COMPARING DIFFERENT POVERTY RANKINGS: EVIDENCE FROM ITALIAN EU-SILC DATASET

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Abstract

In this work we explore if there exists a relationship between poverty and the way individuals exploit their personal endowments. To this end, we check the consistency between different ways of ranking individuals, according alternatively to their income, to multidimensional indicators of well being, and to their "ability" to use efficiently the personal resources they have. To test this hypothesis, we perform an empirical analysis on cross-sectional data from the Italian component of European Statistics on Income and Living Conditions (EU-SILC, 2008). The empirical investigation can be split in three main steps: first we derive multidimensional indicators of individual standards of living, by applying a non-linear principal component analysis, which allows us to rank individuals according to their degree of deprivation; then we identify the main determinants of the poverty status estimating two logit models in which the dichotomous dependent variables are derived either from an income-based poverty measure than from the multidimensional indicators previously defined. Finally we perform an efficiency analysis of individuals' performance in generating their income using the Stochastic Frontier Approach.

Keywords: poverty rate, multidimensional poverty index, non linear principal component analysis, stochastic frontiers approach, EU-SILC dataset.

JEL classification: D31; D63; I32.

1. Introduction

The idea of complementing income and deprivation indicators for poverty analyses is increasingly influential in academic and policy debates. In contrast to the traditional notion of economic indigence, poverty is now conceived as a wider concept, strictly related to a number of hardship conditions. This conceptualization goes back at least to Townsend's influential work (1979), where the use of "direct" indicators of poverty is suggested to investigate living standards at the bottom of the scale. Starting from this pioneer study, in latest years several empirical analyses have been undertaken by adopting a multiplicity of deprivation indicators. One of their common findings is that there is not a perfect overlapping between income-poor and deprived people identified on the basis of multidimensional indicators (see, for instance, Nolan and Whelan, 1996; Whelan and others, 2006, 2007).

In this work we investigate poverty from a different perspective. In particular, we aim at exploring if there exists a relationship between poverty and the way individuals exploit their personal endowments. To this end, we check the consistency between different ways of ranking individuals, according alternatively to their income, to a multidimensional indicator of well being, and to their “ability” to use efficiently the personal resources they have. The common sense is that individuals can be more or less efficient in using their available resources, due to several personal characteristics, and that potential inefficiencies may be relevant in explaining poverty conditions. To test this hypothesis, we perform an empirical analysis on cross-sectional data from the Italian component of European Statistics on Income and Living Conditions (EU-SILC, years 2004-2007), one of the richest dataset currently available for analyzing living standards in Italy. The empirical investigation can be split in three main steps. First of all we derive a multidimensional indicator of individual standards of living which summarizes information from a plurality of items signaling hardship conditions. This data reduction is realized by applying a non-linear principal component analysis, which allows us to rank individuals according to their degree of deprivation.

Subsequently, we identify the main determinants of the poverty status. Moving from Coromaldi and Zoli (2011), we estimate two logit models in which the dichotomous dependent variables are derived either from an income-based poverty measure than from the multidimensional indicator previously defined. We find out that the probability of being respectively income-poor or deprived in several dimensions depends on socioeconomic characteristics, that are slightly different according to the notion of poverty we adopt.

The third step consists in performing an efficiency analysis of individuals’ performance in generating their income. The main challenge in this study is to apply a methodology designed for

firms' product function maximization to an individual income function maximization. To this end, efficiency has been modeled by using the Stochastic Frontier Approach, SFA (Aigner et al., 1977; Meeusen and van den Broeck 1977). The idea is that the SFA, which represents the maximum "income level" that can be reached for a given input set, is assumed to be stochastic in an attempt to identify potential sources of differences in predicted efficiencies among firms (individuals in our case). This implies that the inefficiency effects (U_i) can be expressed as an explicit function of a vector of individual-specific variables and a random error. Among the former we can include, for instance, age, gender, marital status and so on. Since not all individuals, having the same "inputs" or endowment, are able to produce the same frontier income, an additional error term is introduced to represent a sort of "technical inefficiency". Factors included in the error term estimation are those proved as relevant poverty determinants according to the logit models estimated above.

The great advantage of this approach is that it allows us to distinguish between inputs used for the "production of income" and efficiency/inefficiency factors as well as to disentangle distances from the efficient frontier between those due to systematic components and those due to noise. The model used in our estimation is based on the Battese and Coelli (1995) specification. Due to the lack of literature on this issue, following De Witte, van den Brink and Groot (2010), we assume that there exists a "production" function in which we consider the level of education and other social aspects as inputs. After the estimation of the stochastic frontiers, individuals can be ranked on the basis of their technical inefficiency in producing income.

On the basis of the analysis described above, we then compare individuals looking at the three different perspectives: the income level, the degree of multidimensional deprivation and the inefficiency in using individual endowment. Our preliminary results suggest that, despite different endowments, some individuals below the poverty line appear to be able to use their scarce resource endowment more efficiently with respect to individuals above (despite their larger endowment). If this is the case there can be some room for specifically designed policy interventions.

The paper is organized as follows. In Section 2 a brief review of the recent literature on monetary and non monetary poverty measurements, while in section 3 a description of EU-SILC dataset is provided. In Section 4 we derive a multidimensional deprivation index (using the non linear principal component analysis) and we describe and discuss the results of the logit model estimations. In Section 5 we describe the Stochastic Frontier Approach and the main results regarding the degree of efficiency/inefficiency of Italian people. In Section 6 we compare the four

different rankings of individuals obtained by using income, the multidimensional indicators and the SFA.

2. Measuring poverty: monetary vs non monetary indicators

"Economic growth will not reduce poverty, improve equality and produce jobs unless it is inclusive …. The globalization process, when properly managed, becomes an important ingredient for inclusive growth (UNPD, 2012)".

As it comes out clearly from this statement, when dealing with poverty issues many themes are involved and should be tackled. Among them, the exact measurement of the phenomenon helps governments and international organizations to better understand the problem itself, to monitor related issues such as welfare, unemployment, infrastructures and so on and to put in place policies and programs aimed at reduce inequality.

The problem of measuring "poverty" also raises important questions about the exact meaning and understanding of the concept, of its multidimensional nature and of the importance of considering the depth and severity that it could reach all around the world.

A brief surfing on the web, among international organizations and academic research websites, highlights how the phenomenon could be approached. For example the Worl Bank reports how "nearly 1.3 billion people remain below the extreme poverty line with an income of US $1.25 or less a day. Another 2.6 billion live on less than US $2 a day, another common measurement of deep deprivation". On the other side, G.S. Fields (1992) explains how the standard studies of countries' development performances and prospects typically go into great detail about various aspects of macroeconomic conditions (growth, investment, balance of payments, etc.) giving little attention to changes in income distribution that, instead, can be used for a variety of goals including measuring income differences among various groups in the population, characterizing the poor, designing antipoverty efforts, and forecasting the potential for social strife.

These quick spots demonstrates how the current approach to the identification of poverty seems to be quite messy. Notwithstanding the acknowledgement of the multidimensionality concept, the monetary approach mostly retains its dominance in descriptions and analysis, both nationally and internationally. Measuring financial resources remains central in fact even if, having reliable information about material deprivation, could add a lot to the possibility of capturing poverty and inequality.

A very clear and comprehensive review of four different approaches (monetary, capability, social exclusion and participatory approaches) could be found in Ruggeri Laderchi, Saith and Stewart (2003). In particular they point out various theoretical and empirical underpinnings of the various measures highlighting how different interpretations of reality translate into different poverty measures.

From the side of non monetary indicators of deprivation that are now widely used in studying poverty all around the world it should be said that they help to improve the identification of those experiencing poverty and understand how it comes about. They are most productively used when multidimensionality is explicitly taken into account, both in framing the question and in empirical application. While serious methodological and measurement issues remain to be addressed, material deprivation indicators allow for new insights in making poverty comparisons across countries and analyzing changes over time (Nolan and Whelan, 2010).

3. The Data

The analysis of the relationship between poverty and the way individuals exploit their personal endowments, have been performed using the 2008 wave of the Italian data of the European Statistics on Income and Living Conditions (EU-SILC). This represents the most recent and richest dataset currently available for multidimensional poverty analyses in the European Union.

The Italian component of the 2008 EU-SILC data consists of a sample of 26,042 households and 52,433 individuals and it is representative for the Italian population. The survey collects detailed information on income from various sources and on a wide range of non-monetary variables concerning different life domains. Data have been collected both at the household than at the individual level but, for the purpose of this study we have chosen to work considering individuals.

The 44 variables that we have used for the multidimensional poverty analysis are listed in Figure 1 and account for the ability to face basic expenses, material living conditions, and possession of durable goods.

Figure 1: Selected variables and deprivation dimensions

PROBLEMS WITH THE DWELLING:
DARKNESS
ROT IN WINDOW FRAMES OR FLOOR
DAMPNESS
LEAKING ROOF
INSUFFICIENT SPACE

NOISE FROM NEIGHBORS OR FROM THE STREET
POLLUTION, GRIME OR OTHER ENVIRONMENTAL PROBLEMS
CRIME VIOLENCE OR VANDALISM IN THE AREA

POSSESSION OF:
TELEPHONE/MOBILE
COLOUR TV
COMPUTER
WASHING MACHINE
PHONE
DISHWASHER
FRIGO
VHS
VIDEOCAMERA
SATELLITE AERIAL
INTERNET ACCESS

TENURE STATUS
NUMBER OF ROOMS AVAILABLE TO THE HOUSEHOLD

⇨ Housing deprivation

ARREARS ON:
MORTGAGE OR RENT PAYMENTS
UTILITY BILLS
HIRE PURCHASE INSTALMENTS OR OTHER LOAN PAYMENTS

CAPACITY TO:
AFFORD PAYING FOR ONE WEEK ANNUAL HOLIDAY AWAY FROM HOME
AFFORD A MEAL WITH MEAT OR VEG EQUIVALENT
AFFORD A CAR
FACE UNEXPECTED FINANCIAL EXPENSES
MAKE ENDS MEET
KEEP HOME ADEQUATELY WARM

FINANCIAL BURDEN OF THE TOTAL HOUSING COST
FINANCIAL BURDEN OF DEBTS REPAYMENT FROM HIRE PURCHASES
HOUSING COST BURDEN
RENT BURDEN
MORTGAGE BURDEN

MAIN REASON FOR:
UNMET NEED FOR MEDICAL EXAMINATION OR TREATMENT
UNMET NEED FOR DENTAL EXAMINATION OR TREATMENT

NEED FOR:
PUBLIC CONTRIBUTIONS TO HOUSING EXPENSES
PUBLIC CONTRIBUTIONS TO RENT EXPENSES
CASH TRANSFERS FROM THE GOVERNMENT
FINANCIAL HELP TO BUY NEEDS
FINANCIAL HELP TO FACE FINANCIAL DIFFICULTIES

ASSET REDUCTION/GOT INTO DEBT

NOT ENOUGH MONEY TO PAY FOR:
FOOD
CLOTHES
MEDICAL EXPENSES
EDUCATION
TRANSPORT
TAXES

⇨ Financial deprivation

As noted in section 2, defining deprivation requires to discriminate between individual preferences and constraints. The problem could be that, the eventual lack of an item included in

the dataset can reflect individual preferences about the item itself (and, in such a case, absence is due to a personal choice) as well as individual incapacity to afford it. Only this latter motivation can properly be considered as signaling a condition of deprivation. The use of EU-SILC data allows us to reduce the risks of ambiguities in identifying deprived people. In the survey in fact, individual responses about possession of items clearly distinguish between ''lack by choice'' and ''enforced lack'' due to limited resources. In the questionnaire, for each item, respondents are asked whether they have it; if they do not have the item, they are asked whether this is because they cannot afford it or because of other reasons. Such a way of articulating answers permits us to focus only on the aspect of ''enforced lack'' of a good or service as indicator of deprivation, and to exclude lifestyle preferences. Other questions are related to the presence of basic facilities in the household dwelling; their widespread availability suggests that their absence can be mainly due to inability to afford them. Information about the quality of the neighborhood environment and health conditions are also provided.

Our analysis is based on the cross-sectional files (UDB 2008-2, released 2010-08-01). A comprehensive description of all variables used will be given in paragraphs devoted to logit estimates and to stochastic frontiers respectively.

4. The determinants of poverty in Italy

In this section, a comprehensive poverty analysis for Italy is performed. As a preliminary stage, we need to define the concepts of poverty to be considered. Specifically, as far as the conceptualization of multidimensional poverty is concerned, it is necessary to identify the dimensions of deprivation and the variables included in each of them. To this end, fifty variables from the original EU-SILC dataset have been selected and divided into two groups representing different life domains. The first group (22 items) refers to a notion of housing deprivation: it includes variables pointing to the absence of basic housing facilities and signaling precarious accommodation conditions. Variables in the second group pertain to a situation of financial deprivation, being related to the incapacity to face ordinary and unexpected expenses as well as problems in facing arrears on mortgage or rent payments. The complete list of variables considered in the multidimensional analysis is provided in Figure 1.

Drawing on Coromaldi and Zoli (2012), the multiplicity of items included in each group has been summarized in two composite indicators of deprivation by applying two distinct Non Linear Principal Component Analysis (NLPCA), one for each group of variables. The use of the non linear

version of PCA is required by the nature (categorical and binary-type) of the variables under analysis. Similarly to its linear version, NLPCA reduces a multiplicity of variables to a smaller number of orthogonal linear combinations (called principal components), preserving the original structure of the data (Nardo et al., 2005). It is nonetheless better suited to handle ordinal and categorical variables, since qualitative items are transformed into quantitative variables through an optimal scaling process which retains the original variance among the data as much as possible. The quantification can be different according to the type of variables to be treated. Given the nature of our variables, we adopt both an ordinal and nominal scaling. The quantified variables are then analyzed with a linear PCA model, where correlations between the transformed variables and each component are maximized. The amount of variance explained by each subsequent component decreases: the first component accounts for the largest proportion of the total variability in the data, the second component for the next largest amount not accounted for by the first component and so on for higher order components. Since we are looking for an indicator expressing as much as possible the latent information conveyed by the data, we retain only the first principal component extracted for each group as deprivation indicator for that specific life domain. Hence we have two indicators of multidimensional poverty, labeled respectively as housing deprivation and financial deprivation.

For each component, individuals are assigned an object score, defined as the sum over his/her standardized scores on the original variables, weighted by the corresponding variable's loading on the same component (Nardo et al., 2005). Object scores can be interpreted as a measure of the individual degree of deprivation for each dimension, and individuals with lower scores in a given dimension can be considered as more deprived in that dimension, meaning that they are experiencing deprivation on several items included in that dimension. Individuals can then be sorted according to their scores and a ‘‘deprivation score distribution’’ (largely comparable to the income distribution) can be obtained for each of the two life domains.

To provide a comprehensive picture of poverty income, the main determinants of both income poverty and multidimensional poverty (as defined by the previously defined indicators) are investigated. A series of logit regressions are then performed, where the dependent variable is an indicator that is equal to 1 if the individual is experiencing income poverty or one of the two kinds of multidimensional poverty and 0 otherwise. In all cases, in order to identify the most disadvantaged in the population and to ensure the comparability of the results, the poverty

threshold is set at a level that identifies people belonging to the bottom 20 per cent of the income/score distribution[1].

To evaluate how the probability of experiencing deprivation depends on socioeconomic individual characteristics, the following exogenous variables have been taken into account: age of the individual and its square, gender, geographical area of residence (3 dummy variables), urban density (3 dummy variables), education level (5 dummy variables), marital status (4 dummy variables), household typology (7 dummy variables), job position (3 dummy variables), type of contract (2 dummy variables) and status in employment (4 dummy variables).

Outcomes are provided in Table 1 where explanatory variables have generally a significant impact. Outcomes are evaluated by assuming, as reference category, a man living in the Centre of Italy in an intermediate populated urban area, without education, single and living in a one-person household, self-employed, having a temporary job.

As it can be seen, by looking comparatively at the impact of the covariates on each poverty indicator, it is interesting to note that only for income poverty women have a lower probability, ceteris paribus, of being poor than men (for indicators of multidimensional poverty the impact is not significant). Living in the North of Italy is generally associated to lower probabilities of experiencing both income poverty and multidimensional deprivation, whilst the opposite is true for living in the South. Living in densely populated urban areas, however, is associated to a lower probability only for the income indicator, whilst it is associated to higher probabilities for both deprivation indices.

The absence of education is a strong predictor of both deprivation and income poverty, as well as being divorced or widow. As far as the household typology is concerned, it is interesting to note that whilst for the income indicator being a couple (under or over 65) increases, ceteris paribus, the probability of hardship conditions, compared to being a single, for non-monetary indicators of deprivation couples have lower probabilities, suggesting that singles may be relatively disadvantaged as they do not benefit from household's economies of scale.

Retired people are less likely to be deprived but more likely to be income-poor. Finally, compared to self-employed, employees tend to have higher probabilities of being multidimensional deprived (whilst the job status is not significant for the income variable).

[1] Setting a threshold to identify the poor in the overall population is always an arbitrary procedure, irrespective of the indicator used to measure poverty, and it is a debatable issue. This is even truer when a multidimensional concept of poverty is considered. Aiming at identifying people experiencing particularly hardship conditions, we follow Tsakloglou and Papadopoulos (2002) and consider as poor those who are at the bottom quintile of the distribution for both the income and each deprivation measure.

5. Deriving the individual efficiency: The Stochastic Frontier Approach

The neoclassical paradigm in economics assumes that production is always efficient. However, it is quite unrealistic that two individuals – even if identical – can have a similar income using the same inputs and bearing the same costs and profits. This means that the difference between two individuals can be explained through the analysis of efficiency and some unforeseen exogenous shocks (Desli et al., 2002).

A simple OLS regression is not sufficient to estimate the relationship between output and inputs because it does not capture the standard idea of the maximum output possible from a given set of inputs and besides that, it has several limits, such as it does not discriminate between rent extraction and productive efficiency and does not simultaneously take into account distances from the efficiency frontier for a given production function (Feld et al., 2004).

To test whether poverty determinants and standards inputs affect efficiency at the individual level, we have estimated individual production functions using the stochastic frontier approach (SFA)[2]. This approach allows to distinguish between production inputs and efficiency/inefficiency factors and to disentangle distances from the efficient frontier between those due to systematic components and those due to noise.

The main idea is that the SFA, which represents the maximum output level for a given input set, is assumed to be stochastic in order to capture exogenous shocks beyond the control of individuals.

Since all individuals are not able to produce the same frontier output, an additional error term is introduced to represent technical inefficiency that, in turn, is in the control of individuals[3]. The search for the determinants of efficiency changes has been debated in the literature for a long time. The main approaches developed could be broadly represented by the following model (Battese and Coelli (1995):

$$(1) \qquad Y_i = x_i\beta + (v_i - u_i) \qquad i=1,...,N,$$

[2] A number of comprehensive reviews of this literature is now available. See for example Forsund et al. (1980), Schmidt (1986), Bauer (1990), Greene (1993), Coelli et al. (1998), Kumbhakar and Knox – Lovell (2000).

[3] We follow the Farrel, M.J. (1957) measure of firm's efficiency consisting in two components: technical and allocative. The former reflects the ability of a firm to obtain maximal output from a given set of inputs while the latter reflects the ability of a firm to use the inputs in optimal proportions given their respective prices. These considerations are obviously true also at the country level considering that the aggregate output comes from the sum of national producers.

where Y_{it} is (the logarithm of) the production of the *i-th* individual in a given year; x_i is a $k\times1$ vector of input quantities of the *i-th* individuals in a given year; β is an vector of unknown parameters. The unobserved random noise is divided into a first component v_i which are random variables following the assumption of normally distributed error terms [iid N(0, σ_V^2)], and a second independent component defined as u_i which are non-negative random variables. These variables are assumed to capture the effects of technical inefficiency in production and are assumed to be independently distributed as truncations at zero of the N(m_{it}, σ_U^2) distribution. The mean of this truncated normal distribution is a function of systematic variables that can influence the efficiency of an individual:

(2) $m_i = z_i\delta + \varepsilon_i,$

where z_i is a $p\times1$ vector of variables which may have an effect on the production function of an individual; and δ is an $1\times p$ vector of parameters to be estimated.
The technical efficiency of the *i-th* individual in a given period can be derived by the following equation:

(3) $$TE_i = e^{(-u_i)} = e^{(-z_i\delta-\varepsilon_i)}$$

5.1 The efficiency of individuals

To measure the individual efficiency, we perform our estimations using the program FRONTIER 4.1 on the cross-section EU-SILC dataset for the 2008 year. The estimation of an individual production function requires a measure of output. As Y_{it} we have considered the households' equivalised disposable income that is assumed to be a function of three inputs: physical capital (K_{it}), labour (L_{it}) and human capital (H_{it}). However, the measurement of these three inputs is very complex and arguably covers a range of intangibles, from individual's utility to the household's welfare and education.

By assuming that the production function takes the log - linear Cobb-Douglas form, our stochastic frontier production model can be specified as follows:

(4) $$\ln(Y)_i = \beta_0 + \beta_1 \ln(K)_i + \beta_2 \ln(H)_i + \beta_3 \ln(L)_i + v_{it} - u_{it}$$

where the dependent variable is the value of the economic performance of the *i-th* individual that belong to a family at 2008, and the independent variables are dummies derived from the questionnaire demands. As regards physical capital (K_i), we have considered the tenure status variable of EU-SILC dataset. In particular, we have put 1 if a member of the household is also the owner of the accommodation, and 0 otherwise. The human capital (H_i) of an individual is measured by the "Highest ISCED level attained" variable, which considers the educational attainment of a person as the highest level of an educational programme a person has successfully completed. Thus, we have put 1 if an individual has completed the post-secondary non tertiary education and 0 otherwise. Finally, the third input (L_i), which usually, when dealing with production, is measured by the number of employees, here is represented by the main activity status during the income reference period. Thus, we have put 1 if the respondent worked (or was in paid apprenticeship or training) the majority of weeks during the income reference period.

Moreover, to consider the technical inefficiencies of all the individuals of EU-SILC dataset, we model the second component of the error as a function of several observable explanatory variables defined as poverty determinants:

$$
\begin{aligned}
u_{it} = {} & \gamma_0 + \gamma_1 female_i + \gamma_2 age_i + \gamma_3 single_i + \gamma_4 married_i + \gamma_5 divorced_i + \gamma_6 widow_i + \\
& \gamma_7 north_i + \gamma_8 centre_i + \gamma_9 south_i + \gamma_{10} dens\_pop_i + \gamma_{11} int\_pop_i + \gamma_{12} thin\_pop_i + \\
& \gamma_{13} 1\_adu_i + \gamma_{14} 2adu\_u65_i + \gamma_{15} 2adu\_o65_i + \gamma_{16} oth\_hh_i + \gamma_{17} lon\_parent_i + \\
& \gamma_{18} 1\_child_i + \gamma_{19} \_children_i + \gamma_{20} 3\_children_i + \gamma_{21} perm\_job_i + \gamma_{22} temp\_job_i + \\
& \gamma_{23} employee_i + \gamma_{24} self\_employed_i + \gamma_{25} fam\_worker_i + \varepsilon_{it}
\end{aligned} \tag{5}
$$

where the first six variables represents the demographic determinants, as the age of the individual the gender and the marital status. Then we consider the geographical area of residence represented by the macro-areas in which Italy can be divided and the urbanization degree distinguishing among densely, intermediate and thinly populated areas. Moreover, we take into consideration the household type classifying on the basis of family components and the type of contract of job, distinguishing between temporary and permanent job.

The focus of our analysis is the impact of poverty determinants on individual economic performance to somehow try to measure the efficiency of individuals.

Table reports the results of the stochastic frontiers estimations. Since in all specifications we reject the null hypothesis of the insignificance of the non random component of the production

function residual (γ), we can conclude that the stochastic frontier specification is a good model to deal with our task. Moreover, the parameter (γ) also indicates the proportion of the total variance in the model which is accounted for by the inefficiency effects. This parameter, which is significant at the 1% level, indicates that 92% of the variance is explained by the inefficiency effects, confirming that the inefficiency effects are important in explaining the total variance of the model.

The results indicate that the production function performs quite well. All the three inputs: physical capital, measured by the property of a family house, human capital, measured by the level of education attained and labour, measured by the main activity status show always a positive and significant sign. However, the coefficients of the three inputs are significantly less than 1 indicating that output is inelastic with respect to inputs. In addition, the sum of inputs' coefficients is less than 1 which implies decreasing returns to scale.

If we focus our attention on the signs of poverty determinants, we can observe that for the majority of variables, the sign is negative, indicating that all variables have a positive effect on efficiency and hence a negative impact on inefficiency.

In particular, if an individual is a woman or is a single or widow then he/she tends to be less inefficient, while the positive sign of *Age* indicates that the older individuals are more inefficient than the younger ones. As regards the territory determinants, we can observe that an individual which lives in the Centre-North of Italy is more efficient than southern one. Moreover, the efficiency increases if we consider the different urbanization degree even if only the area "densely populated" presents a significant coefficient.

As regards household type, we observe that a family composed by an adult or a lonely parent with children is more inefficient than a family composed by 2 adults with or without children. Finally, the type of contract of each individual shows that a permanent job has a positive effect on efficiency, while the temporary job increases inefficiency. The negative estimate for *Employee* and *Self-employed* implies that individuals that are not family worker tend to be less inefficient.

6. A comparison between poverty and efficiency rankings

To complete and deepen the previous analysis, we compare individuals looking at the three different perspectives: the income level, the degree of multidimensional deprivation measured by housing deprivation and financial deprivation and the inefficiency in using individual endowment.

In the following tables 3 and 4, we report only a part of all individuals of Italian EU-SILC dataset just to show the diverse positions that poor and rich people reach in the different rankings

considered. In this first attempt to compare individuals' efficiency with individuals' position in terms of poverty and deprivation, we simple want to take a picture of the situation in 2008. We do not be able to say anything on the change of individuals' position on time, just because we consider only a year. However, our first results seem very interesting, even if they need a further and deep development.

In Table 3, we compare our four indicators for the first and the last twenty individuals of the first two deciles defined on the basis of income. The first twenty lines represent the poorest people of our sample, while the last twenty the less poor. What we can observe is that the poorest individuals are even the less efficient in terms of use of their endowments. However, they are not in the first position of the deprivation rankings. For example if we consider the two individuals (1018501 and 1018502) which belong to the same family 10185, we can conclude that they are poor as they reach only the 18^{th} and the 19^{th} position in the income ranking and inefficient (7^{st} and 13^{rd} position in the efficiency ranking). But they are not so deprived in terms of housing and financial status since their position is quite high. This amazing result could be explained by the fact that in the deprived indicators there are several aspects that describe the individual's condition, while for the first two indicators income is the most important characteristic of the analysis. This different result between the first two and the last two indicators is constantly observed for all the individuals.

Moreover, if we analyse the less poor people, we can find another important result. For example, if we focus on the family 20608 composed by two individuals (2060801 and 2060802), we can observe that even if they are less poor in terms of income and deprivation indicators, they are not efficient.

The same result can be recognized in the first twenty individuals ranking on the basis of the remaining deciles of income, as reported in Table 4. In fact, if we analyse the 10789 family, composed by two individuals, we can conclude that even if they are not rich but neither poor, they are not efficient.

Finally, in the last part of the Table where we report the richest people of the sample, we can see that they are not only rich in terms of income and deprivation indicators but are even efficient, on the basis of the stochastic frontier approach. The positions of all the twenty individuals for all the four indicators are very high meaning that rich people are able to use their endowment in a very efficient way. This result confirms the ability of rich individual in being efficient.

From this very preliminary analysis of efficiency and poverty, we have learnt that despite different endowments, some individuals below the poverty line appear to be able to use their scarce resource endowments in an efficient way. However, the richest people of our sample remain the more efficient maybe due to their larger endowments.

These results, though, are very interesting because of the possibility for the poor and the middle classes to improve their ability in the efficiently use of their endowments. Policy makers have some room to improve the position of individuals in terms of poverty and efficiency. The direction of policy interventions can be linked to the poverty determinants that enhance the efficiency as we have described in the stochastic frontier estimation.

Table 1: Logit estimations for income poverty and muldimensional poverty indicators

	Income poverty	**Housing deprivation**	**Financial deprivation**
age	-0.134	0.017	0.208
	(0.073)	(0.071)	(0.072)**
age_sq	0.044	0.004	-0.051
	(0.015)**	(0.014)	(0.015)**
female	-0.118	-0.015	-0.018
	(0.026)**	(0.024)	(0.025)
north	-0.309	-0.227	-0.298
	(0.033)**	(0.030)**	(0.031)**
south	0.974	0.607	0.919
	(0.031)**	(0.030)**	(0.030)**
densely populated area	-0.079	0.111	0.173
	(0.028)**	(0.026)**	(0.027)**
thinly populated area	0.059	-0.168	-0.306
	(0.030)*	(0.030)**	(0.031)**
primary education	-0.252	-0.197	-0.120
	(0.042)**	(0.042)**	(0.043)**
sec/tertiary education	-0.926	-0.783	-0.826
	(0.046)**	(0.045)**	(0.046)**
degree	-1.442	-1.239	-1.475
	(0.075)**	(0.066)**	(0.072)**
post-graduate education	-1.567	-1.373	-1.643
	(0.178)**	(0.151)**	(0.169)**
married	0.059	-0.136	0.003
	(0.044)	(0.039)**	(0.042)
divorced	0.717	0.321	0.783
	(0.077)**	(0.069)**	(0.069)**
widow	0.287	0.009	0.195
	(0.064)**	(0.060)	(0.064)**
couple under 65	0.066	-0.081	-0.148
	(0.054)	(0.047)	(0.050)**
couple over 65	0.076	-0.100	-0.174
	(0.044)	(0.043)*	(0.046)**
lone parent HH	1.387	0.264	0.712
	(0.068)**	(0.068)**	(0.066)**
one child HH	0.037	-0.102	0.012
	(0.052)	(0.045)*	(0.046)
two children HH	0.448	-0.291	-0.102
	(0.047)**	(0.044)**	(0.045)*
three children HH	0.416	0.121	0.250
	(0.042)**	(0.039)**	(0.040)**
employee	-0.050	0.612	0.649
	(0.043)	(0.040)**	(0.041)**
family worker	0.306	-0.047	-0.287
	(0.088)**	(0.103)	(0.119)*
permanent job	-0.615	-0.445	-0.505
	(0.045)**	(0.040)**	(0.041)**
unemployed	1.611	0.748	1.055
	(0.051)**	(0.049)**	(0.049)**
retired	0.471	-0.227	-0.270
	(0.044)**	(0.041)**	(0.044)**
other occupation	0.884	0.174	0.336
	(0.034)**	(0.033)**	(0.033)**
Constant	-1.753	-1.312	-1.601
	(0.100)**	(0.097)**	(0.099)**
Observations	52062	52062	52062

Table 2: Inefficiency models with Equivalised Disposable Income as dependent variable

	DEPENDENT VARIABLE: GDP/L	MODEL
PRODUCTION FUNCTION INPUTS	Const β0	9.66*** (1447.24)
	K owner β1	0.22*** (36.62)
	H_sec β2	0.09*** (6.66)
	L_employed β3	0.28*** (48.65)
	const γ0	-2.27*** (-3.16)
DEMOGRPHY DETERMINANTS	female γ1	-0.46*** (-22.49)
	age γ2	0.02*** (22.39)
	single γ3	-0.89** (-1.90)
	married γ4	-0.21 (-0.45)
	divorced γ5	-0.04 (-0.09)
	widow γ6	-1.12** (-2.38)
TERRITORY DETERMINANTS	north γ7	-2.19*** (-4.14)
	centre γ8	-1.25** (-2.36)
	south γ9	1.17** (2.22)
	dens_populated γ10	-1.31** (-2.47)
	int_populated γ11	-0.76 (-1.45)
	thin_populated γ12	-0.20 (-0.37)
HOUSEHOLD TYPE	1adult γ13	1.44*** (4.18)
	2adults_under65 γ14	-1.36*** (-3.91)
	2adults_over65 γ15	-0.43 (-1.25)
	other_hh γ16	-2.79*** (-8.11)
	lonley parent γ17	2.73*** (7.85)

	1child γ18	-1.38***
		(-3.97)
	2children γ19	-0.25
		(-0.73)
	3children γ20	-0.23
		(-0.68)
TYPE OF CONTRACT	perm_job γ21	-1.53***
		(-2.64)
	temp_job γ22	0.88
		(1.53)
STATUS IN EMPLOYMENT	employee γ23	-0.64
		(-1.11)
	self_employed γ24	-0.13***
		(-3.35)
	Family _worker γ25	0.76***
		(13.95)
	sigma squared	2.20***
		(36.80)
	Gamma	0.92***
		(359.32)
	Log likelihood	-33344.37

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

Table 3: Individual ranking of technical inefficiency, income and deprivation indices (first and lasthe last twenty individuals of the first two deciles of income

Individuals' code	Households' code	Ranking efficiency	Ranking income	Ranking housing deprivation	Ranking financial deprivation
1933201	19332	5	1	22933	3005
1933203	19332	9	2	22934	3006
1933202	19332	11	3	22935	3007
2406302	24063	1	4	7250	7703
2406303	24063	2	5	7251	7704
2406301	24063	4	6	7252	9734
446701	4467	15	7	41613	36071
637501	6375	12	9	25613	36461
637502	6375	10	8	25612	39142
2499902	24999	8	10	25614	29377
2499901	24999	14	11	25615	29378
1685201	16852	3	12	25616	33279
1432401	14324	6	13	3906	17626
2244901	22449	16	14	1461	12961
2244902	22449	17	15	1462	12962
2343201	23432	21	16	260	4616
2343202	23432	23	17	261	4617
1018501	10185	7	18	24777	33248
1018502	10185	13	19	24778	33249
847701	8477	18	20	4615	24383
...	...	...	...	...	...
1215503	12155	13101	8682	11915	27589
345901	3459	3868	8683	26782	24978
345902	3459	7776	8684	26783	24979
1355802	13558	6777	8685	33188	6864
1355801	13558	11035	8688	33189	8475
2472401	24724	7867	8686	4127	17891
2472402	24724	10424	8687	4128	17892
2229101	22291	13576	8689	7855	7145
2229103	22291	19989	8690	7856	7146
2229102	22291	22595	8691	7857	7147
2217402	22174	5414	8692	23835	21396
2217404	22174	7775	8693	23836	22748
2217401	22174	8255	8694	23837	22749
2217403	22174	8280	8695	23838	22750
2404601	24046	5527	8696	9391	26857
2404602	24046	7369	8697	9392	26858
2060802	20608	3036	8698	15906	37361
2060801	20608	3435	8699	15907	37362
2569201	25692	6660	8700	9607	6131
389301	3893	4902	8701	41802	16854

Table 4: Individual ranking of technical inefficiency, income and deprivation indices of the first and the last twenty individuals from the third to the tenth deciles of income

Individuals' code	Households' code	Ranking efficiency	Ranking income	Ranking housing deprivation	Ranking financial deprivation
532301	5323	8506	8702	17231	18796
2141502	21415	20013	8703	26784	6704
2141501	21415	20029	8704	26785	6705
2141503	21415	27812	8705	26786	6706
1614701	16147	9942	8706	6446	5158
1078902	10789	3488	8707	26787	24980
1078901	10789	7070	8708	26788	24981
830201	8302	9069	8709	17855	31046
830202	8302	11866	8710	17856	31047
1467301	14673	8426	8711	33190	15980
1494202	14942	7256	8712	3506	944
1494201	14942	13001	8713	3507	945
1493403	14934	7927	8714	1004	10072
1493402	14934	10171	8715	1005	10073
1493401	14934	11470	8716	1006	10074
647601	6476	5904	8717	135	640
765002	7650	8373	8718	22314	9222
765001	7650	10438	8719	22315	9223
1971701	19717	9009	8720	26789	40444
1971702	19717	10206	8721	26790	40445
...	...	...	...	...	...
592701	5927	43503	43486	38719	34334
1613801	16138	43477	43487	38720	18504
1941202	19412	43500	43490	43501	38718
1941205	19412	43482	43488	43499	39251
1941201	19412	43486	43489	43500	43299
1941203	19412	43501	43491	43502	43300
938701	9387	43476	43492	13756	26897
1645101	16451	43483	43493	32013	37969
2134501	21345	43478	43494	43503	34435
610901	6109	43491	43495	41609	43209
610902	6109	43493	43496	41610	43210
653601	6536	43492	43497	25610	40414
653602	6536	43494	43498	25611	40415
2013002	20130	43496	43499	16977	22084
2013001	20130	43505	43500	16978	22085
2220601	22206	43498	43501	14229	26063
2558701	25587	43497	43502	43504	43301
2558702	25587	43499	43503	43505	43302
1744501	17445	43504	43505	41612	38702
1744502	17445	43502	43504	41611	42304