Distribution of poverty and inequality indices for various groups in Greece using the bootstrap technique

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Abstract

The present work estimates poverty and inequality indices in various groups that are known to have high contributions to poverty and inequality, such as farmers, pensioners and families with 3 or more children. Using the bootstrap technique, we estimate confidence intervals for these indices and examine if the decrease of poverty and inequality during the years 1998/99 and 2004/05 in these groups is statistically significant or within the boundary of the confidence interval.

For the purpose of the study, we use household income data from the last two Household Budget Surveys (HBS) which cover the entire population of Greece conducted in 1998/99 and 2004/05 by the National Statistical Service of Greece (NSSG). In regard to the methodological issues, we chose the individual as the unit of analysis and the "family equivalence scales" used by Eurostat.

Keywords: poverty, inequality.

JEL Classification: D31, I32

1. Introduction

During the last decades the concern for poverty and inequality increased. Many empirical studies used different indices to show the magnitude and the intensity of poverty and inequality and some of them explored the structure of poverty and inequality by decomposing them for various socio-economic groups. Most studies conclude that poverty and inequality decreased in Greece during the last decades, and others show that the overall inequality arise mainly from inequalities "within" the various socio-economic groups

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and not "between" them and this result holds regardless of the groups, the indices, the equivalence scales or the reference units that have been used (Mitrakos, 2004; Zografakis, Mitrakos, 2005; Mitrakos, 2008). These studies also point out that some groups have large contributions to overall poverty and inequality, such as households with farmers, pensioners or unemployed members, families with many children and especially those with household head have low educational level. The purpose of this study is to examine poverty and inequality within such groups, and more specifically to study the households that have at least one member with income from agricultural occupation, the households with three or more children, and the households whose head gets a pension from the Agricultural Insurance Organisation (OGA). We estimate poverty and inequality indices along with their confidence intervals for these groups, and test if the decrease of poverty and inequality during the years 1998/99 and 2004/05 in these groups is statistically significant or within the boundaries of the confidence interval.

In literature, many studies have shown similar results concerning vulnerable population groups for many countries. For example, Forster (1995) analyzed poverty across three different demographic groups showing that, in general, poverty among single parents is significantly higher than among families with three or more children which, in turn, have higher poverty levels than all non-elderly families. More recently, Förster και Pearson (2002) studied trends and driving forces of income distribution and poverty in OECD area. Concerning the changes in relative positions of specific social groups, they found that, in those countries where inequalities increased, this happened mostly among the working-age population, whilst there were fewer changes among the retirement-age population. Changes in income distribution generally favoured the prime-age and elderly age groups, particularly those around retirement age. Younger age groups lost ground, in particular those aged 18 to 25, reflecting delayed labour market entry. Similarly, poverty rates for the elderly fell in all but four countries, youth poverty rates increased, and child poverty rates increased slightly in a number of countries. Relative income levels of single parents and persons in workless households are very low and have worsened in a number of countries.

Tsakloglou and Papadopoulos (2001) provided a methodology for identifying population members at high risk of social exclusion using the data of the European Community Household Panel (ECHP) and highlighted similarities and differences across EU member states. They found that the highest levels of aggregate risk of social exclusion were observed in some southern countries (Portugal and Greece) and the UK and the lowest in northern and central European countries (Denmark, the Netherlands, Luxembourg and Germany). In almost all countries it was observed that the looser the links of the individual or the household with the labour market, the higher the risk of social exclusion in comparison with the rest of the population. Turning to similarities and differences across demographic groups, they found that in almost all countries children are facing a higher risk of social exclusion than the rest of the population. To a large extent, this risk is accounted by the higher than average risk of social exclusion facing children living in lone-parent households. The population share of persons living in lone-parent households varies a lot across the EU and

although in all countries this group's relative risk of social exclusion is higher than average, it differs significantly across countries. At the other end of the demographic spectrum, older persons seem to face a risk of social exclusion substantially higher than average in only two southern countries (Greece and Portugal). As a result, Tsakloglou and Papadopoulos concluded that one-size-fits-all policies aimed at fighting social exclusion in Europe are not likely to have a significant impact in all countries.

Of great importance is the study of Tsakloglou (2000) who found considerable similarities regarding the level and the structure of poverty as well as the role and the impact of welfare state policies in the fight against poverty with the rest of the Mediterranean EU member-states. Comparisons were made between the four Mediterranean EU member-states and the three big EU countries (France, UK and Germany) with respect to the relative poverty risk and the contributions to aggregate poverty of eight non mutually exclusive high poverty-risk groups: households headed by farmers, unemployed, retired, all households headed by persons aged 65 or more, one-member households consisting of persons aged 65 or more, mono-parental households, households headed by females, and households headed by persons with no or low educational qualifications. Tsakloglou found that households headed by unemployed or retired persons, persons with low educational levels or females are high poverty-risk groups in all countries under examination, (are high poverty risk groups) with no significant differences between different countries other than the population shares of these groups. On the other hand, there are considerable cross-country differences for the group of households headed by farmers, unemployed persons and the group of mono-parental households. Tsakloglou found that in all Mediterranean countries (including France) the poverty risk of households headed by farmers is higher than that of the rest of the population. The opposite is observed in the UK and, especially, Germany[1]. In addition, even though households headed by unemployed persons are a high poverty-risk group in all countries under examination, the group's position *vis-à-vis* the rest of the population appears to be substantially worse in the more developed countries (Germany, UK, France). Finally, mono-parental households appear in Greece to be a low poverty-risk group[2]. The group's poverty-risk does not appear to be substantially higher than the national average in the other Mediterranean countries (including France), but it is quite high in the UK and, particularly, Germany. These results augurs well with the view

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[1] However, due to their higher population share in the poorer countries, these households contribute more than 15% to aggregate poverty only in Greece and Portugal, whereas the corresponding contributions in Germany and the UK are negligible.

[2] Tsakloglou also notes that despite the lack of a comprehensive protection system for the unemployed, the poverty situation of this group is far less pronounced in Greece than in the rest of the countries. As a result of the discrepancy in the poverty risks and the fact that a considerable proportion of the unemployed in the Mediterranean countries (with the partial exception of Spain) consists of young persons living with their parents and wives of household heads, the contribution of the group to aggregate poverty appears to be substantially higher in the Northern than in the Southern EU countries.

of the authors who claim that there exists a distinct Southern European model of welfare and attribute the differences between these countries and the rest of the EU to a number of socioeconomic factors (Leibfreid, 1993; Ferrera, 1996; Gough, 1996). According to this view, in comparison with the rest of the EU, southern European countries are characterized by more "dualistic" economic structures, with relatively high employment in the agricultural sector and considerable size of the "hidden" economy.

For Greece, there are several empirical studies of the distribution of income and consumption but they use different statistical data, different indices and/or different methodology, so it is not easy to combine or compare their results. In some cases there can be contradictious results that can be explained by the different sensitivity of various indices in different income transfers or, similarly, the intersection of Lorenz curves of distributions in use. Older studies also considered income data unreliable due to extended tax evasion but also because, until recently, not everybody was obliged to submit a tax return. Other studies characterise several inequalities as justified if they are the result of normal functions of the market or unjustified if they are connected with specific interests of various social groups that force the government to achieve higher compensations or incomes (Athanasiou, 1984: pp. 56-64). More recent studies indicate education as a significant factor determinant of income inequalities (Mitrakos, Panopoulou, Tsakloglou, 2002; Mitrakos, 2004) and others conclude that inequalities "within" social groups contribute impressively to the overall inequality than inequalities "between" these groups (Zografakis, Mitrakos, 2005). So, policies attempting to eliminate poverty and inequalities within social groups are more effective than those that attempt the elimination of inequality between groups[3].

In brief, it is clear that, the choice of source and the level of analysis of data (personal or grouping data, etc.) as well as methodological and other choices, such as the reference unit of analysis (household or individual), the equivalence scales used, poverty and inequality indices, etc., are determinants for the results. Some characteristics of poverty and inequality remain valid over time, such as education and unemployment, but others like the residence in rural or urban region have stopped being significant factors determinants of income inequalities (Mitrakos and Tsakloglou, 1998; Tsakloglou, 2000).

2. Methodology

The present work uses household income micro-data from the last two Household Budget Surveys (HBS) (1998/99 and 2004/05) which cover the entire population of Greece conducted by the National Statistical Service of Greece (NSSG). The surveys cover all the non-institutional households of the country and their sampling fraction is 2/1000 (it consists approximately of 6,500 households and 17,500 members). The material contains detailed information about consumption expenditures (actual and imputed), incomes after taxes, social security contributions and transfer payments, socio-economic characteristics of the

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[3] For a general review of poverty and inequality in Greece, see, Studies 55, KEPE, 2004, *Distribution, Redistribution and Poverty.*

households and their members as well as information on a number of housing amenities and consumer durables owned by the household[4].

We chose the individual as the unit of analysis and took into account the differences in size and composition of the household and the differences in needs between children and adults by using "family equivalence scales". The equivalence scales used, are given by the Statistical Office of the European Union (EUROSTAT), and assign a weight of 1.0 to the household head, a weight of 0.5 to each of the remaining adults and a weight of 0.3 to each child (person aged up to 13) in the household[5]. In comparison with other sets of equivalence scales used in empirical distributional studies, these scales are in the middle of the range regarding the economies of scales they imply[6]. These weights are used to estimate the number of equivalent adults of the household. Finally, we use the distribution of total equivalent income per capita that is obtained by dividing total household income by the number of equivalent adults and assigning the result to every member of the household.

The next step is to choose the poverty and inequality indices. We consider someone poor when his income (or consumption) falls below a predefined level called "poverty line". A poverty line can be defined as the necessary income to cover the basic needs for survival (food, clothing and residence) or as the necessary income to obtain the minimum socially acceptable level of living. In the first case we refer to "absolute" poverty where emphasis is given to economic deficiency, though in the last case, the "relative" poverty, emphasis is given to economic inequality. The relative approach defines poverty line as a fraction of the median income (or expenditure) in the society because the mean or median income reflects the usual level of living conditions, so this approach defines the minimum amount for a tolerable life in the society. The main difference of these two approaches is that the relative poverty line increases with the same rate as the average level of living conditions unlike absolute poverty line. For Greek economy, where large population groups have ensure the necessary goods to maintain and reproduce life, conventional poverty approach seems more appropriate[7]. In this study we used as poverty line a fraction (40%, 50%, 60% and 70%) of the median of equivalent income.

In this study, we use poverty percentage (P), which is the proportion of the population falling below the poverty line, and Foster index (F) of Foster, Greer and Thorebecke (1984).

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[4] Some researchers believe that it is better to "clean" primary HBS data before using them (Tsakloglou, 1990; Tsakloglou, 1996; Mitrakos, 2000). These corrections (deflation, different time correspondence, zero incomes and outliers, sample weights, consumption and income definition) concern both consumption expenditures and income and intent to lead to a better approach of real welfare level of households or individuals through common poverty and inequality indices. These corrections also smooth primary data variations and so decrease total inequality level based on total expenditure. For this reason, in this study, no correction is made.

[5] This scale was first proposed by Haagenars et al. (1994) and was adopted in the late 1990s by EUROSTAT as "OECD-modified equivalence scale".

[6] See, Buhmann et al. (1988); Coulter et al. (1992); Banks and Johnson (1994); Blundell and Lewbel (1991); Burkhauser et al. (1996); Mitrakos (2000).

[7] EUROSTAT also supports the use of the conventional poverty approach.

Index F satisfies all basic axioms set by Sen (1976) for poverty indices (focus axiom, monotonicity axiom, transfer axiom, symmetry axiom, mean independence axiom and independence of population size axiom) and is sensitive to the magnitude and intensity of poverty gap as well as the distribution of resources among poor people. The parameter α of index F, called the poverty aversion parameter, takes value α=1, that corresponds to poverty gap (the average distance of poor incomes from the poverty line as a fraction of the poverty line), and value α=2 that gives greater weight to the larger distances from the poverty line and so incorporates the social aversion for extreme poverty. On the contrary, index P violates some of the desired properties for a poverty index (symmetry, mean independence, population size independence, principle of transfers among poor people, focus axiom, and monotony) but provides a clear indication of the magnitude of poverty in population. In particular, index P does not take into account how much poor those people are, but careful use of it and many different poverty lines give a wide image of poverty.

Inequality describes the unequal distribution of wealth or income to the members of a population. It is the opposite of "equality" where everyone gets equal shares of whatever is to be shared (income, wealth, etc.). Inequality was first described using Lorenz curves, but in most cases Lorenz curves intersect and that prohibits the ranking of distributions, so we have to select the appropriate index to measure inequality. An inequality index is a statistic that incorporates the characteristics and the variance of a distribution and corresponds, directly or indirectly, to a social welfare function. It is known that since there is no single social welfare function accepted by all economists, there cannot be a unique inequality index considered to be the best of all, thus different indices can lead to different results. However, the different sensitivity of various indices to different types of transfers, allows us to choose which indices to use with regard to our research and the target groups of the population in which we study inequality.

Since the selection of inequality indices is, to a certain point, subjective, we chose six inequality indices that satisfy all the desired axioms (symmetry, population size independence, mean or scale independence, principle of transfers) and have different sensitivity to transfers. We use the variance of the logarithms (L), the mean logarithmic divergence (N) and Atkinson index with $\varepsilon = 2$, that are relatively more sensitive in transfers in the bottom of the distribution, Theil index (T) and Atkinson index with $\varepsilon = 0.5$ that are more sensitive in transfers in the upper edge of the distribution and Gini coefficient that is more sensitive in transfers around the center of the distribution (Lambert, 1993; Cowell, 1995). We also use the deciles shares of income distribution in order to calculate the S_{80}/S_{20} index that indicates the gap between the first and the last two deciles shares.

In order to construct the confidence intervals for these indices, we use the bootstrap technique[8]. Originally, the bootstrap was suggested by Efron (1979) as a method to derive an estimate for the standard error of arbitrary estimator. The method consists of generating a large number B of samples, called bootstrap samples, and calculate in each of them the estimator or the index we want. If the primary data consists of *n* independent units, it then

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[8] See, Efron (1979); Efron and Tibshirani (1993); Davison and Hinkley (1997).

suffices to take a simple random sample of size *n*, *with replacement*, from the *n* units of data, to get one bootstrap sample. The technique is called a nonparametric bootstrap if nothing is assumed (like a parametric distribution) about the underlying process that generated the data. We only assume that the data in the original sample were "representative" and that sample size was moderately large. Confidence intervals can be computed in the usual way, using either a parametric or nonparametric bootstrap, as $\bar{x} \pm 2s_x$ for a 95% confidence interval, where $\bar{x}$ is the mean value and s_x is the standard deviation of the index we study of the B bootstrap samples. It should be noted that when enough bootstrap samples have been generated, not only the standard error but any aspect of the distribution of the estimator could be estimated. Since we are interested in testing? the null hypothesis that there isn't a difference in poverty and inequality indices between the years 1998/99 and 2004/05, we construct a 95% confidence interval for the difference of each measure in the two periods,

as $(\bar{x}_2 - \bar{x}_1) \pm 1.96 \cdot \sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}$, where $\bar{x}_1, \bar{x}_2$ are the mean values of the index we study for

the years 1998/99 and 2004/05, s_1, s_2 the corresponding standard deviations, calculated of the B bootstrap samples, and n_1, n_2 are the number of bootstrap samples respectively[9]. If the value of zero is not included in the confidence interval we then reject the null hypothesis and there is, indeed, a difference between the years 1998/99 and 2004/05.

3.   Empirical results

Most studies conclude that poverty and inequality decreased in Greece during the last decades, and this is also the case we observe for the years 1998/99 and 2004/05. Table 1 presents poverty and inequality indices for these years according to the distribution of total equivalence income. We observe that poverty percentages have decreased about 3 percentage units, independently of what poverty line we use, showing an important decrease in poverty in general. Most important is the decrease of 3.7% for the poverty percentage using the 40% of median equivalent income as poverty line, showing that almost half of the poorest people in 1998/99 managed to improve their economic status in 2004/05. This result is enhanced by Foster et al. index with poverty aversion parameter a=2 that decreased almost 1 percentage unit showing a decrease in extreme poverty. In addition, Foster et al. index with poverty aversion parameter a=1 decreased almost 2 percentage units, showing that poor people are closer to the poverty line in the year 2004/05 than in 1998/99.

Inequality also decreased significantly during 1998/99 and 2004/05, about 2-7 percentage units, depending on what index we use. Indices with more sensitivity to transfers in the bottom of the distribution decreased the most: Atkinson index with ε = 2 decreased 5%, mean logarithmic divergence (N) decreased 4% and the variance of the logarithms (L) decreased more than 7%. On the other hand, Theil index (T) decreased about 5% Atkinson index with ε = 0.5 decreased more than 2% and Gini coefficient decreased almost 4%.

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[9] Since the number of bootstrap samples B is large enough (B=300 in our case), the mean values are considered normally distributed.

These decreases indicate that the whole distribution of 2004/05 is more equal than the distribution of 1998/99. Only index S80/S20 shows the smallest decrease (about 0.5%) indicating that the relative gap between the first and the last two deciles shares did not decrease considerably.

We want to examine poverty and inequality within some groups that have large contributions to overall poverty and inequality, such as households with farmers, pensioners and families with many children. Table 2 shows the percentage (%) of people living in households with specific characteristics in years 1998/99 and 2004/05. We notice that the percentage of people living in households with three or more children decreased about 2% indicating that families are getting smaller in size through years. The greater decrease, of more than 4%, is noticed on the percentage of people living in households that have at least one member with income from agricultural occupation. This is an indication that people do not want to work in the agriculture sector and select another occupation, which often differs from that of their parents. On the other hand, the percentage of people living in households whose head gets a pension from the Agricultural Insurance Organisation (OGA) increases more than 2 percentage units, showing that old farmers become pensioners.

Table 1: Poverty and inequality indices in HBS (1998/99 and 2004/05)
using total equivalence income distribution

Poverty indices		1998/99	2004/05
Poverty percentage using as poverty line	40% median	7.7	4.0
	50% median	12.9	9.4
	60% median	19.9	16.2
	70% median	27.6	25.4
Foster et al. index, a = 1 (Poverty line = 60% median)		5.9	3.8
Foster et al. index, a = 2 (Poverty line = 60% median)		2.7	1.3
Inequality indices			
Atkinson Index (A, ε = 0.5)		9.23	7.20
Atkinson Index (A, ε = 2)		30.81	25.40
Theil Index (T)		20.15	15.15
Mean logarithmic divergence (N)		18.91	14.80
Gini Coefficient (G)		33.61	29.91
Variance of logarithms (L)		36.38	29.09
S80/S20		3.56	3.05

Source: Calculated from Household Budget Survey (HBS) micro-data 1994/95 and 2004/05.

Table 2: The percentage (%) of people living in households with specific characteristics in HBS (1998/99 and 2004/05)

Characteristics of households	1998/99	2004/05
Households with three or more children	5.2	3.3
Households that have at least one member with income from rural occupation	13.9	9.7
Households whose head gets a pension from the Agricultural Insurance Organisation (OGA)	5.3	7.6

Source: HBS micro-data 1994/95 and 2004/05

For these groups, we used the bootstrap technique to evaluate standard deviation for poverty and inequality indices for both years 1998/99 and 2004/05. First, we notice that the average bootstrap values for all indices, calculated over 300 bootstrap samples, approach the corresponding values from the initial samples. This is shown in tables 3 and 4 for poverty and inequality indices, respectively and indicates that the number of bootstrap samples is enough to estimate standard deviations[10]. Only index S80/S20 differs significantly for all groups and this can be justified by the bootstrap technique.

Table 3: Poverty indices in initial samples 1998/99 and 2004/05 and their estimates from 300 bootstrap samples with the use of various poverty lines for total equivalence income distribution

Poverty Index		Households with three or more children		Households that have at least one member with income from rural occupation		Households whose head gets a pension from the Agricultural Insurance Organisation (OGA)	
		1998/99	Bootstrap	1998/99	Bootstrap	1998/99	Bootstrap
Poverty percentage using as poverty line	40% median	10.6	10.3	6.0	6.2	4.3	3.5
	50% median	13.7	13.6	11.8	11.5	7.5	8.5
	60% median	20.4	19.6	17.3	17.2	20.4	19.7
	70% median	27.2	26.1	25.3	25.1	30.7	29.6
Foster et al. index, a = 1		7.3	7.0	4.7	4.8	3.7	3.6
Foster et al. index, a = 2		3.9	3.8	1.9	2.0	1.0	1.0

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[10] There is a direct connection between the size of the initial sample and the number of bootstrap samples in need, in order to trust the results. Our initial samples are sufficiently large in size, so 300 bootstrap samples are enough.

		2004/05	Bootstrap	2004/05	Bootstrap	2004/05	Bootstrap
Poverty percentage using as poverty line	40% median	6.8	6.6	4.6	4 .4	0.8	0.7
	50% median	11.9	10.8	7.5	7 .7	2.3	2.2
	60% median	15.9	15.8	15.1	14 .5	6.4	6.7
	70% median	24.1	23.7	24.8	24 .4	16.9	16.6
Foster et al. index, a = 1		4.8	4.8	3.3	3.2	0.9	0.9
Foster et al. index, a = 2		2.1	2.1	1.2	1.1	0.2	0.2

Source: Calculated from HBS micro-data 1994/95 and 2004/05 and the bootstrap technique.

Table 4: Inequality indices in initial samples 1998/99 and 2004/05 and their estimates from 300 bootstrap samples for total equivalence income distribution

Inequality Index	Households with three or more children		Households that have at least one member with income from rural occupation		Households whose head gets a pension from the Agricultural Insurance Organisation (OGA)	
	1998/99	Bootstrap	1998/99	Bootstrap	1998/99	Bootstrap
Atkinson Index (A, ε = 0.5)	10.04	9.96	11.21	11.07	10.76	10.67
Atkinson Index (A, ε = 2)	43.45	42.13	33.90	41.07	32.14	31.98
Theil Index (T)	20.29	20.15	25.61	25.28	23.91	23.67
Mean logarithmic divergence (N)	22.54	22.30	22.11	22.39	21.61	21.47
Gini Coefficient (G)	34.63	34.42	36.02	35.88	36.56	36.36
Variance of logarithms (L)	52.17	51.20	39.43	42.32	38.64	38.47
S80/S20	4.13	7.74	3.38	6.05	3.82	6.21
	2004/05	Bootstrap	2004/05	Bootstrap	2004/05	Bootstrap
Atkinson Index (A, ε = 0.5)	7.51	7.38	7.35	7.36	4.68	4.69
Atkinson Index (A, ε = 2)	28.36	27.69	24.75	24.75	15.71	15.78
Theil Index (T)	15.43	15.17	15.82	15.84	10.06	10.09
Mean logarithmic divergence (N)	15.89	15.58	14.83	14.85	9.18	9.22
Gini Coefficient (G)	30.20	29.73	29.96	29.93	23.77	23.80
Variance of logarithms (L)	33.04	32.28	28.09	28.12	16.87	16.96
S80/S20	3.28	6.17	5.44	5.35	2.35	4.16

Source: Calculated from HBS micro-data 1994/95 and 2004/05 and the bootstrap technique.

Finally, Tables 5 and 6 present the mean values of all poverty and inequality indices along with their standard deviation (in brackets) as calculated from the bootstrap technique. We should bear in mind that these results measure poverty and inequality within the groups of interest and not in the entire population. In general, we observe a decrease both in poverty and inequality indices for the years 1998/99 and 2004/05, and this result is enhanced if we consider the confidence intervals for the difference of means, as well. Table 7 presents the confidence intervals for the difference of means of each index in the two periods. First of all, we notice that no confidence interval includes the value of zero, so we reject the hypothesis that poverty and inequality remained unchanged during 1998/99 and 2004/05 within these groups. This result is consistent with the general feeling that all the members of the society improved their economic position during these years, probably due to the economic development that Olympic Games brought.

Table 5: Poverty indices and their standard deviations (in brackets) for specific social groups, using various poverty lines and total equivalence income distribution in HBS 1998/99 and 2004/05

Poverty Index		Households with three or more children		Households that have at least one member with income from rural occupation		Households whose head gets a pension from the Agricultural Insurance Organisation (OGA)	
		1998/99	2004/05	1998/99	2004/05	1998/99	2004/05
Poverty percentage using as poverty line	40% median	10.3 (2.5)	6.6 (2.5)	6.2 (0.9)	4.4 (1.0)	3.5 (1.9)	0.7 (0.5)
	50% median	13.6 (2.6)	10.8 (3.0)	11.5 (1.2)	7.7 (1.4)	8.5 (2.1)	2.2 (0.7)
	60% median	19.6 (2.9)	15.8 (3.7)	17.2 (1.4)	14.5 (2.1)	19.7 (2.3)	6.7 (1.2)
	70% median	26.1 (3.4)	23.7 (4.1)	25.1 (1.5)	24.4 (2.3)	29.6 (3.1)	16.6 (1.5)
Foster et al. index, a = 1		7.0 (1.4)	4.8 (1.3)	4.8 (0.5)	3.2 (0.5)	3.6 (0.8)	0.9 (0.2)
Foster et al. index, a = 2		3.8 (1.0)	2.1 (0.8)	2.0 (0.3)	1.1 (0.2)	1.0 (0.3)	0.2 (0.1)

Source: Calculated from HBS micro-data 1994/95 and 2004/05.

**Table 6: Inequality indices and their standard deviations (in brackets),
using total equivalence income distribution in HBS (1998/99 and 2004/05)**

Inequality Index	Households with three or more children		Households that have at least one member with income from rural occupation		Households whose head gets a pension from the Agricultural Insurance Organisation (OGA)	
	1998/99	2004/05	1998/99	2004/05	1998/99	2004/05
Atkinson Index (A, ε = 0.5)	9.96 (1.19)	7.38 (1.17)	11.07 (1.11)	7.36 (0.62)	10.76 (1.17)	4.69 (0.53)
Atkinson Index (A, ε = 2)	42.13 (5.78)	27.69 (3.67)	41.07 (6.90)	24.75 (1.53)	32.14 (2.18)	15.78 (1.29)
Theil Index (T)	20.15 (2.58)	15. 17 (2.65)	25.28 (3.04)	15.84 (1.53)	23.91 (3.18)	10.09 (1.30)
Mean logarithmic divergence (N)	22.30 (2.96)	15. 58 (2.48)	22.39 (2.15)	14.85 (1.20)	21.61 (2.20)	9.22 (0.96)
Gini Coefficient (G)	34.42 (2.01)	29.73 (2.36)	35.88 (1.67)	29.93 (1.22)	36.56 (1.79)	23.80 (1.18)
Variance of logarithms (L)	51.20 (8.60)	32.28 (5.07)	42.32 (4.39)	28.12 (2.00)	38.64 (3.02)	16.96 (1.44)
S80/S20	7.74 (1.25)	6.17 (0.92)	6.05 (0.33)	5.35 (0.28)	3.82 (0.33)	4.16 (0.17)

Source: Calculated from HBS micro-data 1994/95 and 2004/05.

Table 7: 95% Confidence Intervals for the difference of inequality and poverty indices between 1998/99 and 2004/05.

Index		Households with three or more children		Households that have at least one member with income from rural occupation		Households whose head gets a pension from the Agricultural Insurance Organisation (OGA)	
		Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
Poverty percentage using as poverty line	40% median	-4.1	-3.2	-1.9	-1.6	-3.1	-2.6
	50% median	-3.2	-2.4	-4.1	-3.7	-6.6	-6.1
	60% median	-4.4	-3.3	-3.0	-2.4	-13.3	-12.7
	70% median	-3.0	-1.8	-1.1	-0.4	-13.4	-12.6
Foster et al. index, a = 1		-2.5	-2.1	-1.6	-1.5	-2.8	-2.6
Foster et al. index, a = 2		-1.9	-1.6	-0.9	-0.9	-0.8	-0.7
Atkinson Index (A, $\varepsilon = 0.5$)		-2.77	-2.39	-3.86	-3.57	-6.12	-5.83
Atkinson Index (A, $\varepsilon = 2$)		-15.22	-13.67	-17.11	-15.51	-16.48	-15.91
Theil Index (T)		-5.40	-4.56	-9.83	-9.06	-13.96	-13.18
Mean logarithmic divergence (N)		-7.16	-6.28	-7.82	-7.26	-12.52	-11.97
Gini Coefficient (G)		-5.03	-4.33	-6.19	-5.72	-12.80	-12.31
Variance of logarithms (L)		-20.05	-17.79	-14.74	-13.65	-21.88	-21.12
S80/S20		-1.75	-1.39	-0.75	-0.65	-2.10	-2.02

Source: Calculated from HBS micro-data 1994/95 and 2004/05 and the bootstrap technique.

More specifically, we notice that, the confidence interval of the difference of means is farther than the value of zero for Atkinson index with ε=2, the variance of logarithms and the mean logarithmic divergence. Since these indices are more sensitive to the lower bottom of the distribution that means that people in the lower bottom of the distribution improved substantially their economic status towards equality in all three groups we examined. On the other hand, Foster et al. index with a=2 and S80/S20 index have the smallest distance of the value of zero, indicating that the poorest people in all three groups have barely improved their economic status while the relative gap between the first and the last two deciles shares had the smaller decrement during these years.

People living in households with three or more children improved their performance to poverty more than people living in households that have at least one member with income from rural occupation, while the latter improved more their performance to the former to inequality, according to the distance of corresponding confidence intervals from the value of zero. We have to notice, though, that both these groups decreased their population shares through 1998/99 and 2004/05 so the alleviation from poverty and inequality their members felt through time was more intense.

The group that improved its economic position without doubt is people living in households whose head gets a pension from the Agricultural Insurance Organisation (OGA). Within this group poverty was reduced immensely, and inequality decreased even in half for most indices, so the confidence intervals for the difference of means are afar the value of zero. This result is consistent with applied policies during that period of time, which aimed to alleviate the poorer people, such as pensioners. In fact, pensions from OGA were indeed among the lowest pensions in Greece, and in most cases remain small. Our results show not only that the increase in these pensions seems to be adequate to alleviate more than half of poor pensioners and to provide them a better quality of life but also that these policies were well targeted since they almost eliminated extreme poverty within this group (Foster et al. index with poverty aversion parameter 2 = 0.2). Despite the increase in the population of this group by 2.3% between 1998/99 and 2004/05, these policies improved the economic status of all its members driving them over the poverty line, making their income distribution more equal and even reduced considerably the relative gap between the first and the last two deciles shares.

In conclusion, all three groups examined in this study, namely people living in households with three or more children, in households that have at least one member with income from rural occupation or in households whose head gets a pension from the Agricultural Insurance Organisation (OGA), have gained a better quality of life, but still experience considerable inequalities among them between 1998/99 and 2004/05. The first group of larger families have decreased inequality within the group but poverty remains high, the second group of households with members in rural sector are in better place, having reduced not only inequality but also some poverty indices and the last group of pensioners gained considerably in living conditions, reducing more than in half both poverty and inequality.

4.   Conclusion

The purpose of this study was to examine poverty and inequality within the households that have at least one member with income from agricultural occupation, the households with three or more children, and the households whose head gets a pension from the Agricultural Insurance Organisation (OGA) through the years 1998/99 and 2004/05. We estimated a variety of poverty and inequality indices along with their confidence intervals for these groups, and constructed the confidence intervals for the difference of means for each index, using the bootstrap technique. Then we tested if the decrease of poverty and inequality is statistically significant and, in every case, we rejected the hypothesis that poverty and inequality remain unchanged through 1998/99 and 2004/05 in these groups.

People living in households with three or more children improved their performance to poverty more than people living in households that have at least one member with income from rural occupation, while the latter improved (more) their performance in relation to the former regarding inequality. The group of households whose head gets a pension from the Agricultural Insurance Organisation (OGA) experienced a significant turn towards equality and defeated poverty decisively. This result is consistent with applied policies during that period of time, who aimed to alleviate the poorer people, such as pensioners. Our results show not only that the increase in these pensions seems to be adequate to alleviate more than half of poor pensioners from OGA and to provide them with a better quality of life but also that these policies were well targeted since they almost eliminated extreme poverty within this group, despite the increase of the population of this group between 1998/99 and 2004/05.

Since Greece joined the European Economic and Monetary Union (EMU), Greek economy experienced a significant growth showing a 4.1% increment in real GDP versus the corresponding 1.9% for the rest of the Euro zone for the years 2000-2005. This explains the decrement in poverty and inequality we observed for the entire population, driving to the conclusion that even the poorest population groups could have gained from this economic growth. Our tests confirm that, at least to the three population groups we examined, this was the case.

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