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Estimates of imputed rents and their distributional impact in Greece

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Abstract

Most empirical income studies do not take into account the income advantage that is derived from home ownership, possibly contaminating the results with a bias. Using micro data from the 2004/2005 Greek Household Budget Survey, we estimate the imputed rental income using both a hedonic model and homeowners' self-assessments. Imputed rents are then added to the standard notion of equivalized disposable income and inequality and poverty are reexamined. We find that in a country such as Greece, where homeownership is widespread, imputed rents are far more equally distributed than disposable income, thus resulting in a significant decrease in both inequality and poverty. Moreover the identification of gainers and losers reveals that demographic groups considered as sensitive to poverty such as the elderly, households that are headed by pensioners or by low educated persons and people who live in rural areas enjoy an improvement in their relative income position.

Keywords: imputed rents, hedonic pricing, income distribution, housing

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1. INTRODUCTION

Empirical studies of inequality and poverty usually rely on distributions of disposable monetary income, thus disregarding incomes in-kind (non-cash incomes). Non-cash incomes may arise from private sources or from public provision of services such as health, housing and education. Since individuals derive utility from the consumption of goods and services irrespective of their origin (purchased or provided in-kind), an individual's monetary income may be considered as an insufficient approximation of his/her "command over resources" and, therefore, the estimates reported in the above empirical studies may be seriously biased. Moreover, this practice has important implications for the design of policies aiming to fight poverty and social exclusion, since it may lead to imperfect targeting and misallocation of resources. This is the reason that in recent years many leading researchers and international organizations have called for the development of methods providing reliable estimates of non-cash income components and their incorporation in distributional studies [Hagenaars et al (1994), Atkinson et al (1995), van de Walle and Nead (1995), Canberra Group (2001), Atkinson et al (2002)].

Most probably, by far the largest component of private income in-kind in most European countries is imputed rent; that is, the difference between the full market rental value of the dwelling and the actual rent paid by the tenant. Commission Regulation (EC) No. 1980/2003 gives the following detailed definition: "*The imputed rent refers to the value that shall be imputed to all households that do not report paying full rent, either because they are owner-occupiers or they live in accommodation at a lower price than the market price, or because the accommodation is provided rent free. The imputed rent shall be estimated only for those dwellings (and any associated building such a garage) used as a main residence by the households. The value to impute shall be the market equivalent rent that would be paid for a similar dwelling as that occupied, less any rent actually paid (in the case the accommodation is rented at a price lower than the market price), less any subsidies received from the government or a non-profit institution, less any minor repairs or refurbishment expenditure which the owner occupier households make on the property of the type that would normally be carried out by landlords. The market rent is the rent due for the right to use an unfurnished dwelling on the private market, excluding charges for heating, water, electricity etc.*" As far as housing consumption represents a high fraction of total household consumption, it wouldn't be surprising to expect that the distributional impact of imputed rents may be significant. Indeed, a number of

empirical studies suggest so. Wollfe (1990) shows that poverty in USA falls significantly after the inclusion of imputed rents in income distribution, more importantly the poverty reducing effect is more pronounced among the elderly, Yates (1993) found that imputed rents have a significant impact on the well being of many households in Australia. Moreover the inclusion of imputed rental income slightly decreases inequality from 0.39 to 0.38 (Gini index), Buckley and Gurenko (1997) report a very pronounced effect in Russia, thus concluding that "the distribution of housing in Soviet Russia reduces inequality and provided a strong cushion against the consequences of transition." Frick and Grabka (2003) found both a decline in inequality (for West Germany and USA) and poverty reducing effects for some sensitive subgroups (for the previous countries as well as Great Britain), Gasparini and Escudero (2004) report that measured inequality in Argentina declined after the inclusion of imputed rents, due to an income elasticity of spending in housing less than one, while Saarima (2006) assess both the distributional impact of imputed rents and their non-taxation reporting also a decrease in inequality.

In the same spirit, the major motivation of our study is to address the question of whether the impact of imputed rents on income distribution in the case of Greece is significant and furthermore to perform inequality and poverty analysis using the more extended definition of income generated by the inclusion of imputed rents. The structure of the paper is the following: section 2 describes the methodological decisions taken, section 3 sets the institutional framework the study takes place, section 4 describes the hedonic pricing model that was used for the estimation of imputed rent, income distribution analysis can be found in section 5 and poverty estimations before and after the inclusion of imputed rents are on section 6, section 7 contains some other results and finally section 8 concludes.

2. HOUSING IN GREECE: THE INSTITUTIONAL FRAMEWORK

The consideration of the institutional surroundings of the housing market in Greece is undoubtedly purposeful, not only for interpreting the results meaningfully, but also to enhance and facilitate international comparability. An obvious starting point is the prevalence of home ownership, especially in the form of outright ownership, and, particularly, in the countryside, as shown in Table 1 using the data of the 2004/5 Household Budget Survey that is described below. This fact inescapably

shapes the results of the distributional analysis, as it will be apparent in the next sections. High rates of home ownership are not a Greek particularity; they are encountered across all Southern Europe. This finding has been highlighted in a number of housing studies. For example, Allen et al (2004) state that southern countries (Greece, Italy, Portugal and Spain) have homogenous housing systems and at the same time sufficiently different from that of central and northern Europe, so as to form a distinct model. Thereby they try to understand the distinctiveness of southern housing "within the wider societal structure" of those countries. In the same spirit Hoekstra (2005) adopts the well-known welfare state typology of Esping-Andersen (1990) and tries to explore the interrelations between the Mediterranean welfare state[1] and distinct characteristics of southern housing markets. The author's analysis concludes that countries characterized by social-democratic, corporatist and liberal welfare state regimes do not differ much in housing; however, there are considerable differences between these three types and the Mediterranean one. So a natural question emerges; what are the sources of this distinctiveness? Trying to address this question is beyond the scope of the present study. Nevertheless, we will attempt to describe briefly the formal and informal institutions that surround housing in Greece, in order to understand better whatever particularities exist.

Table 1. Tenure by type of locality: Greece, 2004 (%)

Tenure	Locality			
	Urban	Semi-urban	Rural	All
Outright ownership	36.5	8.8	17.1	62.4
On mortgage	9.3	1.6	1.8	12.7
Market rent	17.0	1.6	0.7	19.3
"Rent-free"	3.9	0.7	0.8	5.5
All	66.8	12.8	20.4	100.0

[1] In fact, this type of welfare state regime wasn't included in the original typology of Esping Andersen. But an overwhelming strand of the upcoming literature considered that southern welfare states are different enough to form a distinct group [Ferrera (1996)]

Housing and social institutions

Since 1950, the rate of homeownership in Greece increased, resulting nowadays in one of the highest in EU. Up to a point, this trend can be explained by social institutions, which persistently encourage homeownership. In the core of the argument lies the strong degree of familialism, which characterizes Greek society (and also it is a distinct feature of Mediterranean Welfare State regime). In comparison with other European societies, Greece is a traditional society where family ties and tradition are strong concepts. House is a common form of intergenerational transfer and tied with the family tradition. In this context, a father may choose to bequeath to his children a house rather than any other financial asset or even to liquidate any other assets in order to finance the construction of a dwelling. Furthermore, behind the family tradition reasons, homeownership is seen as a mean of family protection (low risk investment). Hoekstra (2005) claims that this kind of observed insistence on home ownership acts as a substitute for the deficient southern welfare states. Symeonidou (1997) more harshly characterizes both education and homeownership as a kind of fetish in Greek society that reveals the extent to which family substitutes the welfare state.

Table2. Share of young adults living with their parents (1986)

Country	Men		Women	
	Age Group		**Age Group**	
	20-24	25-29	20-24	25-29
Spain	88.1	53.2	76.1	35.3
Italy	87.8	49.6	70.4	25.5
Greece	76.5	53.8	52.3	23.8
France	56.9	19.3	36.4	8.4
UK	57.2	21.9	33.8	8.6
Germany	64.8	27.4	42.8	11.0

Source: Cordon (1997)

Another socioeconomic factor that may explain the high rates of homeownership is the fact that young people remain in large numbers in the parental home. Table 2 makes an interesting international comparison in the proportion of young men and women still living with parents by age group. It is noteworthy that about half males aged 25-29 still inhabit in their parental houses in contrast with the 19.3% for France or the 21.9% for UK. The mechanisms that underlie young people inclination to delay the formation of their own household is a rather complex issue which has to do with individual socioeconomic characteristic of the young and the interdependencies arising from other major choices such as whether to work or to study [Granado & Castillo (2002)]. What really matters in the context of the present study is (a) that the higher the proportion of young people still leaving in their parental homes, the higher is the rate of home ownership, given that the probability the parental house is own occupied is higher than the probability of the house of a newly formed household to be own occupied. (b) Social institutions (which are the focus of this section) are not avertive to this type of behavior - they rather encourage it.

Housing and state intervention

In order to have a complete picture on the effect of state policies on housing markets, it is not adequate just to describe the current policies, for house is a durable good of extremely long life and the formation of its aggregate stock needs decades to realize. Thus, a historical review on the effect of the state intervention on housing would be the appropriate analytical tool. Such task is out of the scope of the paper. Nevertheless, comprehensive surveys can be found in Emmanuel (1990) and in Kouvelis & Economou (1985). Appendix I provides a brief description of current housing policies in Greece.

At this point it is sufficient to say that state policies either explicitly or implicitly always favored homeownership. Since 1950, when building activity in Greece started to expand, governments either with their active interference (tax allowances of mortgage interest payments, house loans to civil servants, state land policies, rent controls, etc.) or with their absence (almost complete lack of public or social housing, inadequate regulation which allowed the reduction of housing costs by illegal

practices such as the free use of public and natural resources etc) provided a lot of privileges to homeowners [Economou (1987)].

2. DATA AND METHODOLOGY

2.1 Data

The data set used in this study is the micro-data set of the 2004-2005 Household Budget Survey (henceforth HBS), which was carried out by the National Statistical Service of Greece. Its aim is to cover all the private households of the country using a sampling fraction of around 2/1000 (that amounts to a sample containing 6555 households and 17386 individuals). Information is provided about the consumption expenditures, incomes and socioeconomic characteristics of each household and the household members. The survey contains both nominal financial values and self-reported imputed values regarding consumption and income variables. The income data utilized in our study are net of any imputed values, apart from the self-reported imputed rents, in one of the approaches described below. The concept of income used here, includes monetary incomes from all sources (such as wages, self-employment earnings, pensions, rents, interest payments, dividends, cash benefits, etc. It is noteworthy that the income variables were provided by the National Statistical Service net of direct taxes, something that makes them more appealing for a distributional study. Thereafter some adjustments were made to the data. All incomes were expressed to constant mid-2004 prices in order to remove the impact of inflation. Also, as it is standard in the literature, distributions of disposable income were equivalized in order to deal with the comparability problem of households of different size. The equivalence scales used are the "modified OECD equivalence scales" (Haagenars, de Vos, Zaidi, 1994), which assign a weight of one to the household head, a value of 0.5 to each of the remaining adults and 0.3 for each child. Finally the time unit is the month and the income unit is the individual in the context of his/her household.

In order to capture the selective effect of imputed rents to the various groups of "beneficiaries" we differentiate according to housing status utilizing the relevant information of the HBS. Firstly, individuals are divided into homeowners and tenants. Homeowners are, then, divided to those who own the house outright

(outright owners) and to those who still pay interest payments (on mortgage). This distinction in a dynamic context may be meaningless but in our static context is very crucial, for the interest payments may be a substantial portion of a household's expenditure and ignoring it may yield an overestimated level of household welfare. Furthermore, tenants are divided to those who have made private market arrangements (that is, pay the market value rent), the rent-free tenants (the dwelling is provided to them by a third party for free; the third party may be the family, an employer, or someone else).

A very important methodological choice is the one on the imputation method. The decision is not only crucial from a conceptual point of view, but also from a practical point of view, for the different imputation methods have different data requirements and usually the impending choice, as well as the quality of the results, are constrained by what is actually contained in the dataset used. The next section describes in detail what the potential imputation methods are and the rationale behind the decision of which of them will be implemented.

Finally, in order to assess the impact of imputed rents on income inequality we applied a variety of inequality indices: the Gini index, Atkinson index for e=0.5 and e=1.5, Mean Log Deviation and the half of Squared Coefficient of Variation. They satisfy the basic axioms of inequality measurement (Pigou-Dalton Transfer Principle, Income Scale Independence, Principle of Population and Anonymity). The variety of inequality measures used serves the satisfaction of different distributional preferences. For example Mean Log Deviation is more sensitive to transfers in the lower tail of distribution while the half of the Squared Coefficient of Variation is more sensitive to transfers in the upper tail of distribution. On the other hand, the Gini index is relatively less sensitive to transfers in the tails of the distribution. Poverty is assessed by three versions of the popular Foster, Greer and Thorbecke (1984) family (FGT0, FGT1, FGT2), which have the merit of subgroup decomposability, enabling us to track the sources of poverty and poverty change.

2.2 Imputation Methods

Three methods of imputation can be found in the empirical literature; each has its merits and weaknesses:

2.2.1 Opportunity Cost Approach

The rationale of the opportunity cost approach is that if the homeowners weren't homeowners they would have had to pay a rent. This fictitious rent constitutes an income advantage for the owner-occupiers. Utilizing information from the actual rental market can generate an estimate of this fictitious rent. The procedure goes as follows; firstly we have to gather information on housing characteristics (construction year, size of the dwelling, neighborhood characteristics, etc.) and the actual rents paid for each dwelling, then these data will be utilized in order to estimate a model of price determination. If the model is applied on the sub-sample of homeowners, a prediction of the fictitious rent will be generated. However, such an estimate is likely to overstate the real benefit of the homeowners, since imputed occupying a house has not only benefits, but also costs, which should be deducted. Thus, net imputed rent is equal to gross imputed rent minus owner specific costs.

Owner-Specific Costs consist of:

- Maintenance costs (Goods and services intended for ordinary maintenance and repairs of the dwelling, such as painting the walls, etc.). Even if the dataset contains information at the household level for this variable, it is more appropriate to substitute its value with an average from aggregate data; otherwise owner specific costs variable will suffer from unnecessarily high variance.
- Interest payments. In case that the house is not outright owned, mortgage and interest payments would comprise a high percentage of gross imputed rents and their deduction is crucial; especially, if we are interested in examining imputed rents in a life-cycle perspective[2].
- Property taxes. This cost varies with the institutional environment; thus if there are data available it should be deducted from IR.

[2] For example, young homeowners may pay high mortgage interest payments and derive a smaller income advantage from housing than the elderly.

2.2.2 Capital Market Approach

The intuition of this approach differs from the one of the previous approach, in that the house is, now, treated as a financial asset whose return is compared with that of an asset of similar risk. According to economic theory, if capital markets are competitive then financial capital will, freely, flow between different types of investment until their marginal returns will be equilibrated. Following this rationale the implicit return of home equity should be equal to the return of a similarly risky investment such as a risk-free government bond. Again the outstanding mortgages should be deducted from the property value of the dwelling, exactly because we are interested in the net home equity. Finally the resulting value should be multiplied by the rate of return yielding the imputed rent for the house. An algebraic description of this procedure is the following:

Where i is the nominal interest rate, V is the property value of the dwelling and M is the outstanding mortgage.

At this stage two important remarks should be made. Firstly, the treatment of inflation can be a tricky thing. For the multiplication of the property value with the nominal interest rate may confound the effect of inflation on home equity, overestimating the value of imputed rent [Yates (1994), Frick & Grabka (2003)]. Nevertheless this problem can be easily sidestepped if we apply a real interest rate on the home equity (property value) and a nominal interest rate on outstanding mortgage. A second important point is that the property values are based on homeowners' subjective evaluations, which may turn out to be a serious problem (as will be shown in the next section).

2.2.3 Self-Assessment Approach

This is the most simple and straightforward approach. Individuals are asked directly about the fictitious rent of their house. Specifically in the HBS used in this paper, respondents were asked: "*How much rent would you pay for a house similar to yours?*" Owner specific costs should be deducted from the reported values (as is the case with the opportunity cost approach).

If we lay aside the virtue of simplicity, it is important to note that self reported values may suffer from a variety of problems. Interviewees may lack information about their property values and the corresponding rents (this may hold especially for some groups of interviewees such as the poor, the elderly and people living in rural areas). If there is a concentration of missing values in specific groups of observations in the dataset, potential biases can be created. But even in the case that a positive value is reported, how can one be assured that subjective evaluations aren't biased or distorted? A potential upward bias can be caused either from individual's affinity to his or her property (for example, Barr (1987) claims that home's value is greater than house's value) or because of the incentives of the homeowner to overestimate dwelling's value (for example, some people may feel that by consistently overestimating values they may influence market expectations on future prices). In either case a considerable number of researchers seem to feel uncomfortable utilizing self-reported values in their analysis.

2.3 Choosing Preferred and Alternative method

The empirical analysis is often constrained by the amount and the quality of information available. In our case, the information contained in the HBS about the property value of the dwellings is of rather low quality. This fact is not so surprising, because long-time homeowners or owners who have inherited their dwellings are common cases in Greece. In the common case that they have not bought recently or they do not intend to sell their property, it is possible that they are unaware of the prevailing market prices. Therefore, we observed a lot of extreme values on both tails of the distribution and, consequently, we had to abandon the Capital Market Approach.

Comparing the other two approaches, the merits of the Opportunity Cost approach seem to overwhelm the decision about the preferred approach. The Opportunity Cost approach is based on the use of real rent data actually paid by tenants and the implementation of robust econometric techniques. Therefore, it is expected to yield more reliable estimates of imputed rents than the self-assessment approach, which is based on subjective evaluations. Nevertheless if the opportunity cost approach is the preferred one, the simple and easy to implement self-assessment approach allows us to generate alternative estimates of imputed rents. So we are able not only to

compare the two methods and derive some methodological comments, but also to implicitly test the sensitivity of poverty and inequality results with respect to imputation method.

4. THE MODEL

4.1 A hedonic pricing model

Our preferred imputation method (Opportunity Cost approach) is based on a hedonic regression model. Hedonic pricing, which is much appraised in applied econometrics, is based on Lancaster (1966). According to this approach, people derive utility from the characteristics of a good and not by the good itself. Thus, the value of the good depends on the various characteristics it possesses. In this spirit, we run a regression of the natural logarithm of rent on a vector, which contains information on house's characteristics. The following steps describe the application of the model:

Step 1: We run a two-stage OLS estimation model of the natural logarithm of gross rent on a set of housing characteristics. The rent, used as dependent variable, is the actual rent, thus we limit the regression to the sub-sample of renters. This is a case of incidental truncation, where dependent variable is observed only for a subset of population and consequently a potential source of selectivity bias. The usual approach in applied econometrics to deal with this problem and derive consistent estimators is to add an explicit selection equation to the model, a procedure pioneered by Heckman (1979)

Hedonic Equation: $\boldsymbol{Y}=\boldsymbol{X}\boldsymbol{b}+\boldsymbol{u}_1$ (1)

Selection Equation: $s=1[if \quad z\gamma+u_2>0]$ (2)

Where Y is for the natural logarithm of gross rent, X is the vector that contains housing characteristics and Z is the vector that contains variables relevant to the selection process[3]. Correlation between u_1 and u_2 is what causes the selectivity bias and the procedure to deal with it (Heckit method) goes as follows:

(a) Using the entire sample, we estimate the following probit model:

[3] Some variables are common in both the rent determination equation and the selection equation.

$$P(s=1|z) = f(z\gamma) \quad (3)$$

(b) We derive the estimated coefficients from the probit model and we compute the inverse mills ratio (the ratio between the standard normal probability density function and standard normal cumulative density function, each evaluated at $z\hat{\gamma}$.

$$\hat{\lambda} = f(z\hat{\gamma}) / F(z\hat{\gamma}) \quad (4)$$

(c) We run a regression of the natural logarithm of Y on X and $\hat{\lambda}$. The derived estimators are consistent and approximately normally distributed[4].

Step 2: We applied the estimated regression coefficients to the population of homeowners. That is, we estimated the fitted value (prediction) of the model ($\ln \hat{Y}$) for the entire sample.

Step 3: Then in order to transform the log variable into a level variable, which will be used in the subsequent calculation, we multiply each predicted value by an adjustment factor[5]. Algebraically:

$$\hat{y} = e^{\hat{\ln y}}$$

Step 4: In step 3 we derived an estimation of the gross imputed rent per household. In order to proceed, we need a net value of imputed rent; therefore, we have to deduct owner specific costs:

(1) Maintenance and repair costs: An average cost of 0.416 euro per m^2 was used to estimate the cost per dwelling (using the information of the HBS)

(2) Interest on mortgages. Only for the homeowners who are not outright owners.

And finally **Step 5**: We didn't allow for negative values. Therefore, any negative imputed rents (cases where costs surpass gross imputed rent) are assigned to zero. Note that this adjustment concerns mainly mortgage homeowners because the deduction of mortgage interest payments may in some cases be quite high.

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4 See Wooldridge (2002) for more details.

5 The mechanics of this procedure can be found in a lot of econometric textbook (for example in Wooldridge (2002).

The above steps are applied to the variables shown in the next table, and the procedure yielded the estimated distributions of imputed rents. Finally, three plausible specifications were tried, in order to test the sensitivity of the results:

a) The model as it is specified in the following table

b) The same model, but equivalized disposable income is also included in the explanatory variables of the hedonic equation. This specification is in contrast with hedonic pricing theory, for only good's characteristics should define price. Nevertheless disposable income may be a natural proxy of the house's characteristics for which we do not have information.

c) The model is run under the restriction: $X \subset Z$ (X is a strict subset of Z). This restriction, which is described as desirable in a number of applied econometrics textbooks, ensures that at least one variable affects selection equation but it doesn't have a partial effect on y.

Table 3. Variables used in the analysis

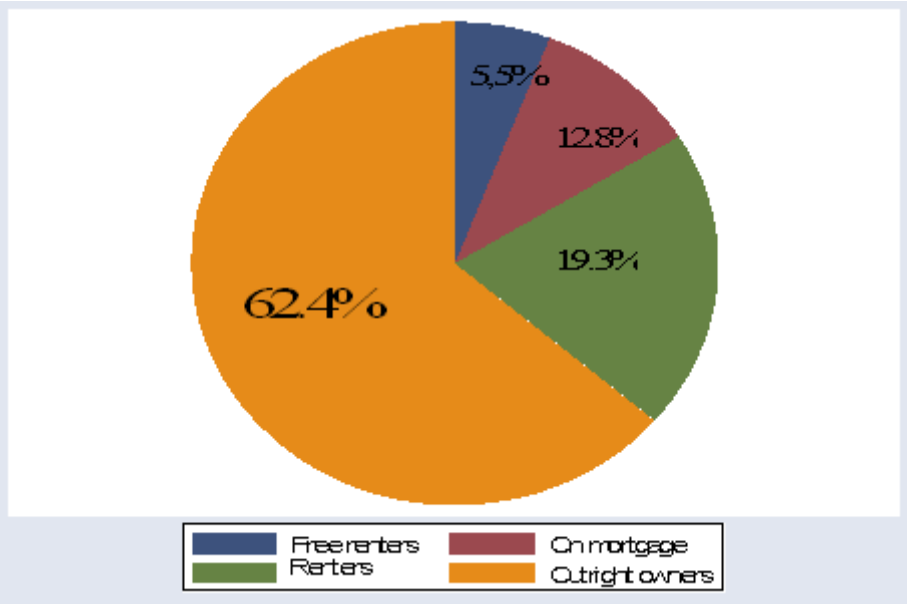
Y	Natural logarithm of rent
X	Location (categorical variable)
	Type of the dwelling (categorical variable)
	Size (continuous variable)
	Construction year (categorical variable)
	Security door (dummy variable)
	Double window crystals (dummy variable)
	WC (dummy variable)
	Garage (dummy variable)
	Heating (categorical variable)
Z	Renter (1=yes, 0=no)
	Natural logarithm of Equiv. disposable income (continuous variable)
	Children (dummy variable)
	Location (categorical variable)
	Age of the household head (continuous variable)

4.1 Descriptive Statistics

The most striking observation concerning housing in Greece, as it was already noted, is the prevalence of homeownership. Chart 1 illustrates that 62.4% of population live in dwellings owned outright by their owners-occupiers.[6] Another 19.3% of lives in population are homeowners who are still on mortgage, adding up the two figures we obtain that about three quarters of the population live in owner occupied dwellings. The renters constitute a considerably lower percentage of population, about 19.3%. Finally, 5.5% of the population lives in rent-free accommodation (i.e. people who do not own the dwelling, nevertheless they do not pay rent; for example the dwelling is provided by the employer, by the parents etc).

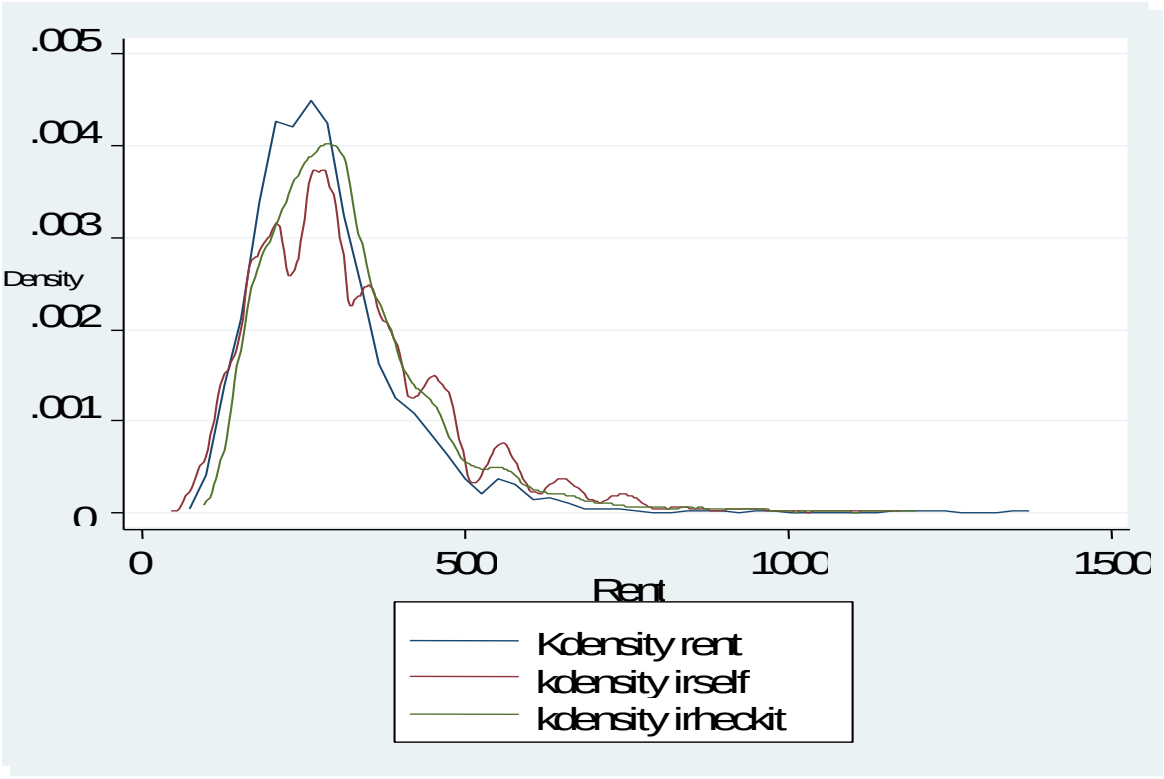
[6]Note that the statistics reported in Table 1 refer to households; not persons.

Chart 1: Housing Tenure (% of total population)



The relatively small size of the rental market may bring about a potential problem in the estimation of imputed rents; because the sub-sample of renters may not contain enough variation to predict accurately the fictitious rent of the house that belongs to the larger and more heterogeneous non-rental market. As Table 1 highlighted earlier, renters are disproportionately concentrated in urban areas; 17% of the total populations are renters who live in urban areas, at the same time only 0.7% of total population are renters who live in rural areas, so we can infer that 88% of renters live in urban areas. Undoubtedly, this heterogeneity between rental and non-rental markets is an inescapable limitation of the hedonic price model and more generally the opportunity cost approach. Nevertheless, as the following graph of kernel densities of the different distributions shows, the estimates derived using the opportunity cost approach do not seem to be follow a dramatically different pattern that those derived using the self-assessment approach (which is the only viable alternative, given our data).

Chart 2. Kernel densities of imputed rent estimates



The blue line is the kernel density for the actual rents and the other two lines represent the kernel densities for self-reported imputed rents (irself) and the hedonic imputed rents (irheckit) respectively. The distribution of self-reported imputed rents appears to behave rather erratically, while the other constructed distribution of imputed rents is smoother. None of them is identical to the one of the actual rents (and, as explained earlier, we did not expect it to be, given the differences between the rental and the non-rental sector).

5. INEQUALITY

5.1 Distributional statistics

A first attempt to assess the distributional impact of imputed rents in Greece is provided in Table 4[7] that examines the distribution of homeownership across

[7] In the appendix, it can be found an identical table when alternative approach is implemented. See Table 4a.

population quintiles, when the members of the population is ranked according to their equivalized disposable income.

TABLE 4. Location of Imputed Rent Recipients in the Income Distribution

Quintile	All	Owner-occupiers			Tenants
		All	Own outright	On mortgage	Rent-free
1 (bottom)	20,0	19,6	21,8	8,7	26,0
2	18,6	18,5	19,4	14,2	20,1
3	19,9	20,2	19,9	21,5	16,0
4	20,7	20,7	19,0	29,1	19,9
5 (top)	20,8	21,0	19,9	26,5	18,0
		100.0	100.0	100.0	100.0

The results are quite striking. The estimates reported in the third column show that home ownership is almost equally distributed across the five quintiles of the income distribution. The next two columns distinguish between homeowners who own outright and those who are on mortgage. Taking into account that most of the home owners own their houses outright, it is not surprising to find that the distribution of the former resembles the pattern we observed for all owner-occupiers. This is not the case of people who are on mortgage. Indeed only 8.7% of the people who are on mortgage belong to the poorest quintile; the corresponding percentage for the top quintile is 26.5%. In fact this is quite natural, since the mortgage market is still quite underdeveloped in Greece and the probability of being granted a housing loan is positively correlated with one's income. Finally the last column refers to the last category of beneficiaries, the rent-free tenants, who are relatively more concentrated towards the bottom of the income distribution. Nevertheless, even this group is fairly evenly spread across the income distribution.

The overall distributional effect of imputed rents is likely to depend on two factors. The first is the pattern of distribution of imputed rents across quintiles; the second its

size in comparison with other income sources. The next two tables[8] try to capture the second factor by showing the equivalized mean imputed rent per quintile for the different subgroups and the percentage increase in equivalized disposable income caused by the addition of imputed rents in income distribution per quintile, respectively.

TABLE 5. Equivalized mean imputed rent per capita per quintile

Quintile	All	Owner-occupiers			Tenants
		All	Own outright	On mortgage	Rent-free
1 (bottom)	88,9	80,2	76,5	3,7	8,7
2	90,3	82,7	75,0	7,8	7,6
3	100,1	93,7	82,7	11,0	6,4
4	109,0	99,6	85,4	14,2	9,5
5 (top)	146,4	136,5	118,2	18,2	10,0
	107,0	98,5	87,5	11,0	8,4

Unsurprisingly, (equivalized) imputed rents per capita rise as we move up in the income distribution and the bulk of the imputed rents accrue to outright home owners. Furthermore, despite the fact that free renters are substantially fewer than those living in dwellings that are still on mortgage, their aggregate imputed rent is not substantially lower than that of the latter. This should be attributed primarily to the fact that most of the housing loans are quite recent and, as a result, the estimated net imputed rent relatively low.

Table 6 reports the proportional rise in the income of the quintiles caused by the inclusion of imputed rents in the concept of resources that are available to the population members.

[8] In the Appendix, it can be found both tables 5 and 6, when alternative approach is implemented. See Tables 5a and 6a respectively.

TABLE 6. Proportional increase in disposable income per quintile due to imputed rents

Quintile	All	Owner-occupiers			Tenants
		All	Own outright	On mortgage	Rent-free
1 (bottom)	24,6	22,2	21,2	1,0	2,4
2	14,7	13,5	12,2	1,3	1,2
3	12,1	11,3	10,0	1,3	0,8
4	9,8	8,9	7,7	1,3	0,8
5 (top)	7,5	7,0	6,0	0,9	0,5
	11,0	10,1	9,0	1,1	0,9

The increase in the equivalized disposable income of the low quintiles is very substantial. Imputed rents are equal to over a quarter of the disposable income of the bottom quintile and 15% of the second poorest quintile. This share declines steadily ass we move to the top quintiles, reaching 7.5% in the case of the top quintile. As expected, most of this increase is accounted by the increases in the incomes of the outright home owners.

Table 7[9] reports the quintile income shares before and after the inclusion of imputed rents in the concept of resources that are available to the household members. After the inclusion of imputed rents, the shares of the three lowest quintiles, and especially the bottom, increase while that of the (from 7.4% to 8.1%, 12.6% to 12.9% and 17.0% to 17.2%) while that of the top two and, especially, the top decline (from 22.8% to 22.7% and 40.2% to 39.1%). Once again, the main driving fore behind these changes are the imputed rents of the outright home owners.

[9] In the appendix, it is produced an identical table containing the same estimations when alternative approach is implemented. See Table 7a.

TABLE 7. Quintile income shares before and after the inclusion of imputed rents

Quintile	Disposable income	Disposable income + imputed rents	Owner-occupiers			Tenants
			All	Own outright	On mortgage	Rent-free
1 (bottom)	7,42	8,16	8,06	8,06	7,38	7,47
2	12,55	12,91	12,87	12,86	12,55	12,61
3	16,99	17,19	17,19	17,17	17,01	16,96
4	22,84	22,66	22,67	22,64	22,89	22,86
5 (top)	40,2	39,09	39,2	39,27	40,17	40,1

5.2 Inequality Analysis: A Graphical Approach

The inequality of two or more income distribution can be compared visually by plotting the well-known Lorenz curve. Lorenz curve plots cumulative proportions of income units (ordered according to their income) against cumulative proportions of income received by these income units. Algebraically it is defined as:

$$L(p) = \int_0^y \frac{x f(x)}{\mu} dx \text{ for } p \in [0,1],$$

where x is the income variable, p is the proportion of population and $f(x)$ the frequency density function. For the purpose of our analysis we define a function $d(p)$, which is the difference between the Lorenz curve of the income distribution when each of the imputed rents categories is included and the Lorenz curve of the baseline distribution (i.e. the Lorenz curve for the equivalized disposable income) that is: $d(p) = L_{ir}(p) - L_{ids}(p)$. Thus, Chart 3 depicts:

$d_1(p)$, when $L_{ir}(p)$ is the Lorenz curve for the distribution of disposable income plus the imputed rent of outright owners.

$d_2(p)$, When $L_{ir}(p)$ is the Lorenz curve for the distribution of disposable income plus the imputed rent of home owners who are still on mortgage.

$d_3(p)$, When $L_{ir}(p)$ is the Lorenz curve for the distribution of disposable income plus the imputed rent of free renters.

and $d_{all}(p)$, When $L_{ir}(p)$ is the Lorenz curve for the distribution of disposable income plus all the imputed rents taken together.

Chart 3. Differences between Lorenz curves

The configuration of $d(p)$- functions is quite illuminating as far as the distributional impact of imputed rents is concerned. Three major points follow.

(a) We can easily see from the diagram that $d_1(p), d_{all}(p), d_3(p) > 0 \quad \forall p \in [0,1]$. This is a case of Lorenz dominance that allows us to safely infer that inequality is reduced according to every possible index of relative inequality [Atkinson, (1970)].

(b) $d_2(p) > 0$ for p<0.66 and $d_2(p) > 0$ for p>0.66 This Lorenz crossing suggest that we cannot infer any unambiguous conclusion regarding the distributional impact when only imputed rents of homeowners who are on mortgage are considered. Whatever conclusion will be conditional on distributional tastes. Given that we

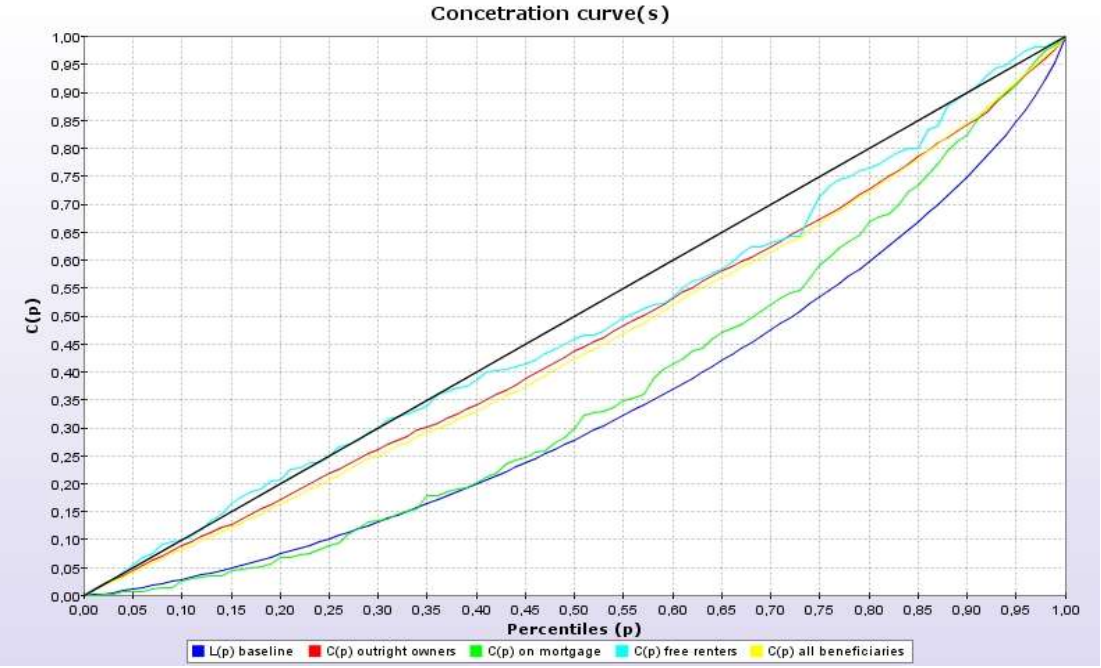
have more inequality at the bottom and less at the top of the distribution, if we choose an inequality index which gives more weight to transfers to the upper tail of distributions (a possible such index would be whatever belongs to the GE family if we set a high enough value of the parameter) then inequality will be reduced and vice versa.

(c) It is more than apparent the similarity between $d_1(p)$ and $d_{all}(p)$. The aggregate effect of income advantage derived from imputed rents depends almost exclusively by the outright owners' imputed rents.

Another useful perspective for assessing inequality is by the use of concentration curves analysis. The logic of concentration curves is similar to that of Lorenz curves with the crucial difference that we plot shares of one variable against quantiles of some other variable. In this sense, Lorenz curves are just a subset of the set of all possible concentration curves (for example, the Lorenz curve for disposable income is nothing else than the concentration curve for disposable income with respect to disposable income). The concentration curves are useful in that they allow us to isolate graphically and compare the distributional effect of each of the non-cash components in question. The corresponding concentration curves are reported in Chart 4.

The red line in Chart 4 is the concentration curve for outright owners' imputed rents with respect to disposable income, the green line is the concentration curve for the imputed rents of those still on mortgage, the light blue line is the corresponding concentration curve for free renters and, finally, the yellow line is the concentration curve when all imputed rents are taken together. Both concentration curves for outright owners' imputed rents and free renters' imputed rents are close to the 45° line, revealing that these two non-cash components are relatively evenly spread across the income distribution. In contrast, "on mortgage" imputed rents are distributed almost as unequally as the initial distribution of disposable income and, in fact, their concentration curve intersects with the Lorenz curve of the distribution of disposable income. Finally, the concentration curve for all imputed rents is very close to the concentration curve for outright owners' imputed rents, exactly because this aggregate non-cash income component depends heavily on the latter.

Chart 4. Concentration curves



Further, Chart 4 is in total agreement with Chart 3. For it can be shown that

 , which is verified in Chart 4[10].

5.2 Inequality Analysis: A Quantitative Approach

This section tries to quantify the changes in inequality that were described in the previous section. For this reason, a variety of inequality indices (Gini, Atkinson for e=0.5 and e=1.5, Mean Log Deviation, half of Squared Coefficient of Variation and decile ratios) were applied to the data. The results are reported in Table 8[11].

[10] In fact this is a manifestation of Jakobsson-Fellman (1976) theorem that was designed to capture the distributive effects of taxation, but it can be easily modified in order to apply in the case of benefits.

[11] In the appendix, it is produced an identical table containing the same estimations when alternative approach is implemented. See Table 8a.

TABLE 8. Proportional changes in inequality indices due to imputed rents

Index	Disposable income	Disposable income + imputed rents (% change)	Owner-occupiers			Tenants
			All	Own outright	On mortgage	Rent-free
Gini	0,3261	-5,7	-5,0	-4,8	0,0	-0,5
Atkinson 0.5	0,0867	-11,7	-10,3	-9,9	0,0	-1,0
Atkinson 1.5	0,2432	-13,6	-12,1	-11,8	0,2	-0,9
MLD	0,1824	-13,5	-12,0	-11,6	0,2	-1,1
Half SCV	0,2253	-11,4	-10,1	-9,3	-0,6	-1,2
DR: 90/10	4,3867	-9,2	-8,3	-8,3	1,4	0,5
DR: 90/50	2,0422	-3,0	-3,6	-3,3	0,1	0,6
DR: 50/10	2,1481	-6,4	-5,0	-5,2	1,3	-0,2

The second column of the table reports the absolute value of the respective index for the baseline distribution, while the next columns report proportional changes with respect to the value of each index for the baseline distribution (distribution of equivalized household disposable income per capita). The estimates show a significant decline in inequality for all indices when either all or own outright imputed rents are considered (from –3,0% to -13,6% for all imputed rents together and -3,3% to -11,8% for outright owner imputed rents). In contrast, a mild increase in inequality is reported when the partial effect of "on mortgage" imputed rents is considered. Nevertheless, as noted earlier, due to intersecting Lorenz curves, this result is not unambiguous, and, in fact, after the inclusion of the imputed rents for home owners who are still on mortgage, unlike the rest of the indices, half SCV records a decline rather than an increase in inequality. Finally the partial effect of the non-cash income that goes to rent free tenants is also equalizing.

5.3 Inequality Analysis: Decomposition by subgroups

The above results mainly refer to aggregate effects in inequality induced by imputed rents. But what is also of potential interest is the source and structure of inequality and how they change by the inclusion of imputed rents in the definition of income. An insight in these issues can be obtained by exploiting the property of decomposability that indices of the Generalized Entropy family possess. Therefore, we performed decomposition by population subgroups on the mean log deviation index. The choice of subgroups has been made with respect to their relevance in the analysis and what is available in our dataset, so we decomposed by household type, socioeconomic status of the household head, education level of the household head, age and tenure status. Obviously the last category is the most relevant in our analysis.

Table 9 reports the results. The first column of the table shows the different partitions of population we adopted and the various subgroups that came up. Column A reports the population share of each subgroup, so that we have an idea of its relevant importance; columns B and C contain the estimates of MLD for the baseline distribution (distribution of disposable income) and the one which includes imputed rents, column D reports the percentage change of the inequality index. Finally columns E and F report the contributions of "within groups" and "between groups" differences to aggregate inequality. The structure of inequality does not change substantially as we move from the distribution of disposable income to the broader income distribution. Inequality declines within all population sub-groups and in all groupings (apart from the last one) inequalities between groups decline, too. The latter should be attributed to the fact that the group of private market renters that has mean disposable income slightly lower than that of the entire population, is left further behind after the inclusion of imputed rents in the concept of resources (imputed rents are zero in their case).

TABLE 9. Inequality Decomposition by Population Subgroups

Characteristic of household or household head	A	B	C	D	E	F
Household type						
Older single persons or couples (at least one 65+)	7,8	0,1460	0,1205	-17,5	0,06	0,06
Younger single persons or couples (none 65+)	18,0	0,2402	0,1934	-19,5	0,24	0,22
Couple with children up to 18 (no other HH members)	33,6	0,1827	0,1648	-9,8	0,34	0,35
Mono-parental household	1,5	0,1930	0,1871	-3,0	0,02	0,02
Other household types	39,1	0,1512	0,1356	-10,3	0,32	0,33
% Within groups inequality		0,1781	0,1554	-12,7	97,6	98,1
% Between groups inequality		0,0043	0,0030	-29,9	2,4	1,9
Socioeconomic group of HH head						
Blue collar worker	23,3	0,1006	0,0828	-17,7	12,8	13,6
White collar worker	14,9	0,1096	0,0980	-10,6	9,0	10,3
Self-employed	23,3	0,2618	0,2153	-17,8	33,4	35,2
Unemployed	2,3	0,1252	0,0978	-21,9	1,6	1,6
Pensioner	27,9	0,1754	0,1178	-32,8	26,8	23,1
Other	8,4	0,1831	0,1417	-22,6	8,4	8,4
% Within groups inequality		0,1677	0,1309	-22,0	92,0	92,2
% Between groups inequality		0,0147	0,0111	-24,0	8,0	7,8
Educational level of HH head						
Tertiary education	20,4	0,1406	0,1249	-11,1	15,7	18,0
Upper secondary education	27,0	0,1495	0,1257	-15,9	22,2	23,9
Lower secondary education	13,0	0,1563	0,1235	-21,0	11,1	11,3
Primary education or less	39,5	0,1627	0,1144	-29,7	35,3	31,8
% Within groups inequality		0,1538	0,1208	-21,4	84,3	85,1
% Between groups inequality		0,0286	0,0212	-25,8	15,7	14,9
Age of HH member						
Below 25	27,0	0,1720	0,1417	-17,6	25,4	26,9
25-64	52,5	0,1770	0,1466	-17,2	50,9	54,2
Over 64	20,6	0,1781	0,1143	-35,8	20,1	16,6
% Within groups inequality		0,1758	0,1387	-21,1	96,4	97,6
% Between groups inequality		0,0066	0,0034	-48,5	3,6	2,4
Housing tenure						
Owner: own outright	62.4	0.1933	0.1582	-18.1	0,26	0,25
Owner: on mortgage	12.7	0.1272	0.1155	-9.1	0,09	0,09
Tenant: private market (non-subsidized)	18.9	0.1733	0.1733	0.0	0,18	0,21
Tenant: rent-subsidized by direct cash transfer	0.3	0.1024	0.1024	0.0	0,00	0,00
Tenant: rent-free	5.5	0.1864	0.1490	-20.1	0,06	0,05
% Within groups inequality		0.1804	0.1549	-14.1	98.9	97.7
% Between groups inequality		0.0020	0.0036	78.0	1.1	2.3

A: Population Share
B: Mean Log Deviation (Disposable Income)
C: Mean Log Deviation (Disposable Income + Imputed Rents)
D: % Change in Inequality
E: % Contribution to Aggregate Income Inequality (Disposable Income)
F: % Contribution to Aggregate Income Inequality (Disposable Income + Imputed Rents)

5.4 Inequality Analysis: Decomposition by sources

In this section we disaggregate the full income of individuals (that is the equivalized income of individuals after the inclusion of imputed rents) in the following factor components; disposable income, outright owners' imputed rents, "on mortgage" imputed rents and free renters' imputed rents in order to assess the contribution of these sources to total inequality. Following Pyatt et all (1980) Gini index can be written as:

$$G=\sum_{k=1}^{K}\frac{m_k}{m}R_kG_k \qquad (1)$$

where m_k and m are the mean of component k and total income respectively. R_k is the relative correlation coefficient of component k (that is the ratio of the covariance of component k with the total income rank and the covariance of component k with its own rank) and finally G_k is the Gini index for the component k. (1) can be rearranged (divide both parts of the equation by G) so as to yield:

$$\sum_{k=1}^{K}w_kg_k=1 \qquad (2)$$

where w_k is the share of component k in total income and g_k is the relative concentration coefficient of component k in aggregate inequality. The product w_kg_k can be interpreted as the proportional contribution of component k in aggregate inequality. From the estimation of g_k we can detect whether an increase in the income component k will increase or decrease aggregate inequality. In fact if $g_k >$ 1 then inequality will increase and if $g_k <1$ inequality will decrease. Furthermore from (1) we can calculate the elasticity of inequality with respect to a proportional change in component k.

$$e_k=\frac{dG}{dm_k}\frac{m_k}{G}=w_kg_k-w_k \qquad (3)$$

Estimates of w_k, g_k, e_k are reported in table 10 for each component and for all components taken together (all home owners' imputed rents and all imputed rents taken together) and for various values of the parameter of distributional sensitivity v (v=1.5, v=2, v=3). The estimates of g_k show that all components mitigate aggregate inequality whatever the value of the distributional sensitivity parameter, since all

gks are less than one, except of the "on mortgage" imputed rents whose g_k is slightly less than one for ν=1.5 but it is slightly more than one for ν>2. These estimates taken together with the w_k values are consistent with the estimations of elasticity of inequality with respect to components k. Indeed elasticity is always negative except of the case of "on mortgage" imputed rents (ν=2, ν=3). Also elasticity of inequality takes its highest value (in absolute terms) when all components are taken together (last row) because the egalitarian effect of owners' imputed rents is enhanced by the effect of free renters' imputed rents. Finally the elasticity of inequality with respect to own outright owners' imputed rents for ν=2 and ν=3 is higher than the elasticity of inequality with respect to all owners' imputed rents (both outright owners and "on mortgage"), exactly because "on mortgage" imputed rents when added in the income distribution undo slightly the equalizing effects of all owners' imputed rents.

TABLE 10. Inequality Decomposition by factor components

	ν=1,5			ν=2			ν=3		
	wk	gk	ek	wk	gk	ek	wk	gk	ek
Disposable Income	0,897	1,046	0,042	0,897	1,044	0,040	0,897	1,043	0,038
All Owners	0,094	0,611	-0,037	0,094	0,625	-0,035	0,094	0,641	-0,034
Own Outright	0,083	0,566	-0,036	0,083	0,569	-0,036	0,083	0,572	-0,036
On Mortgage	0,011	0,950	-0,001	0,011	1,054	0,001	0,011	1,158	0,002
Rent Free	0,008	0,423	-0,005	0,008	0,456	-0,004	0,008	0,461	-0,004
All	0,103	0,595	-0,042	0,103	0,612	-0,040	0,103	0,627	-0,038

6.POVERTY

6.1 Quantitative Results

Poverty is a major issue in contemporary Greece, mainly because poverty rates are relatively high in comparison with EU-averages. So the question that this section attempts to address is whether imputed rents are relevant to the problem of poverty. In order to assess the impact of imputed rents on poverty rates, we will apply the

parametric $FGT(\alpha)$ poverty index. The α parameter is defined as the social aversion to poverty; the higher the value of alpha the higher the aversion to poverty. When the value of the poverty aversion parameter is set at α=0, the index becomes the widely used poverty rate, that is the share of the population falling below the poverty line. When α=1, the index becomes the normalized income gap ratio, while when α=2 the index satisfies the axioms proposed by Sen (1976) (anonymity, focus, monotonicity and transfer sensitivity) and is sensitive not only to the population share of the poor and their average poverty gap, but also to the inequality in the distribution of resources among the poor. Following the practice of Eurostat, the poverty line is set at 60% of the median income. Table 11[12] reports the corresponding results. Its structure is similar to that of Table 8.

TABLE 11. Proportional changes in poverty indices due to imputed rents

Index	Disposable income	Disposable income + imputed rents (% change)	Owner-occupiers			Tenants
			All	Own outright	On mortgage	Rent-free
FGT0	0,1972	-14,0	-11,9	-11,8	1,7	-0,8
FGT1	0,0537	-22,6	-18,4	-18,8	2,6	-1,6
FGT2	0,0226	-31,7	-26,9	-27,4	2,9	-1,9

[12] In the appendix, it is produced an identical table containing the same estimations when alternative approach is implemented. See Table 11a.

TABLE 12. Poverty Decomposition by Population Subgroups

Characteristic of household or household head	Popul. Share	FGT0				FGT1				FGT2			
		A	B	C	D	A	B	C	D	A	B	C	D
Household type													
Older single persons or couples (at least one 65+)	7.8	0,3804	-25,4	0,15	0,13	0,0941	-37,8	0,14	0,11	0,0323	-47,5	0,11	0,08
Younger single persons or couples (none 65+)	18.0	0,2286	-21,9	0,21	0,18	0,0725	-34,8	0,24	0,20	0,0338	-45,8	0,27	0,21
Couple with children up to 18 (no other HH members)	33.6	0,1979	-4,2	0,34	0,37	0,0538	-8,6	0,34	0,39	0,0232	-18,5	0,35	0,40
Mono-parental household	1.5	0,3085	-13,2	0,02	0,02	0,0834	-4,1	0,02	0,03	0,0417	1,9	0,03	0,04
Other household types	39.1	0,1412	-6,5	0,28	0,30	0,0357	-13,6	0,26	0,28	0,0142	-23,8	0,25	0,27
Socioeconomic group of HH head													
Blue collar worker	23.3	0,1600	5,9	0,19	0,23	0,0357	2,5	0,15	0,20	0,0123	-4,8	0,13	0,17
White collar worker	14.9	0,0354	-2,0	0,03	0,03	0,0052	24,0	0,01	0,02	0,0012	43,7	0,01	0,02
Self-employed	23.3	0,2341	-14,1	0,28	0,27	0,0745	-19,1	0,32	0,33	0,0362	-29,0	0,37	0,38
Unemployed	2.3	0,3337	5,3	0,04	0,05	0,0844	-15,9	0,04	0,04	0,0340	-31,3	0,03	0,03
Pensioner	27.9	0,2511	-20,4	0,35	0,32	0,0668	-35,5	0,35	0,28	0,0260	-48,2	0,32	0,24
Other	8.4	0,2689	-17,9	0,11	0,11	0,0800	-14,7	0,13	0,13	0,0366	-16,0	0,14	0,16
Educational level of HH head													
Tertiary education	20.4	0,0393	5,6	0,04	0,05	0,0095	-6,2	0,04	0,04	0,0033	-8,1	0,03	0,04
Upper secondary education	27.0	0,1532	-3,2	0,21	0,23	0,0425	-7,6	0,21	0,25	0,0184	-14,7	0,22	0,27
Lower secondary education	13.0	0,2096	-6,0	0,14	0,15	0,0553	-9,6	0,13	0,15	0,0251	-17,3	0,14	0,17
Primary education or less	39.5	0,3047	-17,4	0,61	0,57	0,0836	-27,7	0,62	0,56	0,0345	-39,4	0,60	0,52
Age of HH member													
Below 25	27.0	0,2096	-4,0	0,29	0,31	0,0588	-6,3	0,30	0,35	0,0258	-13,1	0,31	0,38
25-64	52.5	0,1490	-8,5	0,40	0,41	0,0399	-16,8	0,39	0,41	0,0171	-27,9	0,40	0,41
Over 64	20.6	0,3038	-23,4	0,32	0,28	0,0822	-37,4	0,32	0,25	0,0322	-50,1	0,29	0,21
Housing tenure													
Owner: own outright	62.4	0,2160	-22,4	0,68	0,60	0,0534	-32,6	0,70	0,58	0,0260	-46,3	0,72	0,55
Owner: on mortgage	12.7	0,0831	-9,1	0,05	0,06	0,0544	16,8	0,05	0,05	0,0076	-10,2	0,04	0,06
Tenant: private market (non-subsidized)	18.9	0,1946	28,0	0,19	0,27	0,0604	-34,1	0,18	0,31	0,0202	44,5	0,17	0,35
Tenant: rent-subsidized by direct cash transfer	0.3	0,1604	204,3	0,00	0,01	0,0190	-9,9	0,00	0,00	0,0058	126,8	0,00	0,00
Tenant: rent-free	5.5	0,2600	-25,4	0,07	0,06	0,0506	40,2	0,07	0,05	0,0270	-55,4	0,07	0,04

A: Value of the Index (Distribution of Disposable Income)
B: % Change in Poverty (after the inclusion of imputed rents)
C: % Contribution to Aggregate Poverty (Disposable Income)
D: % Contribution to Aggregate Poverty (Disposable Income + Imputed Rents)

The results reported in Table 11 suggest that poverty is reduced according to all versions of FGT index after the inclusion of imputed rents in the concept of resources. The poverty reducing effect of imputed rents is enhanced for higher values of the poverty sensitivity parameter alpha; when α=2 recorded poverty is reduced by almost 30%. Once again, in line with the corresponding results of Table 8, the bulk of the poverty reduction can be attributed to the imputed rents of the outright home owners, while the partial effect of including the imputed rents of homeowners who are still on mortgage causes marginal poverty increases. Marginal poverty declines come about as a result of the imputed rents of free-renters.

The last step in poverty analysis tries to identify population group at high of poverty and how this risk and their contribution to aggregate poverty change after the change in the concept of resources. The task is accomplished thanks to the property of additive decomposability that FGT index possess and the results are reported in Table 12. The differentiation of population was done by the same criteria as in the preceding inequality decomposition analysis. In general, after the inclusion of imputed rents in the concept of resources the poverty risk declines in almost all population sub-groups; apart, of course, from the tenants. Surprisingly, the poverty risk of members of households headed by white collar workers and tertiary education graduates (two largely overlapping groups) rises when we move beyond the poverty rate, while the opposite is observed in the case of members of households headed by unemployed persons. In general, the poverty risk declines in groups where the household head is more likely to be the outright owner of the dwelling (older persons, living in rural areas, with low educational qualifications, etc.). These are precisely some of the groups with the highest poverty risk in the country.

7. OTHER RESULTS

7.1 Who benefits from imputed rents?

An important question, which always underlies income distribution analysis, concerns the identification of gainers and losers at least in relative terms. The inclusion of imputed rents inescapably will enhance the relative income position of some groups, when at the same time it will deteriorate the relative income position of

some others. Table 13 reports the income position of various demographic groups before and after the inclusion of imputed rents and the respective percentage change. The income position is defined as the normalized mean of each group (mean of equivalized income of the group relative to the national mean). What a careful inspection of Table 13 reveals is that, in line with the results of Table 12, almost all demographic groups that can be considered as sensitive to poverty seem to enjoy an improvement in their relative income position.

TABLE 13: Relative income position and percentage changes in particular group

Characteristic of household or household head	**Income position (Greece: 100)**		**% Change**
	Baseline	**Including IR**	
Household type			
Older single persons or couples (at least one 65+)	73	78	7.1
Younger single persons or couples (none 65+)	103	106	3.0
Couple with children up to 18 (no other HH members)	101	100	-1.1
Mono-parental household	80	81	1.5
Other household types	104	103	-1.5
Socioeconomic group of HH head			
Blue collar worker	88	85	-2.5
White collar worker	137	135	-1.6
Self-employed	108	108	-0.4
Unemployed	68	68	-0.3
Pensioner	91	94	3.0
Other	85	87	2.6
Educational level of HH head			
Tertiary education	147	145	-1.6
Upper secondary education	101	100	-0.6
Lower secondary education	89	89	-0.2
Primary education or less	79	80	2.2
Age of HH member			
Below 25	94	93	-1.2
25-64	110	109	-1.0
Over 64	83	87	5.1
Housing tenure			
Owner: own outright	99	102	3.2
Owner: on mortgage	116	113	-2.8
Tenant: private market (non-subsidized)	95	85	-10.3
Tenant: rent-subsidized by direct cash transfer	79	71	-10.3
Tenant: rent-free	93	98	5.6
Geographical location			
Urban	108,2	107,8	-0.3
Semi-Urban	92	92	0.1
Rural	78	79	1.5

Indeed households headed by pensioners or by low educated people (primary or less) gain about 3% and 2.2% respectively, people aged above 64 5.1%, people who live in rural areas 1.5% and mono-parental households 1.5%. Beside these groups, homeowners, free renters, older single persons or couples (at least one 65+) also enjoy significant gains. Furthermore, if we approach the issue from a slightly different angle, imputed rents are relevant from a life cycle perspective. This is not surprising, as the high cost of private investment in housing dictates that homeownership will be positively associated with the age of the household head (just like the wealth accumulation process). Therefore, the elderly, either seen as pensioners or as individuals who head an elderly household or explicitly as people aged above 64 do enjoy significant income advantages from the expansion of the concept of resources. Similar evidence is reported by Frick & Grabka (2003) for USA, West Germany and the UK. In fact, they conclude; "empirical findings support the hypothesis of owner occupied housing as an effective mean of old age provision not only in terms of raising relative income position but even more in terms of poverty alleviation". Therefore, from this point of view, policies oriented at subsidizing either explicit or implicitly the private investment in housing seem to be compatible with the aim of elderly poverty alleviation (although other significant parameters as well as the specific design are also likely to matter a lot)

7.2 A methodological remark

As noted earlier, international literature on imputed rents provides us with three general imputation methods. Ideally all three of them should have been implemented thus producing the material for useful comparisons. Unfortunately one of them in our case had to be abandoned because of the limited quality of the data that were needed to implement it. So the comparison is made between the opportunity cost approach, which incorporates a hedonic pricing model in order to estimate the fictitious rent homeowners would have to pay and the self-assessment approach, which is based on the subjective evaluations of homeowners.

There are a number of disadvantages associated with the latter approach that make the opportunity cost approach more appealing if the micro-data required for its implementation are readily available. Nevertheless in our case the ex post comparison of the two approaches regarding the results of the assessment of the

distributional consequences of imputed rents, did not produce any substantially different results between the two methods, so as to discourage the use of the self-assessment approach in a future research (for example in a data set which contains limited information on housing or it doesn't contain at all). A similar conclusion is drawn by Arevalo & Castillo (2004) who claim that «the most remarkable result of the paper is that the hedonic values thus obtained by through an "objective" statistical procedure are not that different from the self-imputed values "subjectively" selected by the occupants". Regarding the comparison of the two approaches, there are two plausible ways to implement it. The first amounts to applying robust statistical procedures to compare if there are considerable discrepancies between the two distributions of imputed rents (hedonic and self reported). Alternatively, one can examine in detail the distributional effects of applying the two methods. The latter is taken up in Table 14.

Table 14. Estimates of inequality and poverty indices derived using two alternative approaches for the estimation of imputed rents

	Opportunity Cost Approach			**Self Assessment Approach**			**Difference**		
	All	**Own outright**	**On mortgage**	**All**	**Own outright**	**On mortgage**	**All**	**Own outright**	**On mortgage**
Gini	-5,0	-4,8	0,0	-4,2	-4,1	0,0	0,8	0,7	0,0
Atkinson 0.5	-10,3	-9,9	0,0	-8,8	-8,5	0,0	1,5	1,4	0,0
Atkinson 1.5	-12,1	-11,8	0,2	-10,4	-10,2	0,1	1,7	1,6	0,0
FGT0	-11,9	-11,8	1,7	-9,1	-9,8	2,2	2,9	2,0	0,5
FGT1	-18,4	-18,8	2,6	-15,2	-15,9	2,0	3,2	2,9	0,6
FGT2	-26,9	-27,4	2,9	-22,6	-23,3	2,2	4,3	4,1	0,7

Table 14 has three parts; the first reports estimates of inequality and poverty indices for the opportunity cost approach, the second reports the same estimates for the self assessment approach and the third shows the differences in the proportional changes of the values of the indices from the baseline, using these approaches. From a

qualitative point of view, the two approaches yield very similar results. However, it is worth noting that the declines in the recorded inequality and poverty are always larger when the opportunity cost approach is utilized (albeit, in most cases, marginally so).

8. CONCLUSIONS

The main aim of this paper was to assess the impact of a major non-cash income component, namely the imputed rents, on income distribution, inequality and poverty. The empirical findings clearly demonstrate the importance of including non-cash incomes in applied welfare analysis. For the distribution of these resources may systematically differ from the distribution of monetary resources, thus making their omission a source of potential bias in the estimation of measures of relative well being. Certainly, this is the case in Greece regarding imputed rents. Homeownership is widespread, mostly outright, and imputed rents far more equally distributed than disposable income. Consequently, we found that inequality and (relative) poverty declined substantially after the inclusion of imputed rents in the concept of resources available to the household. Outright home ownership was found to be more prevalent among some of the poorest segments of the population – especially the elderly. From this point of view housing can be considered as a natural means of old age provision; a point highlighted in the context of similar empirical studies of other countries (Smeeding et al (1993), Frick & Grabka (2003)).

APPENDIX A: A brief overview of tax and benefit policies related to housing in Greece[13]

(a) Cash assistance. The most important of this type of benefits is the rent subsidy. Rent subsidy is income tested and provided for those who satisfy certain eligibility criteria. Besides that, there are some other cash benefits of lesser importance and magnitude such as emergency housing benefits for return immigrants, etc.

(b) Benefits in kind such as social housing are extremely limited.

(c) Benefits to homeowner. The most important of them is by far the mortgage interest tax relief. For mortgages taken out before 31 December 1999, taxable income is reduced by the whole amount of interest payment (not capital repayment). For mortgages taken out after 1 January 2000 and before 31 December 2002, taxable income is reduced by the amount of interest payment (not capital repayment) that corresponds to the first 120 sqm of the housing unit (so, if the housing unit is > 120 sqm, the reduction of taxable income is calculated pro rata). For mortgages taken out after 1.1.2003, tax deduction is 15% of the amount of interest payment (not capital repayment) up to a maximum mortgage of 200,000 euro.

13 For details, see Matsaganis and Tsakloglou (2004).

APPENDIX B: Results from self-assessment approach

TABLE 4a. Location of Imputed Rent Recipients in the Income Distribution

Quintile	All	Owner-occupiers			Tenants
		All	Own outright	On mortgage	Rent-free
1 (bottom)	20,7	20,3	21,8	9,6	26,0
2	18,9	18,8	19,4	15,0	20,1
3	19,7	20,0	19,9	20,6	16,0
4	20,1	20,1	19,0	27,9	19,9
5 (top)	20,6	20,8	19,9	26,9	18,0
		100.0	100.0	100.0	100.0

TABLE 5a. Equivalized mean imputed rent per capita per quintile

Quintile	All	Owner-occupiers			Tenants
		All	Own outright	On mortgage	Rent-free
1 (bottom)	84,9	75,7	73,0	2,6	9,2
2	90,3	82,5	76,7	5,8	7,8
3	100,5	94,0	86,2	7,8	6,5
4	110,3	100,6	90,2	10,4	9,7
5 (top)	156,3	146,7	132,7	14,0	9,6
	108,4	99,9	91,8	8,1	8,6

TABLE 6a. Proportional increase in disposable income per quintile due to imputed rents

Quintile	All	Owner-occupiers			Tenants
		All	Own outright	On mortgage	Rent-free
1 (bottom)	23,5	20,9	20,2	0,7	2,6
2	14,7	13,5	12,5	0,9	1,3
3	12,1	11,4	10,4	0,9	0,8
4	9,9	9,0	8,1	0,9	0,9
5 (top)	8,0	7,5	6,8	0,7	0,5
	11,1	10,2	9,4	0,8	0,9

TABLE 7a. Quintile income shares before and after the inclusion of imputed rents

Quintile	Disposable income	Disposable income + imputed rents	Owner-occupiers			Tenants
			All	Own outright	On mortgage	Rent-free
1 (bottom)	8,06	7,95	7,95	7,40	8,06	7,49
2	12,86	12,81	12,79	12,55	12,86	12,60
3	17,18	17,19	17,18	16,97	17,18	16,98
4	22,68	22,69	22,68	22,89	22,68	22,86
5 (top)	39,22	39,36	39,39	40,19	39,22	40,08

TABLE 8a. Proportional changes in inequality indices due to imputed rents

Index	Disposable income	Disposable income + imputed rents (% change)	Owner-occupiers			Tenants
			All	Own outright	On mortgage	Rent-free
Gini	0,3261	-5,0	-4,2	-4,1	0,0	-0,5
Atkinson 0.5	0,0867	-10,3	-8,8	-8,5	0,0	-1,1
Atkinson 1.5	0,2432	-12,0	-10,4	-10,2	0,1	-1,0
MLD	0,1824	-11,8	-10,2	-10,0	0,1	-1,2
Half SCV	0,2253	-10,3	-8,9	-8,2	-0,5	-1,3
DR: 90/10	4,3867	-8,8	-7,0	-7,7	1,6	-0,1
DR: 90/50	2,0422	-3,2	-3,0	-3,2	0,6	0,3
DR: 50/10	2,1481	-5,8	-4,2	-4,7	1,0	-0,4

TABLE 11a. Proportional changes in poverty indices due to imputed rents

Index	Disposable income	Disposable income + imputed rents (% change)	Owner-occupiers			Tenants
			All	Own outright	On mortgage	Rent-free
FGT0	0,1972	-5,8	-4,2	-4,7	1,0	-0,4
FGT1	0,0537	-10,5	-9,1	-9,8	2,2	-0,9
FGT2	0,0226	-18,7	-15,2	-15,9	2,0	-1,8

APPENDIX C: Econometric Results

Specification A (Basic Model)

lrent	coefficient	robust std	t	p value
Location1	-0,146	0,024	-6,110	0,000
Location2	-0,219	0,019	-11,570	0,000
Location3	-0,270	0,029	-9,200	0,000
Location4	-0,296	0,041	-7,270	0,000
Dwelling type1	0,019	0,034	0,550	0,586
Dwelling type2	0,030	0,029	1,020	0,309
Dwelling type3	-0,098	0,108	-0,910	0,363
size	0,008	0,000	24,510	0,000
Construction year1	0,004	0,053	0,080	0,937
Construction year2	0,076	0,052	1,440	0,150
Construction year3	0,151	0,053	2,850	0,004
Construction year4	0,206	0,058	3,560	0,000
Construction year5	0,258	0,071	3,640	0,000
WC	0,033	0,056	0,590	0,553
Garage	0,017	0,047	0,360	0,715
Double window crystals	0,039	0,031	1,250	0,213
Secure Door	0,142	0,036	3,920	0,000
Heating1	-0,031	0,080	-0,380	0,701
Heating2	-0,155	0,024	-6,440	0,000
Heating3	0,034	0,041	0,830	0,408
Heating4	-0,013	0,025	-0,500	0,619
Heating5	-0,053	0,048	-1,110	0,266
Heating6	0,045	0,104	0,440	0,662
Heating7	-0,057	0,076	-0,750	0,451
Inverse mills ratio	-0,054	0,018	-3,040	0,002
_constant	4,974	0,078	63,660	0,000

Observations	=	1260
F (25, 1238)	=	62,87
Prob > F	=	0,000
R-squared	=	0,5889
Root MSE	=	0,23489

Specification B (disposable income had been added to the list of covariates)

lrent	coefficient	robust std	t	p value
Location1	-0,129	0,023	-5,550	0,000
Location2	-0,205	0,019	-10,750	0,000
Location3	-0,263	0,028	-9,470	0,000
Location4	-0,273	0,042	-6,440	0,000
Dwelling type1	0,012	0,034	0,350	0,724
Dwelling type2	0,021	0,029	0,720	0,473
Dwelling type3	-0,115	0,108	-1,060	0,289
Size	0,008	0,000	23,510	0,000
construction year1	0,001	0,051	0,020	0,983
construction year2	0,069	0,051	1,360	0,175
construction year3	0,141	0,051	2,740	0,006
construction year4	0,185	0,056	3,310	0,001
construction year5	0,250	0,068	3,650	0,000
WC	0,046	0,054	0,860	0,390
Garage	0,007	0,043	0,170	0,865
double window crystals	0,027	0,031	0,880	0,378
Secure Door	0,136	0,035	3,830	0,000
Heating1	-0,006	0,082	-0,070	0,942
Heating2	-0,135	0,024	-5,580	0,000
Heating3	0,019	0,040	0,480	0,631
Heating4	-0,014	0,025	-0,550	0,582
Heating5	-0,051	0,049	-1,030	0,305
Heating6	0,051	0,103	0,490	0,622
Heating7	-0,045	0,076	-0,590	0,552
Equivalized disposable income	0,069	0,014	5,070	0,000
inverse mills ratio	-0,077	0,018	-4,220	0,000
_constant	4,554	0,109	41,660	0,000

Observations	=	1260
F(25, 1238)	=	65,34
Prob > F	=	0,000
R-squared	=	0,5961
Root MSE	=	0,23324

Specification C (The model is run under the restriction: $X \subset Z$ (X is a strict subset of Z)

lrent	coefficient	robust std	t	p value
Location1	-0,132	0,023	-5,680	0,000
Location2	-0,209	0,019	-10,970	0,000
Location3	-0,281	0,027	-10,490	0,000
Location4	-0,296	0,041	-7,280	0,000
Dwelling type1	-0,002	0,034	-0,060	0,953
Dwelling type2	-0,018	0,031	-0,580	0,560
Dwelling type3	-0,139	0,110	-1,260	0,207
Size	0,009	0,000	22,850	0,000
Construction year1	-0,016	0,052	-0,310	0,760
Construction year2	0,062	0,051	1,210	0,226
Construction year3	0,139	0,052	2,680	0,008
Construction year4	0,178	0,056	3,160	0,002
Construction year5	0,230	0,069	3,320	0,001
WC	0,030	0,055	0,550	0,585
Garage	0,036	0,044	0,810	0,416
Double window crystals	0,050	0,032	1,570	0,116
Secure Door	0,170	0,036	4,670	0,000
Heating1	-0,003	0,083	-0,040	0,970
Heating2	-0,154	0,024	-6,320	0,000
Heating3	0,020	0,040	0,500	0,621
Heating4	-0,037	0,026	-1,400	0,162
Heating5	-0,033	0,049	-0,660	0,508
Heating6	0,059	0,104	0,570	0,568
Heating7	-0,079	0,076	-1,040	0,298
Equivalized income	0,054	0,013	4,160	0,000
Inverse mills ratio	-0,077	0,019	-4,150	0,000
_Constant	4,658	0,112	41,500	0,000

Observations	=	1260
F (25, 1238)	=	66,28
Prob > F	=	0,000
R-squared	=	0.5983
Root MSE	=	0,23227

References

Allen, J., Barlow, J., Leal J., Maloutas, T., and Padovanni, L., **(2004)** "Housing and Welfare in the Southern Europe". Oxford: Blackwell.

Arevalo, R. and Castillo, J.R., **(2004)** "The Rental Equivalence Approach to Nonrental Housing in the Consumer Price Index. Evidence from Spain", Working Paper 4-17. Economic Series 04.

Atkinson, A.B., Cantillon, B., Marlier, E. and Nolan, B. (2002) "Social indicators: The EU and social inclusion", Oxford University Press, Oxford.

Atkinson, A.B., Rainwater, M. and Smeeding, T. **(1995)**, "Income distribution in OECD countries", OECD, Paris.

Atkinson, B.A., **(1970)** "On the Measurement of Inequality", Journal of Economic Theory 2, 244-263.

Barr, N. **(1987)** "The economics of the welfare state." 1st edition. London: Weidenfeld and Nicholson

Buckley, M. and Gurenko, N., **(1997)** "Housing and income distribution in Russia: Zhivago's Legacy", The World Bank Observer 12(1), 19-32.

Canberra Group (2001), "Final Report and Recommendations, The Canberra Group: Expert Group on Household Income Statistics", Ottawa.

Cordon, J.A.F., (1997) "Youth Residential Independence and Autonomy", Journal of Family Issues, Vol. 18, No. 6, 576-607.

Duclos, J. Y., Arrar A., Fortin, C., "DAD: A Software for Distributive Analysis/Analyse Distributive", MIMAP programme, International Development Research Center, Government of Canada and CREFA, university of Laval.

Economou, D. (1987), "Housing Policy in Greece after Word War II: basic explanatory hypotheses, credit for housing and rent policy", Journal of Social Research, 64, pp. 56-129

Emmanuel, D. (**1990),** "Trends in housing markets and finance and subsidy systems in 1980s: the case of Greece", Urban Studies, 6, pp. 931-950

Esping-Andersen, G., **(1990)** "The Three Worlds of Welfare Capitalism", Cambridge: Polity Press.

Ferrera, M. **(1996)** "The 'Southern model' of welfare in Social Europe", Journal of European Social Policy 6, pp. 17-37.

Foster, J.E., Greer, J. and Thorbecke, E. **(1984)** "A class of decomposable poverty measures", Econometrica 52, pp. 761-766.

Fellman, J. **(1976)**. "The effect of transformations on Lorenz curves", Econometrica, vol. 46, pp. 823-824.

Frick, R. and Grabka, M., **(2003)** "Imputed Rent and Income Inequality: A Decomposition Analysis for Great Britain, West Germany and U.S.", The Review of Income and Wealth, 49 (4), 513-537.

Granado, M. M. and Castillo, J.R., **(2002)** "The Decisions of Spanish Youth: A Cross Section Study.", Journal of Population Economics, 15: 305-330.

Gasparini, L. and Escudero, W. S., **(2004)** "Implicit Rents from Own-housing and income distributions: Econometric estimates from Greater Buenos Aires", Journal of Income Distribution, Volume 12, Number 1-2 / Spring-Summer.

Hagenaars, A.J.M., de Vos, K. and Zaidi, **M.A**., **(1994)** Poverty statistics in the late 1980s: Research based on micro-data, Theme 3, Series C, Eurostat Luxembourg.

Heckman, J. **(1979),** "Sample Selection Bias as a Specification Error", Econometrica, 47: 153-161.

Hoekstra, J. (2005) "Is there a Connection between Welfare State Regime and Dwelling Type? An Exploratory Statistical Analysis", Housing Studies, Vol. 20, No.3, 475-495.

Jakobsson, U. (1976), "On the measurement of the degree of progression", Journal of Public Economics, vol. 96, pp. 301-316

Kouvelis, A. and Economou, D. (1985), "State Housing Policy", National Center of Social Research, Athens. (Mimeograph)

Lambert, P.J., **(2001)** "The Distribution and Redistribution of Income", Third Edition, Manchester University Press, Manchester and New York.

Lancaster, K. J, **(1974)** "A new Approach to Consumer Theory". Journal of Political Economy 74, 132-56.

Malpezzi, S., **(2002)** "Hedonic Pricing Models: A selective and Applied Review", Prepared for Housing Economics: Essays in honor of Duncan Maclennan. Edited by Kenneth Gibb and Anthony O'Sullivan, April 10.

Matsaganis, M. and Tsakloglou, P., **(2004)** "EUROMOD Country Report- Greece 2001".

National Statistic Service of Greece. Household Expenditure Survey 2004/2005. Athens: NSSG

Pyatt, G., Chen, C., and Fei, J. (1980) " The distribution of income by factor components.", Quarterly Journal of Economics, vol 95., pp. 451-474.

Saarima, T. (2006) "Imputed Rents, Taxation and Income Distribution in Finland", Paper presented at the ENHR conference "Housing in an expanding Europe: theory, policy, participation and implementation", Ljubljana, Slovenia 2-5 July 2006.

Sen, A.K. (1976) "Poverty: An ordinal approach to measurement", Econometrica 44, pp. 219-231.

Shorrocks, A. F., **(1984)** "Inequality Decomposition by Population Subgroups," Econometrica, 52, 1369–88.

Shorrocks, A. F., **(1980)** "The Class of Additively Decomposable Inequality Measures," Econometrica, 48,613–25.

Smeeding, T. M., P. Saunders, J. Coder, S. Jenkins, J. Fritzell, A. J. M Hagenaars, R. Hauser, and M. Wolfson, **(1993)** "Poverty, Inequality, and Family Living Standards Impacts across Seven Nations:The Effect of Non-cash Subsidies for Health, Education, and Housing," The Review of Income and Wealth, 39(3), 229–56.

Symeonidou, H., **(1997)** "Welfare State and Informal Networks in contemporary Greece", in Mire Florence Conference: Comparing Social Welfare Systems in Southern Europe, vol. 3 p.337-362, Paris .

Van de Walle, D. and Nead, K. **(eds) (1995)** "Public spending and the poor: Theory and evidence", Johns Hopkins University Press, Baltimore and London.

Wollfe, E. **N.,** (1990) "Wealth Holdings and Poverty Status in the U.S", The Review of Income and Wealth, 36(2), 143-65

Wooldridge, M. J., (2002)" Econometric Analysis of Cross Section and Panel Data", The MIT press, Cambridge Massachusetts, London England.

Yates, J. (1994) "Imputed Rent and Income Distribution", The Review of Income and Wealth, 40(1), 43-66.