

INCOME DISTRIBUTION DETERMINANTS AND INEQUALITY IN CROATIA

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ABSTRACT

This paper presents the determinants of income distribution and their inequality in Croatia. The aim of this paper is to identify all variables affecting income distribution and inequality in Croatia. Looking at the data from 2001 to today, we come to the conclusion about the possible impact of social transfers, inflation, wages, government consumption and other variables on income distribution. In this paper, we will specifically focus on the calculation of inequality in the distribution of income based on the basic indicators for the calculation of inequality such as the Gini coefficient and other measures. Today, we can talk about the influence of the state on income distribution, the impact of education, regional influences, and other impacts, but we can't quantify individual impacts. There is no calculation that would show us the importance of an individual impact or its quantifiable effect. It is precisely the basis of this paper, where it tries to show the effect of certain variables, as well as their importance in order. The issue that goes through this paper is very important because it seeks to determine the determinants of income distribution and on the basis of this determinants, it estimates why inequality in income distribution occurs and how this inequality can affect other aspects of the economy. Based on this paper, one can get an answer on how and whether inequality in the distribution of income affects the creation of an economic crisis. This paper is a continuation of the research conducted in Croatia on the topic of inequality in the distribution of income. However, these papers have looked at the individual effects on income distribution, such as the influence of the state, the level of education etc. Unlike previous works, this paper tries to evaluate all possible impacts on inequality in income distribution and also to show their mutual influence and classify their importance.

Keywords: *Gini coefficient, Income distribution, Inequality*

1. INTRODUCTION

Inequality of income is one of today's major problems affecting modern economics. From inequality of income distribution comes to the inequality of wealth between individuals. From this inequality there are many problems related to the modern economy. One of the problems is the disappearance of the middle class, only very rich or very poor individuals remain. In this paper, we study which variables have the greatest impact on income inequality, ie which variables have no effect. Although, according to the theory, certain variables must have a strong impact on the distribution of income, Croatia shows that these variables have no effect. In addition to the influence of individual variables, we have computed different coefficients such as Theil-T, Theil-L and Theil-S coefficient, Gini coefficient, Plato and Hoover coefficient, and Theil-T and Theil-L Redundancy. In addition, the Lorenz curve for the Republic of Croatia was developed in the observed period.

2. LITERATURE REVIEW

By studying the literature regarding the basic determinants of inequality and income distribution, we come to the conclusion that very little has been written on this topic in Croatia. There are several authors dealing with the topic mentioned, however the dates of the research

refer to the year 2000 and earlier. After 2000, there are no recent researches related to this issue. Authors like Nestić (2002) are concerned with studying economic inequality in Croatia. He studied economic inequality in Croatia in the period from 1973 to 1998. The results of his work were obtained on the basis of data from household consumption surveys for the given period. The results of his work show a decrease in inequality in income distribution, which is completely different from the perception of the public. The same author in 2005 publishes the article "The distribution of income in Croatia: What do the data from the Household Consumption Survey show us?". In this paper, the author deals with the study of the characteristics of income distribution in Croatia for the period 1998-2002, based on the survey data on household consumption. The results of this paper show a slight increase in inequality in the given period, as a result of a non-linear increase in pensions. In 1999, the same author deals with the issue of income distribution and economic growth. This paper gives an overview of basic theoretical and empirical insights on the effects of income distribution on economic growth and the application of such insights into the analysis of income redistribution policy in Croatia. The conclusion of this paper is that for a stable economic growth in the long run, it is best to guide the policy of avoiding unnecessary inequality in the way that the poorer and more vulnerable sections of the population increase the opportunities for success by providing additional health care, quality education, a fair legal system and access assurance financial markets and a satisfactory level of public services. Within a short period of time, well-targeted social transfer programs, an adequate network of social security, and increased public sector efficiency could help. Apart from watching consumption of households and their analysis, other authors are engaged in studying the impact of education on income distribution. Thus, Bejaković (2010) is engaged in studying the distribution of income with regard to education levels. The results of the research showed that young people behave very rationally, that is, they seek those occupations and educational levels that allow them easier employment and higher incomes. In the rest of the survey, statistical data on income distribution in the OECD countries are presented. Cini and others (2011), in their work, are examining the problem of income distribution and poverty analysis of the Republic of Croatia. This paper deals with issues of inequality in the distribution of income and wealth, with particular reference to sources of income inequality as well as the problem of poverty and the way of combating poverty. Unlike authors in Croatia, there are many authors in the world who write about income inequality and its determinants. Authors Galor and Zeira (1993) deal with macroeconomics and income distribution. This paper explores the theoretical link between income distribution and macroeconomics, through investment in human capital. The main interest in this paper is how income and wealth distribution are related to long-run macroeconomic issues, such as economic growth and sectorial adjustment. It is shown that the distribution of wealth can significantly affect aggregate economic activity both in short and in the long run. Afonso and others (2008), studying the determinants of income distribution and efficiency of public spending. In that paper they examine the impact of public spending, education, and institutions on income distribution in advance economies. They also assess the efficiency of public spending in redistributing income by using Data Envelopment Analysis non parametric approach. They find that public policies significantly affect income distribution, notably via social spending, and indirectly via high quality education/human capital, and via sound economic institutions. Okidi and others (2004), wrote a paper entitled "Understanding the determinants of income inequality in Uganda". This paper is interesting because Uganda in last period of ten years experienced gradual and sustained economic growth and poverty reduction. The benefits of growth, however, are not being distributed equally. This study provides insights into deeper understanding of the determinants of income inequality in Uganda. Decompositions by subgroups revealed that household characteristics are influential components of overall inequality, a finding also supported by the results based on the regression analysis.

Perdiz and others (2010) wrote about World's Growth and Inequalities. This paper focuses on the relevance of the choice of a measure (or meaning) of inequality. The prediction that can be deduced from this paper about growth and inequality relationship is that although, in the short term, economic growth may be accompanied by the simultaneous rise of some aspects of inequality and fall of other ones; in long term, economic growth will hardly cause a robust rise in inequality, because inequality has reached historical heights. Wan and others (2006), wrote about inequality –growth nexus in the short and long run: Empirical evidence from China. This paper argues that the conventional approach of data averaging is problematic for exploring the growth-inequality nexus. It introduces the polynomial inverse lag framework so that the impacts of inequality on investment, education, and ultimately on growth can be measured at precisely defined time lags. Kookshin (1997) wrote about trends in and determinants of income distribution in Korea. This paper shows that, contrary to the official statistics, the size distribution of income in Korea has not improved steadily since the late 1970s but deteriorated worst than ever in the late 1980s. It argues that the high rise of real estate price, which causes prevalent sense of relative deprivation, is also a major root of worsened income distribution in the 1980s. Alejos (2003) observe contribution of the determinants of income inequality in Guatemala. This paper decomposes income inequality in Guatemala in factors related to human capital, ethnic and gender discrimination, the occupational structure, and non-labour income. The empirical results show a significant variation in the contribution between the determinants at a national level, and those of each socio-economic group in which the sample is divided. It is found that the most heterogeneous group is that of agriculture and livestock workers. Nonetheless, the role of education as one of the main determinants of income inequality is persistent across the sample. Income inequality and economic growth: enhancing or retarding impact is a theme that is studied by Mekenbayeva and others (2011). The aim of this paper was to study the relationship between income inequality and economic growth in developed and developing countries and make comparisons between them. The analysis is performed by using panel data model for nine countries for 1980-2009 time period. As an indicators of income inequality Gini index is considered and real GDP per capita is used for exhibiting economic progress in the countries under study. Odedokun and others (2001) worked on determinants of income inequality and its effects on economic growth, evidence from African countries. The paper empirically investigates, in the context of African countries, the determinants of income distribution and inequality, the effect of inequality on economic growth and the channels through which inequality affects growth. Campana and others (2006) have written a book on the general distribution of income, which looks very notion of income distribution, its role and impact on economic growth and other determinants of income distribution. Another book called *Modeling Income Distributions and Lorenz Curves* by Chotikapanich (2006), Is a collection of papers, that gives great contributions to the study of personal income distribution and inequality measures. Roine and others (2009) wrote about long-run determinants of inequality. This paper studies determinants of income inequality using a newly assembled of 16 countries over the twentieth century. The results show that periods of high economic growth disproportionately increases the top percentile income share at the expense of the rest of the top decile. Gobbin and others (2004) worked on income inequality data in growth empirics: from cross-sections to time series. As in any other field of applied macro-economic or econometric research, researchers who study income inequality have need to look for suitable data. Although most researches just draw on some ready-made dataset, finding reliable data is not that straightforward and can even be very troublesome. This paper highlights some of the pitfalls in the use of inequality data.

3. DATA

Data used in this paper were collected from the Canback global income distribution database. C-GIDD is the world's most comprehensive and detailed database for GDP and income distribution data. The dataset covers 210 countries, 692 subdivisions (states, provinces, etc.) and 1020 major cities from 1997 to 2017. The variables used in this paper are the number of individuals with household consumption in constant purchasing power parity (\$ PPP) number of households with household consumption in constant 2005 purchasing power parity (\$ PPP). The following graphs show these two variables and their values from 2001 to 2017.

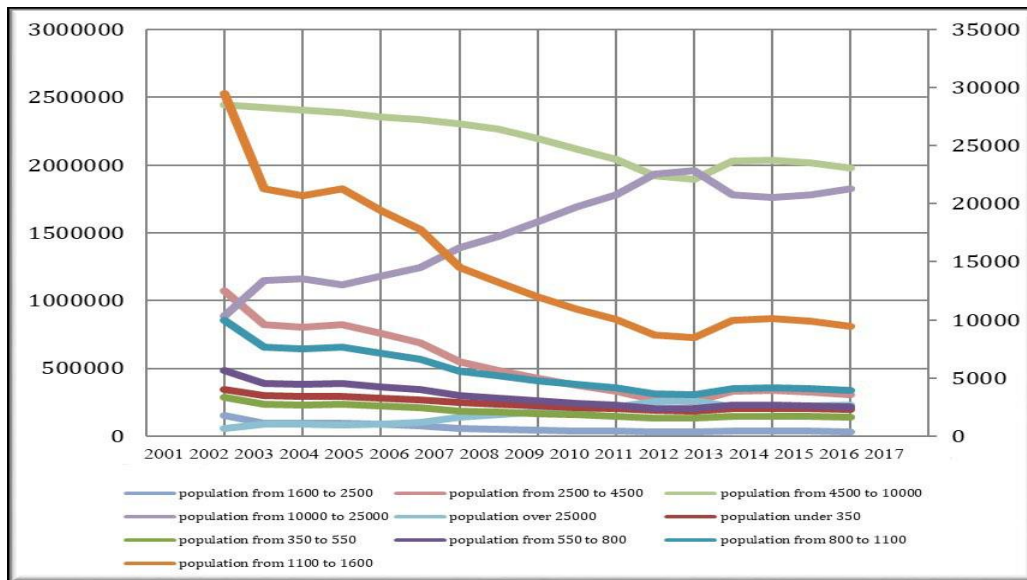


Figure 1: Individuals with household consumption in constant 2005 PPP
 (Source: Canback global income distribution database)

From the above graph we can notice that the majority of the population is within the range of 4500 to 10000 \$ PPP and within the range of \$ 10000 to \$ 25,000 PPP. We can also see that all classes tend to decline from 2001 to 2010, only the pop_10000 to 25,000 class has a tendency of growth. This tells us that there has been a big change in the structure of spending of individuals who slowly grew and moved to that class through the observed years.

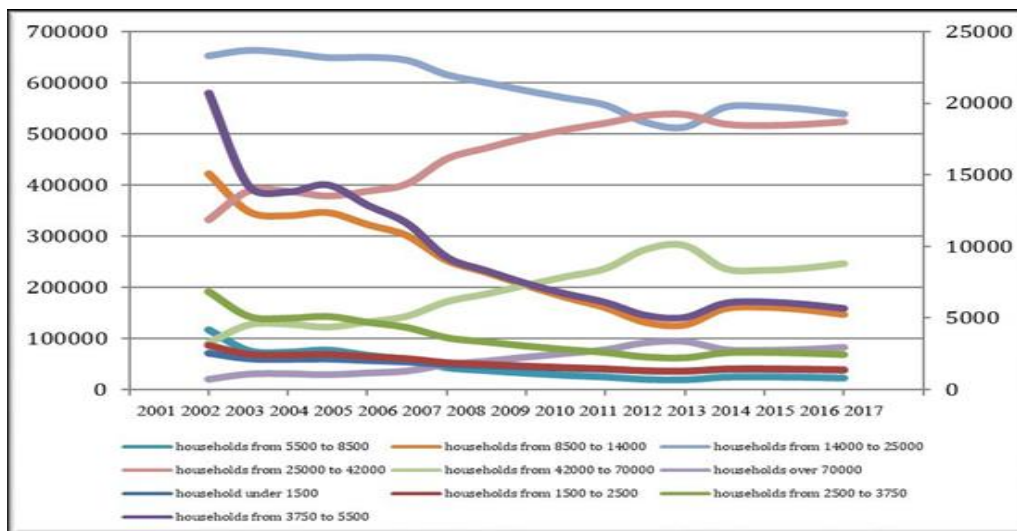


Figure 2: Households with household consumption in constant 2005 PPP
 (Source: Canback global income distribution database)

In Figure 2 we can see that the movement of households by individual classes equals the movement of individuals as shown in the previous graph. It follows that the largest number of households in which the largest number of households falls is that of \$ 14,000 to \$ 25,000 PPP. After that it is followed by a class of \$ 25,000 to \$ 42,000 PPP. We can also observe that the trend is the same as in households and households, and this is why large numbers of households move to a higher grade throughout the observed years. Therefore, the class of \$ 25,000 to \$ 42,000 PPP has a certain growth over a number of years. Although we are writing about income inequality in this paper, the data that we take are individuals and households with household consumption expressed in purchasing power parity in dollars with constant 2005 year. The reason for applying this data to the calculation of social inequality is precisely that there is a large number of negative opinions of scientists about the use of income data as a measure of inequality. We believe that individual income data is not relevant to the calculation of inequality or is not the best measure. More accurate and reliable, and with this we can get measurable results on social inequality if we use spending data. The income statement does not tell us whether this income is sufficient to settle life obligations, but merely represents the figure, while consumption talks about the direct need for a specific income and thus represents a better measure of social inequality. The variables we use to show the equations in the following chapters are as follows:

- A_i : "people" (amount of individuals in group $_i$ of a society), $A_{total} = \sum_{i=1..N}(A_i)$
- E_i : "wealth" (total wealth owned by that group $_i$ of a society), $E_{total} = \sum_{i=1..N}(E_i)$
- N : amount of groups (quantiles, percentiles) in the society
- $Z_{...}$: inequality measure for society (unified group, all groups)
- $R_{...}$: redundancy (maximum entropy of society less actual entropy of society)

The above data will calculate certain parameters that show income inequality in Croatia. Some of the parameters to be calculated are Theil-T, Theil-L and Theil-S coefficient, Gini coefficient, Plato and Hoover coefficient, and the Theil-T and Theil-L Redundancy will also be presented. In addition to these coefficients, Symetric Redundancy and Inequality Issues will be calculated. After that, a comparison of the obtained coefficients or indicators of inequality with some of the more important economic variables of the observed country will be presented. Entropic inequality measures like Theil's entropy actually are not entropies. They are redundancies. The redundancy of a system at a given time is the difference between its maximum entropy (e.g. Theil: $\ln(A_{total}/E_{total})$) and its present entropy (e.g. Theil: $\sum_{i=1..N}(E_i * \ln(A_i/E_i))/E_{total}$) at that time. In a system a certain amount of transformations is possible. The sum of transformations, which already have occurred, cannot be reversed without help from outside. Entropy is a measure that tell us how many transformations have already occurred in that system. The redundancy serves as a measure that tell us how many transformation opportunities are still available. If completely equal distribution in a system leads to maximum entropy of that system and if low entropy of that system is caused by high distributional inequality, then achieving equal distribution means that the distribution process is saturated. In that case a relative equality measure can be defined using the term e^{-R} , where R is the redundancy (the remaining distribution possibility) of the system and e is Euler's constant. As for the relative inequality, $Z=1-e^{-R}$ applies.

The equation for the Theil-T redundancy has the following form:

$$R_{Theil} = -\ln(1 - Z_{Atkinson}) = -\ln(Z_{MacRae})$$

$$\geq \ln\left(\frac{A_{total}}{E_{total}}\right) - \sum_{i=1..n}(E_i * \ln\left(\frac{A_i}{E_i}\right))/E_{total} \quad (1)$$

The following equations that we show is the Theil-L redundancy:

$$R_{liehT} = -\ln(1 - Z_{nosinktA}) \geq \ln\left(\frac{E_{total}}{A_{total}}\right) - \sum_{i=1...N}(A_i * \ln\left(\frac{E_i}{A_i}\right))/A_{total} \quad (2)$$

And recent equation related to Theil coefficients are shown in the following form:

$$R_{sym} = -\ln(1 - Z_{sym}) = 2 * Z_{Plato} * \operatorname{artanh}(Z_{Plato}) = \frac{R_{Theil(E/A)} + R_{Theil(A/E)}}{2} = (R_{Theil} + R_{liehT})/2 \geq \sum_{i=1...N}(\ln\left(\frac{E_i}{A_i}\right) * \left(\frac{E_i}{E_{total}} - \frac{A_i}{A_{total}}\right))/2 \quad (3)$$

The Gini coefficient is a quantitative indicator of the degree of inequality in income levels. The value of the Gini coefficient is in the range from 0 to 1. If the value is closer to zero, than we have an equal distribution of income, and if the value of the coefficient is close to one, we have an unequal distribution of income. The equation for the Gini coefficient is displayed in the following format:

$$Z_{Gini} \geq 1 - \sum_{i=1...N}((2 * \sum_{k=1...i}(E_k) - E_i) * A_i)/(E_{total} * A_{total}) \quad (4)$$

Plato wrote that “any city however small, is in fact divided into two, one the city of the poor, the other of the rich.”. The following equations show the Plato inequality:

$$Z_{Plato} \approx 1 - \arcsin((1 - Z_{sym})^{(0.06 * Z_{sym} + 0.61)}) * 2/\pi \quad (5)$$

The Hoover index, also known as the Robin Hood index, is a measure of income inequality. It is equal to the portion of the total community income that would have to be redistributed (taken from the richer half of the population and given to the poorer half) for there to be perfect equality. It can be graphically represented as the longest vertical distance between the Lorenz curve, or the cumulative portion of the total income held below a certain income percentile, and the 45 degree line representing perfect equality. The equation for the Hoover index has the following form:

$$Z_{Hoover} \geq \sum_{i=1...N}(\frac{E_i}{E_{total}} - \frac{A_i}{A_{total}})/2 \quad (6)$$

There is an inequality measure which takes care of the fact, that aggression against inequality can be positive and negative: The Redistributive Aggression is defined to be the difference between plain inequality weighted by perception (the Symmetric redundancy) and the unweighted plain inequality (the Hoover inequality). This aggression measure is a social entropy measure or it can be interpreted as a redundancy measure for those to whom redistribution is a business. This measure is also called Inequality Issuization.^{[1][SEP]} Symmetric redundancy R_{sym} represent half of the sum of Theil's redundancy $Z_{Theil}(E|A)$ and Theil's redundancy with swapped data $Z_{Theil}(A|E)$

Equations for Inequality issuization for symmetric redundancy are presented in the following form:

$$Z_{sym} = 1 - \exp(-R_{sym}) = 1 - \sqrt{(1 - Z_{Atkinskon}) * (1 - Z_{nosniktA})} \geq 1 - \exp(\sum_{i=1...N}(\ln\left(\frac{A_i}{E_i}\right) * \left(\frac{E_i}{E_{total}} - \frac{A_i}{A_{total}}\right))/2) \quad (7)$$

$$R_A = \frac{R_{Theil+R_{liehT}}}{2} - Z_{Hoover} = R_{sym} - Z_{Hoover} = \sum_{i=1}^N (\ln \left(\frac{E_i}{A_i} \right) * \left(\frac{E_i}{E_{total}} - \frac{A_i}{A_{total}} \right) - \left(\frac{E_i}{E_{total}} - \frac{A_i}{A_{total}} \right) / 2) \quad (8)$$

4. EMPIRICAL RESULTS

Results obtained in this study are shown in the following Figures:

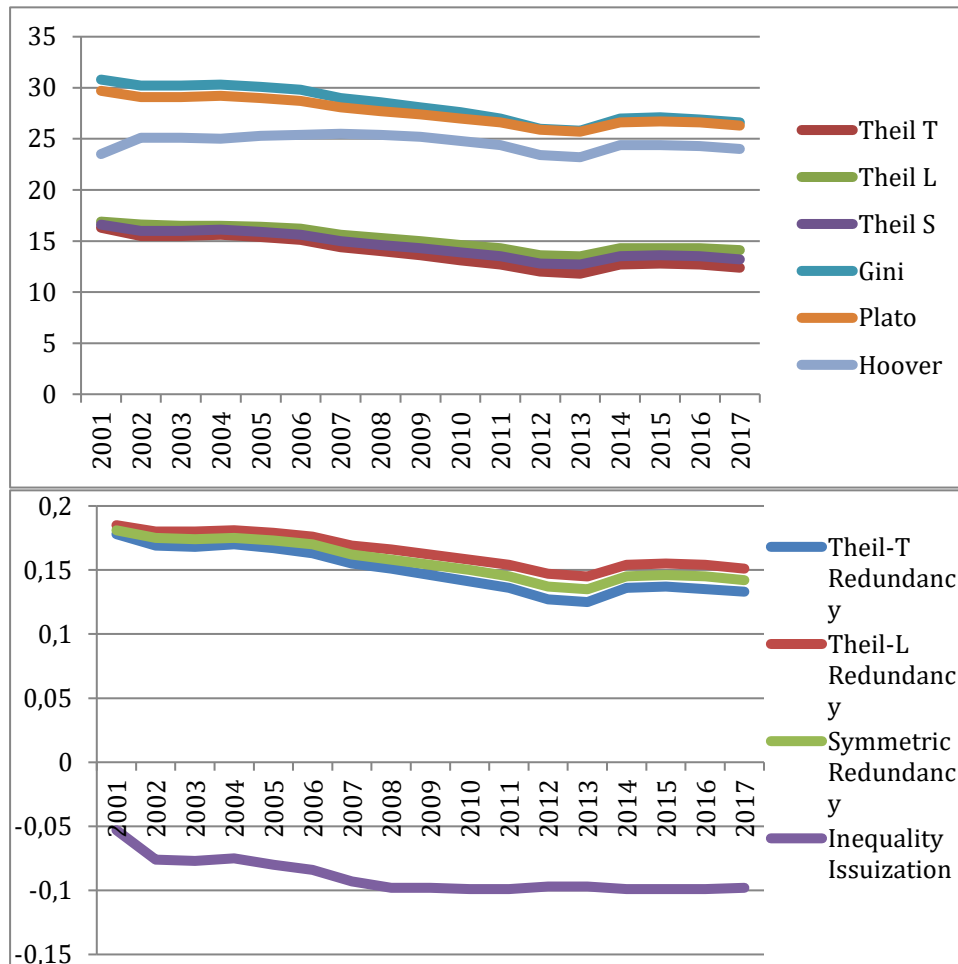


Figure 3: Results for individuals and their coefficients
 (Source: Authors calculation)

On Figure 3 we can notice that all coefficients have been slightly down from 2001 to 2010. After 2010, there is a slight increase in the coefficients. It should also be emphasized that all the observed coefficients have the same pattern of behavior or movement over the observed period of time. As the most important coefficient, we observe the Gini coefficient. Its movement is about 30% in 2001 or 0.3 to 26% in 2015, or 0.26. Given this data, we can say that in Croatia the Gini coefficient indicates significant equality in income distribution. This conclusion is confirmed by the other calculated coefficients.

Figure following on the next page

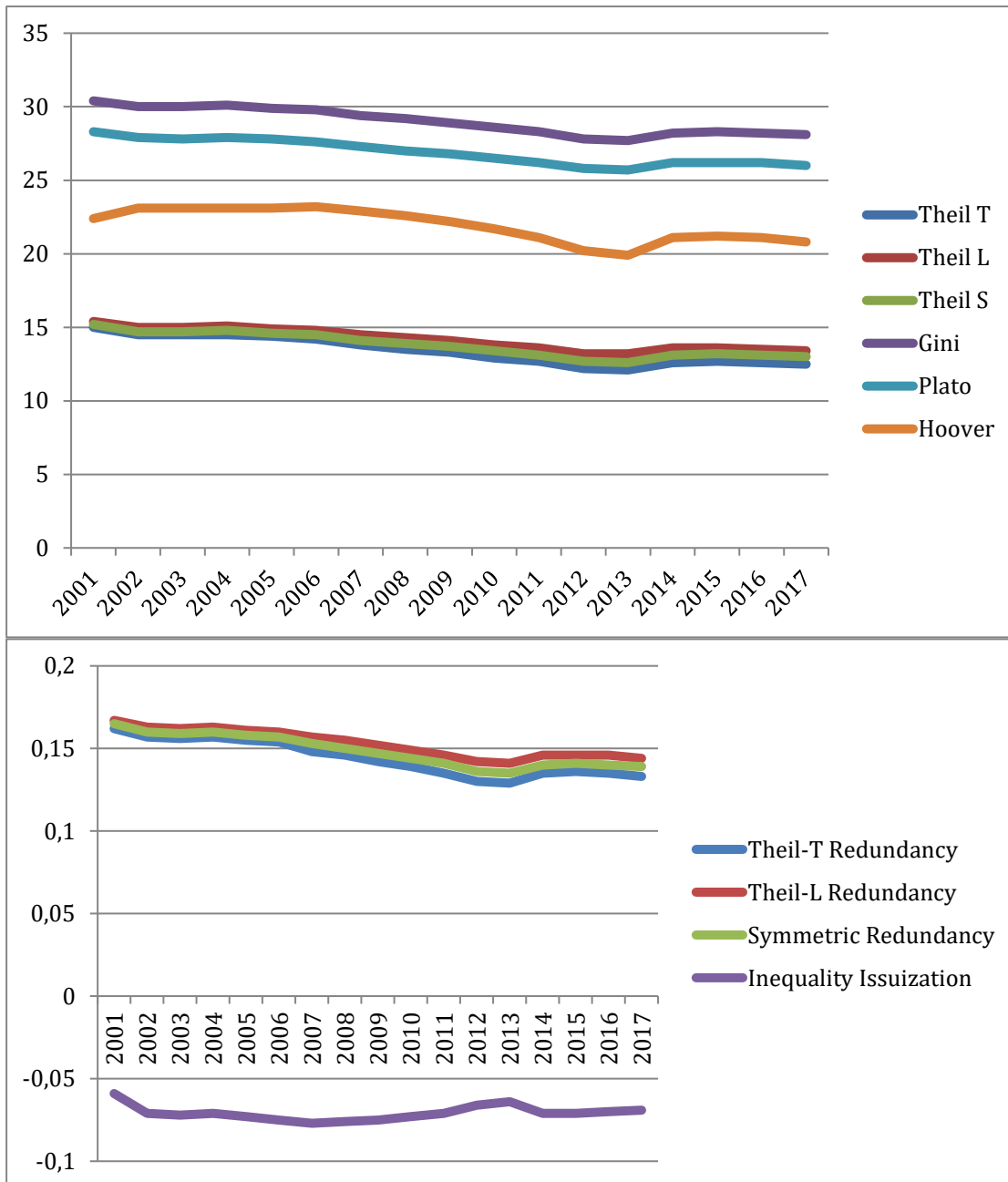
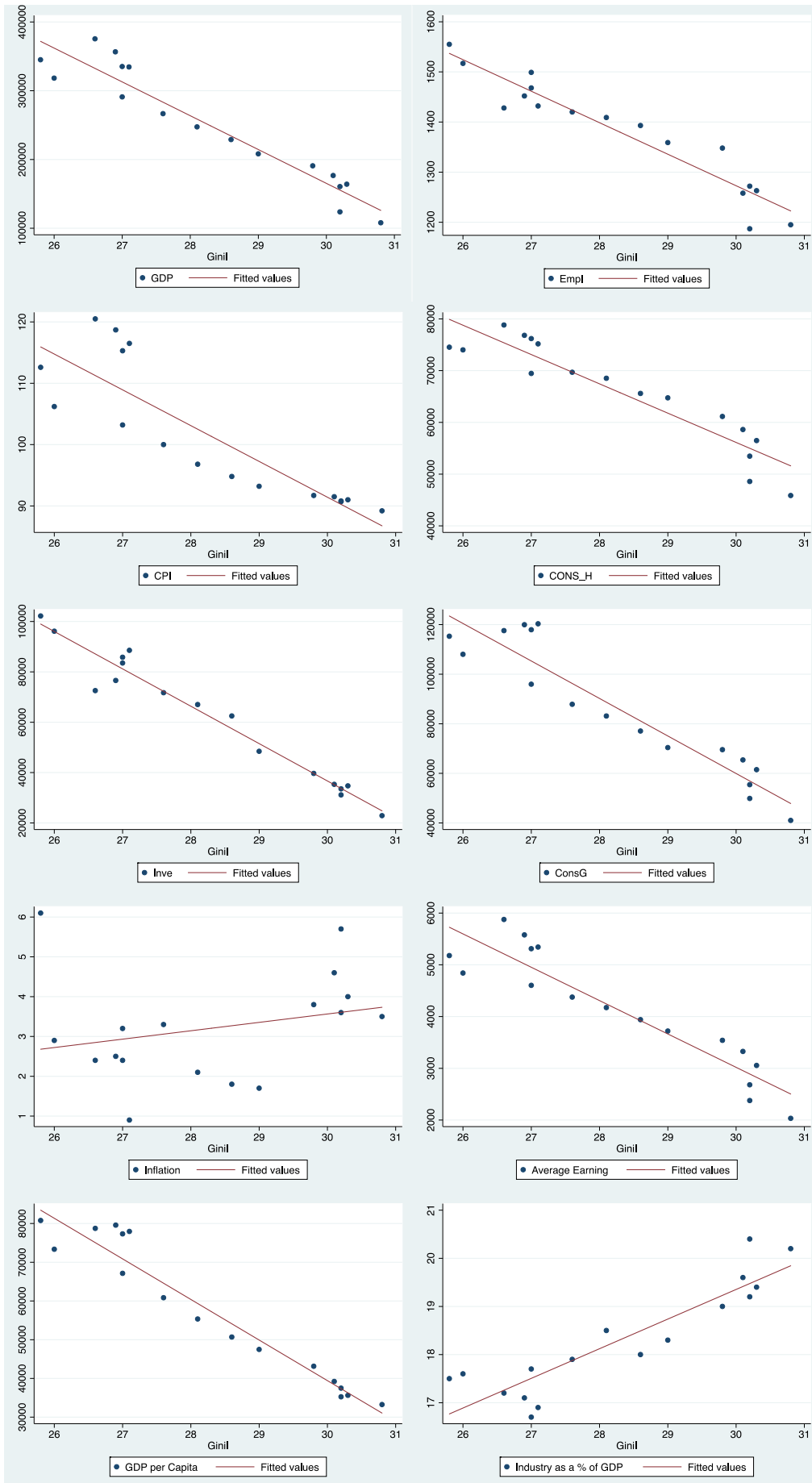


Figure 4: Results for households and their coefficients
 (Source: Authors calculation)

What we can conclude from Figure 4 is that the coefficients calculated for individuals have the same tendency of behavior as the coefficients calculated for households. This confirms the previously derived conclusions about the distribution of income in Croatia. The diagram below shows the scatter diagrams between the Gini coefficient and the more important macroeconomic variables such as GDP, employment, personal consumption ... etc. We can conclude that there is a strong correlation between all variables and the Gini coefficient. In the case of the observed relationship between the Gini coefficient and GDP, we can conclude that there is a large correlation, which can be observed from the observed scatter diagram. The most important reason is that the Gini coefficient is calculated on the basis of individual consumption data, which is one of the constituent parts of GDP. Likewise, the personal consumption on the basis of which the Gini coefficient has been calculated is permeated through all observed variables, and therefore there is a very large correlation between all observed variables.



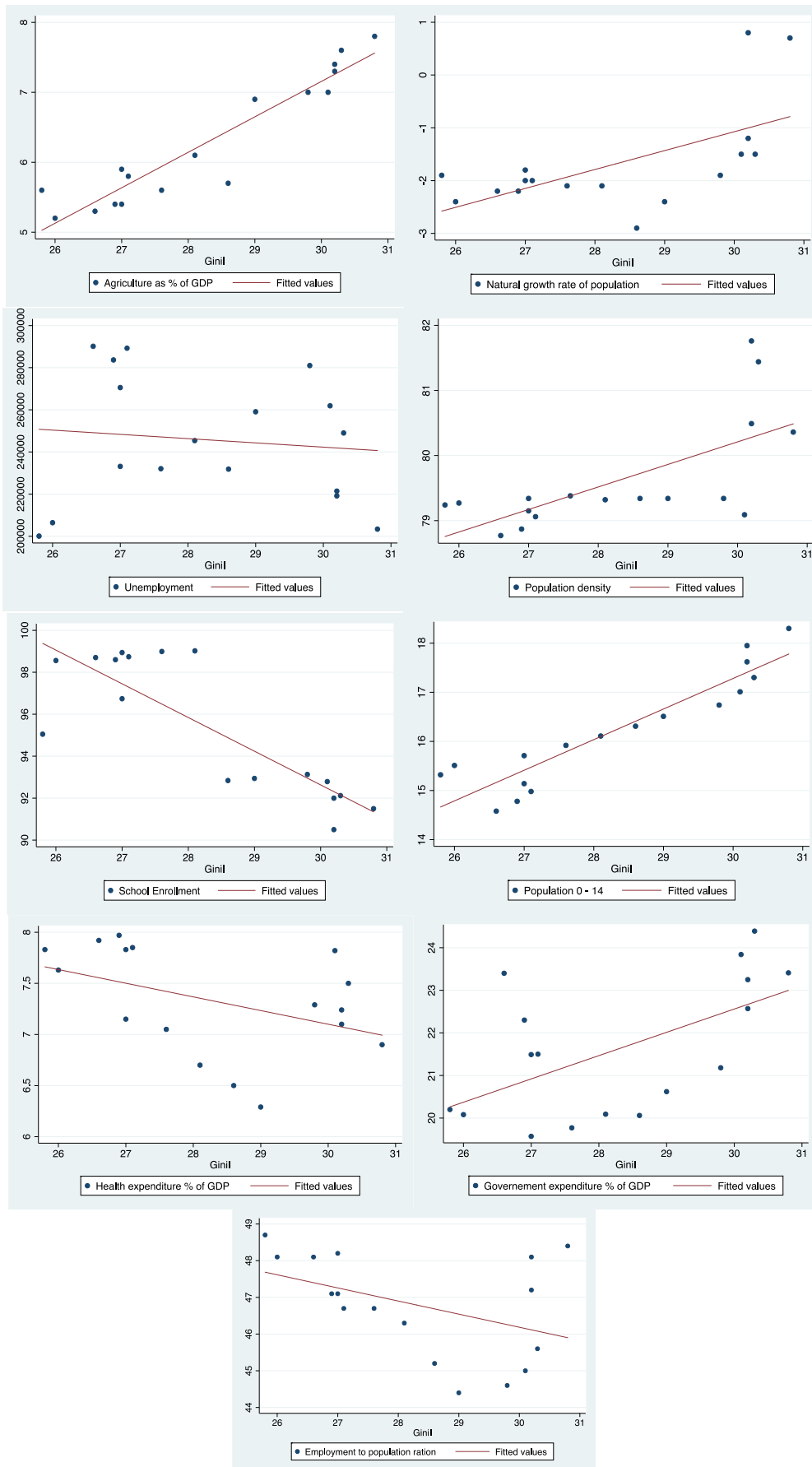


Figure 5: Scatter diagram of the Gini coefficient and the major macroeconomic variables (Source: Authors calculation)

In theory, economic trends have a major impact on income distribution. All macroeconomic variables should have an impact on that distribution. But observing certain variables in our model, we come to a different conclusion. Gross domestic product, employment, government spending and investment have a major impact on income distribution. This can be seen both by theory and by the model, in scatter diagrams. According to theory, surprisingly weak influence on income distribution has unemployment and inflation. Theoretically, they should have a great impact, but in the model, this influence is negligible. However, such same conclusions are drawn by many scientists based on the models developed. Thus, Jant and Jenkins (2001), studying the influence of macroeconomic variables on income inequality in the United Kingdom in the period 1961 to 1991, come to the same conclusion as to the negligible influence of inflation and unemployment. What is particularly appealing in this model is the very weak influence of the total number of enrolled children in educational institutions. Although the theoretical level of education should have a significant effect on the distribution of income, in this case we see that this is not the case. We can conclude that in Croatia there is still no big difference in income among those who have higher education and low education, and there is no significant impact on education on the level of income. Lorenz curve is a graphical representation of the cumulative distribution function of the empirical probability distribution of wealth; it is a graph showing the proportion of the distribution assumed by the bottom y% of the values. It is often used to represent the income distribution, where it shows the bottom x% of households, what percentage of the total income they have. [1] The percentage of households is plotted on the x-axis, the percentage of income on the y-axis. It can also be used to show distribution of assets. In such use, many economists consider it to be a measure of social inequality. It was developed by Max O. Lorenz in 1905 for representing the inequality of the wealth distribution.

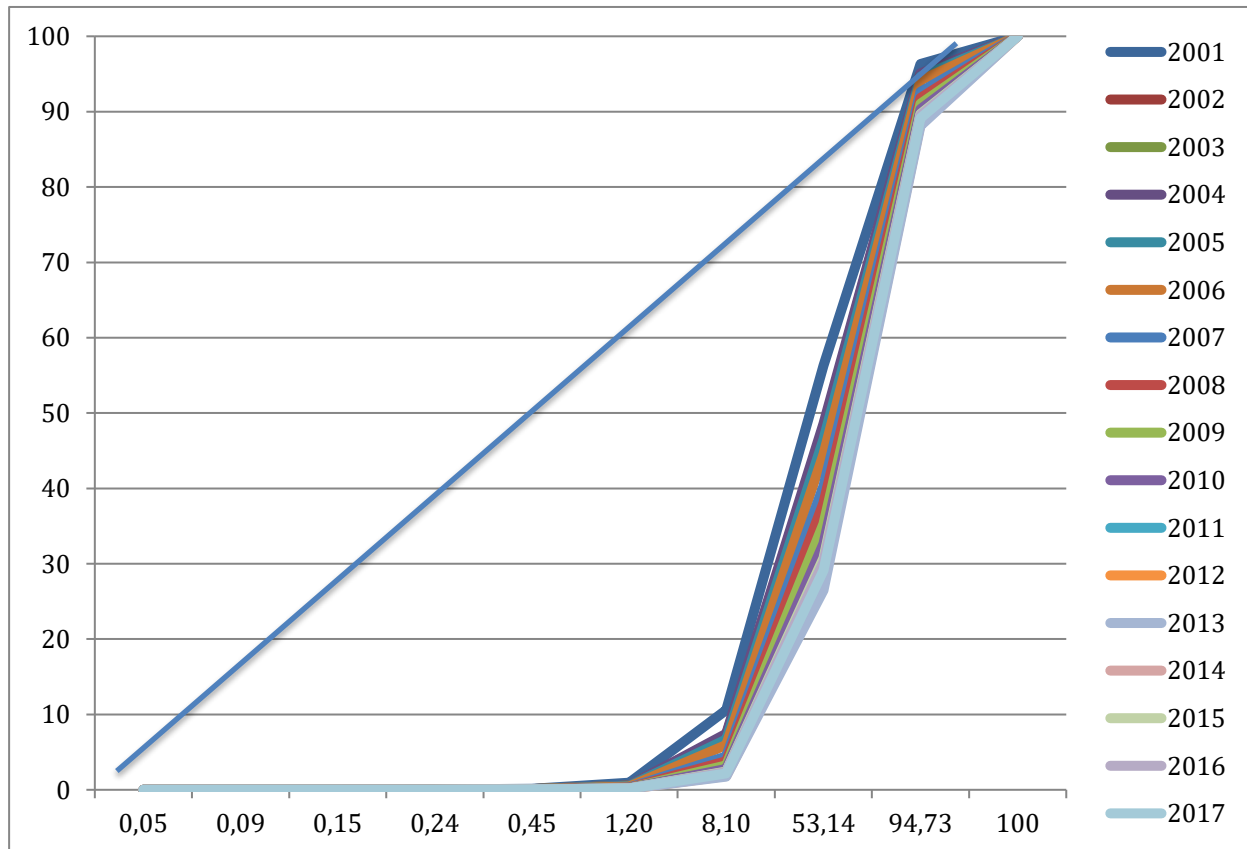


Figure 6. Lorenz curve for Croatia (Source: Authors calculation)

Based on data collected for the Republic of Croatia for the period 2001 to 2017, the Lorenz curve was performed. From the attached Figure we can see that there is a very large deviation from absolute equality. The second observation associated with the derived Lorenz curve relates to changes occurring over a given period of time. We can say that in the observed period there is a shift of the curve to the right, which is a sign of increasing inequality in revenue. In the given period, there is an increase in inequality due to several factors. The most important is the increase in total consumption, the growth in living standards, but also the increasing number of unemployed and the large differences between individual income.

5. CONCLUSION

In this paper, we have presented social inequality or inequality in wealth in the Republic of Croatia. The first part of the paper presents previous research on this topic. We can conclude that there are very few papers on this topic, but no work in which the inequality indices were calculated and presented based on household consumption data. The second part of the paper presents the data collected and needed to calculate the inequality coefficients and the Lorenz curve. While in the third part empirical results are shown. This section presents the calculations of all the major coefficients of inequality and their corresponding equations. In addition, scatter diagrams for all major macroeconomic variables have been made in relation to the Gini coefficient. This coefficient was chosen because of its popularity in scientific circles and because of its representativeness. Although each of the calculated coefficients has its own advantages, it also has its own disadvantages. Therefore, there is no inequality measure that would be good enough without any disadvantages. As the last part of this paper, Lorenz's curve was derived based on two parameters, namely individual consumption by class and total population by class. What we can conclude from this paper is that there is a great inequality in income distribution in Croatia. We calculated this inequality on the basis of Gini and other coefficients. Values of these coefficients show great inequality. Apart from the coefficients of inequality, we also showed the performance of the Lorenz curve, which also confirmed the existence of inequality. However, in addition to the existence of inequality, Lorenz's curve has also confirmed the increase of this inequality over the observed period. By generating scatter diagrams and econometric comparison of the Gini coefficient with other macroeconomic variables, we established a causal link between these variables. Based on these diagrams we can see that the coefficient of inequalities with the macroeconomic variables is very strong and correlated. From this we can conclude that inequalities in income and consumption affect many ways to economic growth and the development of a country. It is necessary to reduce this gap between individual consumption and income categories in order to increase economic growth.

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