1.458 (0.00)***
lnFertility rate				0.000 (0.9)
Rule of law				0.114 (0.2)
constant	0.442 (0.00)***	0.440 (0.002)***	0.921 (0.00)***	6.132 (0.00)***
Observation	232	232	232	232
Countries	15	15	15	15
R-squared	0.85(0.00)**	0.85(0.00)***	0.86(0.00)***	0.87(0.00)***
F test	319.9(0.00)***	254.88(0.00)***	221.11(0.00)***	151.57 (0.00)***

Sources: author's calculation using data from the World Bank, OECD database, SWIID, and the Economist Intelligence Unit (EIU) *p<0.1, **p<0.05, ***p<0.01

Table 4 shows the results of the four step estimations with the relative redistribution included in the models as the redistribution measure. The fixed-effect model seems to be a good fit for the results according to the goodness of fit measures. Inclusion of the relative redistribution does not make any differences in the signs and significance of the baseline growth model variables as in case of the absolute redistribution. In model (3), 1 unit increase in relative redistribution decreases GDP per capita by 0.5% and GDP per capita growth decreases 1.3% for a one unit additional increase in Gini after tax and transfer. In model (4), 1% increase in relative redistribution decreases GDP per capita growth by about 0.002 but this coefficient is statistically insignificant, and GDP per capita decreases by 0.8% for every one unit increase in Gini after tax and transfer. In model (2), relative redistribution is statistically insignificant. However, when relative redistribution is included in the model along with the income inequality, these two measures seem to have a statistically significant negative impact on the GDP per capita income growth. Extending the model (3) with the human development indicators makes the relative redistribution statistically insignificant and leave the effect of the Gini coefficient unchanged as it can be seen in the column (4) which is model (4). In the extended model (4), the impact of the human development indicators is the same as those in the extended model with absolute redistribution. Democracy index and life expectancy have statistically significant negative impacts while the rule of law index and fertility rates are insignificant in the model (4). Therefore, relative distribution is statistically insignificant alone and in the extended model (4), while it has a negative significant impact when it added to model with the income inequality. The impact of the income inequality on the per capita GDP growth is significantly negative in model (3) and model (4).

6. Conclusion

There is complex relationship between income redistribution, inequality, and economic growth. Income redistribution through tax and transfer contribute to decrease income inequality, which can also harm the economic growth. Redistributive policies through investment in education and health care can also promote economic stability and social mobility while increasing income levels. On the other hand, redistribution reduces efficiency, discourage work incentives, and hinder the innovation and productivity.

As explained by Gründler and Scheuermeyer (2015), in developing and middle-income countries, there are negative impacts of inequality on economic growth. Potential negative impacts of inequality is serious due to imperfections in the capital market and the limited welfare system. There is no significant association between inequality and growth in OECD and high-income countries, where opportunities are spread fairly on average. it is also indicated that tax and transfer redistribution contributes to economic growth in poor countries, while it reduces it in wealthy countries.

In the model employed in this study, a four steps equation system is estimated by using panel data analysis with fixed effects models, with the annual data from 2001 to 2017 for the 15 selected OECD countries. In the first step, income level measured by log GDP per capita income, population growth, secondary school enrolment for human capital, and log gross fixed capital formation for physical capital are employed to estimate the log growth of per capita income in the baseline growth model. In the second step, a redistribution measure which is absolute redistribution for the first set of estimates and relative distribution for the second set of estimates is introduced in the model. In the third step, Gini for disposable income is introduced in the model. In the final step, four human development control variables, namely log life expectancy, log fertility rate, democracy index, and rule of law index, are employed in the model.

In the first set of estimations where the absolute redistribution is employed as the income redistribution measure, absolute income redistribution has negative impact on GDP per capita income growth alone itself in model (2) and together with the income inequality in model (3) with the exception of the extended model with human development variables where the absolute redistribution is statistically insignificant. Income inequality has significant negative impact on economic growth in the models. Population growth is statistically insignificant in the first set of models while it has significant negative impact on economic growth in the extended model with human development variables. Secondary school enrollment has significant negative impact on economic growth in baseline growth model and in model (2) and model (3) that contain the relative redistribution and relative redistribution with income inequality respectively, while it is statistically insignificant in the model (4). Democracy and life expectancy are the only statistically significant human development variables which both negatively impact the economic growth.

In the second set of estimations where the relative redistribution in employed as the income redistribution measure, relative redistribution is statistically insignificant when it is added to the growth model alone itself. However, when relative redistribution is included in the model along with the income inequality in model (3), these two measures seem to have a statistically significant negative impact on the GDP per capita income growth. Extending the model (3) with the human development indicators makes the relative redistribution statistically insignificant and leave the effect of the Gini coefficient unchanged. Results regarding the human development indicators, population growth and secondary school enrolment are the same as those in the extended model with absolute redistribution. Democracy index and life expectancy have statistically significant negative impacts while the rule of law index and fertility rates are statistically insignificant. Population growth is only statistically significant in model (4) with a negative impact while the secondary school enrollment has significant negative impact in all models except model (4) where it is statistically insignificant.

Although the results regarding negative impacts of income redistribution and income inequality on economic growth in OECD countries are compatible with the existent literature that shows the same behavior in developed countries, they point out the necessity of formulating new redistribution policies that can foster economic growth and more evenly distributed income at the same time. Although the results of this study are far from being generalizable for the all OECD countries since the number of the OECD countries included in this study is limited due to the limited data availability for the selected variables, the analysis can be retrieved with a wider country coverage and by categorizing the OECD countries with respect to their income levels in the future studies.

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Appendix

Appendix 1. Models with Absolute Variable

Baseline model

Variables	Fixed effect model	Random effect model
lnGDP per capita income	*-0.309* *(0.005)******	0.000 (0.9)
Population growth	-1.328 (0.171)	-1.703 (0.002) ***
Secondary school enrolment	-0.000 (0.013) **	-0.000 (0.142)
lnGross fixed capital formation	.702 (0.000) ***	0.701 (0.000) ***
Constant	0.442 (0.00)***	0.035 (0.213)
Observation	232	232
Countries	15	15
R-squared	0.85(0.00) ***	0.84(0.00) ***
F stat	319.99(0.00) ***	1276.72(0.00) ***
Wald test		

Sources: author’s calculation using data from World Bank

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

Hausman Test for the Baseline Model

Variables	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.

lnGDP per capita income	-0.030	0.000	-0.031	0.010
Population growth	-1.328	-1.703	0.375	0.799
Secondary school enrolment	-0.000	-0.000	-0.000	0.000
lnGross fixed capital formation	0.702	0.701	0.001	0.003
b = consistent under Ho and Ha; obtained from xtreg B = inconsistent under Ha, efficient under Ho; obtained from xtreg Test: Ho: difference in coefficients not systematic chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 14.72 Prob>chi2 = 0.0053				

Sources: author's calculation using data from World Bank

Models with Absolute Redistribution

Variable	Fixed effect	Random effect

lnGDP per capita income	-0.019 (0.114)	0.000 (0.811)
Population growth	-1.483 (0.125)	-1.809 (0.015)**
Secondary school enrolment	-0.000 (0.052)*	-0.000 (0.248)
lnGross fixed capital formation	0.691 (0.000)***	0.701 (0.000)***
Absolute redistribution	-0.009 (0.033)**	-0.000 (0.831)
constant	0.456 (0.000)***	0.0311 (0.384)
Observation	232	232
Countries	15	15
R-squared	0.8604(0.00)***	0.84(0.00)***
F stat	261.22(0.00)***	
Wald test		1271.40(0.00)***

Sources: author’s calculation using data from SWIID and World Bank

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

Hausman Test for the Absolute Redistribution

Variables	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.

lnGDP per capita income	-0.019	0.000	-0.020	0.011
Population growth	-1.483	-1.809	0.326	0.632
Secondary school enrolment	-0.000	-0.000	-0.000	0.000
lnGross fixed capital formation	0.691	0.701	-0.009	0.006
Absolute redistribution	-0.009	-0.000	-0.009	0.004

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 19.77
Prob>chi2 = 0.0014

Sources: author's calculation using data from SWIID and World Bank

Models with Absolute Redistribution and Gini After Tax and Transfer

Variable	Fixed effect	Random effect
lnGDP per capita income	-0.017 (0.14)	0.001 (0.636)
Population growth	-1.311 (0.172)	-1.883 (0.012)**
Secondary school enrolment	-0.000 (0.04)**	-0.000 (0.175)
lnGross fixed capital formation	0.689 (0.00)***	0.698 (0.000)***
Absolute redistribution	-0.008 (0.05)**	-0.001 (0.387)
Gini after tax and transfer	-0.008 (0.03)**	-0.001 (0.327)
constant	0.680 (0.00)***	0.074 (0.190)
Observation	232	232
Countries	15	15
R-squared	0.86(0.00)***	0.85(0.00)***
F stat	222.08(0.00)***	
Wald test		1272.14(0.00)***

Sources: author's calculation using data from SWIID and World Bank

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

Hausman Test for Absolute Redistribution Gini After Tax and Transfer

Variables	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDP per capita income	-0.017	0.001	-0.019	0.011
Population growth	-1.311	-1.883	0.572	0.633
Secondary school enrolment	-0.000	-0.000	-0.000	0.000
LnGross fixed capital formation	0.689	0.698	-0.008	0.005
Absolute redistribution	-0.008	-0.001	-0.007	0.004
Gini after tax and transfer	-0.008	-0.001	-0.007	0.004

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 23.17
Prob>chi2 = 0.0007

Sources: author's calculation using data from SWIID and World Bank

Extended Models with Absolute Variables

Variable	Fixed effect	Random effect
lnGDP per capita income	0.060 (0.003)***	0.007 (0.180)
Population growth	-1.720 (0.08)*	-1.327 (0.128)
Secondary school enrolment	-0.000 (0.9)	-0.000 (0.352)
lnGross fixed capital formation	0.655 (0.000)***	0.678 (0.000)***
Absolute redistribution	-0.003 (0.4)	-0.000 (0.998)
Gini after tax and transfer	-0.006 (0.09)*	-0.001 (0.185)
democracy	-0.126 (0.06)*	-0.063 (0.228)
lnlifeexpectancy	-1.450 (0.000)***	-0.592 (0.000)***
lnfertility rate	0.000 (0.9)	-0.042 (0.063)*
rule of law	0.113 (0.2)	0.031 (0.515)
constant	5.99 (0.00)***	2.654 (0.000)***
Observation	232	232
Countries	15	15
R-squared	0.87(0.00)***	0.86(0.00)***
F test	151.49(0.00)***	
Wald test		1410.21(0.00)***

Sources: author's calculation using data from OECD database, SWIID, the World Bank, and the Economist Intelligence Unit (EIU)

*p<0.1, **p<0.05, ***p<0.0

Hausman Test for Extended Models

Variables	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDP per capita income	0.060	0.007	0.053	0.020
Population growth	-1.720	-1.327	-0.392	0.521
Secondary school enrolment	-0.000	-0.000	0.000	0.000
lnGross fixed capital formation	0.655	0.678	-0.023	0.008
Absolute redistribution	-0.003	-0.000	-0.003	0.004
Gini after tax and transfer	-0.006	-0.001	-0.004	0.003
Democracy	-0.126	-0.063	-0.062	0.046
lnLife expectancy	-1.450	-0.592	-0.858	0.287
lnFertility rate	0.000	-0.042	0.043	0.056
Rule of law	0.113	0.031	0.081	0.093

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 27.90
Prob>chi2 = 0.0019

Sources: author's calculation using data from the OECD database, SWIID, World Bank, and the Economist Intelligence Unit (EIU)

Appendix 2. Models With Relative Redistribution

Models with Relative Redistribution

Variable	Fixed effect	Random effect
lnGDP per capita income	-0.030 (0.008)***	-0.000 (0.889)
Population growth	-1.355 (0.166)	-1.563 (0.030)**
Secondary school enrolment	-0.000 (0.016)**	-0.000 (0.163)
lnGross fixed capital formation	0.701 (0.000)***	0.701 (0.000)***
Relative redistribution	-0.000 (0.803)	0.000 (0.761)
Constant	0.440 (0.002)***	0.042 (0.236)
Observation	232	232
Countries	15	15
R-squared	0.85(0.00)***	0.84(0.00)***
F test	254.88 (0.00)***	
Wald test		1271.71 (0.00)***

Sources: author's calculation using data from SWIID and World Bank

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

Hausman Test for Relative Redistribution

Variables	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDP per capita income	-0.030	-0.000	-0.029	0.010
Population growth	-1.355	-1.563	0.207	0.666
Secondary school enrolment	-0.000	-0.000	-0.000	0.000
lnGross fixed capital formation	0.701	0.701	0.000	0.004
Relative redistribution	-0.000	0.000	-0.000	0.002

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 15.34
Prob>chi2 = 0.0090

Sources: author's calculation using data from SWIID and World Bank

Models with Gini After Tax and Transfer

Variable	Fixed effect	Random effect
lnGDP per capita income	-0.020 (0.076)*	0.000 (0.853)
Population growth	-1.296 (0.178)	-1.700 (0.025)**
Secondary school enrolment	-0.000 (0.03)**	-0.000 (0.152)
lnGross fixed capital formation	0.691 (0.00)***	0.699 (0.000)***
Relative redistribution	-0.005 (0.09)*	-0.000 (0.706)
Gini after tax and transfer	-0.013 (0.004)***	-0.000 (0.579)
constant	-0.921 (0.00)***	0.077 (0.290)
Observation	232	232
Countries	15	15
R-squared	0.86(0.00)***	0.85(0.00)***
F test	221.11(0.00)***	
Wald test		1268.12(0.00)***

Sources: author's calculation using data from SWIID and World Bank

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

Hausman Test for Models with Gini After Tax and Transfer

Variables	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDP per capita income	-0.020	0.000	-0.021	0.010
Population growth	-1.296	-1.700	0.403	0.620
Secondary school enrolment	-0.000	-0.000	-0.000	0.000
lnGross fixed capital formation	0.691	0.699	-0.008	0.005
Relative redistribution	-0.005	-0.000	-0.005	0.003
Gini after tax and transfer	-0.013	-0.000	-0.012	0.004

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B) ^(-1)] (b-B)
= 22.95
Prob>chi2 = 0.0008

Sources: author’s calculation using data from SWIID and World Bank

Extended Models with Relative Redistribution

Variable	Fixed effect	Random effect
lnGDP per capita income	0.060 (0.003)***	0.006 (0.238)
Population growth	-1.730 (0.07)*	-1.222 (0.165)
Secondary school enrolment	-0.000 (0.97)	-0.000 (0.323)
lnGross fixed capital formation	0.654 (0.00)***	0.678 (0.000)***
Relative redistribution	-0.002 (0.4)	0.000 (0.812)
Gini after tax and transfer	-0.008 (0.06)*	-0.001 (0.443)
democracy	-0.126 (0.06)*	-0.062 (0.241)
lnlife expectancy	-1.458 (0.00)***	-0.601 (0.000)***
lnfertility rate	0.000 (0.9)	-0.041 (0.071)*
rule of law	0.114 (0.2)	0.027 (0.576)
constant	6.132 (0.00)***	2.682 (0.000)***
Observation	232	232
Countries	15	15
R-squared	0.87(0.00)***	0.86(0.00)***
F test	151.57(0.00)***	
Wald test		1410.63(0.00)***

Sources: author's calculation using data from the World Bank, OECD database, SWIID, and the Economist Intelligence Unit (EIU)

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

Hausman Test for Extended Models

Variables	(b) FE	(B) RE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDP per capita income	0.060	0.006	0.053	0.019
Population growth	-1.730	-1.222	-0.508	0.509
Secondary school enrolment	-0.000	-0.000	0.000	0.000
lnGross fixed capital formation	0.654	0.678	-0.023	0.008
Relative redistribution	-0.002	0.000	-0.002	0.003
Gini after-tax and transfer	-0.008	-0.001	-0.007	0.004
Democracy	-0.126	-0.062	-0.064	0.045
lnLife expectancy	-1.458	-0.601	-0.857	0.282
lnFertility rate	0.000	-0.041	0.042	0.056
Rule of law	0.114	0.027	0.087	0.092

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 27.93
Prob>chi2 = 0.0019

Sources: author's calculation using data from the OECD database, SWIID, World Bank, and the Economist Intelligence Unit (EIU)

Appendix 3. STATA Outputs of the Analysis

```
. xtreg  lnpercapitagrowth  lngdppercapita popgrowth seconenrol lngfcfgrowth, fe

Fixed-effects (within) regression               Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8573                                         min =          3
     between = 0.6636                                         avg =       15.5
     overall = 0.7501                                         max =         17

                                                F(4,213)          =     319.99
corr(u_i, Xb)  = -0.4306                        Prob > F          =     0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
lngdppercapita |   -.030954   .0108825    -2.84   0.005    -.0524051   -.0095028
     popgrowth |  -1.328539   .9669309    -1.37   0.171    -3.234519    .5774399
    seconenrol |  -.0007204   .0002871    -2.51   0.013    -.0012862   -.0001546
  lngfcfgrowth |   .7026525   .0200149    35.11   0.000     .6631998    .7421052
         _cons |   .4226125   .1178446     3.59   0.000     .1903215    .6549035
---------------+--------------------------------------------------------------
       sigma_u |  .03692771
       sigma_e |   .0378569
           rho |    .487577   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(14, 213) = 1.16                     Prob > F = 0.3076

.
. estimates store fixed

.
. xtreg lnpercapitagrowth   lngdppercapita popgrowth seconenrol lngfcfgrowth, re

Random-effects GLS regression                   Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8494                                         min =          3
     between = 0.9778                                         avg =       15.5
     overall = 0.8490                                         max =         17

                                                Wald chi2(4)      =    1276.72
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+--------------------------------------------------------------
lngdppercapita |   .0003235   .0026821     0.12   0.904    -.0049333    .0055804
     popgrowth |  -1.703708   .5517668    -3.09   0.002    -2.785151   -.6222649
    seconenrol |  -.0001935   .0001318    -1.47   0.142    -.0004518    .0000648
  lngfcfgrowth |   .7016391   .0198165    35.41   0.000     .6627995    .7404787
         _cons |   .0356968    .028674     1.24   0.213    -.0205032    .0918967
---------------+--------------------------------------------------------------
       sigma_u |          0
       sigma_e |   .0378569
           rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------


. estimates store random

.
. hausman fixed random, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
lngdpperca~a |   -.030954     .0003235       -.0312775        .0106023
   popgrowth |  -1.328539    -1.703708        .3751686        .7998595
  seconenrol |  -.0007204    -.0001935       -.0005269        .0002566
lngfcfgrowth |   .7026525     .7016391        .0010134        .0034459
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       14.72
                Prob>chi2 =      0.0053
```

```
. xtreg  lnpercapitagrowth  lngdppercapita popgrowth seconenrol lngfcfgrowth redistl, fe

Fixed-effects (within) regression               Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8604                                         min =          3
     between = 0.2656                                         avg =       15.5
     overall = 0.5726                                         max =         17

                                                F(5,212)          =     261.22
corr(u_i, Xb)  = -0.6208                        Prob > F          =     0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
lngdppercapita |  -.0192291   .0121008    -1.59   0.114    -.0430825    .0046242
     popgrowth |  -1.483021   .9615968    -1.54   0.125    -3.378537    .4124955
    seconenrol |  -.0005731   .0002928    -1.96   0.052    -.0011504    4.13e-06
  lngfcfgrowth |   .6918265   .0204818    33.78   0.000     .6514524    .7322007
       redistl |  -.0092105      .0043    -2.14   0.033    -.0176868   -.0007342
         _cons |   .4562592   .1179154     3.87   0.000     .2238223     .688696
---------------+----------------------------------------------------------------
       sigma_u |  .06599276
       sigma_e |  .03754203
           rho |  .75550063   (fraction of variance due to u_i)
--------------------------------------------------------------------------------
F test that all u_i=0: F(14, 212) = 1.50                     Prob > F = 0.1111

.
. estimates store fixed

.
. xtreg lnpercapitagrowth   lngdppercapita popgrowth  seconenrol lngfcfgrowth redistl, re

Random-effects GLS regression                   Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8492                                         min =          3
     between = 0.9793                                         avg =       15.5
     overall = 0.8491                                         max =         17

                                                Wald chi2(5)      =    1271.40
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
lngdppercapita |   .0009744   .0040723     0.24   0.811     -.007007    .0089559
     popgrowth |  -1.809689   .7442018    -2.43   0.015    -3.268298     -.35108
    seconenrol |   -.000177   .0001531    -1.16   0.248     -.000477     .000123
  lngfcfgrowth |   .7015361   .0198642    35.32   0.000      .662603    .7404692
       redistl |   -.000188   .0008835    -0.21   0.832    -.0019196    .0015436
         _cons |   .0311663   .0357639     0.87   0.384    -.0389296    .1012622
---------------+----------------------------------------------------------------
       sigma_u |          0
       sigma_e |  .03754203
           rho |          0   (fraction of variance due to u_i)

.
. estimates store random

.
. hausman fixed random, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
lngdpperca~a |   -.0192291     .0009744       -.0202036        .0115941
   popgrowth |   -1.483021    -1.809689        .3266682        .6322481
  seconenrol |   -.0005731     -.000177       -.0003961         .000255
lngfcfgrowth |    .6918265     .7015361       -.0097096        .0061671
     redistl |   -.0092105     -.000188       -.0090225        .0042764
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       19.77
                Prob>chi2 =      0.0014
```

```
. xtreg  lnpercapitagrowth  lngdppercapita popgrowth seconenrol lngfcfgrowth redistl gini_disp, fe

Fixed-effects (within) regression               Number of obs      =       232
Group variable: countryid                       Number of groups   =        15

R-sq:                                           Obs per group:
     within  = 0.8633                                         min =          3
     between = 0.6690                                         avg =       15.5
     overall = 0.7587                                         max =         17

                                                F(6,211)           =    222.08
corr(u_i, Xb)  = -0.4331                        Prob > F           =    0.0000
```

lnpercapitag~h	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppercapita	-.0176761	.012023	-1.47	0.143	-.0413766	.0060244
popgrowth	-1.311143	.9570561	-1.37	0.172	-3.19776	.5754732
seconenrol	-.000592	.0002906	-2.04	0.043	-.0011648	-.0000192
lngfcfgrowth	.6897879	.0203352	33.92	0.000	.6497018	.729874
redistl	-.0082195	.0042898	-1.92	0.057	-.0166759	.0002368
gini_disp	-.0087052	.004083	-2.13	0.034	-.0167539	-.0006566
_cons	.6804093	.1572519	4.33	0.000	.3704232	.9903953
sigma_u	.03616053					
sigma_e	.03723196					
rho	.48540449	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(14, 211) = 1.78                     Prob > F = 0.0428

.
. estimates store fixed

.
. xtreg lnpercapitagrowth   lngdppercapita popgrowth seconenrol lngfcfgrowth redistl gini_disp, re

Random-effects GLS regression                   Number of obs      =       232
Group variable: countryid                       Number of groups   =        15

R-sq:                                           Obs per group:
     within  = 0.8512                                         min =          3
     between = 0.9722                                         avg =       15.5
     overall = 0.8497                                         max =         17

                                                Wald chi2(6)       =   1272.14
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000
```

lnpercapitag~h	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lngdppercapita	.001989	.0042019	0.47	0.636	-.0062467	.0102246
popgrowth	-1.883362	.7480466	-2.52	0.012	-3.349506	-.4172174
seconenrol	-.0002136	.0001576	-1.36	0.175	-.0005225	.0000952
lngfcfgrowth	.698416	.020119	34.71	0.000	.6589834	.7378486
redistl	-.0011297	.0013049	-0.87	0.387	-.0036872	.0014279
gini_disp	-.0010643	.0010852	-0.98	0.327	-.0031913	.0010627
_cons	.0743671	.0567433	1.31	0.190	-.0368477	.1855819
sigma_u	0					
sigma_e	.03723196					
rho	0	(fraction of variance due to u_i)				

```
. estimates store random

.
. hausman fixed random, sigmamore
```

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lngdpperca~a	-.0176761	.001989	-.0196651	.011573
popgrowth	-1.311143	-1.883362	.5722184	.6332274
seconenrol	-.000592	-.0002136	-.0003784	.0002524
lngfcfgrowth	.6897879	.698416	-.0086281	.0053737
redistl	-.0082195	-.0011297	-.0070899	.0041947
gini_disp	-.0087052	-.0010643	-.007641	.0040379

```
                          b = consistent under Ho and Ha; obtained from xtreg
           B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       23.17
                Prob>chi2 =      0.0007
```

```
. xtreg  lnpercapitagrowth  lngdppercapita popgrowth  seconenrol lngfcfgrowth redistl gini_disp democ
> racy  lnlifeexpectancy  lnfertilityrate ruleoflaw, fe

Fixed-effects (within) regression               Number of obs      =       232
Group variable: countryid                       Number of groups   =        15

R-sq:                                           Obs per group:
     within  = 0.8798                                          min =         3
     between = 0.2247                                          avg =      15.5
     overall = 0.6775                                          max =        17

                                                F(10,207)          =    151.49
corr(u_i, Xb)  = -0.4563                        Prob > F           =    0.0000

------------------------------------------------------------------------------
lnpercapitagro~h |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------+------------------------------------------------------------
  lngdppercapita |   .0607758    .020138     3.02   0.003     .0210739    .1004777
       popgrowth |  -1.720521   .9810398    -1.75   0.081    -3.654632    .2135897
      seconenrol |  -7.75e-06   .0003201    -0.02   0.981    -.0006389    .0006234
     lngfcfgrowth|   .6550548   .0207014    31.64   0.000     .6142421    .6958675
         redistl |  -.0031039   .0045034    -0.69   0.491    -.0119823    .0057745
       gini_disp |  -.0066997   .0039426    -1.70   0.091    -.0144726    .0010732
       democracy |  -.1262088   .0680229    -1.86   0.065    -.2603153    .0078976
lnlifeexpectancy |  -1.450755   .3107551    -4.67   0.000    -2.063405   -.8381037
 lnfertilityrate |    .000609   .0588492     0.01   0.992    -.1154117    .1166296
       ruleoflaw |   .1130233   .1013645     1.12   0.266    -.0868158    .3128625
           _cons |   5.993129   1.194247     5.02   0.000     3.638682    8.347576
-----------------+------------------------------------------------------------
         sigma_u |  .05029341
         sigma_e |  .03525043
             rho |  .67057634   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(14, 207) = 2.16                     Prob > F = 0.0102

.
. estimates store fixed
```

```
. xtreg lnpercapitagrowth   lngdppercapita popgrowth seconenrol  lngfcfgrowth redistl gini_disp democ
> racy  lnlifeexpectancy lnfertilityrate ruleoflaw, re

Random-effects GLS regression                   Number of obs      =       232
Group variable: countryid                       Number of groups   =        15

R-sq:                                           Obs per group:
     within  = 0.8692                                          min =         3
     between = 0.9664                                          avg =      15.5
     overall = 0.8645                                          max =        17

                                                Wald chi2(10)      =   1410.21
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
lnpercapitagro~h |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+------------------------------------------------------------
  lngdppercapita |   .0073626   .0054878     1.34   0.180    -.0033933    .0181185
       popgrowth |  -1.327545   .8724386    -1.52   0.128    -3.037493    .3824036
      seconenrol |  -.0001537   .0001652    -0.93   0.352    -.0004774    .0001701
    lngfcfgrowth |   .6781451   .0197417    34.35   0.000     .6394522    .7168381
         redistl |  -3.47e-06   .0013893    -0.00   0.998    -.0027264    .0027194
       gini_disp |  -.0018711   .0014106    -1.33   0.185    -.0046358    .0008935
       democracy |  -.0637307   .0528584    -1.21   0.228    -.1673313      .03987
lnlifeexpectancy |  -.5926008   .1454867    -4.07   0.000    -.8777495    -.307452
 lnfertilityrate |  -.0427073   .0229594    -1.86   0.063    -.0877069    .0022923
       ruleoflaw |   .0311899   .0479377     0.65   0.515    -.0627663    .1251461
           _cons |   2.654424   .6176448     4.30   0.000     1.443863    3.864986
-----------------+------------------------------------------------------------
         sigma_u |          0
         sigma_e |  .03525043
             rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------

.
. estimates store random

.
. hausman fixed random, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
lngdpperca~a |    .0607758     .0073626        .0534132        .0201328
   popgrowth |   -1.720521    -1.327545       -.3929762        .5217928
  seconenrol |   -7.75e-06    -.0001537        .0001459        .0002877
lngfcfgrowth |    .6550548     .6781451       -.0230903        .0083917
     redistl |   -.0031039    -3.47e-06       -.0031004        .0044549
   gini_disp |   -.0066997    -.0018711       -.0048286        .0038342
   democracy |   -.1262088    -.0637307       -.0624782        .0466298
lnlifeexpe~y |   -1.450755    -.5926008       -.8581538        .2872701
lnfertilit~e |     .000609    -.0427073        .0433163        .0564934
   ruleoflaw |    .1130233     .0311899        .0818334        .0934585
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                           =       27.90
                Prob>chi2 =      0.0019
```

```
. xtreg  lnpercapitagrowth  lngdppercapita popgrowth seconenrol lngfcfgrowth redist2, fe

Fixed-effects (within) regression               Number of obs      =       232
Group variable: countryid                       Number of groups   =        15

R-sq:                                           Obs per group:
     within  = 0.8574                                         min =         3
     between = 0.5848                                         avg =      15.5
     overall = 0.7234                                         max =        17

                                                F(5,212)           =    254.88
corr(u_i, Xb)  = -0.4646                        Prob > F           =    0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
lngdppercapita |  -.0302004   .0113157    -2.67   0.008    -.0525061   -.0078947
     popgrowth |  -1.355861   .9752132    -1.39   0.166    -3.278218    .5664956
    seconenrol |  -.0007077   .0002921    -2.42   0.016    -.0012835   -.0001318
  lngfcfgrowth |   .7018561   .0203106    34.56   0.000     .6618194    .7418928
       redist2 |  -.0007122   .0028496    -0.25   0.803    -.0063294    .0049051
         _cons |   .4409324   .1390047     3.17   0.002      .166924    .7149409
---------------+----------------------------------------------------------------
       sigma_u |    .041254
       sigma_e |   .0379405
           rho |  .54176696   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(14, 212) = 1.15                     Prob > F = 0.3136

.
. estimates store fixed

. xtreg lnpercapitagrowth   lngdppercapita popgrowth  seconenrol lngfcfgrowth redist2, re

Random-effects GLS regression                   Number of obs      =       232
Group variable: countryid                       Number of groups   =        15

R-sq:                                           Obs per group:
     within  = 0.8498                                         min =         3
     between = 0.9750                                         avg =      15.5
     overall = 0.8491                                         max =        17

                                                Wald chi2(5)       =   1271.71
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
lngdppercapita |  -.0005514   .0039326    -0.14   0.888     -.008259    .0071563
     popgrowth |  -1.563782   .7186853    -2.18   0.030    -2.972379   -.1551845
    seconenrol |  -.0002194   .0001571    -1.40   0.163    -.0005274    .0000885
  lngfcfgrowth |   .7014798   .0198631    35.32   0.000     .6625489    .7404107
       redist2 |   .0001279   .0004198     0.30   0.761    -.0006948    .0009506
         _cons |   .0420381   .0354756     1.18   0.236    -.0274929     .111569
---------------+----------------------------------------------------------------
       sigma_u |          0
       sigma_e |   .0379405
           rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------

.
. estimates store random

.
. hausman fixed random, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
lngdpperca~a |   -.0302004    -.0005514       -.029649        .0106675
   popgrowth |   -1.355861    -1.563782       .2079204        .6660085
  seconenrol |   -.0007077    -.0002194      -.0004883        .0002479
lngfcfgrowth |    .7018561     .7014798       .0003763        .0046796
     redist2 |   -.0007122     .0001279      -.0008401        .0028322
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       15.34
                Prob>chi2 =      0.0090
```

```
. xtreg  lnpercapitagrowth  lngdppercapita popgrowth seconenrol lngfcfgrowth redist2 gini_disp, fe

Fixed-effects (within) regression               Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8628                                         min =          3
     between = 0.6825                                         avg =       15.5
     overall = 0.7465                                         max =         17

                                                F(6,211)          =     221.11
corr(u_i, Xb)  = -0.4553                        Prob > F          =     0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
lngdppercapita |  -.0207098    .011602    -1.79   0.076    -.0435804    .0021609
     popgrowth |  -1.296766   .9590303    -1.35   0.178    -3.187274    .5937425
    seconenrol |   -.000627   .0002886    -2.17   0.031    -.0011958   -.0000581
  lngfcfgrowth |   .6914679   .0202914    34.08   0.000      .651468    .7314677
       redist2 |  -.0055131   .0032591    -1.69   0.092    -.0119376    .0009114
     gini_disp |  -.0136408   .0047305    -2.88   0.004    -.0229659   -.0043158
         _cons |   .9213417    .215484     4.28   0.000     .4965643    1.346119
---------------+----------------------------------------------------------------
       sigma_u |  .03888225
       sigma_e |  .03730238
           rho |  .52072841   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(14, 211) = 1.76                     Prob > F = 0.0457

.
. estimates store fixed


.
. xtreg lnpercapitagrowth   lngdppercapita popgrowth seconenrol lngfcfgrowth redist2 gini_disp, re

Random-effects GLS regression                   Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8505                                         min =          3
     between = 0.9732                                         avg =       15.5
     overall = 0.8493                                         max =         17

                                                Wald chi2(6)      =    1268.12
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
lnpercapitag~h |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
lngdppercapita |    .000868   .0046982     0.18   0.853    -.0083404    .0100764
     popgrowth |  -1.700343   .7608099    -2.23   0.025    -3.191503   -.2091832
    seconenrol |  -.0002258   .0001578    -1.43   0.152     -.000535    .0000834
  lngfcfgrowth |   .6997118   .0201479    34.73   0.000     .6602227    .7392008
       redist2 |  -.0003828    .001013    -0.38   0.706    -.0023683    .0016027
     gini_disp |  -.0009825    .001773    -0.55   0.579    -.0044575    .0024926
         _cons |   .0775519   .0732794     1.06   0.290    -.0660731     .221177
---------------+----------------------------------------------------------------
       sigma_u |          0
       sigma_e |  .03730238
           rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------

.
. estimates store random


. hausman fixed random, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
lngdpperca~a |   -.0207098      .000868       -.0215778        .0109056
   popgrowth |   -1.296766    -1.700343        .4035775         .620191
  seconenrol |    -.000627    -.0002258       -.0004012        .0002497
lngfcfgrowth |    .6914679     .6997118       -.0082439         .005038
     redist2 |   -.0055131    -.0003828       -.0051303        .0031781
   gini_disp |   -.0136408    -.0009825       -.0126584        .0045053
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       22.95
                Prob>chi2 =      0.0008
```

```
. xtreg lnpercapitagrowth   lngdppercapita popgrowth seconenrol  lngfcfgrowth redist2 gini_disp democ
> racy  lnlifeexpectancy lnfertilityrate ruleoflaw, re

Random-effects GLS regression                   Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8692                                         min =          3
     between = 0.9672                                         avg =       15.5
     overall = 0.8646                                         max =         17

                                                Wald chi2(10)     =    1410.63
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000
```

lnpercapitagro~h	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lngdppercapita	.0068046	.0057624	1.18	0.238	-.0044895	.0180986
popgrowth	-1.222604	.8795275	-1.39	0.165	-2.946446	.5012386
seconenrol	-.0001634	.0001655	-0.99	0.323	-.0004879	.000161
lngfcfgrowth	.6785741	.0197614	34.34	0.000	.6398424	.7173058
redist2	.0002577	.0010809	0.24	0.812	-.0018609	.0023764
gini_disp	-.0015105	.0019702	-0.77	0.443	-.005372	.002351
democracy	-.0621715	.0530621	-1.17	0.241	-.1661713	.0418283
lnlifeexpectancy	-.6017595	.1439895	-4.18	0.000	-.8839737	-.3195453
lnfertilityrate	-.0417651	.0231197	-1.81	0.071	-.0870788	.0035487
ruleoflaw	.0270415	.0483875	0.56	0.576	-.0677963	.1218793
_cons	2.682018	.6040489	4.44	0.000	1.498104	3.865932
sigma_u	0					
sigma_e	.03524255					
rho	0	(fraction of variance due to u_i)				

```
.
. estimates store random

. xtreg  lnpercapitagrowth  lngdppercapita popgrowth  seconenrol lngfcfgrowth redist2 gini_disp democ
> racy  lnlifeexpectancy  lnfertilityrate ruleoflaw, fe

Fixed-effects (within) regression               Number of obs     =        232
Group variable: countryid                       Number of groups  =         15

R-sq:                                           Obs per group:
     within  = 0.8798                                         min =          3
     between = 0.2460                                         avg =       15.5
     overall = 0.6869                                         max =         17

                                                F(10,207)         =     151.57
corr(u_i, Xb)  = -0.4477                        Prob > F          =     0.0000
```

lnpercapitagro~h	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppercapita	.0606255	.0200478	3.02	0.003	.0211015	.1001495
popgrowth	-1.730803	.9807137	-1.76	0.079	-3.664271	.2026644
seconenrol	-9.71e-06	.00032	-0.03	0.976	-.0006406	.0006212
lngfcfgrowth	.6548556	.0206952	31.64	0.000	.6140553	.6956559
redist2	-.0025049	.0033242	-0.75	0.452	-.0090585	.0040487
gini_disp	-.0088638	.004722	-1.88	0.062	-.0181732	.0004456
democracy	-.1264645	.0677038	-1.87	0.063	-.2599419	.0070129
lnlifeexpectancy	-1.458858	.3062287	-4.76	0.000	-2.062585	-.8551309
lnfertilityrate	.0004777	.0588147	0.01	0.994	-.115475	.1164303
ruleoflaw	.1146323	.1008886	1.14	0.257	-.0842685	.3135331
_cons	6.13206	1.158024	5.30	0.000	3.849028	8.415093
sigma_u	.04906069					
sigma_e	.03524255					
rho	.65962146	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(14, 207) = 2.17                     Prob > F = 0.0101

.
. estimates store fixed


.
. hausman fixed random, sigmamore
```

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lngdpperca~a	.0606255	.0068046	.053821	.0199607
popgrowth	-1.730803	-1.222604	-.5081996	.5092714
seconenrol	-9.71e-06	-.0001634	.0001537	.0002874
lngfcfgrowth	.6548556	.6785741	-.0237185	.0083336
redist2	-.0025049	.0002577	-.0027626	.0032709
gini_disp	-.0088638	-.0015105	-.0073533	.0044794
democracy	-.1264645	-.0621715	-.064293	.0459042
lnlifeexpe~y	-1.458858	-.6017595	-.8570983	.2828037
lnfertilit~e	.0004777	-.0417651	.0422428	.0563956
ruleoflaw	.1146323	.0270415	.0875908	.0926815

```
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                           =       27.93
                Prob>chi2 =      0.0019
```

```
. xtsum lnpercapitagrowth gdppercapita popgrowth seconenrol  grossfcfgrowth redist2 gini_disp democra
> cy  lifeexpectancy fertilityrate ruleoflaw
```

Variable		Mean	Std. Dev.	Min	Max	Observations
lnperc~h	overall	.0369193	.0983943	-.3170848	.2696524	N = 255
	between		.0097974	.021196	.0588367	n = 15
	within		.0979361	-.3390022	.279967	T = 17
gdpper~a	overall	52318.75	45063.93	707.9836	240676.9	N = 255
	between		45124.24	2149.346	205386.7	n = 15
	within		11082.66	11777.82	87608.94	T = 17
popgro~h	overall	.0067801	.0049901	-.0183664	.0208243	N = 255
	between		.0043694	-.0002706	.0148416	n = 15
	within		.002648	-.0119202	.0151408	T = 17
secone~l	overall	112.9184	19.50661	80.0404	163.935	N = 232
	between		19.77289	91.32117	158.5626	n = 15
	within		8.715843	90.15479	146.036	T-bar = 15.4667
grossf~h	overall	1.44e+10	5.79e+10	-4.20e+11	2.90e+11	N = 240
	between		2.47e+10	-4.65e+08	1.01e+11	n = 15
	within		5.27e+10	-5.06e+11	2.04e+11	T = 16
redist2	overall	38.22385	10.52442	5.555555	50	N = 255
	between		10.83093	6.947104	48.97909	n = 15
	within		.9186539	34.41002	41.08534	T = 17
gini_d~p	overall	29.81647	4.830208	22.8	42.5	N = 255
	between		4.951848	24.54706	40.95882	n = 15
	within		.5955875	28.06941	31.46941	T = 17
democr~y	overall	.8185412	.1266242	.375	.965	N = 255
	between		.1216794	.4400588	.9267647	n = 15
	within		.0464809	.6085412	.9361294	T = 17
lifeex~y	overall	79.95255	2.006835	71.5	82.8	N = 255
	between		1.688586	74.71765	81.48235	n = 15
	within		1.164334	76.7349	83.3349	T = 17
fertil~e	overall	1.742353	.2290221	1.3	2.4	N = 255
	between		.21992	1.364706	2.141176	n = 15
	within		.0844567	1.477647	2.001177	T = 17
ruleof~w	overall	.8828549	.1236975	.5	1	N = 255
	between		.1248871	.5145882	.9835882	n = 15
	within		.0262059	.7819725	.9379725	T = 17