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EQUITY IN THE DELIVERY OF INPATIENT CARE IN ITALY

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1 Introduction

All Italian citizens have universal coverage. The National Health Service is regionally based and it provides universal coverage free of charge at the point of use. Equal access to uniform levels of health care according to needs ought to be guaranteed to everyone.

Previous papers [Van Doorslaer et al (2000); Van Doorslaer et al (2002)] have showed that in some European countries there is pro-poor inequity in GP visits, and that, in almost all of the countries, the inequity in specialist visits is pro-rich. Yet, it was showed that by using a pooled analysis there is pro-rich inequity in hospital admission in many EU members [Masseria et al 2003].

The aim of this paper is to analyze more in detail the Italian health care system. In particular, the attention is focused on the characteristics of the Italian hospital systems to understand which are the main problems to tackle.

I will try to assess to what extent the goals of equal access to inpatient care for equal needs irrespective of income has been achieved in Italy. The data are taken from the Multiscopo survey 1999-2000, conducted by ISTAT. Various topics are objects of the analysis, but the main purpose of the survey is to describe the health conditions of the population and the use of the health care services. However, there is no information about the income level of the Italian population. To overcome this problem, I matched the Multiscopo survey (1999-2000) with the Eurostat survey (1999) for Italy; the latter provides income information.

Two measures of hospital admission are used to measure and quantify the level of horizontal inequity in inpatient care. In the survey, the reference period for inpatient rate is three months. A longer-term measure of hospital admission probability was built. All the interviewees with chronic diseases were asked to report whether they were admitted to hospitals without time constraints. These variables were used to generate a proxy for the inpatient rate.

The level of detail of the survey concerning the hospital care questionnaires in the three months before the interview is very high. This permits to deal with other important issues, such as the role of regional disparities and specialists' referrals on the overall level of inequality and inequity.

It is now possible to differentiate hospital admissions (reference period three months) referred by specialist from the others. This clearly can help in explaining the role that

specialist physicians play. Moreover, it is possible to see if there is a relation between specialists' referrals to hospitals and the reasons for which the admission took place. In fact, it is possible to know whether the admission was due to disease or surgery, birth or pregnancy, check up, or other reasons. Public from accredited private hospitals are differentiated.

The other major issue is the contribution of regional disparities. Regions are the ones that deliver the health care services to the population through health care organizations and public and accredited private hospitals. They are also responsible for the quality, appropriateness and efficiency of the services provided. Patients are completely free to choose between public or accredited private hospitals, within or outside their local unit service or region. In general, in the South the percentage of patients who opt for receiving inpatient care outside their region is higher than in the North or the Centre. The Multiscopo survey gives the possibility to analyse this phenomena. It is possible to know where the hospitalisation had taken place. Interviewees were asked to report whether the hospital in which they were admitted was located inside or outside their region of residence. It is interesting to understand the relation between this decision and specific health conditions, socio-economic and geographic characteristics.

The paper starts with a short explanation of how equity is defined and measured. Section 2 provides a description of the data and estimation method used, and section 4 presents the main results.

2 Defining and measuring horizontal inequity in health care delivery

To achieving horizontal equity in inpatient care, resources ought to be allocated according to needs, irrespective of personal characteristics not related with the needs, such as income. In fact, it is supposed that "people in different degrees of ill-health have different medical needs, and people in the same state of ill-health have the same need" (Wagstaff, Van Doorslaer and Ruffer, 1993).

To understand if people in equal needs receive similar treatments, regardless of their income it is necessary to quantify and test for violation of the principle of horizontal

equity. The measure of inequity is based on the indirect standardization approach proposed by Wagstaff and Van Doorslaer (2000)[1].

In case of inequity favouring the better-off (worse-off) the medical care and needs concentration indices (respectively CM and CN), and the horizontal inequity index ($HI_{WV)}$ have positive (negative) values.

3. Data and estimation methods

3.1 Data description

The data are taken from the Multiscopo Italian survey, conducted by ISTAT. Every three years a representative panel of households and individuals are interviewed to have a picture of the Italian health status. The main object of the survey is to describe the health conditions and habits of the Italian population. I will analyze the data from the last available survey (1999-2000) to understand the level of inequity and inequality in the Italian hospital system.

In the Multiscopo survey, there is no information about the income level of the Italian population. To overcome this gap I have matched the Multiscopo survey (1999-2000) with the Eurostat survey (1999) for Italy. Indeed, the latter provides income information (see appendix 2). The *lninc* is the natural logarithm of the net imputed household income per equivalent adult, obtained by using the Carbonaro scale. The variable r_i is the fractional rank and it is derived ranking the net imputed household income per equivalent adult.

The measure of inpatient care (*inp1*) is based on the question: "During the last 3 months, have you been admitted to a hospital as in-patient?" However, 3 months are a relatively short period to measure properly the hospital admission probability. To overcome this problem, I built a proxy for a longer-term inpatient rate by using the answers of interviewees with chronic illness[2] (*Pinp1*). In fact, they are asked whether they were admitted to hospitals without any time constraint.

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[1] In the appendix I report a description of the methodology.

[2] People with chronic illness are asked whether they were admitted to hospitals.

Other variables will be also object of analysis. In the Multiscopo survey, it is, indeed, possible to know whether the hospital admission was decided by a GP, the emergency room, a hospital specialist, a specialist outside the hospitals, or by other health professionals. The dummy *ref_spec* is equal one if it was a specialist the one who decided the hospital admission.

It is asked also whether the hospital in which individuals were admitted was located in the municipality, in the province, in the region of residence, in other Italian regions, or abroad. The dummy *loc_reg* is based on this question (it is equal one if interviewees went to a hospital located in their region of residence or equal zero otherwise).

Different measures of self-reported health status are used. Self-assessed health (*sah*) and hampered in daily activity (*healthlimit*) are the main variables that I will consider. Responders rate their health status by choosing between five categories: "very bad, bad, fair, good and very good" health conditions. Based on these five categories four dummy variables were built; people in very good health are the reference category. The other question is "Are you hampered in your daily activity by any physical or mental health problem, illness or disability?" In this case, the dummy variable, healthlimit1, represents the answer: "yes, severely"; healthlimit2: "yes, to same extent"; and the reference category is represented by individuals not hampered in their daily activity. In the survey other health measures are reported. Different chronic illnesses were objects of the questions. I will consider the relative effect of people with at least one chronic disease on the probability of being admitted in hospital (the dummy *chronic* equals one if interviewees declared to have chronic illness). Another variable is also used: reason of hospitalisation. In the survey it is asked whether the hospitalisation happened for disease or surgery reasons (*dis-sur*), for birth or pregnancy reasons (*birth*), for check-up (*checkup*) or for other reasons (*other_re*).

Age is captured by six dummy variables, namely 16-34, 35-44, 45-64, 65-74 and more than 75 years old. However, I did not estimate the effect of age alone but I took in consideration the interactions between age and gender. Therefore, in the model, male individuals between 16 and 34 years old are the omitted category.

Education and activity status dummies represent the non-need variables. For the education level two dummies are used. Responders could choose among three categories " Third level of education; second level of education; less than second level

of education". People with the highest level of education (*ED1*) represent the reference category. For what it concerns the activity status, employed people are the reference category. Based on the questionnaire, I built other six dummy variables: *inactive, housework, retired, unemploy, student,* and *self-employ*.

It is also possible to differentiate public, private accredited and fully private hospitals. Two dummies were built for the private hospital (*hospital3* equals one when the hospital in which the admission took place was private but accredited; *hospital4* equals 1 when it was a fully private hospital).

The regional information is very detailed. A dummy for each region was built; the reference category is Lazio.

3.2 Estimation methods

A probit model is used to estimate the hospital care needs, y. To predict the probability of inpatient admission it is necessary to use a latent variable model. The idea of a latent *y** is that there is an underlying propensity to use medical care that generates the observed state, *y*.

y = 1 if y* > 0

y = 0 otherwise

where,

$$y^* = a + b \ln inc + d X + g S + p R + u \qquad (13)$$

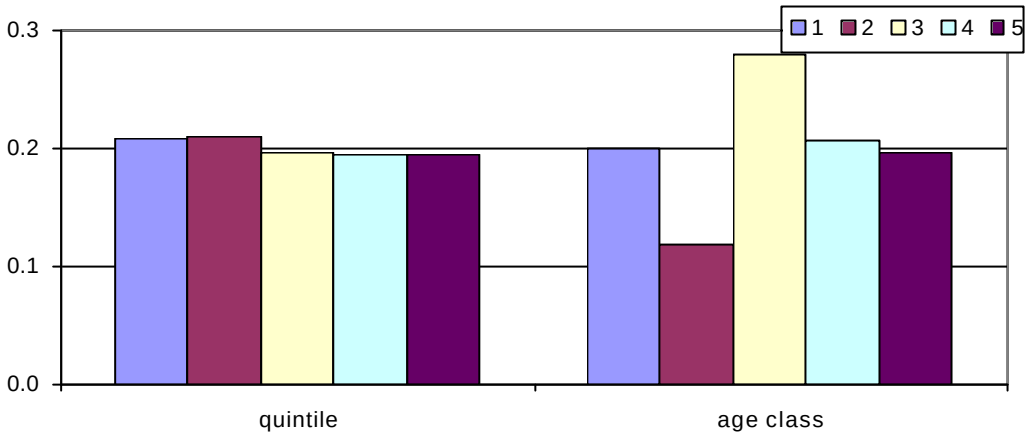
X represents the need variables (*sah* and *healthlimit* dummies and the interactions' dummies between age and gender), *S* the socio-economic dummies (education level and activity status), and *R* represents the regional dummies.

4. Inequity in hospital admission

In the three months before the interview only 4% of the population was admitted to hospital as inpatient. The percentage of admission was slightly higher for people in the lower income class (figure 1) hence, the inequality seems to be in favour of people in the lower socio-economic classes. Among the people who were admitted to hospital 8%

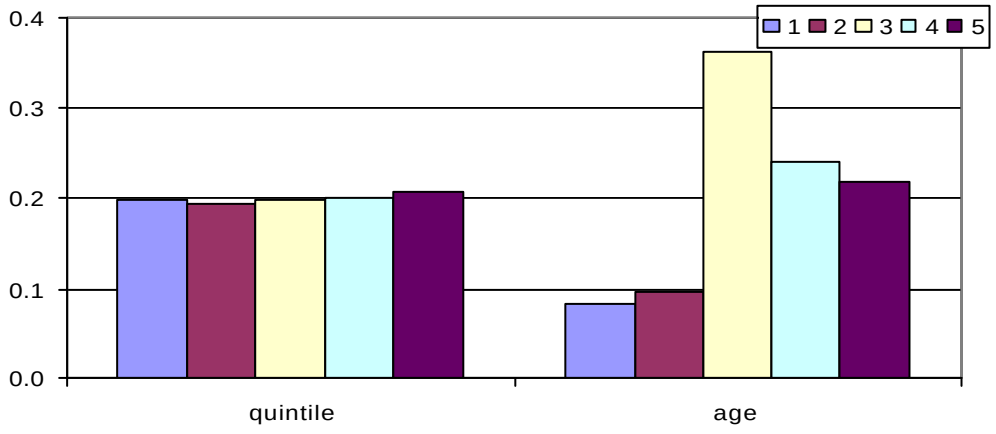
were in very poor health, 24% in poor health and 43% in fair health. As expected, older people had a higher probability of being admitted in hospitals. In fact, for people between 65 and 75 years old the average admission rate was 6% and for people over 75 was 8.5%.

Figure 1. Distribution of the probability of being admitted to hospital by income quintiles and age classes



By considering the inpatient proxy (*pinp1*), nearly 20% of the people with chronic diseases were admitted to hospitals. It is worth noting that, in this case, there was a slightly positive relation between the probability of being admitted to hospitals and the individual income level (figure 2). People with less than 45 years have less probability of being admitted to hospitals than previously and, surely, this is related with the fact that only people with chronic diseases are now analysed.

Figure 2. Income quintiles and age classes' distributions for the inpatient rate proxy



4.1 Income-related inequity in inpatient care

For having equity in the hospital admission rate the probability of being admitted to hospitals ought to depend only on health conditions and not on socio-economic or geographical characteristics of people.

Table 1 shows that Italian people with higher needs have a higher probability of receiving inpatient care (columns 2 and 3). The two measures of self-reported status are the most important determinants of needs for inpatient care overall. Activity status and education seem to influence the hospital probability admission only slightly. People with less than a secondary level of education seem to have higher inpatient rate, while students have a lower one than their counterparts. The marginal effect of the logarithm of the net equalised income is not statistically significant.

Table 1. Probit results for the two measure of inpatient rate (marginal effects)

	Inpatient rate 3 months (*inp1*)		Inpatient rate proxy (*Pinp1*)	
	dF/dx	z	dF/dx	z
sah2*	0.012	3.920	0.078	10.450
sah3*	0.032	8.760	0.219	26.350
sah4*	0.087	12.840	0.453	33.420
sah5*	0.139	13.360	0.499	26.260
healthlimit1*	0.069	15.600	0.207	25.490
healthlimit2*	0.030	12.060	0.118	25.000
male2*	-0.006	-1.850	0.058	6.780
male3*	0.001	0.320	0.121	15.160
male4*	0.007	1.640	0.194	16.860
male5*	0.004	0.900	0.197	15.000
female1*	0.017	5.220	-0.008	-1.150
female2*	-0.001	-0.160	0.041	4.770
female3*	-0.010	-3.430	0.103	12.570
female4*	-0.008	-2.280	0.125	12.310
female5*	-0.010	-3.120	0.123	11.670
educ2*	0.007	2.180	0.020	2.700
educ3*	0.003	0.890	0.020	2.840
selfemploy*	-0.001	-0.280	-0.014	-2.540
student*	-0.015	-4.690	-0.031	-3.380
retired*	0.003	1.240	0.041	7.560
housework*	0.004	1.360	-0.004	-0.780
inactive*	-0.005	-0.990	0.077	4.920
unemploy*	0.003	1.020	0.002	0.290
lninc	-0.001	-1.020	0.007	2.980

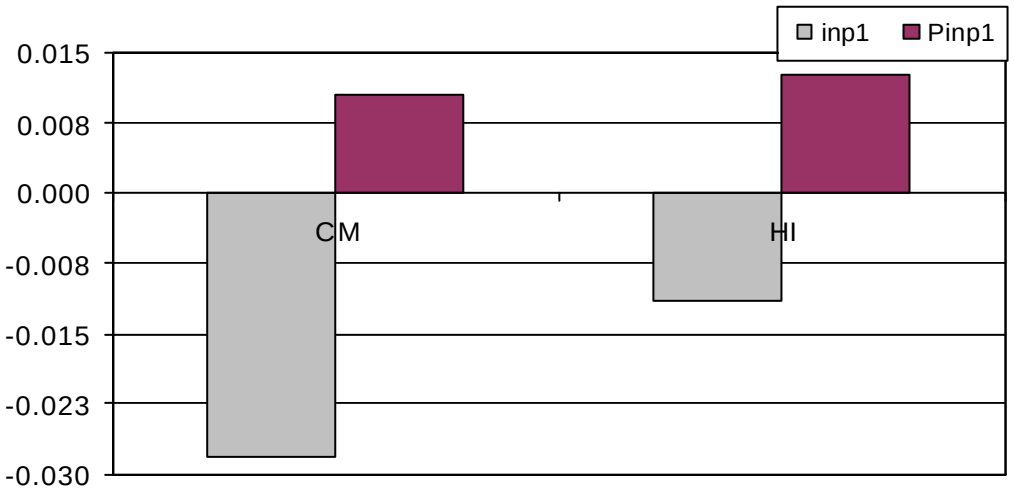
The results change radically if we consider as dependent variable the inpatient proxy (*Pinp1*) instead of the three months probability (table 4.5, columns 4 and 5). Self-

assessed health and health limitation measures are still the main determinants of hospital admission, but the interactions between age and gender become also statistically significant. The needs for hospital care seem to increase with age. The role of socio-economic variables is more relevant than in the three months inpatient estimates. People without higher education, in retired and inactive schemes, have more possibilities of being admitted to hospitals, leaving all other variables constant. On the contrary, self-employed and student positions seem to have a negative effect on the probability of receiving inpatient care. The logarithm of the net equalised income has positive and statistically significant marginal effect.

The concentration index for medical care is negative but not statistically significant (the Cm is -0.028 with a t-statistics of 2.05) for the three months hospitals admission. Thus, there is pro-poor inequality in the 3 months inpatient probability. However, whenever the inpatient rate proxy is estimated, the inequality becomes pro-rich and statistically significant (the CM is 0.01 with a t-statistics of 2.24) (Figure 3).

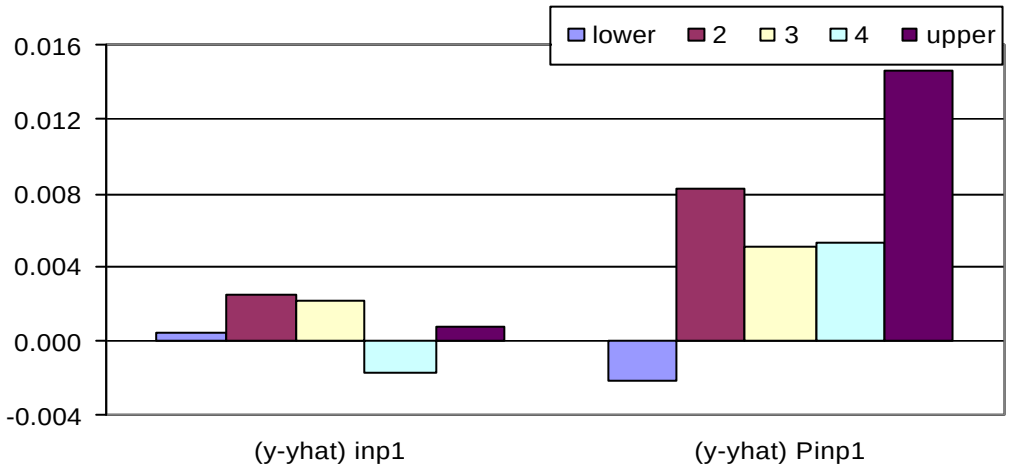
Concerning the horizontal inequity index coefficients, there is no inequity when the three months period time was estimated (the Hi is equal to - 0.011, with a t-statistics of 1.03), yet there is pro-rich inequity (the HI is 0.013 with a t-statistics of 3.08) when the longer-time hospital admission probability is used as dependent variable.

Figure 3. Medical care concentration index and horizontal inequity index for the two measure of inpatient rate



Looking at the differences between the actual and predicted probability of hospital admission by income quintiles it is easy to understand the differences between the two measures (Figure 4). In both cases the actual distribution is higher than the predicted one, but with one exception. By estimating the three months probability we discover that people in the fourth income quintile, given their needs, should use more hospital care than they actually do. However, the estimates obtained by using the inpatient proxy show a different scenario. People in the first quintile are the only category for which the receipt of inpatient care is not enough to cover their needs (also in Masseria et al. where the Eurostat survey was used to estimate the one year probability, this difference is negative only for the lowest income quintile). The probability of being admitted to hospitals seems to be more in favour of the middle class than of the richest one by estimating a shorter period probability.

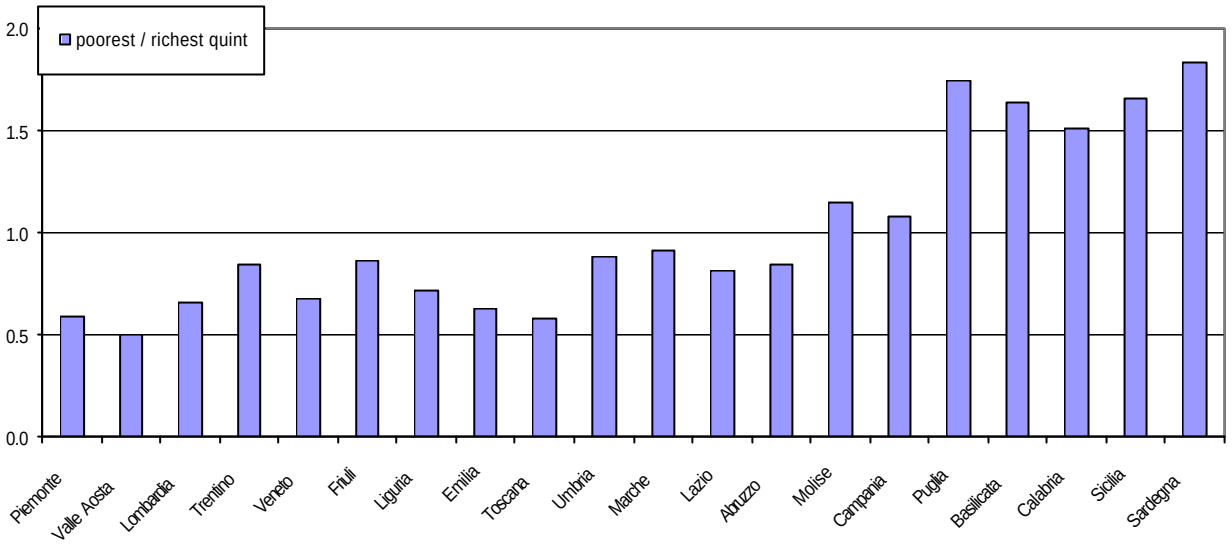
Figure 4. Difference between actual and predicted hospital probability by income quintiles for both the two inpatient rate' measures



4.2 Regional differences in hospital admission probability

The South of Italy is less wealthy that the rest of the country. Figure 5 shows that in the South and Islands, there were more people in the lowest quintile than in the richest one.

Figure 5. Proportion of people in the poorest quintile over the richest one among regions.



By estimating both the inpatient measures I will analyse the role that the region of residence plays on the level on inequity in hospital admission.

As before, there is a large difference between the results obtained using the three months and the longer-term inpatient rate (table 2). Regional disparities seem to be more relevant when the hospital admission probability is estimated by the inpatient proxy. Many regions show a statistically significant marginal coefficient. In general, the probability of hospital admission is lower in the regions of the South and Northwest, leaving all other variables constant. For example, in Campania, Calabria, Sicilia, Valle Aosta and Piemonte the probability of hospital admission is statistically significantly lower than in Lazio. In Trentino, Lombardia and Veneto it is higher.

No significant differences are noticeable in the HI_{WV} index with the introduction of regional dummies among the regressors for both the inpatient measures.

Table 2. Probit results with regional dummies (marginal effects)

	Inpatient rate 3 months (*inp1*)		Inpatient rate proxy (*Pinp1*)	
	dF/dx	z	dF/dx	z
sah2*	0.013	4.030	0.075	10.080
sah3*	0.032	8.930	0.216	26.090
sah4*	0.089	12.980	0.455	33.460
sah5*	0.141	13.500	0.504	26.460
healthlimit1*	0.069	15.670	0.210	25.880
healthlimit2*	0.030	12.060	0.121	25.590
male2*	-0.006	-1.850	0.061	7.050
male3*	0.001	0.330	0.123	15.400
male4*	0.007	1.660	0.199	17.150
male5*	0.004	0.930	0.200	15.150
female1*	0.017	5.220	-0.010	-1.330
female2*	0.000	-0.110	0.040	4.620
female3*	-0.010	-3.420	0.100	12.290
female4*	-0.008	-2.220	0.122	12.000
female5*	-0.010	-3.080	0.117	11.120
educ2*	0.007	2.180	0.017	2.230
educ3*	0.003	0.880	0.016	2.290
selfemploy*	-0.001	-0.230	-0.015	-2.660
student*	-0.015	-4.690	-0.026	-2.840
retired*	0.003	1.250	0.040	7.390
housework*	0.003	1.290	0.005	0.860
inactive*	-0.006	-1.090	0.083	5.240
unemploy*	0.003	0.970	0.010	1.620
Piemonte*	-0.003	-0.750	-0.017	-2.180
ValleAosta*	-0.006	-1.390	-0.032	-3.360
Lombardia*	0.006	1.740	0.023	2.890
Trentino*	0.002	0.530	0.034	3.770
Veneto*	0.001	0.200	0.025	2.970
Friuli*	0.002	0.620	0.008	0.970
Liguria*	0.003	0.790	-0.002	-0.200
Emilia*	-0.003	-0.730	0.012	1.380
Toscana*	-0.003	-0.750	-0.014	-1.750
Umbria*	0.001	0.120	0.002	0.180
Marche*	-0.002	-0.550	0.002	0.200
Abruzzo*	0.009	2.320	0.001	0.130
Molise*	0.002	0.580	-0.003	-0.350
Campania*	0.001	0.350	-0.052	-7.080
Puglia*	0.004	1.040	-0.011	-1.380
Basili~a*	0.008	1.820	0.000	-0.030
Calabria*	-0.002	-0.650	-0.026	-3.450
Sicilia*	0.000	0.100	-0.043	-5.610
Sardegna*	0.004	1.150	-0.002	-0.220
lninc	-0.001	-0.970	0.004	1.860

5. Equity issues related with the hospital referral and location.

To analyse more deeply the Italian hospital system and eventually to uncover peculiar problems, the following part of the paper has the purpose to assess whether there is equity in both hospital referrals and localization. I will also try to understand the reasons

that drive patients to be referred by specialists or to opt for a hospital located outside their regions of residence.

5.1. Was the specialist who decided the hospital admission?

Specialist physicians decided 42% of the hospitalizations. It is interesting to understand whether there is a relation between a hospital referral decided by a specialist and the health conditions of patients.

The two measures of self-reported status (sah and health limitation) do not play a significant role in explaining why the hospitalization was decided by a specialist (table 3). On the contrary, leaving all other variables constant, the probability of being admitted by specialists increases whenever the hospitalization was due to birth or pregnancy reasons, and to diseases or surgery. The presence of chronic conditions also raises the needs for specialists' referrals. Moreover, young female patients seem to be more prone to be referred by specialists. The probability of being admitted to hospitals by a specialist physician and not by a GP or through the emergency room physicians increases in a statistically significant way whenever the hospitalization was in private hospitals (both accredited or not). Socio-economic characteristics seem not to influence significantly the probability of being admitted by specialists. Only people in the most disadvantaged socio-economic class (with less than secondary level of education and unemployed) have a statistically significant lower probability of specialists' referrals. Neither income nor region dummies have a statistically significant effect.

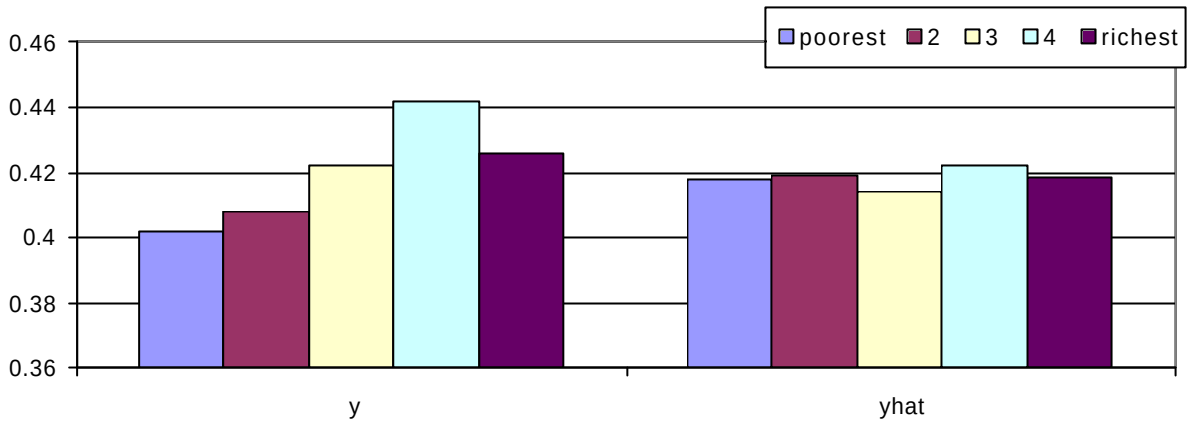
Figure 6 shows the actual and predicted distributions of specialist' referrals by income quintiles. The medical concentration index is positive (the value is 0.015). Indeed, specialists more often refer richer people than their counterparts. People in the fourth income quintile are the ones who are most often referred by specialists. However, the pro-rich inequity in the medical concentration index is not statistically significant (the t-statistic is 1.15). Furthermore, there is no inequity in the needs for hospital referrals by specialists (the CN is almost zero, 0.001, and the t- statistic is 0.33). The horizontal inequity index is positive (0.15) but not statistically significant (the t-statistic is 1.12). On average, people in the less advantaged classes are slightly discriminated in favour of

the people in the middle and high classes. Yet, it was impossible to detect any inequity in hospital referral.

Table 3. Probit results for specialist's referral to hospitals (marginal effects)

ref_spec	dF/dx	Robust Std. Err.	z	P>z
sah2*	0.018	0.058	0.320	0.751
sah3*	0.013	0.059	0.220	0.827
sah4*	-0.002	0.064	-0.030	0.976
sah5*	0.004	0.073	0.050	0.962
healthlimit1*	-0.022	0.034	-0.640	0.524
healthlimit2*	0.019	0.028	0.680	0.495
male2*	-0.048	0.059	-0.790	0.428
male3*	0.030	0.052	0.590	0.557
male4*	-0.037	0.061	-0.600	0.550
male5*	-0.112	0.060	-1.760	0.078
female1*	**0.116**	**0.053**	**2.200**	**0.028**
female2*	**0.161**	**0.057**	**2.810**	**0.005**
female3*	0.080	0.054	1.480	0.138
female4*	0.025	0.060	0.430	0.670
female5*	**-0.115**	**0.055**	**-2.010**	**0.045**
dis_sur*	**0.070**	**0.030**	**2.370**	**0.018**
birth*	**0.184**	**0.053**	**3.410**	**0.001**
other_re*	0.062	0.033	1.910	0.056
chronic*	**0.064**	**0.028**	**2.200**	**0.028**
hospital3*	**0.163**	**0.032**	**5.080**	**0.000**
hospital4*	**0.211**	**0.099**	**2.060**	**0.039**
educ2*	-0.064	0.051	-1.230	0.219
educ3*	**-0.103**	**0.050**	**-2.070**	**0.038**
selfemploy*	0.040	0.044	0.930	0.355
student*	-0.026	0.067	-0.390	0.698
retired*	-0.043	0.036	-1.180	0.240
housework*	-0.058	0.036	-1.570	0.118
inactive*	-0.020	0.071	-0.290	0.775
unemploy*	-0.067	0.038	-1.710	0.087
Piemonte*	0.086	0.059	1.460	0.144
ValleAosta*	0.028	0.082	0.340	0.732
Lombardia*	-0.033	0.052	-0.630	0.526
Trentino*	0.008	0.059	0.140	0.892
Veneto*	0.059	0.058	1.020	0.308
Friuli*	0.048	0.059	0.820	0.414
Liguria*	0.053	0.058	0.930	0.352
Emilia*	0.014	0.058	0.240	0.808
Toscana*	-0.021	0.058	-0.360	0.720
Umbria*	0.049	0.066	0.750	0.455
Marche*	0.035	0.061	0.580	0.564
Abruzzo*	-0.053	0.051	-1.030	0.301
Molise*	-0.042	0.058	-0.720	0.472
Campania*	0.016	0.055	0.290	0.771
Puglia*	0.026	0.053	0.490	0.626
Basilicata*	-0.101	0.055	-1.750	0.081
Calabria*	-0.094	0.052	-1.760	0.079
Sicilia*	-0.048	0.055	-0.870	0.386
Sardegna*	0.014	0.055	0.250	0.806
lninc	0.004	0.014	0.270	0.791

Figure 6. Actual and predicted distributions of hospital referral by income quintiles



5.2. Did the hospitalization took place in the region of residence or not?

Patients can freely choose the hospital where to receive the treatments: 87.2% of the admissions were in public hospitals, and 93.6 % of the hospitalized people went to hospitals located in their regions of residence.

As for hospital referrals it is interesting to understand the reasons for which people opted for a hospital located outside their region of residence.

The self-assessed measure of health status has not the expected sign (table 4). Leaving all other variables constant, people with worse health conditions have less probability of being hospitalized inside their regions of residence. This can have different causes. Worse is the health condition, higher is the value that people give at the ward specialization, reputation, waiting time and perceived quality of the hospital. On average, older people tend to have higher probability of receiving the treatments inside their regions of residence. Whenever patients decide for a hospital located in another region the probability both that they go to fully private hospitals and that they are referred by specialist physicians is higher than when they stay in their region. People with a lower level of education tend more often to stay in their regions. It is interesting to note that the region of residence influences the probability of receiving hospital care in another region. In the Northwest, Umbria and the South the probability to opt for a hospital located outside the region of residence is higher, leaving all other variables constant. The logarithm of the net equalized income has a negative but not significant value.

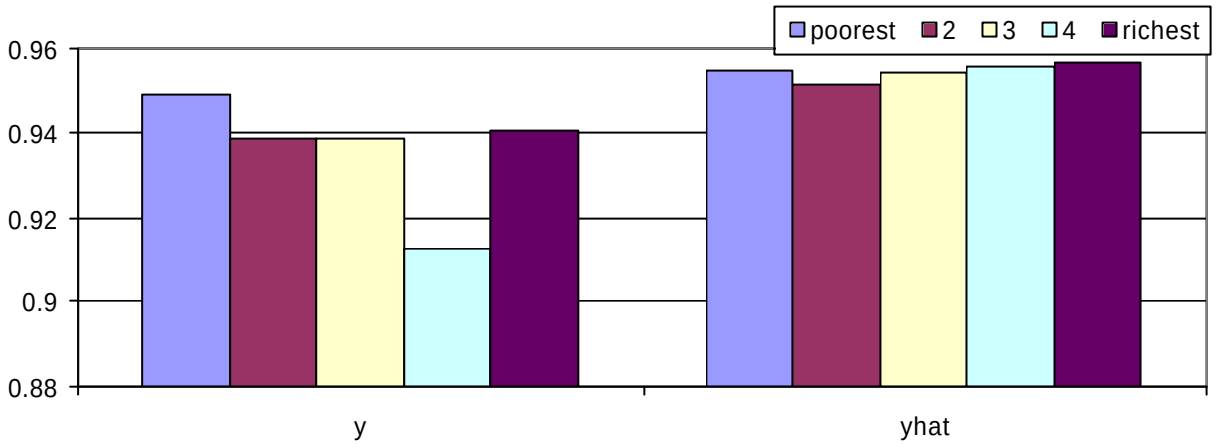
Table 4. Probit results for hospital localisation (marginal effects)

loc_reg	dF/dx	Robust Std. Err.	z	P>z
sah2*	-0.023	0.022	-1.170	0.242
sah3*	**-0.041**	**0.021**	**-2.100**	**0.036**
sah4*	-0.049	0.032	-1.900	0.057
sah5*	**-0.094**	**0.054**	**-2.530**	**0.011**
healthlimit1*	-0.019	0.014	-1.500	0.133
healthlimit2*	0.005	0.008	0.610	0.544
male2*	0.007	0.016	0.420	0.675
male3*	**0.028**	**0.010**	**2.240**	**0.025**
male4*	**0.032**	**0.009**	**2.400**	**0.016**
male5*	**0.032**	**0.010**	**2.090**	**0.036**
female1*	0.014	0.012	1.040	0.297
female2*	0.006	0.015	0.370	0.712
female3*	**0.024**	**0.010**	**1.890**	**0.059**
female4*	**0.040**	**0.007**	**3.690**	**0.000**
female5*	**0.043**	**0.007**	**3.830**	**0.000**
dis_sur*	0.009	0.009	1.000	0.317
birth*	0.026	0.010	1.890	0.059
other_re*	0.003	0.010	0.340	0.737
chronic*	0.001	0.009	0.130	0.897
hospit~3*	-0.011	0.010	-1.190	0.233
hospit~4*	**-0.226**	**0.078**	**-4.740**	**0.000**
ref_spec*	**-0.052**	**0.009**	**-6.620**	**0.000**
educ2*	**0.030**	**0.010**	**2.530**	**0.011**
educ3*	**0.039**	**0.019**	**2.370**	**0.018**
selfemploy*	-0.004	0.015	-0.260	0.796
student*	-0.031	0.030	-1.280	0.201
retired*	-0.016	0.014	-1.280	0.202
housework*	0.018	0.010	1.550	0.122
inactive*	0.023	0.017	0.920	0.357
unemploy*	-0.002	0.013	-0.190	0.850
Piemonte*	**-0.091**	**0.047**	**-2.750**	**0.006**
ValleAosta*	**-0.354**	**0.096**	**-5.770**	**0.000**
Lombardia*	-0.009	0.024	-0.380	0.704
Trentino*	**-0.108**	**0.056**	**-2.850**	**0.004**
Veneto*	-0.048	0.036	-1.700	0.089
Friuli*	-0.030	0.036	-1.020	0.306
Liguria*	**-0.063**	**0.042**	**-2.010**	**0.045**
Emilia*	-0.021	0.030	-0.800	0.424
Toscana*	-0.012	0.027	-0.470	0.641
Umbria*	**-0.087**	**0.049**	**-2.510**	**0.012**
Marche*	-0.045	0.040	-1.440	0.149
Abruzzo*	**-0.071**	**0.041**	**-2.390**	**0.017**
Molise*	**-0.226**	**0.073**	**-4.890**	**0.000**
Campania*	**-0.065**	**0.039**	**-2.230**	**0.025**
Puglia*	**-0.112**	**0.049**	**-3.330**	**0.001**
Basilicata*	**-0.244**	**0.073**	**-5.270**	**0.000**
Calabria*	**-0.214**	**0.066**	**-5.080**	**0.000**
Sicilia*	-0.035	0.032	-1.320	0.186
Sardegna*	0.026	0.012	1.480	0.138
lninc	-0.003	0.005	-0.680	0.497

The analysis per income quintiles of the actual and predicted distribution of the probability of receiving hospital care in the region of residence, it is useful to describe the level of inequality and inequity. No inequity was detected in the medical and needs concentrations indices for hospital location (the CM and CN values are respectively –

0.003 and 0.001, with t-statistics of 1.32 and 2.8). Figure 7 shows that people in the lowest income quintiles tend to stay in their region of residence, while the middle class (the 4th quintile) opts more often for a hospital located outside their regions. No difference in the probability is observed among the other income quintiles. The horizontal inequity index is negative (-0.004) but not statistically significant (the t-statistic is 1.66). On average, the difference among the actual and need-predicted values is negative for all the income quintiles. Given their needs, people go outside of their regions more than they ought to, in particular people in the fourth income quintile.

Figure 7 Actual and predicted distributions of hospital referral by income quintiles



6. Conclusion and discussion

Different scenarios appear from the analysis of the results concerning the probability of being admitted to hospital. The results obtained by estimating the three months probability are not comparable with the ones obtained estimating a longer-term probability. Which ones are more reliable? It is difficult to discover.

In Italy, as in other European countries, the concept of equity in access to health care is a central object. All Italian citizens have universal coverage, and the access to hospital is free of charge. Moreover, only a small percentage of the population receives hospital care every year and hospital care is more need based than other health care services. Thus, it is not an easy task to measure needs for inpatient care. People with higher needs have always the priority. However, it is important to know what happens at the margin, if the statement of "equal treatments for equal needs' is really achieved for all the type

of needs, for all the socioeconomic categories, and for all the different geographical areas.

Given these problems, three months reference period for inpatient care cannot be an appropriate period for measuring the level of equity in hospital admission. In the short run the admission rate is only 4% and, hence, the estimates might lack power. Moreover, it can be more susceptible to peculiar situations. The proxy for inpatient rate can clearly solve these problems. No time constraints are present. The presence of pro-rich inequity in the probability of being admitted in hospital for people with chronic diseases is an indicator of the unjust distribution of the inpatient rate in the society. The level of care ought to depend only on the level of needs and not on income or other personal characteristics. However, the inpatient proxy captures only a sub-sample of all hospitalisations. What it misses are all the hospital admissions for people without chronic illness. In a previous paper [Masseria et al, 2003] we measured the one-year inpatient rate by using the Eurostat survey, and again we found pro-rich inequity. In both cases (inpatient proxy and one year probability) the results show that the more discriminated are the people in the lowest income quintiles. For the other income classes, the actual distribution is higher than the predicted one, and hence, these categories use hospital care more than they need. Therefore, it seems that a redistribution of resources in favour of the poorest people can be not only equitable but also efficient.

The other important issue is regional disparities. The South of Italy is less wealthy. Even if the percentage of people in either very poor or poor health status is higher in the South and the Islands, the results show that the probability of receiving inpatient care is lower in these areas. People in equal needs are discriminated on the basis of their region of residence. Geographical inequalities are found.

To make it worse, in Umbria and the South people tend to move to other regions to receive hospital care. This can be related with the shortage of resources but also with the quality of the treatments. People in the more disadvantaged socio-economic classes tend to stay in their region. The middle and richest classes are the ones who mainly opt for a hospital located outside their region of residence. Even if patients do not contribute to treatment costs, many other costs are correlated with the decisions of being hospitalized in another region. The middle and richest classes have a more wide range of

possibilities. Thus, in the South there are two sources of income inequity. 1) The better-off have more probability of receiving inpatient care than their counterparts for the same level of needs in their region of residence. 2) They can also opt more easily for moving to a different region whenever they consider too long the waiting time or they perceive not adequate the quality of the ward and hospital. Other factors evidence that this decision is related both with the financial possibilities of patients and with the perceived quality of specialists, wards, and hospitals. Indeed, the patient is more likely to go outside the region of residence whenever it was a specialist who made the referral. Moreover, the probability to receive inpatient care in private hospitals (both accredited and not) is higher whenever patients decide to move to another region.

By using the three months inpatient rate, it was impossible to detect inequity in hospital referrals. People in the less advantaged classes are only slightly discriminated. The middle class is the one that is more often referred to hospitals by specialists. The main problem is to define the needs for specialists' referrals. Indeed, the two measures of self-reported status are not significant. On average, the probability of being admitted by specialists increases whenever the hospitalization was due to birth or pregnancy reasons, and to diseases or surgery. Even if no inequity was detected in specialists' referrals, specialists can influence the probability of opting for a hospital located outside the region of residence and for private hospitals (both accredited or not). Insofar as these decisions depend on quality issues, specialists' referrals play an important role.

It is worth noticing that it was possible to analyze only the probability of being admitted to hospitals at least for one night. Day-hospital admissions are not considered. Clearly, it would be interesting to differentiate elective from emergency care.

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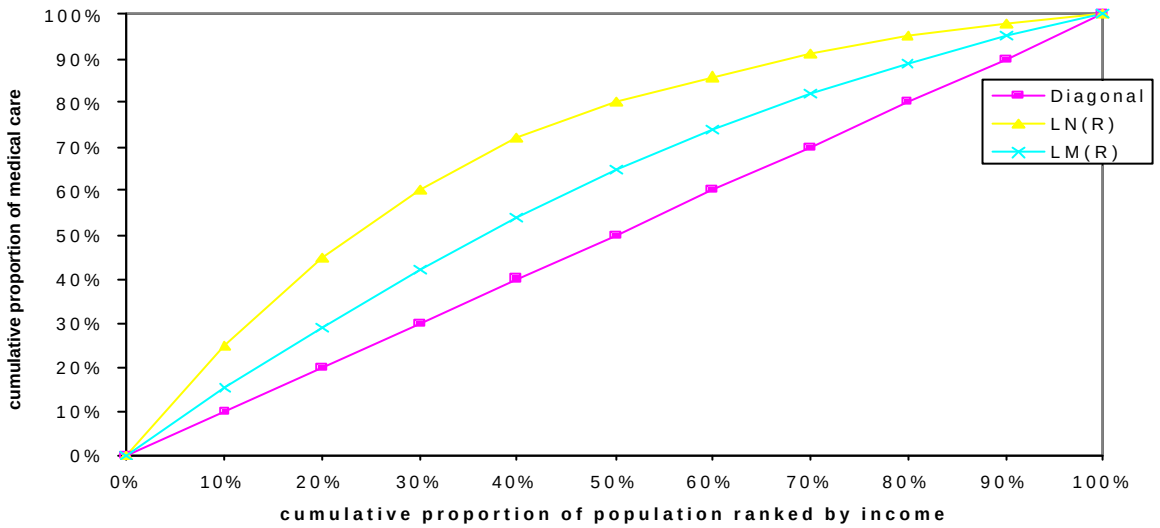
APPENDIX 1
How to measure the horizontal inequity index

Supposed that y_i is the amount of medical care received by an individual i in a given period, the distribution of medical care by income can be represented by the medical care concentration curve $L_M(R)$.
In figure 1, the horizontal axis is the cumulative proportion, R, of the sample ranked by income (from the worst-off to the most well-off), and the vertical axis is the cumulative proportion of medical care. Therefore, $L_M(R)$ plots the proportion of medical care used by each person ranked by income. If there is equality in medical need, $LM(R)$ coincides with the diagonal. If, on the contrary, the delivery of medical care advantages the worse-off (better-off), $L_M(R)$ lies above (below) the diagonal.

Figure 1. Horizontal inequity index



The concentration index, CM, is a measure of the degree of inequality in the distribution of medical care that is associated with the income of individuals. Thus, CM is based on $L_M(R)$, and it is defined as twice the area between $L_M(R)$ and the diagonal.
2) However, the needs of health care are, on average, related with the income distribution. Thus, it is not sufficient to measure the inequality in medical care but it is necessary to quantify also the degree of inequality in needs. Using the indirect standardization approach, it is possible to generate the predicted value of medical care for each individual, $\hat{y}_i$, that depends only on the needs of the population. The predicted value indicates the amount of medical care that each individual would have received if she/he had been treated, on average, by the system, as others with the same need characteristics. The concentration curve for needs, $L_N(R)$, plots the need of medical care. There is equality in needs if $L_N(R)$ coincides with the diagonal. On the contrary, if the delivery of medical care advantages the worse-off (better-off), $L_N(R)$ lies above (below) the diagonal.

As before, it is possible to define the concentration index for needs *CN*, corresponding to $L_N(R)$, as twice the area between $L_N(R)$ and the diagonal.

3) To quantify the level of horizontal inequity in the delivery of health care it is necessary to compare the level of needs with the amount of medical care received by ranking each individual by income level. The principle of "equal treatment for equal need" is violated if the share of medical care does not equal the share of needs. Thus, the degree of horizontal inequity can be measured by comparing the curves $L_M(R)$ and $L_N(R)$. When there is horizontal equity, HI_{WV} equals zero. However, a zero index value is a sufficient but not necessary condition for implying no inequity. For example, it is possible that inequity in favour of the poor in one part of the distribution is exactly cancelled out by inequity favouring the rich in another part of the distribution Yet, there is horizontal inequity favouring the better off (worse-off) if the need concentration curve lies above (below) the medical care concentration curve.

The horizontal inequity index, HI_{WV}, can be defined as twice the area between $L_N(R)$ and $L_M(R)$ and it is equal to the difference between *CM* and *CN*:

$$HI_{WV} = 2\int_0^1 [L_N(R) - L_M(R)]dR = C_M - C_N \qquad (2)$$

In case of inequity favouring the better-off (worse-off) *CM*, *CN* and HI_{WV} have positive (negative) values.

Alternatively, it is possible to compute *CM* and *CN* with a "convenient" regression. Kakwani et al (1997) and Wagstaff, van Doorslaer (2000) show that *CM* can be computed using the following OLS weighed regression:

$$2s^2\left(\frac{y_i}{\bar{y}}\right) = g_1 + d_1 r_i + u_1 \qquad (3)$$

where s^2 denotes the variance of the relative rank, yi is the use of medical care, and $\bar{y}$ the weighted average mean. It can be proven that the OLS estimator of d_1 is equal to *CM*. CN can be computed by replacing $\hat{y}_i$ with y_i.

Given that *CM* and *CN* are not independent, HI_{WV} can be obtained by using the following "convenient" regression:

$$2s^2\left(\frac{y_i - \hat{y}_i}{\bar{y}}\right) = g_2 + d_2 r_i + u_1 \qquad (4)$$

and it can be proven that $\hat{d}_2 = C_M - C_N = HI_{WV}$ [Wagstaff, van Doorslaer (2000)].

This methodology is very attractive, because it permits to calculate also the standard error of CM, CN and HI_{WV}.

APPENDIX 2

Matching between the Multiscopo survey (1999-2000) and the ECHP data survey for Italy (1999)

1. Data description

In the Multiscopo survey there are 52332 households and 116485 individuals older than 16; while in the Eurostat there are only 4972 households.

The Eurostat survey for Italy provides *ytot* that is the net household income. The household income includes all the monetary income received by the household during the year of reference. It considers all the different sources of income: income from work, private income, pensions and other direct social transfers.

From both the Eurostat and the Multiscopo surveys, I selected six categorical variables: *age, gender, educ, activity, hhact and sector*.
Age is captured by four categories, namely 17-34, 35-44, 45-64, and more than 65 years old. For *gender*, category 1 represents men and category 2 women. For the education level (*educ*) I used 3 categories: 1) third level of education; 2) second level of education; and 3) less than second level of education. The activity status (*activity*) is captured by the following categories: 1) employees, 2) self-employees, 3) retired people, 4) other. *Hhact* indicates whether in the family the second household member earns income (1 if "not" and 2 if "yes"). The variable *sector* defines the activity sector of the household: 1) other sector, 2) agriculture, 3) industry, and 4) services.

2. Matching procedure

I applied a matching procedure at the household level to compute the net household and individual income in the Multiscopo survey. The purpose is to use the Eurostat income information to impute the income in the Multiscopo survey.
The first step is to make the two surveys comparable. The variables that need to be comparable are the ones described before: *age, gender, educ, activity, hhact* and *sector.* Indeed, they are necessary to create cells both in the Eurostat and in the Multiscopo surveys.
The second stage is to combine (the Stata command is "append") the Multiscopo database with the Eurostat one in one file. The file dimension will be of 57304 observations, 52332 from the Multiscopo survey and 4972 from the Eurostat. An additional variable *eui* was created (*eui* is equal one if the observations come from the Eurostat database or equal zero otherwise)
To move from an observation file to a cell file the income variables are "collapsed". Means (*y_mn*) and standard errors (*y_sd*) of the income level are generated on the basis of the following group of variables: *eui, age, gender, educ, activity, hhact* and *sector*[3]. At this point, *y_mn* and *y_sd* are available only for the Eurostat cells.
For imputing *y_mn* and *y_sd* to the Multiscopo survey, it is necessary to create a variable *cod* that represents the interaction between *age, gender, educ, activity, hhact* and *sector* in both the surveys:

*gen cod= age + sex*10 + educ*100+ activity*1000+ hhact*10000 + sector*100000*

Seven hundred sixty eight interactions are possible. To give an example, one cell may be represented by individuals in the age category one, who are male with a third level of education, employees in the industrial sector and who have a second source of income in the family. Another cell may describe individuals with the same characteristics ad exception of *hhact* (there is no other source of income in the family). Even if each cell represents individuals with standardised characteristics, different levels of income are possible. For this reason, the average and the standard error level of income are recorded for each cell.
In both databases, there are comparable cells[4]. The variable *cod* permits to apply *y_mn* and *y_sd* of the different Eurostat cells to the corresponding Multiscopo cells through a merging procedure.
Now that the average and standard error of the income level are available also for the Multiscopo survey, it is necessary to move again from the cell file to the observation file through a merging procedure.

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[3] Weights (*p*) are used to generate *y_mn* and *y_sd*. The weight *p* of the total file (Multiscopo plus Eurostat) is a weighted sum of the Multiscopo weight (*pms*) and Eurostat weight (*peu*) (57000000 is the total number of Italians)

P = pms/52332*57000000+peu/4972*57000000.

[4] Given the large differences in the sample size, some cells are not present in both the surveys. A higher number of interactions is possible in the Multiscopo survey. The non-common cells were deleted.

Income information is now available also in the Multiscopo cells. However, the income level is constant among the households that have the same *cod*. To increase the variability of the imputed income, I computed the following function:

gen ytot =(invnorm(uniform()) y_sd + y_mn*

replace ytot = y_mn if y_sd ==.

Thus, it was possible to generate normally distributed random numbers with mean *y_mn* and standard deviation *y_sd*[5].

[5] Negative numbers are also provided. For the purpose of this analysis I deleted the negative income values.