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HEALTH CARE QUALITY, ECONOMIC INEQUALITY, AND PRECAUTIONARY SAVING

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Abstract

We argue that health care quality has an important impact on economic inequality and on saving behaviour. We exploit district-wide variability in health care quality provided by the Italian universal public health system to identify the effect of quality on income inequality, health inequality and precautionary saving. We find that in lower quality districts there is greater income and health dispersion and higher precautionary saving. The analysis carries important insights for the ongoing debate about the validity of the life-cycle model and interesting policy implications for the design of health care systems.

Keywords: income inequality, precautionary saving, health care.
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1. Introduction

In countries with public health systems, such as the UK or Italy, individuals are entitled to receive the same *quantity* of health care in case a treatment is deemed necessary. However, there are wide and persistent geographical differences in the *quality* of care received, and the goal of this paper is to explore the effect of such disparities on economic outcomes. There is ample evidence that health status improves with the quality of health care received (see for instance Hurd and Kapteyn, 2003). In contrast, not much is known about the effect of the quality of health care on health and income inequality. Further, it is not clear whether and how households insure against health risks if they happen to live in a low-quality public health care district. In this paper we do not address the issue of why quality differentials exist among regions, districts, or cities, but rather assume that quality is given and study the effect of existing quality dispersion on measurable economic outcomes.

The reason why we might expect a negative relationship between quality of health care and income inequality is straightforward. Consider that for prime-age adults spells of poor health are associated with low productivity and hence low earnings. Suppose that health care is only provided by the public sector, but that its quality varies across geographical areas or districts. Let's also make the simplistic assumption that in high-quality health districts treatment is prompt and effective, so as to offset health shocks completely, with no loss of earnings. Then health shocks will have no effects on earnings inequality in such districts.

In low-quality districts treatment is eventually effective, but patients face long waits before treatment is received. During such waits, they either cannot work or work fewer hours than desired. Then health shocks result in a loss of earnings, at least temporarily. If in each period health shocks affect only a fraction of the working population, the resulting earnings distribution will be more dispersed. After people retire, poor health has no bearing on pension incomes, which only depend on the history of wages. Therefore, income inequality within the retired will also be unaffected. The differential impact of health shocks on the income distribution of the working population and of the retired provides a strong benchmark case for the empirical analysis.

Consider next the effect of the quality of health care on health inequality. High-quality districts will again have minimal dispersion, attributable to initial heterogeneity in health status (genetic factors and the like). In low-quality districts, however, people hit by a health shock will be in worse health for at least the time they have to wait before receiving treatment. At any point in time, there will be more dispersion in health conditions in poor health districts. Moreover, such difference will hold regardless of the working status of individuals, a qualitative implication that allows us to distinguish the effect of the quality of health care on the two distinct cases of income and health inequalities.

Besides its effect on aggregate economic outcomes, such as inequality, health care quality also affects individual behavior. In the second part of the paper, we address the question of whether and how individuals insure against the risk of poor health in the presence of heterogeneity in the quality of health care they receive. In countries where health coverage is universal and provided free of charge, as is the case in Italy and most of Europe, the need to purchase insurance should be absent. But the health care provided by local public hospitals may be of low quality; or local private hospitals may offer health care of a higher quality. Whatever the channel is, consumers may feel the need to increase their coverage against the risk of poor health. If insurance markets were perfect, private health insurance would be the answer. In the absence of such markets, people may rely on self-insurance, i.e., saving to purchase high-quality care. After a health shock, a buffer of precautionary saving allows people to pay out-of-pocket for private care in their own district, or incur travel expenses to be treated by the public health system in higher quality districts.

The paper's empirical application is performed using Italian household data. The Italian National Health System (NHS) provides universal coverage for most risks, but as we shall document more extensively later, the quality of public health care provided varies considerably between and even within regions. Italy therefore provides an ideal ground for testing the hypothesis that variability in the quality of health care affects income inequality and prompts precautionary saving.

The rest of the paper is organized as follows. In Section 2 we present a simple framework to think about the effect of health care quality on income and health dispersion. We also discuss the potential impact of the quality of health care and health risk on precautionary saving. Section

3 describes the survey data and the indicators of the quality of health care provided by the Italian NHS. Section 4 discusses the empirical evidence on inequality and Section 5 that on precautionary saving against the risk of poor health. Section 6 concludes.

2. Health care, inequality and precautionary saving

The connection between health status and socioeconomic variables has provided a large body of research in recent years. There is ample empirical evidence that economic resources are associated with health outcomes. Studies to date have consistently shown that income and wealth improve such health indicators as mortality, incidence of diseases, and self-reported health status. While the association between health and economic resources is well documented and accepted, there is considerable disagreement over its source (Smith, 1999; Deaton, 2003). Economists have been more interested in the effect of health on economic well-being, arguing that poor health (disability, chronic disease and the like) affects labor market outcomes and ultimately individual resources, while medical scientists have stressed instead that background differences in economic resources and socioeconomic variables determine differences in health outcomes.

The framework that we use to analyze the connection between income and health takes into account the potential two-way causation between health and economic resources. We then use information on health care quality to investigate the importance of quality on such economic variables as health inequality, income inequality and saving behavior.

2.1. Income and health inequality: A simple framework

A convenient framework for our analysis starts out from the following system of two equations linking health status and income (Deaton, 2003):

$$h_t = \alpha_1 + \beta_1 h_{t-1} + \gamma_1 y_t + \varepsilon_{1t} \tag{1}$$

$$y_t = \alpha_2 + \beta_2 h_t + \varepsilon_{2t} \tag{2}$$

where h is health and y income. The error terms capture all other factors affecting health and income and are therefore likely to be heteroskedastic.

Two parameters are of particular interest to us: β_1 ($0 \leq \beta_1 < 1$), which measures persistence in health status, and β_2 ($\beta_2 \geq 0$), which captures the effect of health on income. Deaton (2003) emphasizes that β_1 depends on health care quality: if treatments are prompt and effective, better care reduces the persistence of bad health shocks (β_1 gets closer to zero as quality improves). On the other hand, it may be the case that quality care keeps people in good health from falling into bad health. Examples include treatments to reduce blood pressure, and keeping diabetics on a low blood-glucose diet and treatment. This would imply that better quality could actually increase β_1, in the sense that it keeps people in good health from falling into bad health. As we shall see in Section 4, the data support a negative relation between persistence in health status and health care quality.

The impact of health in the income equation (2) will be different for workers and for the retired. For workers, β_2 will be strictly positive if people in better health are more productive. For the retired, whose main income source is their old-age pension, there is no feedback from health to income, so that β_2 should be zero.[1] Of course, the *level* of pension income may depend on the history of earnings, and therefore (if $\beta_2>0$) on how one's health evolved over the working life-cycle. However, the level of pension income is independent of current health (and thus $\beta_2=0$ after retirement). Furthermore, the Italian pension rules imply that there should be limited feedback from health to pension income. In fact, people can take early retirement pensions with no penalty if affected by a bad health shock, thus making the pension a function of the best years of earnings.

The γ_1 parameter captures the effect of income on health. This effect can be indirect, as emphasized in the development literature: higher incomes afford better nutrition. But in developed countries it most likely captures the direct effect that income has on the ability to

[1] The other parameters of the model may also be affected by health care quality. For instance, β_2 could be negatively related to the quality of health care if spells of poor health are associated with foregone earnings, or if high quality health care districts have shorter waiting lists. The qualitative insights of the model would not be affected if we allow for this further channel between income and health care quality.

purchase health care when needed. Of course, income may also proxy for the influence played by other factors, such as education (Grossman, 2000). In our empirical work we control for as many factors as possible.

To see clearly the effect of the quality of health care on income and health inequality, take the simplest case where health does not directly depend on income (γ_1=0) and idiosyncratic shocks to income are unrelated to idiosyncratic shocks to health, so that cov(ε_{1t},ε_{2t}) = 0. Taking the variance on both sides of (2) yields:

$$Var(y) = \sigma_{22} + \frac{\beta_2^2}{1-\beta_1^2}\sigma_{11} \tag{3}$$

where $\sigma_{11} = Var(\varepsilon_{1t})$ and $\sigma_{22} = Var(\varepsilon_{2t})$. An increase in either β_1 or β_2 is associated with higher income inequality. For the working population, this implies that in high-quality health care districts (low β_1) there should be less income inequality than in low-quality districts (high β_1); that is, one should expect $\frac{\partial Var(y)}{\partial quality} = \underbrace{\frac{\partial Var(y)}{\partial \beta_1}}_{>0}\underbrace{\frac{\partial \beta_1}{\partial quality}}_{<0} < 0$. For the retired, instead, β_2=0 and there should be no effect of health care quality on the income variance, i.e., $\frac{\partial Var(y)}{\partial quality} = 0$. In the more general case where the income and health shocks are correlated and $\gamma_1 \neq 0$, these conclusions still hold true if cov(ε_1,ε_2)>0 and γ_1>0 (see Appendix A).

A relation for health dispersion can also be derived. Again, in the case where health does not directly depend on income (γ_1=0) and cov(ε_{1t},ε_{2t}) = 0, the following relation holds:

$$Var(h) = \frac{1}{1-\beta_1^2}\sigma_{11} \tag{4}$$

An increase in β_1 unambiguously increases the variance of health. This implies that higher health care quality districts should be characterized by less health inequality. In this case, the

β_2 coefficient does not appear: the effect of quality on health inequality should be the same for workers and retired.

In the more general case where shocks are correlated, $\text{cov}(\varepsilon_1,\varepsilon_2) = \sigma_{12}$ and $\gamma_1 \neq 0$, the positive effect of an increase in β_1 on the variance of health still holds true if the covariance between shocks is positive and γ_1 is positive (see Appendix A). However in this case the β_2 coefficient appears in the expression for $Var(h)$ and one cannot say if the effect is stronger for workers or for the retired.

2.2. Precautionary saving

So far we have implicitly assumed that people who live in low quality districts cannot purchase high quality health care within or outside their district. Let us now consider the possibility that high quality health care can be purchased privately or that people can travel to higher quality care districts. In this case, those living in low quality districts who can afford high quality care will be able to bring their β's in line with those living in better health care districts. In other words, they would be able to reduce the persistence of their health shocks and to cut on waiting times for treatment. If all people who live in such districts could do that, health care quality should not affect income and health dispersion across districts.

However, purchasing health care privately or outside the district is expensive. Health care treatment often involves large outlays that only the better off can afford. If only the better off can access high-quality care at a cost, the prediction on income dispersion described in section 2.1 is preserved: there should be higher income dispersion among workers in low-quality districts. In fact, in these districts health shocks would leave the earnings of the rich unaffected, while still lowering the earnings of the poor.

An important implication of our analysis is that people living in low quality districts will either purchase private health insurance or save more to face potential health costs in the future. In our application we shall assume that actuarially fair health insurance is not available, and therefore consider the implications of health risks for household saving.

The theory of intertemporal consumption choice suggests that over the life cycle individuals engage in precautionary saving in response to a number of different (uninsurable)

risks, such as wage risk, unemployment risk and health risk. Wage and unemployment risk have been discussed in a number of papers, see Caballero (1990) and Kimball (1990) for theoretical insights, Guiso, Jappelli and Terlizzese (1992) and Carroll and Samwick (1999) for empirical evidence.[2]

In so far as health risks have an impact on employment and earnings, they are similar to job-related risks. But the theoretical and empirical literature is much less developed than for income risk. Kotlikoff (1989) presented the first simulation analysis of a life-cycle model with uncertainty about medical expenditures showing that asset accumulation is considerably lower in an economy with public and universal insurance than in an economy in which individuals must self-insure their medical expenses through saving. Palumbo (1999) shows that the risk of medical expenditures in old age is a likely explanation of why the elderly do not run down their assets as fast as the life-cycle model would predict.

Empirical evidence on the importance of precautionary saving for health-related shocks is scant, although a few studies exist. Starr McCluer (1996) finds that households with no health insurance save on average more than people with insurance, other things equal. Gruber and Yelowitz (1999) find that Medicaid eligibility has a significant negative effect on wealth holdings, and positive association with consumption expenditures. They interpret this finding as evidence that Medicaid eligibility lowers the expenditure risk and the need for precautionary saving. Gertler and Gruber (2002) investigate the extent to which families are able to insure consumption against major illness using panel data from Indonesia that combines measures of health status with consumption information. They find that there are significant economic costs associated with these illnesses, albeit more from income loss than from medical expenditures and a striking rejection of full consumption insurance. As with other tests of the consumption insurance model, their test does not distinguish between mutual insurance from others and self-insurance (precautionary saving) as different channels for consumption insurance. In the context of the Italian economy, Atella et al. (2005) proxy cohort-specific health risks with the cohort-level variance in health expenditures, and exploit the variability induced by health care reforms in the early 1990s to test for precautionary saving.

[2] It is worth noting that those who live in low quality health districts incurring earnings losses due to waits for treatment are hard to distinguish from temporarily laid-off people.

In Section 4 we assess whether self-insurance of health risks is empirically relevant taking sample of individuals who are unlikely to be affected by sources of risk other than health. To this purpose, we shall limit our sample to individuals who are past retirement age. Conditioning on their initial wealth, health status and other demographic characteristics, we expect to observe higher saving among those who face greater health risk. In our sample, health risks should have a large impact on saving for those individuals who live in lower quality health districts but can access high quality care by incurring substantial costs. Therefore we expect the precautionary saving effect to be compounded by residence in low quality health districts.

3. Health care quality indicators

Geographical disparities in the quality of health care are of particular interest in Italy, which has a classical social insurance scheme. Risks are pooled in a national fund (the National Health System, or NHS) and health contributions are income-related through a system of regressive payroll tax rates. Since 1978 membership in the NHS has been compulsory for all Italian residents. The government collects health contributions, but responsibility for health care is delegated to regional governments, as the 1992 reform introduced principles of decentralization and managerial criteria in the administration of public hospitals.

The Italian health system is universal, and in principle covers all health risks for any amount. In practice, children under 12 years of age, persons older than 65 and households with income below a given threshold are fully covered; other population groups contribute small fees for drugs and medical services. Health care is provided by the public sector through public and private hospitals and diagnostic centers.

There are 1489 hospitals in Italy, and more than half (846) are public. Moreover, the vast majority of private hospitals (535) are accredited; they provide services to the national health system and are then reimbursed. Thus truly private hospitals account for only 7.2 percent of the

total.[3] As a result of the wide coverage offered by the public system, private health insurance is not common. For instance, according to the Survey of Household Income and Wealth (SHIW), only 5.9 percent of the respondents older than 50 years and 1.8 percent of those older than 70 were covered by private health insurance in 2000. And even among those who were covered, fewer than 8 percent reported being fully covered for medical expenditures in the previous year. So the overwhelming majority of Italians rely on health care provided directly or indirectly by the national health system.

The reliance of most Italians on the public health service is borne out in their spending patterns. When individuals use the public health service as outpatients they are asked for a co-payment; inpatients get treatment for free, unless they require extra comfort (such as a private room). Co-payment is waived for low income individuals (particularly children and the elderly), patients suffering from specific chronic conditions and for emergency treatment. For this reason, individuals who use the public health service do not devote to health spending a large proportion of their total expenditure, and only a small group reports significant health-related expenses.

In fact, the aggregate health spending share - the ratio of average health spending to average total expenditure - is just 2.8 percent (3.2 percent in the sample where the head of the household is over 50 years old).[4] Only 15.3 percent of households report a health spending share of 5 percent or higher (17.6 percent in the 50+ group); the fraction spending more than 20 percent is tiny (1.6 percent in the total sample, and 2.0 percent for the 50+ sample). It is worth stressing that health spending considered includes doctors fees and drugs (whether prescription or over the counter), but not travel expenses incurred by patients who get treated out of their local health district.

Even though the Italian NHS provides national standards and, in principle, guarantees equal treatment, there is considerable regional variability in the distribution and management of resources across regions, resulting in significant differences in the quality of health care. In 1997

[3] The source is the 1998 issue of *Strutture e attività degli istituti di cura*, published by the Italian Bureau of National Statistics (ISTAT). The same source reports that there were 4.3 beds per 1000 inhabitants in public hospitals, 1.1 in accredited private hospitals, and only 0.1 in private hospitals.

[4] The data refer to 1993 and 1995, and are drawn from the Survey of Family Budgets, a large annual diary survey – over 30,000 households a year - run by the Italian Statistical Office. See Battistin, Miniaci and Weber (2003) for a description of the main features of this survey.

the national average of per capita public health spending was €970, but this figure conceals significant regional differences.

As shown in Figure 1, the regional distribution of per capita health expenditures highlights that in some Northern regions such as Liguria and Emilia-Romagna per-capita health expenditure was close to €1,200, while in the South it did not exceed €1,000.[5] These differences can partly be explained by differences in the age structure of the population across Italian health districts (the population in the South is on average younger than in the North), but also reflect genuine differences in the distribution of public resources and therefore quality of health care, given that the National Health System features separate regional budgets with incomplete financial aid from the central government. The differences in the quality of health care also depend on how public resources are managed by regional administrations and local health providers. In fact, it is generally held that health management is poorer in the South than in the rest of the country.

Finding comprehensive measures of the quality of health care is a difficult task. In the medical literature, Jencks *et al*. (2000) ranks U.S. states on the basis of whether interventions that are known to be correct were administered for conditions such as heart failure, stroke, pneumonia, and screening for breast cancer. The authors find considerable variation in quality between states. For instance, the less populous states and those in the Northeast rank consistently high in relative performance while other more populous states and those in the Southeast low.

Recent research has shown that the quality of health care affects health status indicators and health care utilization. Fuchs, McClellan and Skinner (2004) find for a sample of 313 US metropolitan statistical areas (MSA) that variability in mortality between areas depends not only on standard risk factors such as cigarette use, obesity, education, income, age and sex, but also on regional dummies. The most plausible interpretation of these geographical effects is that they are correlated with differences in the quality of health care between states or metropolitan areas.

Introducing geographical dummies into health regressions is tantamount to assuming that the geographical factor operates at the level of a broad spatial aggregate. This is a strong assumption in that, as noticed in Section 2.2, patients could well travel from low to high quality

[5] These statistics do not account for interregional mobility of patients, which likely reduces the expenditure differentials.

health districts. However, the costs of traveling (including that of acquiring information in the new location and the travel risk) are often too high to make it feasible.[6]

In this paper we rely primarily on a self-reported indicator of the quality of health care, but we will show that objective indicators paint a very similar picture. Although self-assessed quality is certainly bound to be affected by measurement error and might be contaminated by individual preferences and characteristics, subjective measures have the great advantage that they vary with individuals. So these measures allow easier identification of the effect of quality on health outcomes and, at least in principle, can disentangle merely geographical effects (say, pollution, climate, etc.) from genuine differences in quality.

The 1993 Survey of Household Income and Wealth (SHIW), a large representative sample of the Italian population, elicited respondents' assessment of the quality of health care. More precisely, people were asked to rate the quality of public health care in their city on the basis of their own experience. The score is coded on a scale from 1 (lowest quality) to 10 (highest). Figure 2 plots the average provincial score against the province's latitude (an Italian province has approximately the size and administrative meaning of a US county).

The figure highlights considerable *inequality in quality*: there is a clear and strongly positive relation between quality and geographical latitude, with people living in the South reporting much lower satisfaction with the quality of public health care than people living in the North.[7]

Quality indicators based on survey questions capture perceived quality, which does not necessarily correspond to objectively measured quality, because survey measures could be contaminated by individual characteristics. To take into account this potential criticism, we check the reliability of subjective quality scores examining their association with objective indicators. Indeed, such indicators convey a similar picture.

The left panel of Figure 3 plots the percentage of women aged 40 and above that have undergone mammography in the absence of symptoms against their region of residence's

[6] Chandra and Skinner (2002) document wide variations in health care utilization within the United States and even within given states and cities, and show that the omission of regional indicators or quality in health regressions can severely bias the impact of socioeconomic variables on health status indicators.
[7] There is also considerable within-region variability (results are omitted here for reasons of space).

latitude.[8] The proportion of mammographies with no symptoms is a standard measure of the quality of health care (see Fiscella *et al*., 2000). An alternative objective measure of quality is the percentage of women aged 25 and above undergoing Papanicolau (*pap smear*) testing in the absence of symptoms. This is plotted against latitude in the left panel of Figure 4. In both cases, a strong positive relation again emerges. Remarkably, this holds true even after conditioning on education, as the right panels of Figures 3 and 4 show: college graduate women living in low-latitude (southern) regions are less likely to be tested for breast or ovarian cancer than college graduate women living in high-latitude (northern) regions.

The proportion of mammographies or pap smear tests in the absence of symptoms is not necessarily correlated with good treatment of the kinds of illness that interfere with work activities, such as osteoarthritis of the knee or hip, back pain, blocked carotid artery, or glaucoma. However, these quality indicators exhibit the same geographical pattern as the average provincial quality score reported in Figure 2. In fact, the correlation coefficient between the proportion of mammographies and the average provincial quality score is 71%, and that between the proportion of pap-tests and the average provincial quality score, 73%. Note also that the provincial score has the advantage that it varies more geographically (there are 95 provinces vs. 20 regions).

These three indicators of quality are not only consistent among themselves, but also consistent with the data on the number of hospital beds, waiting lists for specific treatments, number of doctors per 1000 inhabitants, and number of hospitals. Overall, they indicate better health care in Northern regions (with a peak in the provinces of Trentino) and poorer in the South (particularly in the provinces of Sicily), but also better care in small towns than in large cities. It is this wide variability across provinces that allows us to identify the effect of quality of health care on district-wide health and income inequality and, in a second step, its effect on household saving against health risks.

4. Income and health inequality

[8] In Figures 3 and 4 we use the geographic latitude of the region's city capital.

We start by describing the data available to us. Both the 1993 and 1995 SHIW provide data on socioeconomic characteristics of the household, such as income, consumption and wealth, and demographics, such as province of residence, age and education. About half of the 1993 sample is re-interviewed in 1995 (see Appendix B for more details on the survey). While the 1993 survey contains a health quality indicator, self-reported health status is reported only in 1995. In our analysis of inequality we rely on province-level indicators of health and income dispersion in 1993 and 1995. To estimate the saving equation we instead use the panel component of the survey.

As mentioned in Section 3, a special section of the 1993 SHIW elicited respondents' assessment of the quality of health care in their municipality. The score, coded on a scale from 1 (lowest quality) to 10 (highest) and aggregated at the province level, is our main measure of provincial (district) health care quality. The 1995 SHIW contains a special section where respondents are asked detailed questions about their health, such as self-assessed health status, disability, and permanent health conditions. Health status (h) is ranked on a 1-5 scale (1=*Very Poor*, 2=*Poor*, 3=*Fair*, 4=*Good*, 5=*Very Good*). Self-assessed health measures are well known to correlate strongly with objective indicators (Currie and Madrian, 1999), and may be more relevant when we analyze behavior.[9]

We use as our key measure of dispersion the coefficient of variation because it is unit free and can be sensibly compared across income, health and education. Unlike the variance of log(income), it can be computed also for zeros or negatives. In using the coefficient of variation we follow an established practice in health inequality analyses conducted on the basis of arbitrarily scaled health status information (Deaton and Paxson, 1998).

In Section 2.1 we showed how a simple model of the health-income dynamics may imply higher income variability in lower quality districts. This negative relation is only true for earnings, not for pension income (β_2=0 for the retired in the framework of Section 2.1). A simple test of the proposition runs as follows: use district level information on health care quality, the

[9] Deaton and Paxson (1998) discuss the pro and cons of using self-reported health status and its dispersion as a proxy for the moments of the underlying distribution of health. One of the problems in the literature is that health status is an ordinal measure, and since stochastic dominance is not preserved under monotone transformation, there is no guarantee that higher dispersion in measured health status corresponds to higher dispersion in the underlying health distribution.

variance of income and age, and check whether there is a negative relation between income variance and quality for working-age individuals and no relation for the retired. The model also outlined that dispersion in health status should be negatively related to the quality of health care, but since quality continues to exert its effect on health status also after retirement, the relation should not depend on whether individuals are receiving wage income or pension income.

Figures 5 and 6 report most graphically the relation between income inequality, as measured by the coefficient of variation of income, and the quality of health care. All variables are based on provincial level statistics from the 1993 SHIW (there are 91 provinces overall). We stratify the SHIW sample according to the retirement status of the head (aged 60 and above), and compute the coefficient of variation of disposable income for each province and each age group.

Figure 5 shows a clear negative relation between income inequality and quality of health care in the group of working-age individuals, while no relation emerges in Figure 6 in the sample of retired individuals. This is prima facie evidence on the validity of the model of Section 2.1. Figure 7 displays the relation between the coefficient of variation of self-reported health status, computed using 1995 SHIW data, and quality, computed using 1993 SHIW data. In this case we do not distinguish between working and retired population, as suggested by the framework of Section 2.1. Good quality districts, such as Bologna or Milan, feature lower dispersion of health status as the model would suggest.

While two-way graphs are informative, they may also be misleading, for example if income inequality and the quality of health care are not correlated with each other but happen to be correlated with a third factor. To account for such spurious correlation, we now consider the following regression:

$$CV(y)_p = \alpha + \beta E(y)_p + \gamma Q_p + \delta E(h)_p + X_p'\psi + \varepsilon_p \qquad (5)$$

where $CV(y)_p$ is the coefficient of variation of disposable income in province p, Q an indicator of health care quality and X are other variables likely to affect income dispersion (notably age

and education). Given that the model gives different predictions for workers and for the retired, we stratify our sample on the basis of age (aged less than 60, and 60 or more).[10]

We expect the γ coefficient to be negative in the pre-retirement age sample and to be zero in the post-retirement age sample. Table 1 presents estimation results.

To illustrate, in column (1) the sample includes heads of household before retirement age. For this group, we find that income is significantly more dispersed in those provinces where education is more dispersed and average income is higher. More importantly, income inequality falls with the quality of health care. For the sample of retired, the results, reported in column (2), are substantially different. Average income and education dispersion still have a positive impact on the coefficient of variation in income, but health care quality has no effect, as predicted by the theory.

Column (3) reports the results obtained when pooling the two samples. We allow for both the intercept and the effect of quality to differ for the two age groups. The quality of health care matters only for the young. Adding further regressors to the specification of Table 1, such as the proportion of blue- and white-collar workers, self-employed, and professionals in each province or the proportion of individuals by sector (industry, services, public administration) does not change the results. Dropping the self-employed has also no effect on the results.[11]

To provide a sense of the magnitude involved in the estimated coefficients, we compute the percentage reduction in income inequality among workers – as measured by the coefficient of variation of income – if the quality of health care is improved in all provinces to reach the level of the best province (Reggio Emilia). The implied inequality reduction is large (on average, 20 percent). Of course, cities with the lowest quality experience the largest reduction in inequality (Frosinone, Livorno, Oristano, with values close to 50 percent), while in provinces with very good quality of health care (Bolzano, Sondrio, Trento) the impact is negligible.

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[10] The reason we use age is that, unlike retirement, it is not an endogenous variable. However, when we split the sample by retired/working status, the results are similar. The effect of health care quality on income inequality is –0.048 (with a standard error of 0.018) in the sample of workers, and –0.019 and not statistically different from zero (the standard error is 0.018) in the sample of retired.

[11] We also introduced female life expectancy at the regional level as a proxy for average lifetime health. The coefficient of this variable was not statistically different from zero and the other results remained unchanged.

So far the quality indicator is the subjective assessment of health care quality reported in the 1993 SHIW. In column (4) we use instead the proportion of individuals satisfied with medical care in the 20 Italian regions, taken from official statistics (ISTAT, 1999). The advantage of this indicator is that it is obtained from a completely different sample, but its drawback is that it displays less variability (some regions are so large as to include as many as 10 different provinces, while some others have only 1 or 2). Even with this indicator, however, we find that quality has no effect on the provincial income dispersion of the old, but has a significant, negative effect on the income dispersion of the young. The results are similar if we use objective indicators of quality, such as those used in the construction of Figures 3 and 4.

In Table 2 we test the other prediction of the model, namely that low quality of health care should be associated with higher dispersion of health status, other things equal. The regression analysis confirms this prediction, whether we use the provincial SHIW indicator in column (1), the regional ISTAT indicator in column (2), or other objective indicators of quality. Interestingly, we find that average income and the distribution of education have no effect on health dispersion, while provinces with higher average health status tend to drag dispersion in health status down.

5. Precautionary saving

To illustrate the importance of the health risk motive for saving, consider the following extreme case. Suppose that in low quality districts medical treatments are available after such long waits as to be ineffective. Alternatively, suppose that they are received promptly but are medically inadequate, for example because of doctors' inexperience. Confronted with the risk of not being able to "fix" their stock of health capital, people living in low quality district may respond by insuring themselves against such risks. In the bad state of the world the insurance pays hospital bills for high quality private health care in the same district (if a private sector exists there), or travel expenses to receive high quality public health care in a different district. If health insurance markets are complete, people would choose this option; if these markets are absent or incomplete, self-insurance (saving) may be the only available option. Other options

may exist, of course, such as reverse altruism, and in the analysis that follows we will try to control for some of these factors.

For most of the life cycle, health risks coexist with other risks, such as employment, productivity, demographic, or even political risks (pension reforms).[12] A clear way to assess whether self-insurance of health risks is empirically relevant is to take a sample of individuals who are unlikely to be affected by other sources of risk. To this purpose, we limit our sample to those individuals who are past retirement age in 1995. Conditioning on their health status and health risk, we expect to observe a higher saving rate among those who live in lower quality health districts.

We should stress that the health care reforms of the early 1990s were followed by an increase in the level and variance of out-of-the-pocket medical expenditures, see Atella and al. (2005). If we had a long panel we could check if there was an increase in precautionary saving from the 1980s to mid-1990s. Unfortunately, in our 1995 cross-section (or in the limited 1993-95 panel) we cannot test for this effect. However, our estimates will still reflect the health care reforms of the early 1990s.

The key to successfully estimate the effect of health risk on precautionary saving is to construct a credible measure of health risk. We take as health risk the variance associated with falling into the worst possible health category (very poor health, or h=1), $\Pr(h=1)(1-\Pr(h=1))$, because this is likely to be the relevant event for precautionary saving. In fact, very bad health could lead to major peaks in health spending - including nursing home - in those districts where publicly provided health care quality is low. This is the relevant event that could lead to precautionary saving (Hubbard, Skinner and Zeldes, 1995).

We estimate health risk running an ordered probit regression for health status h. The results are shown in Table 3. We control for a quadratic age polynomial, education, income, and a full set of province dummies. We then use the ordered probit estimates to construct the predicted

[12] Pension reform risk is not usually discussed in the literature, but it must be kept in mind in the case of Italy in the 1990s. The public pension scheme was widely perceived as unbalanced, yet nobody could tell in advance when and how it would be reformed. Two pension reforms were implemented in 1993 and 1995, that drastically cut future pensions for younger workers. They affected consumption (Miniaci and Weber, 1999) and savings (Attanasio and Brugiavini, 2003) of the working age population, but had little impact on the elderly.

value of $\Pr(h=1)(1-\Pr(h=1))$, which we take as our main indicator of health risk. Our approach differs slightly from those taken in previous literature.

Edwards (2003) uses $\Pr(h=1)$ as indicator of health risk and relates it to the share of risky assets in household portfolios. While empirically the difference between $\Pr(h=1)$ and $\Pr(h=1)(1-\Pr(h=1))$ is likely to be negligible at low levels of $\Pr(h=1)$, there is a difference of emphasis, given by whether one is willing to measure risk with the mean or with the variance of the "very poor health" indicator. Hubbard, Skinner and Zeldes (1995) and Palumbo (1999) use US data and measure health risk with the variance of out-of-pocket health expenditure. While this may be appropriate where most of the health care is privately provided, it is less appropriate in our case. For example, if people travel across districts to obtain high-quality public health care, out-of-pocket health spending does not capture the associated travel expenses and therefore is a poor indicator of the risk associated with poor health status.

Armed with an estimate of health risk, we test for precautionary saving running the following regression:

$$\frac{s_{ip}}{y_{ip}} = \alpha_0 + \alpha_1 R_{ip} + \alpha_2 \overline{Q}_p + \alpha_3 \overline{Q}_p R_{ip} + X_{ip}'\theta + f_p + \zeta_{ip} \qquad (6)$$

where s denotes saving (defined as disposable income minus expenditure), $\overline{Q}_p$ the provincial average of self-reported health care quality, R_{ip} the individual-specific indicator of health risk, and ζ_{ip} is the error term. The individual-specific health risk variable should capture the effect of precautionary saving; the interaction of health risk with the quality of health care should capture the compounding effect exerted by residence in low-quality health district. We thus expect α_1 to be positive and α_3 to have a negative sign.

Since the quality indicator may be correlated with other unobserved provincial effects, the regression includes a full set of 95 province dummies (f_p). This implies that the direct effect of the provincial average self-reported health care quality (the $\overline{Q}_p$ variable) is subsumed in the fixed

effects and drops out from the estimation; however, the interaction of quality with health risk (the $\overline{Q}_p R_{ip}$ variable) is identified.

Our sample excludes the young (aged less than 50). The matrix X includes a quadratic polynomial in age, education, number of children, marital status, family size and health status. In the specification using the 1993-95 panel, it also includes the lagged wealth-income ratio.

The results, reported in Table 4, are in line with the theory's prediction. In column (1), other things equal, people facing a higher risk of falling in very poor health save more (a coefficient of 1.85, statistically different from zero at the 5 percent level). Those living in low quality health districts save proportionally more than those living in high quality districts (a coefficient of –0.48, statistically different from zero at the 1 percent level. The other effects are as expected. Saving is lower for those starting with a higher wealth-income ratio and for people with fewer children. Healthy and more educated people save more, as do people with larger families.[13]

In column (2) we restrict the analysis to the sample of households present in both the 1993 and the 1995 waves. This reduces the number of observations (from 2950 to 1587), but allows us to use the lagged wealth-income ratio to account for the initial condition and the history of shocks. The results are quite similar to the basic specification. In columns (3) and (4) we use a slightly different ordered probit model to predict health risk, excluding income. The results are again quite similar to the basic specification, regardless of whether we control for the lagged wealth-income ratio.

We also investigated the possibility that SHIW respondents under-report their total expenditure more in those areas where health care quality is lower. To this end, we constructed a proxy for measurement error taking the difference between a "diary-based measure" of the logarithm of non-durable spending and the corresponding SHIW records; see Battistin, Miniaci and Weber (2003) for details on how diary information from another survey are used to generate imputations in SHIW. We found that measurement error is indeed higher in areas where health

[13] Unobserved heterogeneity in savings behavior correlated with health risk or quality of health care may bias these estimates in unknown direction. For example, thrifty individuals may invest little in their health capital (thus increasing health risk), and may choose to live in low cost areas, which may be negatively correlated with the quality of health care. Ideally, one would instrument for health risk and the quality of health care. However, it is hard to come up with any such instrument in our context.

care quality is lower, but that it has no consequence for the coefficients of interest reported in Table 4. The results, omitted for reasons of space, are available on request.

Our estimates imply that health risk has an important effect on the saving rate: if health risk disappeared, and all other variables took their mean values, the saving rate would fall by 2.9 percentage points. The median fall would however be smaller, at 1.6 points. Health risk also reduces the extent to which the elderly decumulate their assets. In the sample of the retired, 15.5 percent of households have negative saving. If health risk disappeared, 35.1 percent of households would have negative saving.

Figure 8 uses the specification in column (1) of Table 4 to provide a graphical assessment of the combined importance of health risk and of the quality of health care in explaining the saving behavior of the retired. The solid line is a plot of $\hat{\alpha}_2\overline{Q}_p + \hat{\alpha}_3\overline{Q}_p\overline{R}$, where $\overline{Q}_p$ is the provincial average of health care quality and $\overline{R}$ is the national average of health risk. The line thus plots precautionary saving (relative to income) of an individual facing the national risk of falling in very poor health but the quality of health care of the province where he/she lives. If the effect of other regressors were also evaluated at some common value, an average individual living in Catania, where quality of health care is at its lowest, would have a saving-income ratio an order of magnitude higher than in Brescia, featuring the highest health care quality.

The scatter points in Figure 8 represent $\hat{\alpha}_2\overline{Q}_p + \hat{\alpha}_3\overline{Q}_p\overline{R}_p$, allowing both quality and health risk to be province-specific. Provinces located above the line have higher health risk than the national average, resulting in extra saving. Provinces located below the line have lower health risk than the national average, with the opposite effect. So the vertical distance between the scatter point and the line is an estimate of the extra (or less) saving induced by differences in health risk across provinces. Thus, a province like Naples has higher health risk than the national average, while Rome has lower health risk. Note that the vertical distance would be an estimate of $\alpha_3\overline{Q}_p\left(\overline{R}_p - \overline{R}\right)$, the extra saving induced by health risk differentials even if we allowed the value of the regressors to vary across provinces.

6. Conclusions

In this paper we have argued that health care quality has an important impact on economic inequality and on saving behaviour. This impact is difficult to measure using cross-country data, because quality differences are inextricably correlated with other institutional and economic differences across countries. We have therefore adopted the more promising approach of detecting the effects of quality within a single country, and exploited district-wide variability in health care quality and provision of the Italian universal public health system to identify the effects of quality on income inequality, health inequality and precautionary saving.

We have matched Italian microeconomic data with geographic indicators of quality, and find that in lower quality districts there is greater income and health dispersion, and higher precautionary saving. Our empirical results suggest that differences in the quality of health care contribute to explaining economic inequality and saving decisions, with important insights for the debate about the validity of the life-cycle model and policy implications for the design of health care systems.

As far as the life-cycle model is concerned, our finding that people engage in precautionary saving in response to health risk contributes to explaining why people do not decumulate assets during retirement in the way predicted by the life-cycle model. As for policy implications, if the goal of national and regional policy is to promote equality of opportunities and reduce health disparities, one should seek to improve the standards in those districts that display poor quality of health care.

Appendix

A. Derivations

Consider the general model discussed in Section 2:

$$h_t = \alpha_1 + \beta_1 h_{t-1} + \gamma_1 y_t + \varepsilon_{1t}$$
$$y_t = \alpha_2 + \beta_2 h_t + \varepsilon_{2t}$$

The variance in health and income can be expressed as a function of the parameters and of the variances and covariance of the shocks. Let σ_{11} be the variance of ε_1, σ_{22} the variance of ε_2 and σ_{12} be the covariance between ε_1 and ε_2. Then:

$$Var(y) = \sigma_{22}\left[1 + \frac{(\gamma_1\beta_2)^2}{(1-\gamma_1\beta_2)^2 - \beta_1^2}\right] + \frac{\beta_2^2\sigma_{11}}{(1-\gamma_1\beta_2)^2 - \beta_1^2} + \frac{2\beta_2^2\gamma_1}{(1-\gamma_1\beta_2)^2 - \beta_1^2}\sigma_{12}$$

and

$$Var(h) = \sigma_{11}\left[\frac{1}{(1-\gamma_1\beta_2)^2 - \beta_1^2}\right] + \frac{\gamma_1^2\sigma_{22}}{(1-\gamma_1\beta_2)^2 - \beta_1^2} + \frac{2\gamma_1}{(1-\gamma_1\beta_2)^2 - \beta_1^2}\sigma_{12}$$

We can check that the derivative of $Var(y)$ with respect to β_1 is positive if both γ_1 and σ_{12} are non-negative. The derivative of $Var(h)$ with respect to β_1 is also positive if both γ_1 and σ_{12} are non-negative while the derivative of $Var(h)$ with respect to β_2 is ambiguous in this general case.

B. The 1993-95 Survey of Household Income and Wealth

The primary purpose of the Bank of Italy Survey of Household Income and Wealth (SHIW) is to collect detailed data on demographics, households' consumption, income and balance sheets. The SHIW surveys a representative sample of the Italian resident population. Sampling is in two stages, first municipalities and then households. Municipalities are divided into 51 strata defined by 17 regions and 3 classes of population size (more than 40,000, 20,000 to 40,000, less than 20,000). Households are randomly selected from registry office records. From 1987 onward the survey has been conducted every other year and covers about 8,000 households, defined as groups of individuals related by blood, marriage or adoption and sharing the same dwelling.

Since 1991 the survey has been designed to have a rotating panel feature. All households are asked whether they are willing to be interviewed again, but a fraction (approximately 25 percent) of those who are available are nonetheless dropped from the sample. In the panel component, the sampling procedure is also two-stage: (1) selection of municipalities (among those sampled in the previous survey); (2) selection of households re-interviewed. The net response rate (the ratio of responses to families contacted net of ineligible units) in 1993-95 was 77.3 percent. See Brandolini e Cannari (1994) for more details on the survey.

Health status (very poor, poor, fair, good, excellent) is available only in 1995. The *quality of health care* in the city of residence (on a scale from 1 to 10) is available for each household head in 1993. Our analysis therefore relies on the panel section of the SHIW: 45 percent of the sample interviewed in 1993 was in fact re-interviewed in 1995.

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Figure 1: Per capita public health spending

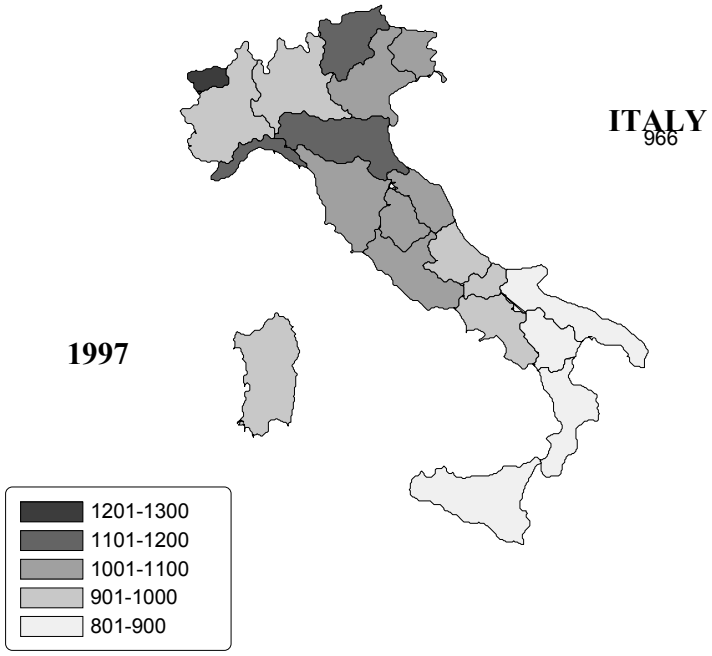
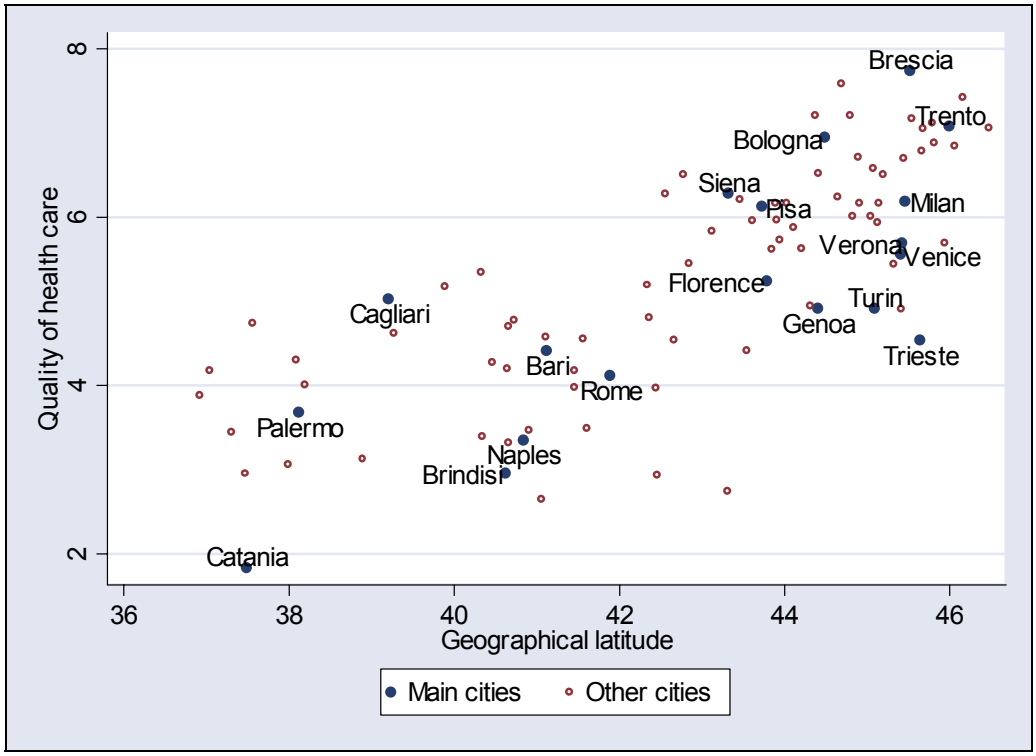
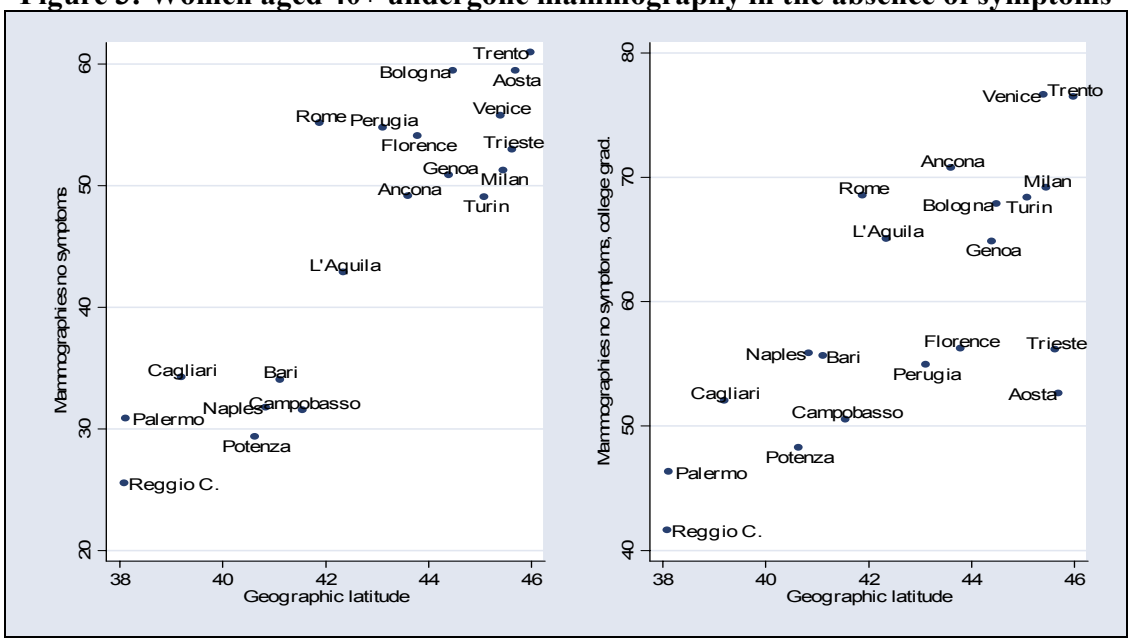


Figure 2: Quality of health care across cities



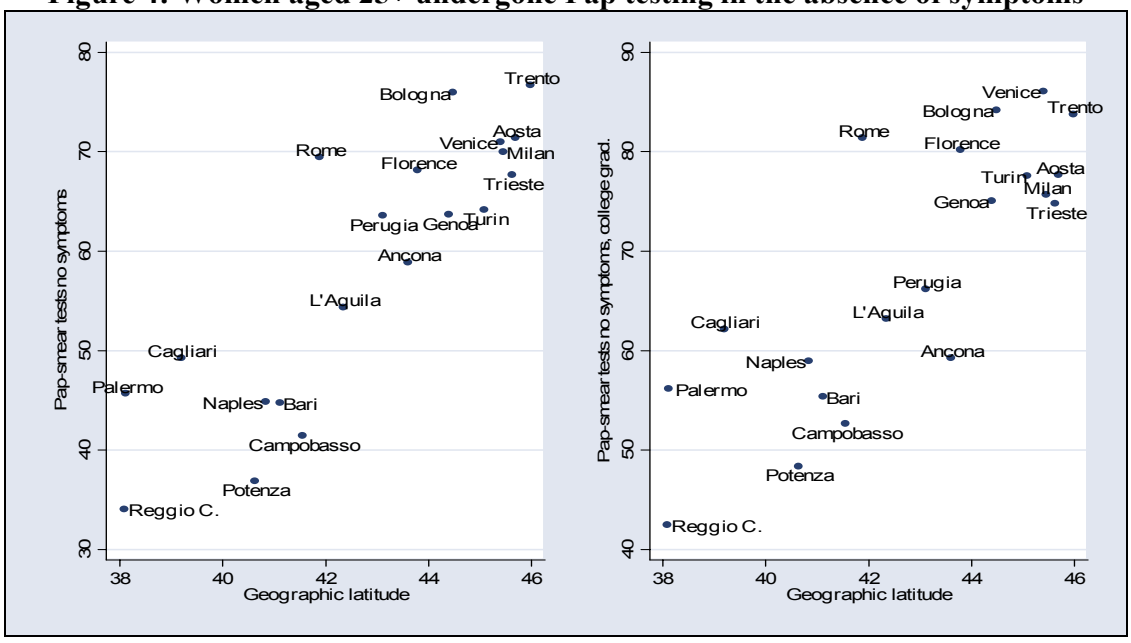
Source: Our elaborations from the 1993 Survey of Household Income and Wealth.

Figure 3: Women aged 40+ undergone mammography in the absence of symptoms



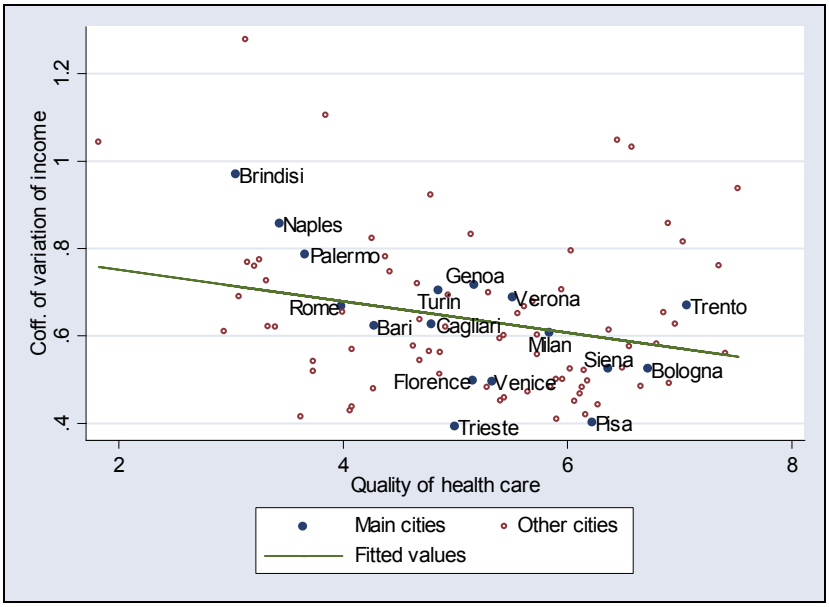
Source: ISTAT - *Struttura e dinamica sociale* unit from the health interview survey *Health status and use of health services* - Years 1999-2000. The data are expressed as rates per hundred women.

Figure 4: Women aged 25+ undergone Pap testing in the absence of symptoms



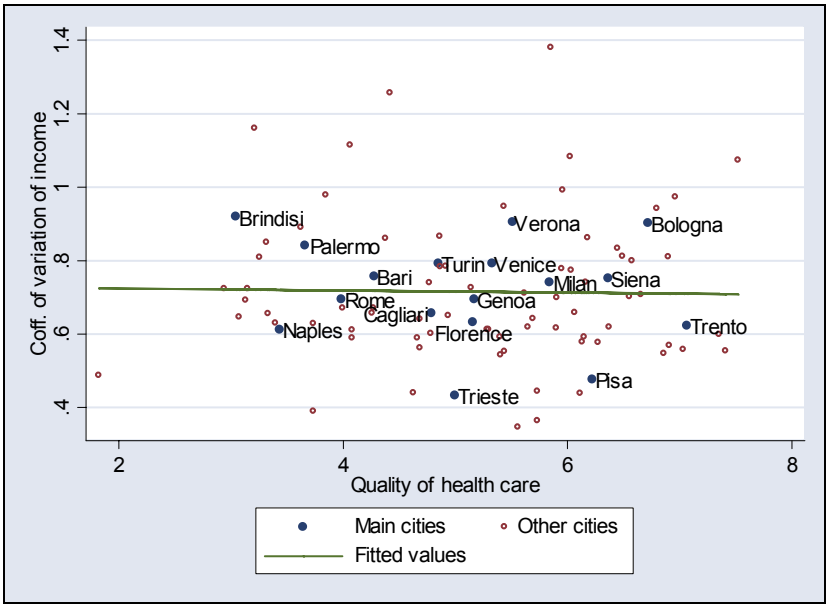
Source: ISTAT - *Struttura e dinamica sociale* unit from the health interview survey *Health status and use of health services* - Years 1999-2000. The data are expressed as rates per hundred women.

Figure 5: Income inequality of workers by quality of health care



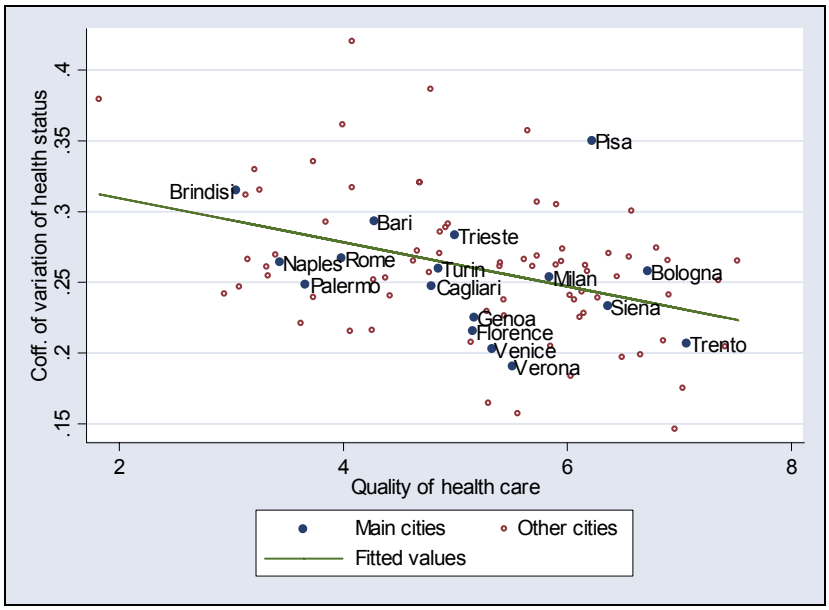
Source: Our elaborations from the 1993 Survey of Household Income and Wealth.

Figure 6: Income inequality of the retired by quality of health care



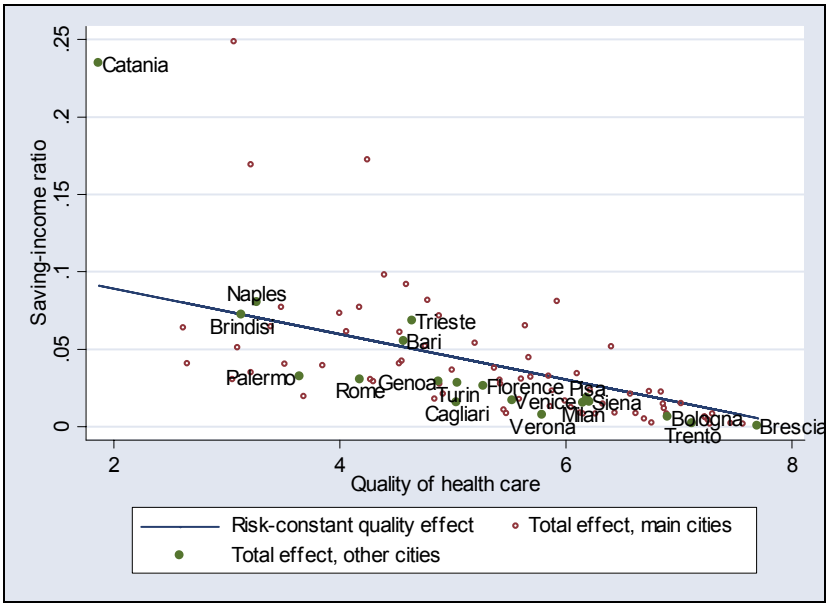
Source: Our elaborations from the 1993 Survey of Household Income and Wealth.

Figure 7: Health inequality by quality of health care



Source: Our elaborations from the 1993 and 1995 Survey of Household Income and Wealth.

Figure 8: The effect of quality of health care and health risk on saving



Source: Our elaborations from the 1993 and 1995 Survey of Household Income and Wealth.

Table 1
The effect of quality of health care on income dispersion

	Young	*Old*	*All*	
	(1)	(2)	(3)	(4)
Income	0.0055	0.0078	0.0058	0.0059
	(0.0025)	(0.0022)	(0.0015)	(0.0016)
Rural	0.0870	-0.0006	0.0427	0.0333
	(0.0673)	(0.0682)	(0.0477)	(0.0477)
Age	-0.0080	0.0028	-0.0032	-0.0018
	(0.0104)	(0.0084)	(0.0062)	(0.0063)
Education	0.0118	0.0320	0.0273	0.0272
	(0.0233)	(0.0171)	(0.0137)	(0.0137)
CV(Education)	0.5779	0.2875	0.2866	0.2769
	(0.2980)	(0.0859)	(0.0817)	(0.0844)
Health	-0.0312	0.0783	0.0367	0.0394
	(0.0616)	(0.0516)	(0.0396)	(0.0396)
Quality	-0.0553	-0.0134	-0.0002	-0.0038
	(0.0174)	(0.0185)	(0.0170)	(0.0222)
Young			0.0793	0.0775
			(0.1914)	(0.1959)
Young × Quality			-0.0662	-0.0787
			(0.0211)	(0.0275)
Constant	0.7684	-0.3240	0.2451	0.1573
	(0.5911)	(0.6106)	(0.4651)	(0.4697)
Observations	91	91	182	182
R^2	0.19	0.35	0.28	0.27

Note: The dependent variable is the coefficient of variation of family income. All variables are based on provincial level statistics from SHIW 1993 (91 provinces in all). The dependent variable is the coefficient of variation in disposable income. In column (1) the sample includes household heads before retirement age (60 years). In column (2) the sample includes household heads past retirement age (60 years). Columns (3) and (4) use both samples. In column (1), (2) and (3) "Quality" is the subjective assessment of health care quality reported in SHIW 1993. In column (4) it is the proportion of individuals satisfied with medical care in the 20 Italian regions, taken from official statistics (ISTAT, 1999). Standard errors are reported in parentheses.

Table 2
The effect of quality of health care on health dispersion

	(1)	(2)
Income	-0.0000	0.0000
	(0.0005)	(0.0005)
Rural	0.0185	0.0176
	(0.0159)	(0.0155)
Age	0.0013	0.0018
	(0.0016)	(0.0016)
Education	-0.0070	-0.0049
	(0.0052)	(0.0050)
CV(Education)	-0.0432	-0.0742
	(0.0729)	(0.0735)
Health	-0.0821	-0.0865
	(0.0176)	(0.0172)
Quality	-0.0125	-0.0197
	(0.0042)	(0.0056)
Constant	0.6448	0.6442
	(0.1380)	(0.1355)
Observations	91	91
R^2	0.46	0.48

Note: The dependent variable is the coefficient of variation of health status. Unless noted otherwise, all variables are based on provincial level statistics from SHIW 1995 (91 provinces in all). The dependent variable is the coefficient of variation in health status. In column (1), "Quality" is the subjective assessment of health care quality reported in SHIW 1993. In column (2) it is the proportion of individuals satisfied with medical care in the 20 Italian regions, taken from official statistics (ISTAT, 1999). Standard errors are reported in parentheses.

Table 3
Ordered probit for health status

	Males		*Females*	
	(1)	(2)	(3)	(4)
Age	-0.0392	-0.0409	-0.1005	-0.1132
	(0.0411)	(0.0411)	(0.0273)	(0.0272)
Age^2	0.0002	0.0011	0.0514	0.0604
	(0.0322)	(0.0322)	(0.0205)	(0.0205)
Education	0.0423	0.0503	0.0442	0.0548
	(0.0049)	(0.0044)	(0.0049)	(0.0046)
Income	2.1799		3.4700	
	(0.5483)		(0.5499)	
Observations	3329	3329	3818	3818

Note: The dependent variable is self-reported health status (5 = very good, 4= good, 3= fair, 2= poor, 1= very poor). The sample consists of all men aged 51-80 and all women aged 51-85 in SHIW 1995. Provincial dummies are in all regressions. Standard errors are reported in parentheses.

Table 4
The effect of health risk and quality of health care on saving

	(1)	(2)	(3)	(4)
Health risk	1.8520	2.2071	2.5450	2.8547
	(0.8236)	(0.8790)	(0.8204)	(0.8850)
Health risk × Quality	-0.4767	-0.4778	-0.3162	-0.3533
	(0.1621)	(0.1731)	(0.1643)	(0.1778)
Age	0.0264	0.0271	0.0350	0.0327
	(0.0108)	(0.0116)	(0.0107)	(0.0115)
Age^2	-0.0147	-0.0167	-0.0239	-0.0231
	(0.0081)	(0.0086)	(0.0079)	(0.0084)
Education	0.0074	0.0079	0.0121	0.0121
	(0.0021)	(0.0023)	(0.0021)	(0.0023)
# kids at home and away	-0.0154	-0.0059	-0.0162	-0.0066
	(0.0047)	(0.0051)	(0.0047)	(0.0051)
Married	-0.0010	0.0138	-0.0164	-0.0005
	(0.0167)	(0.0181)	(0.0168)	(0.0182)
Divorced	-0.1997	-0.1715	-0.2179	-0.1888
	(0.0573)	(0.0541)	(0.0573)	(0.0541)
Family size	0.0281	0.0336	0.0288	0.0342
	(0.0068)	(0.0076)	(0.0068)	(0.0076)
Health status	0.0095	0.0137	0.0109	0.0149
	(0.0072)	(0.0080)	(0.0071)	(0.0079)
Wealth/Income lagged		-0.0020		-0.0021
		(0.0012)		(0.0012)
Constant	-1.0312	-1.0269	-1.2689	-1.1794
	(0.3675)	(0.3995)	(0.3642)	(0.3958)
Observations	2950	1587	2950	1587
R-squared	0.10	0.15	0.10	0.15

Note: The dependent variable is the ratio of saving to disposable income at the household level. The sample consists of retired heads aged 50 and over in the 1995 SHIW. "Quality" is the provincial average of the subjective assessment of health care quality reported in SHIW 1993. Provincial dummies are included in all regressions. Health risk is defined as $\Pr(h=1)(1-\Pr(h=1))$, where $\Pr(h=1)$ is the estimated probability of being in very poor health from the ordered probit of Table 3. Columns (1) and (2) are based on a model where health status depends on income, age and education, while columns (3) and (4) are based on a model where health status depends on age and education alone. Columns (2) and (4) are based on the panel household sample.