“The Importance of Income Inequality at the Top End of the Distribution as Opposed to the Bottom End as Determinant of Growth”

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ABSTRACT:

The aim of this study was to analyze whether income inequality is a determinant of national growth and whether this influence is different when income inequality in the upper and the lower decile of income distribution are separately examined. According to the statistical analysis that was held, income inequality was found to have some statistically significant connection with the national economic growth of selected OECD countries, but only in the long run. Moreover, the research findings indicate that when a distinction is made between top-end and bottom-end income inequality, top-end inequality has a positive effect on growth, while bottom-end inequality has a negative effect. Investment and fertility rate were not found to have a statistically significant effect on growth. The above findings were evident in all four periods that were studied. The results imply that states in OECD countries, as well as countries not belonging to this group, need to pay heavy attention to bottom-end income inequality, as a means of controlling and fostering their growth potential, while at the same time leaving top-end inequalities, which not only do not undermine growth, but also drive it. Future researchers are encouraged to conduct the same research with other countries as well, especially developing ones, while also including in the research other factors moderating the effects of income inequality in growth.

Keywords: Income Inequality, National Growth, Top-end Inequality, Bottom-end Inequality, Investment, Inflation, Fertility Rate.

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1. Introduction

The aim of this study is to analyze whether income inequality is a determinant of national growth and whether this influence is different when income inequality in the upper and the lower decile of income distribution are separately examined. More specifically, this dissertation has the following aims:

- To examine whether income distribution is a determinant of national growth
- To assess whether income inequality in the upper and the lower decile of income distribution have different impacts on national growth
- To assess whether inflation, fertility and investment are correlated with income inequality, thereby also indirectly influencing economic growth of countries

Income inequality refers to differences identified in the money earned and overall standards of well-being among different groups of people. Such groups may refer to whole countries, which are most of the times studied, or to groups within local, national, or regional populations, or even individuals within these groups (Atkinson, 2015). According to Piketty (2014), the main reason that had driven income inequality has been the increasing inequality in wages and salaries, especially between highly and low-skilled labour, as well as between developed and developing countries. Income inequality has very important consequences. First of all, it is associated with health problems for the population, given that in countries with high income inequality healthcare is accessed more by the high-income groups (Sapolsky, 2005). Countries with high income inequalities also tend to face important social issues, with economic instability, social unrest and criminality being at the forefront; all of which undermine a country’s social cohesion (Wilkinson & Pickett, 2009). In its pure economic context, income inequality undermines aggregate demand for products and services, thereby also negatively affecting consumption (Castells-Quintana & Royuela, 2012).

Income distribution and economic growth are both characterized in existing academic literature as factors that are both determined within an economic system. Even though it is generally accepted that income inequality has a negative effect on growth, the mechanisms and channels through which such an effect takes place differ among countries and different economic systems. No matter the channels to be used each time, the central axiom is that income inequality undermines the accumulation of physical and human capital. In turn, these two factors and their undermined accumulation harm economic growth.

According to Benabou (1996), inequality has a negative effect on growth by reducing investment opportunities and borrowers’ incentives, creating macroeconomic volatility and raising the fertility rate. In contrast, researchers like Baro (2005) have found that income inequality has little or no relation with economic growth and rates of investment. At the same time, empirical research suggests that lowering inequality by reducing disparities at the bottom of the distribution has a greater positive effect on economic performance than if the focus was reducing top inequality (Voitchovsky, 2005). The proposition that income inequality affects economic growth in different ways, depending on the level of development of a given economy is not a new finding, but has been rather early indicated by Kuznets (1955), according to whom, Inequality does not present a linear function with respect to Income. Instead, as an economy develops, economic inequality will first increase exponentially, but will subsequently start decreasing after a certain income level of the economy.
The available literature thus, points towards a multidimensional and rather complex effect of inequality on growth, insofar inequality can either foster or inhibit growth. Moreover, the majority of the positive mechanisms may be attributed to top-end inequality, whilst many of the inhibiting mechanisms may be attributed to inequality at the bottom-end of the distribution, or to increased overall inequality. The final effect of inequality on growth therefore, will thus be dependent on the coefficients of these contradicting effects.

Despite the fact that the contradicting effects of top and bottom-end inequality have been identified early in the available theoretical literature, the empirical literature on the subject relies heavily on regressing only a single inequality measure, often in a (linear) growth equation. Based on data for developed and developing countries, other researches demonstrate different effects of inequality on growth. However, all of these results seem to be highly sensitive to various methodological aspects of the analysis employed, such as the econometric method employed, the time period under consideration and the quality of data.

Taking the above brief framework into consideration, it was first of all considered as very important to study income inequality as a determinant of national growth, given that national growth is what all countries seek to achieve, especially in the current period of crisis. Therefore, studying the influence of any factor in national growth is important, as a means of finding ways to boost national growth in a global context. Next to that, despite the fact that the greatest emphasis of the modern debate on inequality has been placed on the top 1% earners, the relative significance of the top-end to that of the low-end inequality, has been less well-documented. The present thesis, thus, intends to draw special emphasis on these types of income inequality as well, attempting to explore the relative importance of inequality as determinant of growth, at the top-end of the distribution as opposed to the bottom-end, assuming that the influence of inequality on growth is not only a function of the spread of the distribution but also of its shape. Last but not least, the present thesis aims at filling the gap identified in previous research findings and existing theoretical frameworks regarding the diverse opinions and findings for whether income inequality is a significant determinant of growth.

Even though my research aim is to test the findings of Voitchovsky (2003), the present thesis presents an original contribution to the ongoing literature of the effects of inequality on growth insofar it examines a more recent period (1995-2011), using an expanded number of 34 (as opposed to 20) OECD countries, and testing for the mediating effects of not only Investment, but also Inflation and Fertility. Moreover, it tests the author’s proposed inverse effects of top and bottom-end inequality in the years immediately before and after the break of the recent financial crisis of 2008.

The paper is structured as follows: The second section provides the theoretical framework on which the research with respect to this study is based. Specifically, this section outlines and analyzes the theory of income inequality and national growth, while also reviewing previous research findings regarding the relationship between the two variables. The third section is that of research methodology. The particular section describes the methodology used for the study and justifies the selection of the research methods that were followed. The fourth section outlines the empirical results of the study, while Section 5 interprets and discusses them with respect to the theoretical framework developed in Section 2, as well as the aims and objectives of the
research. The same section summarizes the findings of the research, presents the most important conclusions drawn from, and provides the theoretical and practical implications of research results, the limitations of the study, as well as directions for future research.

2. Background Research in Income Inequality

2.1. Income Inequality – Definition and Overview

Income inequality, also commonly referred to as “economic inequality”, “wealth inequality” or “wealth gap”, refers to differences identified in the money earned and overall standards of well-being among different groups of people. Such groups may refer to whole countries, which are most of the times studied, or to groups within local, national, or regional populations, or even individuals within these groups (Atkinson, 2015). Income inequality can be identified among the same groups or countries in different historic periods, also taking into consideration differences in economic systems that countries have followed over time (Lambert, 2001).

In most cases, income inequalities are studied as an economic indicator for the countries or groups tested every time. However, as Wilkinson & Pikket (2009) point out, there are also social implications of income inequality. In general, countries with high income inequalities are associated with higher levels of social insecurity and criminality, which primarily derive from the high sense of injustice people belonging to lower income groups feel, especially when comparing their living standards with those belonging in higher-income groups.

There are a number of reasons and factors that have caused income inequalities. According to Piketty (2014), the main reason that had driven income inequality has been the increasing inequality in wages and salaries, especially between highly and low-skilled labour, as well as between developed and developing countries. De Soto (2000) points out that income inequality is the outcome of capitalism and the laws of the free market that are applied in Western economies and the rest of the world. According to Navarro (2007), income inequalities have mainly emerged, because of the higher automation of business activities nowadays, which require from candidates and employees to have excessive skills, in order to be able to earn a higher salary. The fact that the wages of low-skilled labour face downward pressures, due to the oversupply of such type of labour, also explains why there is great income inequality between developed and developing economies (Svizzero & Tisdell, 2003). What is more, income inequalities are also created as a result of ethnic, gender and other forms of discrimination identified within local, national, regional, and even international contexts (Merino, 2016). Other country-specific factors determining income inequality include income taxation, access to education, as well as overall economic development (Galor & Zeira, 1993). Last but not least, there is also the neoclassical approach, according to which income inequalities exist, because of the different value added provided by different types and categories of labour (Salverda et al., 2009).
Income inequality has very important consequences. First of all, income inequality is associated with health problems, given that in countries with high income inequality, healthcare is more accessible only by the high-income groups. As such, those belonging to low-income groups are more likely to experience health problems, some of which may be transmittable, thereby also affecting the wider population (Sapolsky, 2005). As mentioned above, countries with high income inequalities also have important social issues to face, with social instability, unrest and criminality being at the forefront, all of which undermine a country’s social cohesion (Wilkinson & Pickett, 2009). In its pure economic context, income inequality undermines aggregate demand for products and services, thereby also negatively affecting consumption. In a similar context, income inequality is often correlated with high unemployment rates, which, in turn, leads to more households facing high debt (Castells-Quintana & Royuela, 2012). Taking the above into consideration, and as it will be thoroughly analyzed in the following sections, income inequality is also perceived as a factor seriously undermined long-term growth and development of the economies facing it.

2.2. The History of Studying Income Inequality

Studying income inequality has a long history, which shall be traced back to the classical school of economics and the work of famous classical economists, such as Adam Smith and David Ricardo. For Adam Smith, societies in which the majority of its members are poor cannot achieve high growth rates. In a similar context, David Ricardo has advocated that regulating income distribution shall be at the forefront of political economy (Bigsten, 1983, Ferrán, 1997; Atkinson, 1997). However, subsequent literature, did not place income inequality at the forefront of the discussion. “Economists who went to graduate school in the 1970s and early 80s may well be forgiven for viewing inequality as a peripheral topic. Those who think about it at all will almost certainly think of it as an ‘outcome’ – the result of some underlying distribution of assets; of the work and saving decisions of individuals; and of prices determined by a range of different markets: for land, labor, capital and goods. Up until early in this decade, the contemporary economics profession seemed to have little to say about the impact that inequality – the distributions of income and wealth, more generally – might have on other variables, such as the overall efficiency of an economy proxied for instance, by its growth rate” (Ferreira, 1999). The views of neoclassical economists resurfaced during the 1980s and as a result of the debt crisis that emerged during that period. Even in that period, though, emphasis was not placed on income inequality, but rather on factor distribution of income, which measured how GDP is divided between wages and profits. Studying this function of income distribution, though, does not say much about real income distribution, i.e. how income is distributed among people belonging to a country’s, as well as the world’s, overall population.

2.3. Current Research in Income Inequality

There is no doubt that there are many countries that managed to reduce their income inequalities since the 1990s (Blau & Kahn, 2009). However, income inequality is still major issue of global concern, which has also been associated with the economic crisis. The rationale behind this argument lies in that income inequalities benefit the wealthy, in the sense that they become more powerful and occupy an even more expensive lifestyle. Middle-class consumers lag behind in terms of status, and try to compensate for this loss by consuming beyond their
capabilities. In this way, middle-class household get into debt, and this eventually causes their purchasing power to gradually diminish further, thereby affecting negatively the economy and the businesses operating in it, leading to economic crisis, which becomes even more intense, the more consumers are unable to cover their debt (Atkinson & Morelli, 2010).

According to Inequality.org (2016), the world has generally become wealthier since 2001. In fact, the share of poor people (people earning $2 per day or less) fell to about a half from 2001 to 2011 (from 29% to 15%), while, as presented in the following figure, the share of the other income groups also increased during the period examined.

**Figure 1: Global Population by Income Group**

![Global Population by Income Group](image)

(Source: Inequality.org, 2016)

As Figure 2 indicates, most of the world’s adults own at least $10,000 of wealth. However, 71% of the global population holds only 3% of the world’s wealth. Those owning wealth of value of $100,000 or higher represent only 8.1% of the global population. However, they also hold 84.6% of the world’s wealth.
Referring to wealth inequalities within countries, U.S.A. has the highest income inequality in the world (80.56%, or Gini coefficient of 0.8056), despite the fact that it is the wealthier country in the world. It is followed by Sweden (79.90%), UK (75.72%) and Indonesia (73.61%) (Inequality.org, 2016).

2.4. Measuring Income Inequality

Given that income inequality is a multi-functional variable, and given the various types of income inequality that exist, there is no consensus with regards to its operationalisation. However, the Gini Coefficient is the most widely accepted and used index for representing and measuring income inequality. It took its name from the Italian statistician and sociologist Corrado Gini (Gini, 1921) and was first published in his work in 1921. In simple terms, the Gini coefficient is the ratio that measures the area between the equality line and the Lorenz curve.
The value of the Gini Coefficient lies between zero and one. At a value of one, income is considered to be earned by only one person, thereby representing perfect income inequality. In contrast, when the Gini Coefficient equals zero, this indicates that income is perfectly equally distributed among all income earners in a given population (Caminada et al., 2000).

According to Figini (1999), Gini Coefficient is “...the arithmetic average of the absolute value of the difference between all pairs of income. For example, if Gini is 0.4, the expected difference between any pair of observations, chosen randomly from the distribution, is 0.8 times the mean income” (Figini, 1999). It is evident from the above that the smaller the Gini Coefficient is, the lower the income inequality in a given population. The Gini Coefficient is highly sensitive to changes in income, especially when compared to other measures of income inequality. As such, even a slight movement of income from a higher to a lower income group is likely to decrease the value of the Gini Coefficient (Figini, 1999).

Despite the wide acknowledgment and acceptance of Gini Coefficient as a central measure of income inequality, it is also characterized by inefficiencies. The most important of these, which are highly associated with the aims and objectives of this study, is that it does not capture top/bottom inequality, thereby often creating an erroneous idea, when examining the effects of inequality on growth, and especially the effects of different inequality at different levels of income distribution on growth, as this is the central research objective of this study, after all. In other words, Gini Coefficient measures income inequality in the wider population of a country. However, failing to distinguish income inequality within different levels of the income distribution leads to misleading conclusions about a country’s income distribution. This is because if the size of the population belonging to a certain level of income distribution increases, then Gini Coefficient may be altered, but the new Gini Coefficient will give the impression that income inequality level has changed for the whole population, without, however, this being accurate (Schmid, & Stein, 2013).

In order to deal with the above inefficiency, the P50/P10 and the P90/P50 ratios are used, which are both ratios used to calculate the median income to the bottom and upper bound value of income distribution respectively. Taking the P50/P10 ratio first into consideration, the higher
this ratio is, the wider is the gap between people’s income at the bottom and average level of income distribution, thereby also indicating higher bottom-end inequality. As far as the P90/P50 ratio is concerned, this is used to calculate the upper bound value of the ninth decile to the median income. The higher this ratio is, the higher is the income gap between those belong to the upper and average income levels. As it will be thoroughly outlined in the methodology section of this study that follows, the use of the above ratios is justified by their ability to provide a simple and quick picture of inequality at different levels of the income distribution (Schmid, & Stein, 2013).

2.5. Income Inequality and Economic Growth

2.5.1. General Framework

Previous theoretical researches have often come up with mixed results regarding the relationship between income inequality and growth. Even though on the academic level, the converging thesis is that inequality is on the aggregate harmful for growth, the channels through which this effect is transmitted differ in accordance to the model used. The central argument is that high inequality in income distribution can slow down the accumulation of physical and human capital, which in turn are the main sources of growth. In practice, though, the experiences of countries across the globe, even with the OECD countries, differ in terms of how income inequality affects growth.

There are several OECD countries whereby citizens belonging to upper income levels have benefit from overall increases in income, in contrast to those belonging to lower income groups, whose growth in income has been moderate or even non-existing. As such, when studying the economic performance of countries, the interest shall not concentrate only on actual growth, but also on income distribution. This does not mean that emphasis shall be placed only on national levels of poverty, but also on income distribution in its wider sense. An interesting question to be answered here is whether OECD policies for redistributing wealth shall have any positive or negative effects on growth, as well as whether any trade-offs need to be made, when countries design policies to increase income equality and growth at the same time.

Kaldor developed a line of reasoning in 1956, as a means of explaining the relationship between income inequality and growth. According to the author, the Marginal Propensity to Save (MPS) of the rich is higher than the MPS of the poor, what in academic literature has been maintained as the Kaldor Hypothesis. The author utilised the axiom that savings equal investment, so as to demonstrate that since investment is linked to GDP growth, economies subject to higher income inequality should grow faster. The rationale behind this argument lies in that high earners are mainly those who invest in productive activities. If income is evenly distributed, excess income for investment will be less, thereby undermining investments and, thus, economic growth. However, as mentioned earlier, the central argument most widely supported in academic literature is that income inequality has a negative effect on economic growth. According to the available theories in the academic literature regarding income inequality, income inequality negatively affects growth through the following channels:
- **Inequality reduces investment opportunities:** As mentioned before, wider distribution of income decreases the excess income that could be used for investments, thereby also undermining economic growth, due to the direct link between investment and growth.

- **Inequality reduces borrowers' incentives:** In mere contrast with the above channel, if only a few people have wealth concentrated on their hands, the remaining do not have the incentive to borrow money for investment purposes, since they are not able to satisfy their loans.

- **Inequality creates macroeconomic volatility:** Income inequality leads to social, economic and political instability. In such uncertain and volatile macroeconomic conditions, growth is undermined.

- **Inequality lowers economic growth by raising the fertility rate:** Rich people tend to have less children, and they tend not to rely on their care during retirement. For poorer people, having many children is a means of having economic assistance when the children grow. Thus, when income inequality increases, fertility rates increase, but growth is undermined (Khoo & Dennis, 1999).

- **Top and bottom Inequality:** As it will be explained in a separate section of this section, inequality at the bottom end of the income distribution undermines growths, more than inequality at the top-end, with the latter also being likely to increase growth (Aghion et al., 1999).

The above framework and its factors that have a moderating effect on the influence of income inequality in economic growth are diagrammatically presented in the following causal diagram:

**Figure 3: The Factors Influencing the Effects of Income Inequality on Growth**

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IE ← INV/IR/INF → G

IE: Income Inequality
INV: Investment Opportunities
IR: Interest Rates
INF: Macroeconomic Volatility
FERT: Fertility Rate
G: Economic Growth
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As derived from the above figure, specific causal mechanisms and effects have been identified, when evaluating the effect of income inequality on growth. As it will be analyzed in the data analysis section, the aforementioned mechanisms and effects have led to the development of proxies, which have been used in this study, in order to capture the effects of certain factors on the relationship between income inequality and economic growth. These proxies are:

1. Inequality reduces investment opportunities: [Proxy \( INVt-1 \)]
2. Inequality reduces borrowers' incentives: [Proxy \( IRt-1 \)]
3. Inequality creates macroeconomic volatility: [Proxy \( INFt-1 \)]
4. Inequality lowers economic growth by raising the fertility rate: [Proxy lnFERT_{t-1}]

2.5.2. *Income Inequality and Investment Opportunities*

The underlying assumption regarding the argument that income inequality negatively affects growth through investment lies in that when people cannot have easy access to capital (i.e. they cannot borrow money easily), it is difficult to be productive, thereby undermining growth. According to Aghion, Caroli and Garcia Penalosa (1999) and their article “Inequality and Economic Growth”, the rich people of a population are characterized by low marginal productivity of investment, because they face diminishing returns on their investment. In contrast, the marginal productivity of investment of the poor is higher, given that they are also more productive, but their access to capital is limited, thereby having limited investment opportunities. In other words, if income distribution was more equal, lower-income people would have better access to capital and more investment opportunities, which, through the higher marginal productivity of investment of these people, would lead to higher growth (Galor & Zeira, 1993).

Benabou (1996) also reached the same conclusion, while examining the relationship between economic growth and individual capital investment. The researcher notes that in imperfect capital markets, whereby capital is limited and income inequality is such that only a few can have access to it, investment rates will also be unequal across the population. Given the law of diminishing returns, this means that high inequality will decrease aggregate output. “Therefore the more unequal the distribution of individual endowments, and hence investment, the less the current output, and therefore the less the growth rate” (Benabou, 1996).

2.5.3. *Income Inequality and Borrowers’ Incentives*

In consistency with the above, in economies subject to high income inequality, the borrowing incentives of people belonging to bottom levels of the distribution are few, because, below a level of income distribution, the cost of borrowing becomes higher than the wealth of the borrowers. As such, if income is redistributed and income distribution becomes more equal, this shall increase borrowers’ incentives, as well as the number of borrowers over the number of lenders. In the opposite case, i.e. when borrowers’ wealth is not enough to cover their investment plans, borrowers will be less, thereby reducing the aggregate level of investment efforts and, thus, undermining growth (Aghion et al., 1999).

2.5.4. *Income Inequality and Macroeconomic Volatility*

Alesina & Perotti (1994) explain how high inequality creates political instability and through that macroeconomic volatility. Inequality implies unequal access to investment opportunities across individuals, which along with the existence of capital market imperfections generate “persistent credit cycles”. In imperfect economies, i.e. in economies whereby people have uneven access to capital, or there are limited investment opportunities and only for those with high wealth, it is difficult to for the supply and demand for capital to reach equilibrium. The existence of credit-investment cycles implies that there are periods when the investment activities are non-optimal, which in turn signifies that the long run growth of this economy is
actually lower than its potential level. The regulator of the economy has two options. The first is to reduce credit constraints. The second is to **render high-yield production technology (HPT) widely available.** If anyone who is willing, is equally able to invest directly in HPT, this could lead to a persistent economic boom, which would increase the growth rate to its optimal level.

Economic development factors, such as structural changes like deregulation of patents on the one hand, or increased credit market efficiency, fighting corruption and bureaucratic constraints on the other, could achieve optimal growth rates. The same applies equally to any kind of HPT, such as increased Human Capital. Increased investment in Human Capital would imply for the agent the direct cost of education plus an opportunity cost, which would consist of the earnings forgone while studying. If the agent is at the subsistence level of income, she will most probably invest in lower levels of Human Capital, decreasing thus ceteris paribus her productivity and her income, creating thus a vicious circle (Alesina & Perotti, 1994).

### 2.5.5. Income Inequality and Fertility Rate

According to Khoo & Dennis (1999), the negative relationship between income inequality and economic growth shall be attributed to the increase in fertility rate that is caused by income inequality. More specifically, and unlike previous studies, which take into consideration market imperfections, the authors focus more on fertility rate and base their analysis on the assumption that when people have many children, then the payoff of having children during the life span increases. This phenomenon is mainly evident in poorer people of the population, given that the wealthier parents are, the greater the cost of having children. At the same time, wealthy parents also do not expect, and do not need, from their children to provide payoff sometime in the later stages of their lives. According to the economic model developed by Khoo & Denis (1999), wealthier people’s incentive to have children is lower than that of poorer ones, and this leads them to the conclusion that higher income inequality, which means that more people are poor, leads to higher fertility rate, and this, in turn, has an adverse effect on growth.

In a similar context, Perotti (1996) also examined growth as a function of income distribution and fertility rate. What the researcher found was that when the income of middle class – the normally biggest income class in a population – increases, the fertility rate drops, while growth levels also increase. The researcher also points out that wealthier people have a higher opportunity cost associated with raising their children, and, thereby, cause a reduction in the fertility rate. As such, a more equal income distribution, which would increase the incomes of people in lower income groups, would increase fertility rates, and this would have a negative effect on growth (Perotti, 1996).

### 2.6. Previous Research Findings on the Effects of Inequality on Growth

Apart from the framework developed by Kaldor, there are also previous research findings supporting the inverse relationship between income inequality and growth. One research supporting this nature of the relationship between the two concepts in the one conducted by Easterly (2007). The researcher conducted research in order to identify whether income
inequality, as a measured by the Gini Coefficient, has an impact on various functions of growth and development, and specifically on prosperity, good quality institutions, and high schooling. Data was collected from the WIDER (2000) dataset about countries belonging to the following four regions: (1) East/South Asia and Pacific, (2) Western Hemisphere, (3) Europe and Central Asia, and (4) Middle East and Africa. According to the research findings, income inequality negatively affects overall prosperity, institutions and schooling, which the author suggests, following the existing academic literature, that they are mechanisms through which higher income inequality leads to decreasing per capita income, which in turn is an important indicator of growth. The researcher concludes in that although income inequality’s main effects on growth are indirect (i.e. through other development functions that are affected by income inequality and in turn affect growth), the findings of the research indicate that there is also a strong independent and direct impact of income inequality on growth.

In a similar context, Berg & Ostry (2011) review the main results of the analysis held by the International Monetary Fund (IMF) regarding the effect of income inequality on growth and development. According to the authors, there is indeed a negative effect of income inequality on growth, not only in terms of economic prosperity, but also in terms of higher education. Of course, it is important to note that according to IMF, income inequality does not actually affect growth rate, but rather the time it takes for a country to reach certain growth rates.

The research findings of Castells-Quintana & Royuela (2012), though, provide different insights regarding the relationship between income inequality and growth. The researchers conducted research, in order to identify the effect of income inequality on growth in the period of the economic crisis that has hit the world since the second half of 2008. In fact, the researchers collected cross-sectional international data from 1980 onwards, so as to also make comparison between the crisis of the early 1980s and the crisis that the world currently faces. The researchers found for both periods that income inequality affects growth only when interacting with unemployment and urbanization, thereby indicating that income inequality may affect growth indirectly, i.e. through the moderating effect of other factors.

Clarke (1995) offers further different insights in the relationship between inequality and growth. The researcher conducted cross-country growth regressions, in order to examine the relationship between inequality and growth, as well as to comment on the existing academic literature surrounding this relationship. According to the findings of the research, there is first of all a clear and robust negative effect of income inequality on growth. However, despite the statistical significance of this correlation, it seems that the magnitude of the aforementioned relationship between the two concepts is small, since changes in income inequality by one standard deviation above or below the mean was found to lead to changes in growth by about 1.3% only. Even if this percentage is considered by some to be significant, Clarke (1995) points out that his research findings must be treated with great care. Specifically, the researcher notes that although income inequalities were found to be negatively correlated with growth, designing public policies to reduce income inequality does not mean that future growth will be empowered. The rationale behind his argument lies in decreasing income inequality incurs higher governmental spending towards those citizens belonging to low income groups. If this spending is higher than the gains of reducing income inequalities at a national economy’s levels, this shall mean that future growth shall be undermined instead. This conclusion is highly consistent with the analysis and the arguments developed by Friedman (2008). Following the fundamental
principles of from the social thought of the Indian philosopher P. R. Sarkar, Friedman (2008) advocates that in every country there must be a living wage and a maximum wage, the balance of which determines the incentives that citizens have, in order to work and be productive. In other words, some certain of inequality is accepted and must exist, so that labor has the incentive to work more. Any attempts towards reducing inequality shall offer more incentives to low-income labour to be more productive. However, the cost of such incentives shall not exceed their benefits for the long-term growth of the economy.

Last but not least, Baro (2005) also conducted research, in order to identify whether income inequality has a role to play in influencing economic growth. The researcher collected data regarding inequality and growth for a panel of different countries and found that income inequality has little or no relation with economic growth and rates of investment. Specifically, the researcher points out that although in poor countries income inequality may contribute to reducing growth, in richer countries income inequality may be an additional driver of positive growth.

2.7. Effect of Income Inequality in Different Deciles of Income Distribution on Economic Growth

As it was mentioned in the introductory section of this dissertation, one of the aims of the study is also to examine the consequences of inequality on growth at different levels of the income distribution. As it also became evident from the previous section, previous research has identified a number of factors that determine and influence the effects of income inequality on growth. However, it is the intention of this research to concentrate on the effects of income inequality at different levels of income distribution on growth; to put otherwise, in what follows this study concentrates on the influence of the different deciles of income distribution on the role that income inequality plays in determining a country’s economic growth. The importance of studying income inequality effects on growth at different deciles also derives from the inefficiency of the Gini Coefficient in providing a reliable picture of the effects of income inequality on growth.

As such, at the top of the distribution, individuals can afford to undertake their investment plans. Next to that, and as it is also reflected in the analysis regarding imperfect economies, income earners at the top of the distribution have easier access to capital, thereby being more likely to make big investments. As also analyzed in the previous section, investments are directly linked to growth and income inequality indirectly affects economic growth through the moderating effect of opportunity investments. There are, however, several scholars (Aghion, & Bolton, 1997; Banerjee & Newman, 1993; Galor & Zeira, 1993) who advocate that income earners at lower levels of the distribution are not likely to benefit from this overall growth, and this means that, under such circumstances, the economy is difficult to reach equilibrium levels. Following the above, if wealth is not redistributed in way that people at lower levels of the distribution increase their income in the long-run, then investment opportunities shall be reduced, since fewer and less productive investments will be carried out. Reducing taxation and increase wages at lower income levels, as well as lowering interest rates, could help people at the bottom levels of the income distribution to also benefit from growth at higher levels, thereby increasing overall growth as well (Aghion & Howitt, 1998). It follows that if people in different deciles of
the income distribution have different investment opportunities, then the effect of income inequality on economic growth through investment opportunities must also differ (Benhabib, 2003).

At the same time, and as it was analyzed in the previous section, even when capital markets are perfect, income inequality shall reduce the borrowing incentives of people at bottom levels of the distribution, since the relationship between their own wealth and the money they borrow is negatively altered (Aghion & Bolton, 1997). In the above context, people from lower-income groups that wish to reach the living standards of those in higher income-group will increase their consumption at the expense of their savings, which, in the short-run may lead to market growth through increasing spending, but in the long-run overall economic growth will once again be undermined (Nurkse, 1953). As income inequality deepens, and the gap between low and middle incomes widens, the free-riding effects of wealthier people’s investments in the economy get gradually undermined, thereby leading to reduced growth (Nurkse, 1953). As such, and following the theoretical framework developed by Voitchovsky (1999), income inequality shall be more reduced at lower levels of the income distribution, and it is on inequality at these low levels that emphasis shall be placed on (Voitchovsky, 2003).

Apart from the above, the different influence of top and bottom-end income inequality on growth is also verified by the corresponding analysis of IMF on the particular subject, In fact, according to the analysis of the IMF, when income share increases in the top 20% of a population (or the top-20 countries of the world in terms of their real per capita GDP), then GDP growth shall decline in the long-run. However, when income share increases in the bottom 20% of a population (or the bottom-20 countries of the world in terms of their real per capita GDP), then GDP growth is higher. The corresponding report of the IMF concludes in that the poor and the middle class matter the most for growth via a number of interrelated economic, social, and political channels (Dabla-Norris, et al.2015).

In a similar context, Birdsall (2007) also conducted research, in order to study the effects of income inequality on growth. The researcher reviewed existing literature and the findings of previous research and found that income inequality does not have the same effects on growth at all levels of the income distribution. Specifically, the researcher found that the majority of previous research findings support that inequality generally harms growth, but this is more likely to happen at low levels of income and not the high ones. Moreover, and talking about the general effect of inequality on economic growth, the researcher found that inequality negatively affects economic growth mostly in markets that are underdeveloped in terms of capital and information.

Regarding fertility rates, there is the opinion that people belonging to lower income groups cannot afford to have many children, thereby being subject to low fertility rates. However, as the analysis has indicated so far, people belong to lower income distribution levels actually tend to have more children, both as a result of their difficult daily life (having children helps in improving poor people’s psychological state) (Ahituv & Moav, 2003). In terms of income inequality, inequality at higher levels of income distribution shall further reduce fertility rates, thereby further fostering positive growth. In low levels of income distribution, though, income inequalities shall lead to further increasing fertility rates, thereby further undermining economic growth (Charles-Coll, 2013).
Taking the above into consideration, it becomes evident that when examining the effects of income inequality on economic growth at different levels of income distribution, borrowers’ incentives (as associated with interest rates) shall not be included in the analysis. At the same time, the research findings outlined and discussed in this section indicate that the other three mechanisms and factors moderating the effect of income inequality on economic growth (i.e. investment opportunities, macroeconomic volatility and fertility rates) are likely to influence economic growth in different ways at different income distribution deciles. Therefore, this study does not take the effect of these mechanisms on economic growth for granted and controls for these mechanisms, so as to identify whether their effect on growth is different at different deciles, and, thus, whether the effect of income inequality on growth as a whole is indeed negative at different levels of income distribution.

3. Method for Empirical Analysis

3.1. Research Methods

The research that was held for the purposes of this study was quantitative. The aim of this type of research is to collect data that is measurable and quantifiable, so as to be statistically analyzed (Bradley, 2007). In contrast to qualitative research, quantitative research is appropriate for collecting vast amount of data from a large sample. What is more, given that quantitative research results are statistically analyzed, they are considered as more reliable and objective than the results of qualitative research. This is because interpretation of quantitative results derives from statistical analysis and is not based on the subjective interpretations of researchers, as it happens in qualitative research (Bell, 2005).

Research using secondary data from the OECD database was held. The selection of the countries examined therefore was dictated by the availability of data.

3.2. Description of the Data Set and the Research Model

The sample of the research, from which the study’s dataset emerged, consisted of 34 OECD countries. Secondary quantitative data was collected with regards to their income inequality and their per capita GDP growth. Specifically, data about these countries was collected for four periods: 1995-2000, 2000-2005, 2005-2011 and overall from 1995-2011. The rationale behind choosing only OECD countries and only the time periods mentioned above lied in that data about income inequality and growth was available online only for this group of countries and only for the aforementioned periods.

Regarding growth (income), real GDP per capita was used in order to measure growth of the sample countries (in the analysis, the term GDP was used as a shorthand to refer to real per capita GDP). In order to measure inequality, both general inequality, as well as inequality at the top and bottom-end of the income distribution was measured. General (or overall inequality) was measured through calculating the Gini coefficient. As mentioned in the previous section, the Gini Coefficient takes values from 0 to 1, with 0 representing perfect income equality and 1 representing perfect income inequality. In order to measure inequality at the bottom levels of the
distribution (bottom-end inequality), the P50/P10 ratio was used, which, as also analyzed in the previous section, is used to calculate the median income to the upper bound value of the first decile of income distribution. In a similar context, top-end inequality was measured by using the P90/P50 ratio.

Investment, inflation and fertility were also variables that were used in the analysis, following the causal mechanisms that were analyzed in the previous section. Taking investment first into consideration, this was represented by the Gross Fixed Capital Formation variable of the Country Statistical Profiles Database of OECD, measuring the percentage annual investment growth (Barro, 1996). As far as inflation is concerned, this variable was used, since, according to Barro (1996, p. 316), “even low or moderate inflation rates (such as the ones we have witnessed within the OECD) have a negative temporary impact on long-term growth rates; this effect is significant and generates a permanent reduction in the level of per capita income.”. Regarding fertility, the coefficient of fertility used in this study reflects the effect of fertility on growth, based on the theoretical model and the channels of influence of inequality on growth developed by Voitchovsky (2003).

All the variables used in the research were sourced from the OECD Income Distribution Dataset (IDD). The IDD is a very valuable source of information, which provides indicators of inequality based on the income that households earn, according to their size. “The Income measurement for Inequality is defined as household disposable income in a particular year. It consists of earnings, self-employment and capital income and public cash transfers; income taxes and social security contributions paid by households are deducted. The income of the household is attributed to each of its members, with an adjustment to reflect differences in needs for households of different sizes (i.e. the needs of a household composed of four people are assumed to be twice as large as those of a person living alone)” (OECD, 2011). It is worth noting that the IDD provides income measures both before and after taxes, as well as both before and after movements of income along different income levels. As such, its measures also indicate the effects of any income redistribution policies that have been applied by countries during each review period every time.

3.3. Methods of Data Analysis

Log-linear OLS regression analysis was held, in order to analyze the data collected. Referring to the variables of the model, the dependent variable was growth, measured as the growth rate of the logarithmic value of real GDP. As far as independent variables are concerned, top, bottom and top & bottom inequalities and their combinations were used to develop the regression model to be tested for its ability to predict real GDP growth. The relevant significance levels were also calculated, in order to identify whether investment, inflation and fertility rates are indeed associated with different measures of income inequality in the 34 OECD countries of the sample. The measures of growth that were used as the dependent variable was that of the beginning of the years, while the values of the independent variables used were those of the previous year, so as to check the effect that inequalities and the rest of the variables had on the growth rate of the following year.
Taking the above into consideration, the growth model that was used was an equation, which was actually a log-linear function of Inequality measures (including the Gini coefficient, as well as top and bottom initial inequality; investment, inflation and fertility).

The growth rate was calculated by using the following equation:

\[ y_{it} = ay_{i,t-1} + \beta X_{it} + u_{it} \]  \hspace{1cm} (1)

Where, \( t \) denotes a 1-year period starting in the year \( t \) and \( i \) denotes each country. \( y_{it} \) is the logarithmic value of real GDP per capita. \( u_{it} \) is the error term including the unobserved country effect (\( \eta_j \)) and the time effect (\( \eta_t \)). The vector \( X_{it} \) includes the lagged values of the Inequality measures and the control variables. This set of controls includes the Gini coefficient of the previous year, as well as both top and bottom of distribution inequality measures in \( t-1 \), i.e. 90/50 and 50/10, to account separately for the impact of both ends of the distribution. The other explanatory variables are: the average investment rate measured in \( t-1 \), the CPI, measuring Inflation rates for each country at \( t-1 \), and the fertility rates in \( t-1 \).

To summarize:

\[ \text{Growth}_{it} = y_{it} - y_{i,t-1} \]  \hspace{1cm} (2)

\[ X_{it} = \beta_1 \text{Inequality}_{i,t-1} + \beta_2 \text{Income}_{i,t-1} + \beta_3 \text{Investment}_{i,t-1} + \beta_5 \text{Inflation}_{i,t-1} \]

\[ + \beta_6 \text{Fertility}_{i,t-1} \]  \hspace{1cm} (3)

\[ u_{it} = \eta_j + \eta_t + e_{it} \]  \hspace{1cm} (4)

...so that:

\[ y_{it} - y_{i,t-1} = (a-1)y_{i,t-1} + \beta X_{it} + u_{it} \]  \hspace{1cm} (5)

Two separate models A and B were developed, and two separate datasets were devised, so as to examine for both the short and the long-term effects of Inequality of Growth. The sample covers 34 OECD countries for the years 2005-2010 in Model A and for 1995-2011 and 2000-2011 in model B.

The short-lag structure of Model A, using the panel estimation technique, and the long-lag structure of Model B, using cross-sectional analysis, capture the short and long term effects respectively, of inequality on growth. These two separate approaches, the estimation of a single long growth spell with a cross-sectional method on the one hand is being exemplified by Deininger and Squire (1996), whereas the selection of the repeated one-year growth spans with panel estimation techniques is being exemplified Forbes (2000). Even though my research aim was to test the findings of Voitchovsky (2003) by replicating her model specifications, it presents an original contribution to the ongoing literature of the effects of inequality on growth insofar it examines a more recent period (1995-2011), using an expanded number of 34 (as opposed to 20) OECD countries, and testing for the mediating effects of, not only Investement, but also Inflation and Fertility. Moreover, it tests the author’s proposed inverse effects of top and bottom-end inequality in the years immediately before and after the break of the recent financial crisis of 2008.

The statistical analysis of the data collected was held with the use of SPSS Statistics 2.0.
4. Results of Empirical Analysis

4.1 Model A: Short term effects, Panel Estimation

Model A examines the short-term effects of the different measures of Inequality on Growth. In order to do so, Panel Estimation techniques were employed, with the 1-year lagged variable of the variables being regressed against the Dependent Variable. This way I managed to capture the short-term effects of the previous years’ values on my dependent variable. The choice of the period under examination (2005-2010) was made having in mind that the financial crisis broke in 2008. This way I will be able to examine for the short-term effects of Inequality, in years of generally positive growth rates, and years of generally negative growth rates, in Table 1.3.

Table 1.1 represents the findings of the regressions of the Independent Variables and the Mediators separately, for the period 2005-2010.

<table>
<thead>
<tr>
<th>Dependent: ΔlnGDP</th>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
<th>(e)</th>
<th>(f)</th>
<th>(g)</th>
<th>(h)</th>
</tr>
</thead>
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<td>lnGDP_t-1</td>
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<td>0.047***</td>
<td>0.049***</td>
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</tr>
<tr>
<td></td>
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<td>(0.010)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
</tr>
<tr>
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<td>0.001***</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>INF_t</td>
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<td>-0.007***</td>
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<td>-</td>
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<tr>
<td></td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
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</tr>
<tr>
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<td>-</td>
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</tr>
<tr>
<td>TOP_t</td>
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<td>-</td>
<td>0.027</td>
<td>0.028</td>
<td>0.026</td>
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<td>(0.102)</td>
<td>(0.102)</td>
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<td>(0.101)</td>
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<td>-0.039**</td>
<td>-0.044**</td>
<td>-0.042**</td>
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<td>(0.101)</td>
<td>(0.017)</td>
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<td>0.550***</td>
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<td>0.736***</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>N</td>
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<td>198</td>
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<td>198</td>
</tr>
<tr>
<td>Valid N</td>
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<td>183</td>
<td>183</td>
<td>183</td>
<td>183</td>
<td>183</td>
<td>183</td>
<td>183</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>.144</td>
<td>.110</td>
<td>.139</td>
<td>.142</td>
<td>.265</td>
<td>.210</td>
<td>.235</td>
<td>.148</td>
</tr>
</tbody>
</table>

34 countries: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.
6 years (05-10) N=198, Valid N=183 list wise

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01, **** p < 0.001
In Table 1.1 we see that controlling for the separate inequality measures, Gini and Top-end inequality are insignificant predictors of GDP growth of the subsequent year. Bottom-end Inequality demonstrates a negative effect with significance at p < .1. When top and bottom-end inequality are regressed directly on growth (Column c) they move in opposite directions, with top-end inequality demonstrating the expected positive effect on short term growth, albeit insignificant. Similarly, bottom-end inequality demonstrates the expected negative effect, highly significant at p < .01. When the mediator variables, namely Investment, Inflation, and Fertility, are regressed directly on growth (Column e) they are all highly significant, indicating that as per my theory section, they indeed, have an effect on the short-term growth of the following year. Controlling for the individual mechanisms of Investment, Inflation and Fertility, and top and bottom-end inequality, the effects of bottom-end inequality are marginally lower, compared to the -.045 that it was when only top and bottom inequality were accounted for (Column d). No matter how marginal the decrease, there is support for the hypothesis that at least Investment and Inflation do capture part of the effects of Inequality. The non-significant effect of Fertility instead, may be explained by the short-term structure (1 year) of the model, which does not capture the changes in fertility rates, as opposed to the highly elastic values of Inflation and Investment.

Table 1.2 represents the regressions of the dependent variable controlling simultaneously for all the mediating mechanisms and different inequality measures. The goodness of fit, with the simultaneous inclusion of all the mediating mechanisms, rises to .305, capturing a greater part of the variation in growth. Indeed, as indicated in the table below, Investment and Inflation are significant predictors of growth. Taking columns (1) to (3) into consideration, inequality, measured by either the Gini coefficient and 90/50 ratio individually are non-significant, while the 50/10 percentile ratio, was found to be negative and marginally significant to economic growth of the following year. Once again, when both top and bottom inequality measures are used simultaneously, their coefficients move in opposite directions gaining significance. Specifically, the coefficient of bottom-end inequality is negative and significant at p < .01, whereas the coefficient of top-end inequality is positive and significant at p < .1. In general, we see that the Gini is usually non-significant and gains significance only when regressed together with bottom-end inequality.
Table 1.2: Short Term Effects: Results for Period 2005-2010 – Control Variables - No Dummies

<table>
<thead>
<tr>
<th>Dependent:</th>
<th>(a)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
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</thead>
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<tr>
<td>$\Delta \ln GDP_t$</td>
<td>.046***</td>
<td>-.053***</td>
<td>-.054***</td>
<td>-.058***</td>
<td>-.053***</td>
<td>-.053***</td>
<td>-.053***</td>
</tr>
<tr>
<td>lnGDP$_{t-1}$</td>
<td>(.123)</td>
<td>(.010)</td>
<td>(.011)</td>
<td>(.009)</td>
<td>(.012)</td>
<td>(.010)</td>
<td>(.011)</td>
</tr>
<tr>
<td>INV$_{t-1}$</td>
<td>.001****</td>
<td>.001****</td>
<td>.001****</td>
<td>.001****</td>
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<td>.001****</td>
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<tr>
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<td>-.001</td>
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<td>-.004</td>
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</tr>
<tr>
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<td>-.106</td>
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<td>TOP$_{t-1}$</td>
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<td>.023</td>
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<td>.030*</td>
</tr>
<tr>
<td>BOT$_{t-1}$</td>
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<td>.693****</td>
<td>.597****</td>
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<td>.640****</td>
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<tr>
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<td>No</td>
<td>No</td>
<td>No</td>
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<td>No</td>
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<tr>
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<td>183</td>
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<td>183</td>
</tr>
<tr>
<td>Adj. R$^2$</td>
<td>.142</td>
<td>.288</td>
<td>.268</td>
<td>.293</td>
<td>.284</td>
<td>.302</td>
<td>.305</td>
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</table>

N=198 Valid N=183 list wise

Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01, **** p < 0.001

Table 1.3 presents the results of the same analysis that was held for the period 2005-2010, including time-dummies, so as to disentangle the perceived effects from the year-specific effects. As Forbes (2000, p.872) notes, the country dummies are included to control for time-invariant omitted-variable bias, and the period dummies are included to control for global shocks, which might affect aggregate growth in any period but are not otherwise captured by the explanatory variables. It is with this in mind that the period 2005-2010, was selected, so as to be able to examine the year-specific effects immediately before and after the break of the financial crisis.
Table 1.3: Short Term Effects: Results for Period 2005-2010 – Control Variables - Time Dummies Included

<table>
<thead>
<tr>
<th>Dependent:</th>
<th>(a)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \ln GDP_t$</td>
<td>-0.028***</td>
<td>-0.032***</td>
<td>-0.025***</td>
<td>-0.032***</td>
<td>-0.027***</td>
<td>-0.032***</td>
<td>-0.024***</td>
</tr>
<tr>
<td>$\ln GDP_{t-1}$</td>
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<td>(.088)</td>
<td>(.009)</td>
<td>(.007)</td>
<td>(.009)</td>
<td>(.008)</td>
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<tr>
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<td>.001***</td>
<td>.001***</td>
<td>.001**</td>
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34 countries: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

6 years (05-10) N=198 Valid N=183 list wise

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

When we account for the year-specific effect, the goodness of fit almost doubles from approximately .3 in Table 1.2 to approximately .6 in Table 1.3 throughout. When the effect of the Gini coefficient in columns 4 and 5 is considered, its value becomes negative when top-end inequality is accounted for, and positive when bottom-end inequality when bottom-end inequality is accounted for (albeit insignificant in both cases), verifying that Gini is an unstable
predictor of growth. However, when both top and bottom-end inequality are examined simultaneously (Column 6), a positive effect of .28 of top-end inequality and negative effect of -.024 for bottom-end inequality are identified, both significant at p<.05.

The coefficients of investment at (t-1) to the growth of the subsequent year remain positive and significant at p<.01, irrespectively of which inequality measure is being controlled for. The same applies for the CPI, which remains constantly negative and highly significant (p < .001). With regards to the role of fertility in the equation, when the dummy variables are excluded in Table 1.2, there is no statistical support for its correlation with growth. When the time-dummies variables are included however in Table 1.3, the regression returns with a marginal significance of p < .1 and a coefficient of -.013 (.007), only when the top-end inequality is controlled for, and the same applies when both top and bottom-end inequality are measured. What is interesting to note at this point, is that the effects of the Year Dummy variables, returned constantly negative and highly significant only for the years after the break of the financial crisis in 2008.

When we compare the coefficients of top and bottom-end inequality regressed directly on growth (Column a) to those with the mediators included (Column 6), we see an unexpected increase in their coefficients. This may be due to the reverse impact of the spillover of growth on inequality, as the relation of inequality is not linear, but it also demonstrates a reverse effect of inequality on growth. However, in Column 6 the coefficients gain significance, indicating that the proposed mechanism convey indeed part of the effect.

4.1 Model B: Long-term effects, cross-sectional analysis

Table 2.1 represents the results of the analysis for the period 1995-2011, i.e. the whole review period of this study. The method used in Model B is that of the long lag structure (16 years), using cross-sectional analysis between the growth rates of 2011 regressed on the lagged variables of 1995 to capture the long-term effects of inequality on growth.

As indicated in Table 2.1 below, for the 16-year period 1995-2011, the effects of single inequality measures on growth are consistently negative and significant at p<.05, irrespectively of whether inequality is measured by the Gini, 90/50, or 50/10 deciles, indicating a negative long-term effect of inequality throughout the income distribution. Moreover, the effects of Investment, Inflation and Fertility lose their previously strong short-term significance in the long run, indicating that their effect is being captured by Inequality instead. When top-end and bottom-end inequality are measured together, the results indicate a greater negative effect of bottom-end inequality on the growth of 2011, despite the fact that statistical significance has been lost. Both their coefficients are indeed lower than the respective values, when only top and bottom inequality are regressed directly on growth, indicating that part of their effects has been captured by the mediators, however the lack of significance does not allow for robust conclusions.
Table 2.1: Long Term Effects: Results for Period 1995-2011 – Control Variables

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<th>(a)</th>
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<td>.436</td>
<td>.441</td>
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<td>.442</td>
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34 countries: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States

2 years (1995 and 2011)  N=34 Valid N=34 list wise

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01, **** p < 0.001

For this reason, I will proceed to examine the same long-term effects for the period 2000-2011 in Table 2.2. Once again, the method used is that of the long lag structure (11 years), using cross-sectional analysis of the growth rates of 2011 regressed on the lagged variables of 2000 to capture the long-term effects of inequality on growth.
The regression for the period 2000-2011, seems to confirm my hypothesis that bottom-end inequality is negatively related to long-term growth, while there is no support for the proposed positive effect of top-end inequality. When inequality is measured only by the Gini Coefficient (Column 1) or 90/50 (Column 2), their effects are negative but not significant. When however, it is measured only by 50/10 index (Column 3), it is marginally significant again at p<.1. However, when inequality is measured both by the Gini Coefficient and 50/10 index (Column 5), a negative but insignificant effect of the Gini Coefficient is identified, whereas bottom-end inequality demonstrates a strong positive and significant at p < 0.1 effect on long term growth.

When examining the expected effects of top against bottom-end inequality (Column 6), the
results verify the negative effect of bottom-end inequality on growth, with a strong coefficient of -0.713, significant at p<0.05, while the effect of top-end inequality is insignificant. Investment, Inflation and Fertility were also found not to have a significant effect on growth for this time period as well.

Comparing the coefficients of top and bottom-end inequality without the mediators (Column a) to those when the mediators are included (Column 6), bottom-end inequality demonstrates a lower value, indicating that part of the effect of bottom-end inequality is indeed captured by the combined mediating variables in the long run.

5. Discussion and Conclusion

The present dissertation points towards a multidimensional and rather complex effect of inequality on growth. The available theoretical literature indicate that inequality can either foster or inhibit growth. Moreover, the majority of the positive mechanisms may be attributed to top-end inequality, whilst many of the inhibiting mechanisms may be attributed to inequality at the bottom-end of the distribution, or to increased overall inequality. The final effect of inequality on growth therefore, is dependent on the coefficients of these contradicting effects.

Despite the fact that the contradicting effects of top and bottom-end inequality have been identified early in the available theoretical literature, the empirical literature on the subject relies heavily on regressing only a single inequality measure, often in a (linear) growth equation. Based on data for developed and developing countries, other researches demonstrate different effects of inequality on growth. However, all of these results seem to be highly sensitive to various methodological aspects of the analysis employed, such as the econometric method employed, the time period under consideration and the quality of data.

Even though my research aim was to test the findings of Voitchovsky (2003), it presents an original contribution to the ongoing literature of the effects of inequality on growth insofar it examines a more recent period (1995-2011), using an expanded number of 34 (as opposed to 20) OECD countries, and testing for the mediating effects of not only Investment, but also Inflation and Fertility. Moreover, it tests the author’s proposed inverse effects of top and bottom-end inequality in the years immediately before and after the break of the recent financial crisis of 2008.

Taking the results of the short-term panel data analysis of the period 2005-2010 without dummies first into consideration, these are consistent with the findings of Voitsovy (2003), who also conducted a similar analysis for the period 1975-2000 and found that in the short run inequality shall have no effect on economic growth. Regarding the results presented in Table 1.3 (period 2005-2010, time-dummies included), the fact that the value of Gini coefficient becomes negative, when the top of the distribution is being controlled for, and positive when bottom inequality is controlled instead, is also consistent with the suggestion of Voitchovsky (2003) that the Gini coefficient is insignificant as a result of acting as a proxy for both the positive and negative effects of the top and bottom end inequality respectively. The fact that results are different, when top and bottom-inequality are examined simultaneously, is also consistent with the analysis of Voitchovsky (2003). Indeed, in such cases the author suggests that top and bottom
inequality variables generate opposite effects, and as a consequence, their coefficient ends up being pulled towards zero when either one or the other is the sole inequality measure in a regression. When together, their standard error rises (reflecting a high level of inter-correlation) and each coefficient moves away from zero in opposite directions, becoming significant.

Results in Tables 1.2 and 1.3 differ from those in Tables 2.1 and 2.2 insofar as the former examine a shorter period of time. In contrast, compared in Tables 2.1 and 2.2, whereby the whole review period is analyzed. This outcome is highly consistent with the analysis of Alesina & Perotti (1994) and the influence of inequality in macroeconomic volatility. According to the researchers, income inequality adds to the macroeconomic volatility of a country, but it takes time for such an effect to be observed in the real economy. Therefore, when the period 2005-2010 was examined (Table 1.2), it seems that such an effect on inequality may not have been evident. However, this long-term effect must have prevailed from 1995 to 2011. Taking the research findings of Birdsall (2007) into consideration could be also important at this point, in the sense that the researcher has found that inequality negatively affects economic growth mostly in markets that are underdeveloped in terms of capital and information. In other words, and also following the analysis of Castells-Quintana & Royuela (2012), the effect of inequality on growth has most of the times been found to be indirect, which means that inequality mainly influences economic growth through influencing other factors (e.g. investment, unemployment etc.). As such, the effects of changes in such factors on growth are also more likely to be evident in the long-run, rather than in the short-run.

Yet, the other variables that were used in the analysis were not found to have a significant effect on growth. More specifically, although researchers like Aghion et al. (1999) and Benabou (1996) support that income inequality undermines investment activities and through this opportunities for further growth, investments were not found to influence growth in the model that was developed in the research for this study. Moreover, and in contrast to the findings of Khoo & Dennis (1999), as well as those of Perotti (1996), fertility rate was not found to affect growth either. This, of course, does not prove that inequality does not have an effect on growth. Rather, the associated outcome of this research may be explained by the particular data set that was used for particular time periods. Indeed, all the aforementioned researches were conducted in earlier periods that the one that was tested in this research. Probably, the effects on growth of variables such as investment and fertility rate may change from period to period.

In any case, it was found that in the long run inequality has a negative effect on growth, especially when bottom-end inequality is taken into consideration. This outcome is consistent with the research findings of Easterly (2007), as well as those of Berg & Ostry (2011) and their review of the findings of the IMF, who all found a negative correlation between income inequality and growth, also only in the long-run. At the same time, the findings of this research contradict up to a point those of Castells-Quintana & Royuela (2012), Clarke (1995), Friedman (2008) and Baro (2005), who found that the significance of the relationship between income inequality and growth is not so highly supported by previous research findings, as well as the official data on the two variables available from OECD and other official sources. Once again, the time period that is examined every time must have some role to play in determining the effects of income inequality on growth.
Taking research results for all periods into consideration, there is significant support from the analysis that both the short and long-term effects of bottom-end inequality on growth is consistently negative in both models used, and for all the periods that were reviewed. This implies that state authorities that seek to find ways to increase growth through reducing inequality shall place emphasis on reducing income inequality among the poor by far and foremost along the income distribution. The findings of Cingano (2014) are also important here, though, according to whom the effect of inequality on growth is also negative when the second, third and fourth income decile are studied as well. This, however, does not undermine the findings of this research, given that the abovementioned deciles form the lower middle income levels of the income distribution. As such, they could also be used to describe bottom level income inequality as well.

In any case, the empirical findings of this research indicate that bottom end inequality reduces growth both in the short and the long run, while the short-term positive effect of top-end inequality does not spill over in the long run. The above outcomes verify the research findings of Dabla-Norris et al. (2015) where it was found that inequality has a positive effect on growth at the top deciles of the income distribution, and a negative effect at the bottom deciles. It is, therefore, once again verified that when examining inequality, the income groups that are examined need to be specified every time, because inequality at upper income levels may be beneficial for growth and only in the short run, while inequality at lower levels shall definitely undermine it. Indeed, in the above context, the assumption that the control mechanisms and factor of the model illustrated in Figure 3 affect growth in different ways, when examined in terms of different deciles of the income distribution.

Another possible explanation for the positive short term effect of top-end inequality has to do with the short lag structure which is being used in the panel estimation of Model A and the long lag structure, being used in the cross-sectional analyses of Model B, which capture the separate short or long-term effects of Inequality on GDP growth. These effects demonstrate the tendency to be positive and negative respectively, as Knowles (2005), Banerjee and Duflo (2003), or Forbes (2000) have demonstrated. However, even acknowledging that different structures of time periods may capture different effects of inequality, the current common approach that places emphasis on a single inequality variable and examines its individual effects on the short-term and long-term growth may be challenged.

In the above context, although it becomes evident that overall inequality has a negative effect on growth in the long-run, it is also important to identify whether this overall effect is driven more by inequalities identified in certain deciles of the income distribution. As derived from the findings of this research, a same Gini Coefficient that indicates the same level of inequality at different deciles, can lead to different effects on growth. Given, though, that inequality at the top deciles of income distribution was found to lead to positive growth, it follows that the ideal income distribution that fosters growth is the one whereby bottom-end inequality is controlled and gradually decreased, whereas inequality at top levels of the distribution is maintained. This, of course, does not means that the effect of inequality at the bottom of the distribution on growth shall be offset by the effects of inequality at the top, and vice versa. In any case, the above finding also justifies the use of the P50/10 and P90/50 ratios, apart from Gini Coefficient, in measuring income inequality. Indeed, if Gini Coefficient had only
been used, the different effects of income inequality on growth would not be reflected, and changes in growth as a result of income inequality could not have been explained by changes in income inequality at different levels of the income distribution.

To sum up, the findings of this research could be summarized as follows: *Income inequality was found to have some statistically significant connection with the national economic growth of selected OECD countries, but only in the long run. Moreover, the research findings indicate that when a distinction is made between top-end and bottom-end income inequality, top-end inequality has a positive effect on growth, while bottom-end inequality has a negative effect. Investment and fertility rate were not found to have a statistically significant effect on growth. The above findings were evident in all four periods that were studied.*

The above findings have very important theoretical and practical implications. Taking theoretical implications first into consideration, research findings indicate that inequality in different income groups influences growth in different -actually opposite- ways, thereby implying that when the impacts of income inequality on any other function are examined, it is important to conduct the analysis taking different income groups every time. Moreover, and even when studying the effects of income inequality of growth in general, the time whereby such effect is analyzed shall also be taken into consideration, since, as the research findings indicated, income inequality has a negative effect on growth only in the long run. As such, the effects of the control mechanisms and factors illustrated in the diagram of Figure 3, shall not be taken for granted, unless the discussion is held about the long run.

As far as practical implications are concerned, the analysis indicates that OECD countries, as well any country, i.e. even those that are not OECD-members, need to pay huge attention to inequalities identified at the bottom deciles of income distribution, since these are the income groups whose inequalities affect national growth at most. Essentially, measures towards reducing inequality shall mean increasing governmental spending in social welfare towards the poor, as well as increasing their wages and offering them more and better employment opportunities, as a means of increasing employment for low-income groups, and, if possible, their earnings. Next to the above, reducing taxation of people in low income groups, while also increasing access to education of these people, shall further reduce bottom-end inequality, thereby further fostering growth. The above are indeed very important, if the consequences of income inequality both from an economic and a social perspective are taken into consideration, as these are described in the second section of this dissertation (Sapolsky, 2005; Wilkinson & Pickett, 2009).

Of course, following the research findings of Clarke (1995), as well as the theoretical framework developed by Friedman (2008), such policies shall be designed and implemented with great care, and only when the benefits offered by enhancing greater equality are higher than the cost of implementing such policies. Otherwise, long-term growth will not be fostered, but it will rather be undermined, and this will again have a more negative impact on lower-income groups, no matter whether income distributions has become more fair for them.

At the same time, although it is proposed above that countries need to pay very much attention to reducing income inequality and especially at the bottom levels of their income
distribution, this does not mean that in this way they will certainly grow. Indeed, following the research findings of Castells-Quintana & Royuela (2012), Clarke (1995), Friedman (2008) and Baro (2005), the negative relationship –actually, even any relationship- between income inequality and growth is not widely supported by empirical evidence and certainly not in the short-run. In any case, though, reducing income inequality, especially in low-income groups, is always positive, as the theoretical framework on which this dissertation is based indicates. As such, even if growth is not increased, reducing income inequality shall certainly offer many economic and social benefits to OECD countries, as well as other countries across the globe. After all, although income inequality has decreased during the last decade, the phenomenon of income inequality remains an important phenomenon still evident in a global context, even in very rich countries such as United States, and it, therefore, needs to be managed through policies such as those recommended above.

Last but not least, this study was also subject to certain limitations. One of these refers to the indicators that were used for the measurement of inequality and growth. Specially, one major drawback of the inequality indicators that were used in the analysis is that their value changes, as changes in the income distribution take place, i.e. when changes in income occur. The problem is that when a change in income occurs, it is difficult to identify the level of the income distribution where the change occurred, which would be very important, in order to identify the effects of income distribution on growth.

Related to the above is also another major limitation of the study, the one of including certain variables in the analysis, while at the same time excluding others. Specifically, Deininger and Squire (1996, p.565) suggest that when income inequality is measured, “the data should be based on nationally representative surveys, they should cover the entire population rather than subsets, and they should encompass all levels of income”.

It is indeed very difficult to assess the direct effects of income inequality on growth, taking into consideration the several indirect effects that income inequality can also have on growth. This means that results of the analysis have been subject to omitted variable bias, which could be positive or negative, depending on the variables that were excluded. For example, excluding the degree of capitalism from the regression model shall have led to positive bias, whereby excluding market corruption shall have led to negative bias. In the same context, the findings of Castells-Quintana & Royuela (2012) indicate that factors such as unemployment and urbanization are also likely to play a significant moderating role on growth. However, it is very difficult to predict and measure the exact effects of omitted variables. Of course, excluding variables from the model is not necessarily a limitation, since, based on the research findings of Easterly (2007), there is also direct and independent effect of income inequality on growth, irrespective of the other factors that affect and are affected by income inequality. In any case, and taking the above into consideration, future researchers that have access to more information and have more time available for such an analysis shall carry out a study including other variables like those mentioned above, which were omitted from this study. In this way, more indirect effects of income inequality shall be found, while a number of factors that have a moderating effect on the effect of income inequality on growth shall also be identified.

Referring to the research variables that were used in the analysis, another limitation is
certainly their endogeneity. Given the approach of standard panel, which was followed for the purposes of this research, the existence of real GDP per capita in both sides of the equation indicates that in the case that within-group techniques are used, then coefficients of other independent variables are also likely to be influenced by changes in real per capita GDP, due to their correlation with this variable (Easterly, 2007; Hsiao, 1986). As a means of providing a solution to this problem Forbes (2000) has used the so-called “first-difference GMM technique”, as developed by Arelano and Bond (1991). The above indicate that apart from the variables, the techniques used in each model should be taken into consideration as well, so as to ensure that the full set of coefficients is consistently estimated.

Next to the above, another limitation of the study is the fact that OECD countries were only used in the analysis. As mentioned in the methodology section of this study, the decision to include data from OECD countries only in the analysis lied in that income equality and growth data was available online only for these countries. In any case, though, the decision to use a sample of 34 OECD countries makes the sample very homogenous, given that it consists of countries with high incomes, especially compared with non-OECD countries. By using this sample, the research also fails to take into consideration the effects of income inequality in one country on the growth of another country, as these could emerge from transfers of labor, capital and overall trade activities. The above limitation has important implications for future researchers, who could conduct the same research in the future, using data from many more countries, also encompassing developing countries as well. This would provide a more rational, realistic and complete view of the effect of income inequality on growth, while also providing important insights and implications regarding how income distribution and inequality shall be handled not only in developed, but also in developing economies. After all, given that bottom-end income inequality was found to have a more significant effect on growth, probably conducting the study for developing countries is even more important than conducting it in developed ones.
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