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Chapter 1

General introduction

This thesis consists of three chapters dealing with important topics for the well-being of individuals: retirement, health and happiness. All together are micro studies that deal with policy relevant research questions. The first chapter is about whether a pension reform has effects on income smoothing and labor supply, the second one is about the effects of health insurance coverage in the developing word, and the third one is about happiness and economic theory.

The combination of an increasing life expectancy, a declining fertility and a lower economic growth implies a big burden on the sustainability of public pension systems in different countries around the world. As a response, a growing number of countries raised, or are planning to raise, their official retirement age as part of a pension reform. We evaluate such a reform in the first chapter of the thesis. In particular, the idea of this chapter is to investigate whether this type of reform affects labor supply behavior of older single individuals in the presence of uncertainty about income, health and life expectancy. Our model closely follows the models of retirement behavior proposed by Rust 1989 and Rust and Phelan 1997 and we conduct our empirical analysis using data for the Netherlands. The models does a good job on predicting the main patterns observed in the data. It predicts that as individuals get older their labor supply declines considerably and this varies by age and gender. Next, we use the model to simulate the pension reform implemented in the Netherlands in 2012, which aims at gradually increasing the retirement age from 65 to 67. Together with this reform, we also explore a hypothetical one that immediately increases the retirement age to 67. We compare both reforms. The simulation results show a small impact on the effective retirement age for the first reform and a bigger impact for the second one, as expected. Respectively, individuals postpone their retirement by less than one month and seven months on average; while differences across individuals mainly depend on their gender and health status.

The contribution of this chapter is that it increases the understanding of Social Security reforms. Several empirical studies suggest that policies that change rules of Social Security and, in particular, the retirement age, have effects on income smoothing and labor supply. But the size of these effects might vary. Some literature for the U.S. finds that this type of reform indeed encourages individuals to work longer but the response is small. Studies for other countries typically find more significant effects. There is also evidence of no impact on labor supply when the studies consider borrowing constraints. Thus, it is not surprising to observe different sizes of the effects depending on the type of reform and the country under analysis. In our case, we find that a reform that gradually increases the age of retirement has a rather small impact on behavior but a reform that immediately increases the legal age has a more significant impact. This make sense if we consider that the implementation of the reform under analysis is gradual and it only targets one part of pension system in the Netherlands (first pillar). There are also non-economic incentives such as social norms and framing of behavioral responses that policy makers should take into account.

A second relevant topic in this thesis is the role of health insurance and its effects on individuals' behavior. The fact that individuals value insurance because it helps them to smooth consumption has long been recognized by the literature. Individuals would like to have the same consumption over time and over possible outcomes. This means that given the choice between: i) two years of average consumption, and ii) one year of extremely high consumption and one year of extremely low consumption, people would be much happier with the former. In this line, health insurance has been proved to help individuals to smooth consumption in the presence of adverse health shocks. The intuition is that insurance allows to translate consumption from periods when it is high to periods when it is low due to the presence of a severe illness. The latter is a concern because it has negative consequences not only on medical expenses but also on labor supply and productivity.

The presence of a health shock and its consequences is particularly worrying in developing countries, where many individuals do not have access to health insurance. The main reason for that is that insurance reaches mainly formal workers. Informal ones do not have any type of insurance and they have to face the presence of a health shock by themselves. This is relevant not only because informality comprises a large fraction of the workforce but also because many of the informal workers are poor. As a response to this challenge, Governments on these countries have been implementing health insurance programs targeted to the poor. But to date, there are not many rigorous evaluations and, therefore, no much knowledge about how to design them best (Acharya et al. 2013). This is exactly the motivation for our second chapter.

In this chapter, we use data from Peru to evaluate the impact of access to a very popular Health Insurance program called "Seguro Integral de Salud (SIS)" for individuals outside the formal labor market on a variety of measures for health care utilization, expenditure and health indicators. We do this by means of a regression discontinuity design. As expected, and in contrast to studies for a number of other countries, we find strong effects of insurance on health care utilization, such as visiting a doctor, receiving medication, medical analysis and surgery. We also find some effects on preventive care (vaccination and pregnancy care), but they are much less pronounced. We find positive effects on health care expenditures, most likely at the high end of the distribution, and no clear effects on self-reported health measures.

Our interpretation of these results is that the SIS program was able to encourage poor individuals to seek medical attention. They receive treatments when they need them, but they are less inclined to invest in preventive care. This is not surprising, as the program does not provide any incentives to actually do so. Taken together our findings on utilization and expenditures, the intuition is that once individuals get in touch with the health care system, they use the services and they are even willing to pay themselves for the ones they feel are important. This is a good new for a developing country where many people might not seek any care, self-medicate or might give up treatments when the appropriate care is too expensive. Compared to health care systems in other developing countries, the Peruvian one is a notable exception. It reaches its goal to provide access to medical care to many poor people. There is no evidence on the effects on health though; but it is imaginable that increased access will ultimately lead to better health outcomes. We discuss in the chapter why it remains a challenge for the future to measure those, together with how relevant is the program's design and the role of incentives on health care providers and individuals.

In the third chapter we approach the well-being of individuals from a different perspective: happiness. The literature on happiness economics or individuals' subjective well-being is still in its infancy but it brings valuable information about individual's preferences. For the first time, we can say there is a proxy of what we call utility in our microeconomic courses. If we are able to link this proxy to outcomes from our theoretical models we think new roads will open. The challenge is, of course, how to formalize this link. That is exactly what we do in this chapter by exploring whether subjective well-being and utility measures are correlated. By doing so, we aim to close, at least partly, the gap between two disconnected literatures: the literature on the individuals' well-being on the one hand and, on the other hand, the literature on the intra-household allocation of time and resources. The former literature is characterized by a rather loose connection with theory, whereas the latter has a close connection with theory and uses structural models. We use a model of the latter type (Chiappori et al. 2002). As a first step, based on a model of intra-household allocation of time and resources, we estimate the parameters underlying the mechanisms that govern intra-household allocation of resources and individual preferences in a dataset from the Netherlands. In a second step, we recover utilities from the estimated parameters and relate them to different measures of subjective well-being available in our data. While utility appears to be poorly related to overall measures of subjective well-being, it appears to be more closely linked with domain-specific subjective well-being measures.

Ideally, one would expect a positive correlation between utilities and general measures of well-being. However, the correlation will never be perfect. This is what we find in our analysis. Our utility measures use just two inputs: consumption and leisure. Both can be argued to be very important, but they are not the only inputs. Of course, there are other factors influencing individual's responses to well-being questions or life events that are taking place in the lives of people. For this reason, it is more difficult to find large correlations between well-being and utility measures. A clearer picture arises though if we consider satisfaction with several domains of life, which can be seen as the building blocks of satisfaction with life as a whole (Ferrer-i Carbonell and Van Praag 2002, Van Praag et al. 2003).

The main lesson from this last chapter is that, certainly, it is possible to link economic theory to happiness data. Of course, we do not aim to cover all the aspects related to this topic. We only focus on closing the gap and, by doing so, on having some piece of work that increases the understanding on this issue. The possibilities to further investigate this are broad and challenging. The results might be happy.

Chapter 2

The impact of an increase in the legal retirement age on the effective retirement age

This chapter is a coauthored work with Frederic Vermeulen.[1]

2.1 Introduction

Population ageing is one of the most important challenges that are posed to the OECD countries. The combination of an increasing life expectancy, a declining fertility and a lower economic growth implies a big burden on the long term sustainability of public pension programmes in many countries. As a response to this challenge, a growing number of countries raised, or are on the verge of raising, their official retirement age as part of a pension reform. Such a change was quite early adopted by the United States' government. One of the provisions in the Social Security Amendments of 1983, for example, gradually increased the age for collecting full social security benefits from 65 to 67 over a long period that began in 2000. Similar policies are being adopted in many member states of the European Union, with Denmark, Germany and the United Kingdom as important examples (see European Commission 2012 for a detailed overview).

Still, it is well-known that in many OECD countries, there is a substantial gap between the official retirement age and the effective retirement age. Although there are notable exceptions (like Japan, Korea and Mexico), the average effective retirement age is lower than the official retirement age in most of the OECD countries. In countries like Austria, Belgium and Luxemburg, the average gap is not less than five years (OECD 2009).

The aim of this paper is to analyze the impact of an increase in the official retirement age on the effective retirement age in the Netherlands. Like in many other OECD countries, there is an agreement

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between the Dutch government and the social partners to gradually increase the official retirement age from 65 to 67 by 2023. Obtaining insights into the efficacy of this reform is therefore of substantial policy relevance.

A first feature of our analysis is that we make use of a dynamic programming (DP) model of retirement. DP models are based on recursive methods for solving sequential decision problems; in our case the decision when to retire. Such models have enabled economists to formulate and solve a variety of problems involving decisions over time and under uncertainty. As a result, they have now become an important and versatile tool in a host of areas, including labor economics, industrial organization, economic demography and marketing (see, e.g., Rust 1994, 2006 and Adda and Cooper 2003, for numerous references). Given the fact that the increase of the official retirement age will only be in full force by 2023, a DP model seems the most natural starting point for our analysis. One of the most important advantages of structural modeling is its potential to predict the impact of future or hypothetical policy changes.

A second feature of our study is that we will exclusively focus on older singles' retirement behavior. This choice has the big advantage that it allows one to circumvent well-known issues associated with the modeling of retirement decisions of individuals in couples. Most of these issues can be brought back to the question which model should be used to model such individuals' retirement decisions. Some authors (for example, Rust and Phelan 1997, French 2005, French and Jones 2011 and Eckstein and Lifshitz 2011) focus on the labor supply decisions of one of the spouses in a couple while they take the behavior of the other spouse as exogenously determined. They consider a unitary model, which assumes that a couple behaves as a single decision maker. One issue here is that there is quite some empirical evidence that this assumption is too strong (see Browning and Chiappori 1998, Cherchye and Vermeulen 2008 and Cherchye, De Rock, and Vermeulen 2009, for some recent examples). Other authors explicitly account of the fact that there are multiple decision makers in couples. Gustman and Steinmeier 2000, 2004 for example, assume a noncooperative approach, where each spouse maximizes own utility while taking into account the actions of the other spouse. van der Klaauw and Wolpin 2008, on the other hand, assume that couples' preferences are captured by some weighted combination of both spouses' preferences. A collective model à la Chiappori 1988 is considered by Michaud and Vermeulen 2011, though they focus on a static retirement model. Given the above, it can be argued that our focus on the behavior of pure singles, where, given individual rationality, the unitary model applies to by definition, offers us a very clean setting to conduct our empirical analysis.

A third feature of our analysis is that the structural model that we build in this paper is applied to new administrative data from Statistics Netherlands (CBS). The main advantage of our data is that it includes very accurate and detailed information on individual incomes and pension entitlements. This level of accuracy will be most useful when we formulate the intertemporal individual budget constraints, with which rational preference maximizing individuals are confronted under uncertainty. As far as we know, an analysis that is based on Dutch administrative data on incomes and pension entitlements has not been conducted yet. A previous study for the Netherlands was conducted by Heyma 2004. He also uses a DP model to provide insight into the dynamics between institutions, earnings, health and retirement behavior. His basic hypothesis is that the retirement decision is a choice between different alternatives such as employment, early retirement, disability and unemployment. So his paper is focused on analyzing the substitute pathways for labor market exit by including more choices in his model. Availability of these alternatives is restricted by institutional constraints. He finds that institutional structures are determinants of retirement, particularly eligibility conditions and substitution between these exit routes. However, in our paper, the issue of pathways into retirement is not a concern (see Section 2.2 for details) and we use administrative information on pension entitlements whereas he uses survey data for only two moments in time (1993 and 1995).

The main aim of our empirical analysis is to investigate in what way the pension system, and more specifically the official retirement age, affects labor supply behavior of older single individuals in the presence of uncertainty about income, health status and life expectancy. Our model closely follows the models of retirement behavior proposed by Rust 1989, Rust and Phelan 1997, and Karlstrom et al. 2004. Like these authors, we focus on the binary choice between working and not working and assume that consumption equals net income in each period. Although this setting is restrictive, our data set does not allow us to go any further in this respect. It should also be noted though that the Netherlands have a well-developed occupational pension scheme (which we take into account in our analysis) that makes other savings relatively less important. One substantial difference between our application and those in Rust 1989, Rust and Phelan 1997, and Karlstrom et al. 2004 is that we solely focus on singles while they apply a unitary model to individuals who can also be married.

The rest of the paper is organized as follows. Section 2.2 provides a brief description of the pension system in the Netherlands and describes the administrative data that we use. Section 2.3 presents our DP model and gives details on the empirical specification. The estimation results are presented in Section 2.4. In Section 2.5, we provide simulation results with respect to the planned gradual increase in the official retirement age and a hypothetical reform that immediately increases the official retirement age. More specifically, we will analyze the impact of these policy changes on the effective retirement age. Section 2.6 concludes.

2.2 Background and data

2.2.1 The pension system in the Netherlands

The Dutch pension system combines three pillars. As Ewisk 2005 describes, the first pillar consists of pensions that are pay-as-you-go financially based (with the Dutch abbreviation AOW). This state benefit is an old-age pension provided to all residents in the Netherlands at the age of 65 and it is linked to the minimum wage. No distinction is made between men, women, employees, self-employed or immigrants. There is no means-test to check eligibility, which implies that other forms of income have no effect on the level of the AOW benefit. It depends on household composition though. Single individuals receive a different benefit than cohabiting or married individuals.[2] All residents between the ages of 15 and 65 are building up claims for the AOW. The entitlement accrual equals 2 percent for every insured year, which leads to a 100 percent entitlement for individuals who live in the Netherlands for 50 years without gaps. A gap occurs when a person resides outside the Netherlands. The AOW benefit was equal to a yearly amount of 11,211 euros in 2005.

The second pillar comprises the old-age occupational pensions (OP), which are privately organized by employers and employees. These occupational pensions are mandatory, funded and defined benefit for the large majority of workers. There are two ways to define the level of expected benefits. In the

[2]For instance, in 2005, single individuals received 11,211 euros and cohabiting or married individuals 7,980 euros.

final pay scheme, the pension is based on an annual replacement rate of 1.75 percent of the final salary, whereas, in the average pay scheme, the pension is calculated based on a replacement rate of 2 percent of the average career salary. These accrual rates imply that, by each year individuals decide to continue working, they earn those percentages of their respective salary. It is expected that if the working period is between 35 to 40 years, the total pension benefit will be around 70 percent of the salary, including first pillar benefits (see Ewisk 2005 for more details). Therefore, the occupational pension scheme is considered supplementary to the AOW pension.

The third pillar comprises voluntary pensions. They are intended to complement or improve the occupational and AOW benefits and they must be organized by an insurance provider. This third pillar consists of defined contribution pensions and part of these receive a favorable tax treatment.

In this paper, we focus on the first and second pillars. Therefore, we will define an individual's retirement income as the sum of the state and occupational pensions.

2.2.2 Data

The data set used in our study is drawn from a combination of three administrative data sets from Statistics Netherlands (CBS). The first data set is called "Pension Entitlements" and it is available for the years 2005, 2006 and 2007. This data set contains new and valuable information on entitlements and attainable pensions from the second pillar. It is provided from pension funds, which ensures a high level of accuracy. Moreover, it also contains information about the franchise, which is an important variable for the computation of the pension income.

The second data set comes from an income panel study (called IPO). It contains detailed information about individual and household incomes and it is provided by the Dutch national tax administration. Again, this ensures a high level of accuracy. This data is basically a panel survey because it is based on a randomly drawn set of "key persons" who are followed over time. Information about all the household members in the key persons' households is also recorded. To match this data set with the pension data, we use the waves 2005, 2006 and 2007.

A third data set that we use is drawn from a population registration (called GBA). This dataset is used to exclude individuals who migrated and to take into account the fact that some individuals we focus on died over the period covered.

By merging these three data sets (using individual specific identifiers), we build a panel that contains the main information we need for our DP model. In addition to demographic characteristics such as age and gender, we have detailed information on incomes and pension entitlements. A drawback of our data set is that it does not contain any information about the individuals' educational level or on detailed categories of their health status. In the case of health status though, we can construct a binary variable, which indicates whether an individual is in good or bad health. The latter is then defined by receiving income from disability benefits.

As mentioned in the introduction, we focus on the retirement decisions of male and female singles, which allows us to consider a standard unitary model. Singles are defined as individuals who are not married or cohabiting, and who are separated, widowed or divorced. We further focus on individuals who are between 58 and 70 years old in the year 2005. These thresholds are chosen because we want to focus on the retirement behavior of older workers. As we observe in the data, younger individuals might not be thinking yet about their retirement (few individuals retire before age 58). Similarly, few

Table 2.1: Socio-economic status in 2007

	Employment / Retirement Status			
Age in 2007	Employed	Early retired	Retired	Total
60	107	15	-	122
61	99	25	-	124
62	48	20	-	68
63	33	11	-	44
64	13	5	-	18
65	19	-	9	28
66	1	-	15	16
67	3	-	9	12
68	2	-	-	2
69	1	-	-	1
70	2	-	2	4
71	-	-	1	1
72	-	-	1	1
Total	328	76	37	441

individuals above 70 are still working and most of them are retired. We further focus on employees with an observed income (thus excluding the self-employed and individuals who receive assistance). We follow these employees until 2007 and record those who transit to early retired and normal retired status. We keep individuals with a defined benefit plan since there are only few individuals with a defined contribution plan.

Our final sample has 1,323 observations of 441 individuals. Table 2.1 shows the socioeconomic status of these individuals in the year 2007. Note that these individuals will either remain employed or they will retire through early retirement or normal retirement. It is clear from the table that the share of people out of the labor force is increasing with age. Obviously, the pathway through early retirement is initially most important. This status is taken over by normal retirement for the oldest individuals in the sample.

Table 2.2 gives some summary statistics on our sample. In 2005, on average, individuals are around 60 years old, 54.2 percent are men, 88.5 percent are native (where native means born in The Netherlands), 95.5 percent are in good health status and all of them are employees. Income and pension entitlements (in the second pillar) are on average 42,521 euros and 28,842 euros respectively. In 2006 and 2007, variation on the time-varying variables is observed (i.e. age, health, employment, income and entitlements).

It should be noticed that all individuals who reported themselves as employees are assumed to be full-time workers. The information about employment status comes from the IPO and in this dataset there is no information about the number of working hours and therefore we are not able to construct a variable that disentangles between full-time and part-time work. Thus, in our sample, we pull together two types of employees, those who have a full-time job and those who have a part-time job and we assume all work full time. This is not a very strong assumption if we consider that we are focusing the analysis on singles. According to the CBS, 62 percent of the singles between 55 and 64 years old worked at least 35 hours in 2007. The numbers amount to 85 percent for men and 31percent for women.[3] Clearly, the incidence of part-time work is larger for women (69 percent) and, therefore, the more sensible implication of our

[3]CBS StatLine data for single individuals (including single parents).

Table 2.2: Descriptive statistics of initial state variables

	2005	2006	2007
Age (years)	59.98	60.98	61.98
	(2.179)	(2.179)	(2.179)
Male	0.542	0542	0.542
Native	0.885	0.885	0.885
Good health	0.955	0.950	0.944
Employed	1.00	0.844	0.736
Income (euros)	42,521	44,126	45,876
	(13,522)	(14,043)	(14,703)
Pension entitlement (euros)	28,842	29,433	30,055
	(6,440)	(6,630)	(6,833)

Note: Standard deviations in parentheses.

assumption would be for them. We are implicitly assuming that older women who work part-time do not react too different than those who work full-time which might be difficult to defend. This assumption though is perhaps not too strong given a study by De Vos and Kapteyn 2004, who address the importance of dealing with female part-time work, that showed no significant differences.

Another important feature of our study is that we do not consider disability insurance and unemployment insurance schemes as pathways into early retirement. The concept of substitute pathways for the Dutch labor market exit was an important phenomenon in the past but it is not a significant concern to date (Euwals et al. 2012). In the 1990s, Kerkhofs et al. 1999 find that high replacement rates in the disability and unemployment insurance schemes reduce the probability to apply for early retirement. Additionally, they find that the early retirement scheme seems to be preferred over the other two schemes (after controlling for replacement rates). Similarly, by using a panel survey (CERRA) for 1993 and 1995, Heyma 2004. finds that early retirement, disability and unemployment schemes serve as substitute pathways for retirement. However, to date, several policy reforms implemented in the 1990s have reduced the substitution between the different exit routes. By using administrative Dutch data for the health care sector between 1999 and 2006, Euwals et al. 2012 find that the inflow into early retirement and disability insurance has decreased over time and employment rates of the elderly have increased significantly. Thus, the importance of the disability insurance as an alternative exit route is substantially reduced in the last decade. The policies implemented also had effects on the substitution between unemployment and disability insurance. According to recent estimates, there is almost no hidden unemployment in disability enrollment (Koning and van Vuuren 2007, 2010). Overall it seems that the reforms to prevent early labor market exit implemented in the Netherlands have been successful. Therefore, we decided not to include disability and unemployment insurance schemes as choice alternatives or states in our model.

2.3 The model

2.3.1 A dynamic programming formulation

We formulate our retirement model as one where individuals are faced with a sequential decision problem in a discrete finite horizon setting. We use the standard assumption that individuals are expected discounted utility maximizers. In each time period, the decision to retire is modeled as a binary choice between working and retirement. Individuals are assumed to observe the available information in each period and, conditional on that, calculate expected discounted utilities for each of the two alternative employment states. Finally, they are assumed to choose the alternative that maximizes their expected discounted utility. The choice between working and retirement in the next period defines our control (decision) variable, whereas the available information about income, pension entitlements, current employment status and some demographic variables define the set of state variables. Since individuals do not know their future labor income nor their future health status, they have to make decisions under uncertainty. This uncertainty then affects their decisions, which is modeled through conditional probabilities. These probabilities represent the individual's beliefs and are used to calculate expected discounted utilities. Retirement is assumed to be an absorbing state.

Since this type of problem generally does not have a tractable analytical solution, we follow the typical approach that is based on Bellman's optimality principle. This implies that we use a backward induction process to obtain an optimal decision given certain conditions on a controlled process. To implement backward induction, we start in the last time period and for each possible combination of the state and control variables we calculate expected discounted utilities and decision rules. We continue the backward induction recursively for previous periods until we reach the first time period. This results in a decision rule that contains an optimal retirement sequence given individual beliefs and constraints. At every time period, individuals take the decision to retire if this alternative brings the highest expected discounted utility for every possible continuation of the problem. This is made by comparing the value functions for each alternative state, which summarizes the future consequences of choosing each alternative accounting for the uncertainty we described before.

The individual's period preferences are represented by a random utility function $U_t(s_t, d_t, \theta_u)$, where s_t is a vector of state variables at year t, d_t denotes the control variable (if the individual decides to stop (continue) working in time period t, then the control variable takes the value 1 (0)), and θ_u the parameters to be estimated. Following Rust 1989 and Rust and Phelan 1997, we assume a partition of the state variables into two components: $s_t = (x_t, \varepsilon_t)$, where x_t is a vector of observed state variables and ε_t is a vector of state variables that is observed by the individual but not by the econometrician. The vector of observed variables x_t considers the individual's current employment status, labor income, retirement income, health status, origin and age at time t. For empirical tractability, we assume the following additive form for the period utility function:

$$U_t(s_t, d_t, \theta_u) = u_t(x_t, d_t, \theta_u) + \varepsilon_t(d_t),$$

where the alternative specific error term $\varepsilon_t(d_t)$ is assumed to be independent and identically distributed according to a type 1 extreme value distribution. As mentioned above, the individual has to choose in an environment with uncertainty about future incomes, future health and life expectancy. This uncertainty is modeled through conditional probabilities that are represented by a transition probability matrix $p_t(x_{t+1}|x_t, d_t, \theta_p)$, where θ_p denotes a vector of unknown parameters that characterize an individual's expectations (or beliefs) about those uncertain variables.

Following Rust and Phelan 1997, we formulate our problem in terms of a value function $V_t(s_t)$, which summarizes the future consequences of choosing each alternative (retirement or working) while accounting for the uncertainty an individual is faced with. This function represents the expected discounted utility of an individual who is in state s_t and follows an optimal decision j from time t onwards until she reaches the final period T (set at the year where the individual is 70 years old):

$$V_t(s) = \max_j E\left[\sum_{t=1}^{T} \beta^t U_t(s_t, d_t, \theta_u) | s_t = s\right]. \tag{2.1}$$

This value function, as well as its associated decision rule (j), depends on the underlying primitives of the structural model $(U_t(.), p_t(.))$, which, on their turn, depend on two sets of parameters. The first set of parameters is the vector $\theta = (\theta_u, \theta_p, \beta)$, which contains the preference (θ_u) and beliefs (θ_p) parameters and the discount factor (β). The second set of parameters is the vector τ that contains the rules of the pension system (such as the normal retirement age, the accumulation of pension entitlements and the level of benefits). The details of how these rules influence the computation of pensions are given later.

By our assumption on the partition of the state variables, $s_t = (x_t, \varepsilon_t)$, and integrating out the unobserved state variables, we can derive a conditional choice probability $P_t(d|x, \theta, \tau)$ that provides the basis for estimating the unknown model parameters. More specifically, through the assumption of a type 1 extreme value distribution of $\varepsilon_t(d_t)$, a multinomial logit representation of the conditional choice probability can be derived[4]:

$$P_t(d = d'|x, \theta, \tau) = \frac{\exp(v_t(x_t, d = d', \theta, \tau))}{\sum_{d \in D(x_t)} \exp(v_t(x_t, d, \theta, \tau))},$$

where $D(x_t)$ is the choice set in state x_t and v_t is the expected value function defined recursively by:

$$v_t(x_t, d_t, \theta, \tau) = u_t(x_t, d_t, \theta_u) + q_{t+1}\beta \sum_{\delta \in \Delta} \left\{ \log \sum_{d_{t+1} \in D(x_{t+1})} \exp(v_{t+1}(x_{t+1}, d_{t+1}, \theta, \tau)) \right\} p_t(x_{t+1}|x_t, d_t, \theta_p, \tau),$$

where q_{t+1} is the individual's survival probability from period t to $t+1$, and Δ is the set of possible transitions.

The expected value function $v_t(.)$ is related to the value function $V_t(.)$ defined in equation (2.1) by the following identity:

$$V_t(x_t, \varepsilon_t) = \max_{d \in D(x_t)} [v_t(x_t, d_t, \theta, \tau) + \varepsilon_t(d_t)].$$

The next step consists of defining the likelihood function to estimate the model parameters. Given panel data on observed state and control variables, x_t^i, d_t^i (where i is an index to refer to an individual in the data, $i = 1, ..., I$), we can estimate the model parameters by looking for the value of θ such that the following likelihood function is maximized:

$$L(\theta) = L(\theta_u, \theta_p, \beta) = \prod_{i=1}^{I} \prod_{t=1}^{T} P_t(d_t^i | x_t^i, \theta, \tau) p_t(x_t^i | x_{t-1}^i, d_{t-1}^i, \theta_p, \tau).$$

To estimate the model, we follow the two-stage estimation procedure that was proposed by Rust 1989. In a first stage, the beliefs parameters θ_p are estimated by using a partial likelihood function involving only products of the conditional probabilities $p_t(.)$. In a second stage, the estimates of θ_p are used to solve the backward recursion numerically which allows one to estimate the remaining parameters

[4]More details can be found in Rust and Phelan, 1997.

(β, θ_u) using a partial likelihood function with only products of the choice probabilities $P_t(.)$. Although this procedure is not as efficient as full maximum likelihood, Rust 1989 and Rust and Phelan 1997 argue that the efficiency loss is not too big and the computational burden is considerably reduced. Karlstrom et al. 2004 use a similar estimation procedure in their study.

2.3.2 Individual preferences

The structural part of the individual's preferences at time t are assumed to be represented by a Cobb-Douglas utility function, which implies:

$$U_t(s_t, d_t, \theta_u) = [\alpha \ln c_t + (1-\alpha)\ln l_t] + \varepsilon_t(d_t),$$

where c_t and l_t respectively denote consumption and leisure at time t. The parameter α is associated with the consumption share in the individual's full income at time t, while $(1-\alpha)$ represents the share of leisure. In the empirical analysis, we assume that α depends on the individual's gender and age (denoted by g_t and a_t respectively) which act as preference shifters.[5] In particular, we assume that $\alpha = \exp(\alpha_0 + \alpha_1 g_t + \alpha_2 a_t)/(1+\exp(\alpha_0 + \alpha_1 g_t + \alpha_2 a_t))$, where α_0, α_1 and α_2 are to be estimated. These individual preference shifters are state variables in the DP model. Coherency of the utility function is guaranteed since $\alpha \in]0,1[$.

As stated before, there are no savings in our model. As such, an individual's consumption in period t equals her income in that period. This income contains both labor income and non-labor income, where the latter contains pension benefits for individuals who are claiming benefits. In the case of leisure, we define a set of two leisure options: one leisure value that corresponds to full time working and one leisure value that corresponds with retirement. Taking into account a working week of 40 hours and 46 working weeks per year and allowing for time to sleep and personal care, we obtain $1,040$ hours of leisure for the option of working and $2,880$ hours for the retirement option.

2.3.3 Control and state variables

The next step is to carefully define control and states variables in the DP model. The constructed panel allows us to formulate a model with a four-dimensional vector of observed state variables and a one-dimensional vector of control variables.

2.3.3.1 Control variable

d_t: This binary variable denotes the employment or retirement decision. It takes the value $d_t = 1$ when the individual retires. It means that she decides to enjoy income from only state and occupational pensions and $2,880$ hours of leisure. In contrast, the decision variable takes zero value, $d_t = 0$, when the individual continues working, which means that she chooses to receive labor income (and possibly an occupational pension at a later age) and enjoy $1,040$ hours of leisure. Similar to Rust and Phelan 1997, we assume that individuals have a perfect control over their future employment status, so $e_{t+1} = d_t$ with probability 1, where e_{t+1} denotes the employment status at period $t+1$. Although individuals are uncertain about their

[5] In principle, more preference shifters can be included in the analysis. However, given the particular data at hand, we faced a multicollinearity problem when we also included variables like health status.

future income, this assumption implies that an individual who decides to continue working is committed to that decision until the next period in which she makes a new decision.

2.3.3.2 State variables

c_t: Given the assumption of no savings, consumption is set equal to the individual total annual income, that is discretized into five intervals. The total income includes labor and non labor income net of contributions. Non labor income is defined as the sum of a disability benefit, a state pension, a survivor and an occupational pension income (where some incomes, of course, are equal to zero for some states). Before retirement, the data shows that the main income source comes from labor income. After retirement, the main source of income comes from state and occupational pensions. We deduct from the total income those contributions made to the state and occupational pension systems. This in order to include a most accurate measure of income in the utility function specification of our model. The cut points for the income intervals are constructed by taking the 20th, 40th, 60th and 80th percentile of the distribution of income. For each year, the specific values of the cut points vary according to the income profile estimation discussed in the next subsection.

g_t: This binary variable denotes the gender of an individual. It takes the value of 1 for males and 0 for females.

a_t: This variable indicates the age of an individual in period t.

h_t: This binary variable captures the health status in period t, which can be good or bad. We consider individuals in bad health if they receive disability income (and are employees) according to the IPO dataset.

The unique decision (control) variable for individuals is whether to retire or to continue working. We assume that this decision is taken at the beginning of each year. This means that, at the beginning of each year, the individual observes the available information and, conditional on that, she calculates expected discounted utilities for the two alternatives and chooses that alternative which maximizes expected discounted utility. Retirement is assumed to be an absorbing state which means that if she decides to retire she will not start working again. The available information (state variables) at the beginning of each year is the income in the previous period, the pension entitlements she has built in the state and occupational pension system, the health status, the age and the current employment status. However, the individual is uncertain about future income, future entitlements and consequently future pensions. Therefore, we need to estimate the evolution of these variables and, as indicated before, we use these estimates (beliefs) in the second stage of the estimation procedure.

2.4 Estimation results

In what follows, we will first discuss the evolution of the state variables and give the (first stage) estimation results of the individuals' beliefs. Next, we will discuss the (second stage) estimation results of the preference parameters.

2.4.1 Evolution of state variables and estimation of beliefs

The transition matrix $p_t(.)$ represents the individual's beliefs about her future health, income and life expectancy. Similar to Rust 1989, Rust and Phelan 1997, and Karlstrom et al. 2004, we impose two main assumptions: the assumption of individual rational expectations and exclusion restrictions. The first assumption implies that beliefs about future health, income and life expectancy coincide with the population behavior of these variables. The second assumption implies that we can decompose the transition matrix as a product of conditional probabilities for each component and estimate them separately. The following equation shows the decomposition of $p_t(.)$:

$$p_t(x_{t+1}^i|x_t^i, d_t^i, \theta_p) = \pi_y(y_{t+1}^i|y_t^i, d_t^i, h_t^i, a_t^i) \times \pi_h(h_{t+1}^i|h_t^i, a_t^i) \times \pi_q(q_{t+1}^i|q_t^i, g_t^i, a_t^i),$$

where $\pi_y(.)$ is the conditional transition probability for income, $\pi_h(.)$ is the conditional transition probability for health status and $\pi_q(.)$ is the conditional survival probability. Each of these conditional probabilities can be estimated independently of each other in the first stage of the estimation procedure. In the second stage, we use these estimates to solve the DP model by recursion in a numerical way and estimate the remaining parameters (β, θ_u).

2.4.1.1 Labor income

We ran two regressions to estimate the labor income profiles, the fixed and the random effects model. Our preferred specification assumes that (log) income from employment is explained by demographic variables such as age, health, gender, origin and birth year. As expected, we find that under both models age and health have a positive and significant effect on income (see Table 2.3). Older workers expect a 3.3 percent annual increase in their income whereas healthy workers expect an increase of respectively 19.5 and 27.9 percent relative to unhealthy workers all else equal. Note that the estimated coefficient of health status varies depending on the model chosen.

Table 2.3: Estimation of labor income

	Fixed effects	Random effects
Age	0.033^{**}	0.033^{**}
	(0.003)	(0.003)
Male		0.397^{**}
		(0.022)
Native		0.111^{**}
		(0.031)
Health	0.195^{**}	0.279^{**}
	(0.038)	(0.032)
Birthyear		0.041^{**}
		(0.003)
Constant	8.313^{**}	-72.11^{**}
	(0.143)	(6.665)
σ_u	0.636	0.558
σ_e	0.188	0.188
ρ	0.920^{**}	0.898

Note: A double asterisk refers to significance at the 95 percent level. Standard errors in parentheses

Recall that the fixed effects model allows us to control for omitted time-invariant variables such as education level. Since we lack educational information in all of the data sets that we use, this model might be more appropriate than the random effects model. We performed a Hausman test and we find that the fixed effects model is to be preferred over the random effects model. Note that in our preferred model, the unobserved heterogeneity (ρ) is still important and significant. 92 percent of the unexplained variation is captured by the individual effects.

Next, we predict the evolution of labor income by using the fixed effects estimates and the estimated unobserved effects. Following Rust 1989 and Rust and Phelan 1997, we do this by using the continuous (log) income variable and we obtain increasing income profiles explained by the significantly positive effect of age. Nevertheless, since we do not observe many individuals working after 65 years old, we stop the prediction at this age and assume that individuals who work beyond that age keep their last income. This assumption is reasonable if we consider that few employers and employees at this stage take actions to significantly improve productivity.

The discretization of the income distribution is an important concern in our model. To keep it simple and numerically feasible, we only consider five grids but it could easily be extended to an arbitrary number of grids, with the unavoidable increasing computation time though. For example, Rust and Phelan 1997 consider 25 intervals for the total family income, whereas Karlstrom et al. 2004 consider 400 intervals for the labor earnings. However, they mention that their estimation results were rather robust with smaller numbers of points. In our case, we compute the cut points for the intervals by taking the 20th, 40th, 60th and 80th percentiles of the distribution and we repeat this process during the whole period of analysis.

We then estimate the labor income transition probability matrix conditional on previous income, health status and age category, $\pi_y(y_{t+1}|y_t, d_t = 0, h_t, a_t)$. We decide to condition on the last two variables because both have a positive and significant effect on the income profiles according to the fixed effects model. We also take this decision because we do not have enough observations per age if we additionally consider other variables such as origin or gender. Moreover, in order to have enough observations, we group individuals in five classes, where each class contains five age intervals starting from 58 years old until 70 years old (the last class includes individuals between 65 and 70 years old). We assume that individuals in each class share the same transition probabilities.[6]

Table 2.4 displays the income transition probability matrix. Each cell displays the probability of being in each quintile in period $t+1$ conditional on having been in a specific quintile, and having a specific health status and age category in period t. For instance, a 58 years old individual who has been observed in good health status and in the first quintile of the distribution has a 97 percent probability to stay in the same quintile in the next period, whereas a 60 years old individual has only a 94 percent probability to remain in the same quintile.

2.4.1.2 Pension income

The next step is to estimate the pension entitlements and the pension income transition probability matrix, $\pi_y(y^i_{t+1}|y^i_t, d^i_t = 1, a^i_t)$. We model the AOW (state pension) entitlements in a deterministic way by assuming that in each year the individual resides in the Netherlands she accumulates 2 percent of the full benefit. This is based on the current regulation which says that the accumulation of AOW entitlements depends on the years an individual has lived in the Netherlands from his 15 birthday until he is 65 years old. The accrual rate (ar) is assumed to be 2 percent for each year in which there is insurance and 0

[6] We do not have enough observations for individuals in the last class, so we have assumed that they share the same transition probabilities as individuals in the previous category (60-64 years old).

Table 2.4: Transition probability matrices: Labor income

Good health; age 58-59	$\hat{\pi}_y(y_{t+1}\|y_t, d_t = 0, h_t = 1, a_t)$				
y_t	20^{th}	40^{th}	60^{th}	80^{th}	100^{th}
20^{th}	0.97	0.03	0.00	0.00	0.00
40^{th}	0.02	0.94	0.04	0.00	0.00
60^{th}	0.00	0.02	0.95	0.03	0.00
80^{th}	0.00	0.00	0.00	0.97	0.03
100^{th}	0.00	0.00	0.01	0.04	0.95
Good health; age 60-64	$\hat{\pi}_y(y_{t+1}\|y_t, d_t = 0, h_t = 1, a_t)$				
y_t	20^{th}	40^{th}	60^{th}	80^{th}	100^{th}
20^{th}	0.94	0.04	0.00	0.01	0.00
40^{th}	0.06	0.84	0.10	0.00	0.00
60^{th}	0.02	0.02	0.85	0.12	0.00
80^{th}	0.01	0.03	0.03	0.78	0.15
100^{th}	0.00	0.00	0.04	0.04	0.91
Good health; age 58-59	$\hat{\pi}_y(y_{t+1}\|y_t, d_t = 0, h_t = 0, a_t)$				
y_t	20^{th}	40^{th}	60^{th}	80^{th}	100^{th}
20^{th}	1.00	0.00	0.00	0.00	0.00
40^{th}	0.13	0.87	0.00	0.00	0.00
60^{th}	0.00	0.17	0.83	0.00	0.00
80^{th}	0.00	0.00	0.25	0.50	0.25
100^{th}	0.00	0.00	0.01	0.04	0.95
Good health; age 60-64	$\hat{\pi}_y(y_{t+1}\|y_t, d_t = 0, h_t = 0, a_t)$				
y_t	20^{th}	40^{th}	60^{th}	80^{th}	100^{th}
20^{th}	0.75	0.00	0.25	0.00	0.00
40^{th}	0.00	0.67	0.33	0.00	0.00
60^{th}	0.23	0.00	0.77	0.00	0.00
80^{th}	0.00	0.00	0.00	1.00	0.00
100^{th}	0.00	0.00	0.04	0.04	0.91

percent for the years the individual lives abroad (b_t^i):

$$AOWentitlement_t^i = (50 - b_t^i)ar.$$

The expected state pension, $AOWpension_t^i$, is obtained by simply multiplying the entitlement with the annual AOW benefit at year t, $AOWbenefit_t^j$. The annual AOW benefit for a single equals 11,211 euros in 2005. This amount is multiplied by 100 percent if the individual has lived in the Netherlands for at least 50 years, whereas it is multiplied by a lower percentage if the individual has lived abroad. Since we do not have a variable that records years lived abroad, we are unable to accurately compute the expected state pension. Therefore, we use the origin of individuals as a proxy variable in our estimation. If the individual was born in the Netherlands, we assume that she retires receiving the full benefit of 11,211 euros. If the individual was born abroad, she is assumed to have gaps equivalent to 30 percent, so she only gets an incomplete state pension of 7,848 euros.[7]

In the case of the OP entitlements estimation, it is important to realize that the accumulation follows the income process because individuals accumulate a percentage of their income for each year they continue working. In our case, entitlements accumulated until 2007 are recorded in the "Pension entitlements" data set. Therefore, we use these as starting points of the optimization problem. For the future entitlements estimation, we use the estimated labor income profiles ($\hat{y}_t^i$) and apply the following formula:

$$OPentitlement_t^i = (\hat{y}_t^i - franchise_t)r[(1 + index)^\wedge(65 - a_t^i)].$$

The equation says that for a a_t^i years old employee, we assume that she will accumulate entitlements until she reaches the age of retirement and this process depends on the earnings net of franchise, accrual rate (r) and indexation. In our model, labor earnings are those estimated before (using the fixed effects model) and the franchise variable remains the same as the one observed in 2007. The accrual rate equals 2 percent and we do not assume any indexation. The expected annual OP pension is then computed by adding accumulated entitlements until 2007 with the future (accumulated) entitlements until retirement:

$$OPpension_t^i = Accumulatedentitlement_t^i + [\sum_{a_t^i}^{64} OPentitlement_t^i].$$

The total pension income is obtained by simply adding the AOW and OP annual pensions. Similarly as with labor income, we first estimate both pensions using the (log) continuous variables and then, we discretize total pension by taking the same quintiles as for labor income. Next, we estimate the transition probability matrix conditional on previous income and age category, $\pi_y(y_{t+1}^i | y_t^i, d_t^i = 1, a_t^i)$. We decide to condition only on age in order to have enough observations and reasonable probabilities. Similar as before, we group individuals in five age categories which are assumed to have the same transition probabilities.[8]

Table 2.5 displays the estimated transition probability matrix for pension income. Similar as for the transition for labor income, the conditional probabilities tend to decrease with age.

[7] Assumption based on projections of future pension incomes according to Statistic Netherlands.

[8] Individuals in the last category share the same transition probabilities as individuals in the previous category (60-64 years old).

Table 2.5: Transition probability matrices: Pension income

Age 58-59	$\hat{\pi}_y(y_{t+1}\|y_t,d_t=1,a_t)$				
y_t	20^{th}	40^{th}	60^{th}	80^{th}	100^{th}
20^{th}	0.94	0.04	0.01	0.01	0.00
40^{th}	0.06	0.86	0.06	0.01	0.01
60^{th}	0.00	0.09	0.79	0.11	0.01
80^{th}	0.00	0.00	0.11	0.82	0.07
100^{th}	0.00	0.00	0.01	0.11	0.88
Age 60-64	$\hat{\pi}_y(y_{t+1}\|y_t,d_t=1,a_t)$				
y_t	20^{th}	40^{th}	60^{th}	80^{th}	100^{th}
20^{th}	0.84	0.05	0.05	0.02	0.05
40^{th}	0.03	0.77	0.09	0.00	0.11
60^{th}	0.00	0.06	0.70	0.11	0.13
80^{th}	0.01	0.00	0.06	0.79	0.14
100^{th}	0.01	0.01	0.00	0.04	0.95

2.4.1.3 Health status

Being healthy or not affects the ability to work and enjoy leisure and this effect might be related with previous health status. To construct this variable we use the information recorded in the IPO dataset and we consider individuals in bad health as those who receive a disability benefit.[9] Individuals in good health then are those who do not receive this benefit. The advantage of this measure is that it is objective because individuals should be evaluated to determine their degree of disability. Only handicaps above a certain level lead to the right to receive a benefit which implies that individuals must be in a very bad health to claim this benefit. The disadvantage, however, might be that it underestimates the proportion of individuals in bad health, since it is possible to be in bad health and less able to work without receiving any disability income.

After constructing the health variable, we estimate the transition probabilities from the results of a dynamic probit model which accounts of unobserved heterogeneity and previous health condition. In this specification, we control for the initial condition problem by an approach suggested by Wooldridge 2002. We find that the lagged value of health has a stronger effect than other variables alone (which points to strong state dependence). This implies that the chance to continue being in good health depends strongly on having been in good health in the previous period. We also performed a static probit with age, gender and origin as explanatory variables. We found only a significantly estimated (negative) effect of age on the probability of being in good health and a considerable amount of unobserved heterogeneity. Therefore, we decided to stick to the dynamic probit model. Obviously, in our specification, unobserved heterogeneity (ρ) is still present but less prominent than in the static case (67.9 percent versus 86.6 percent of the unexplained variation is captured by individual effects). Table 2.6 shows both the static and dynamic probit estimations.

Table 2.7 shows the estimated health transition probability matrix, $\pi_h(h^i_{t+1}|h^i_t,a^i_t)$. We only condition on previous health status and age because they are the only significantly estimated explanatory variables in our dynamic probit specification. In this case, we do not need to group individuals by age intervals because we obtain reasonable probabilities by age. Our results show that the estimated probability of remaining in good (bad) health as a function of previous good (bad) health status is pretty high, which

[9] Note that individuals can receive a disability benefit while still working.

Table 2.6: Estimation of health status

	Static probit	Dynamic probit
Age	-0.045**	-0.041*
	(0.018)	(0.022)
Male	-0.222	-0.051
	(0.186)	(0.217)
Native	0.145	-0.116
	(0.250)	(0.321)
Lagged health		1.871**
		(0.536)
Initial health		4.637**
		(1.692)
Constant	7.300**	0.243
	(0.999)	(1.184)
σ_u	2.546	1.455
	(0.086)	(0.454)
ρ	0.866**	0.679**
	(0.008)	(0.136)

Note: Dependent variable: good health status. A double asterisk refers to significance at 95 percent level; an asterisk refers to significance at the 90 percent level. Standard errors in parentheses.

Table 2.7: Transition probability matrices: Health status

Age=58	$\hat{\pi}_h(h_{t+1}\|h_t,a_t)$	
h_t	Good	Bad
Good	0.99	0.01
Bad	0.12	0.88
Age=60	$\hat{\pi}_h(h_{t+1}\|h_t,a_t)$	
h_t	Good	Bad
Good	0.99	0.01
Bad	0.11	0.89
Age=64	$\hat{\pi}_h(h_{t+1}\|h_t,a_t)$	
h_t	Good	Bad
Good	0.99	0.01
Bad	0.01	0.99

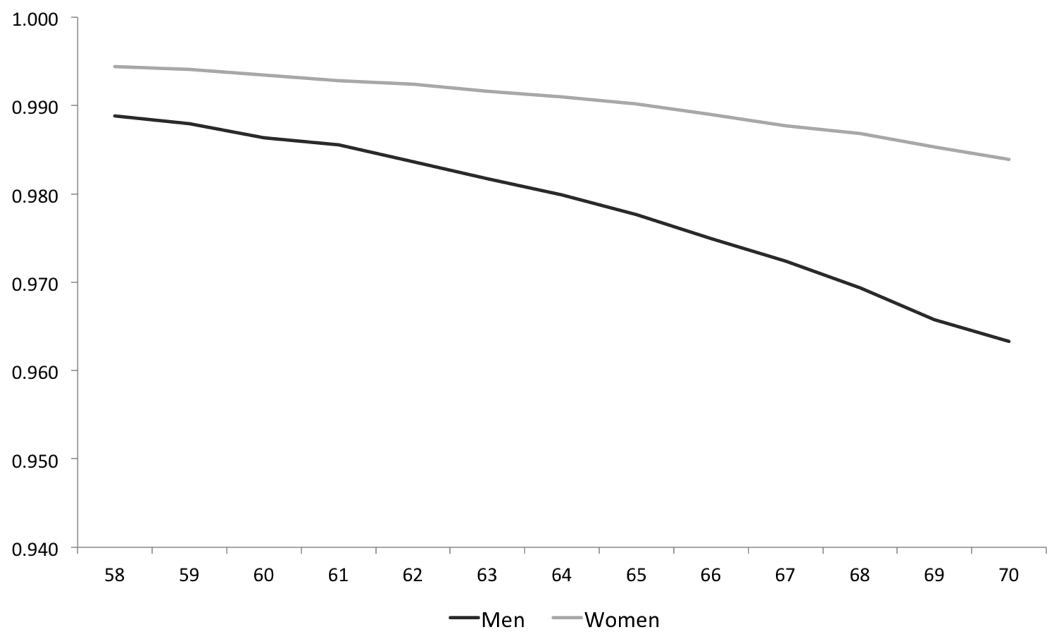
reflects the strong state dependence discussed before. The negative effect of age on health status is only slightly observed in the probability of remaining in good health, whereas it is more clearly observed in the probability of remaining in bad health. For instance, a 58 years old individual has a 99.9 percent chance to remain in good health status if she has been observed in good health in the previous period, whereas she has 85.8 percent chance to continue having a bad health if she had a bad health status before. In contrast, for a 64 years old individual, the chance to remain in bad health status is much higher (99.5 percent) and the chance to continue having a good health status is practically unchanged.[10]

[10]For individuals older than 66, we assume that they have the same transition probabilities as individuals at this age.

2.4.2 Survival

The survival probabilities are specified exogenously by age and gender from the current mortality tables available at Statistics Netherlands. As expected, probabilities decline with age for both genders and they are higher for woman across all age cells (see Figure 2.1).

Figure 2.1: Conditional survival probabilities by age and gender



We did not estimate the survival (mortality) transition probabilities for single individuals because we do not have enough observations to do it consistently, especially for the very old. Most probably, we would have had to use external data sources and extrapolation techniques in order to match mortality rates from Statistics Netherlands projections (see Rust and Phelan 1997). For simplicity, we just use the current mortality tables conditional on age and gender and we assume that single individuals have the same survival probabilities as the entire population.

2.4.3 Estimation results with respect to the preference parameters

We next use the estimates of the conditional transition probabilities in the second stage of the estimation procedure to solve the model numerically and estimate the preference parameters (β, θ_u). We do this by incorporating the conditional probabilities in the expected value function $v_t(x_t, d_t, \theta, \tau)$ of the model. This means that, in each time period, individuals calculate their expected discounted utilities for the two alternatives (retire or work) using their probabilities of possible changes in health status, income and survival and choose the alternative that maximizes their expected discounted utility.

Table 2.8 shows the estimates of the parameters of the utility function.[11] Our baseline results indicate that individuals value consumption and leisure differently depending on whether they are male or female. Men tend to value consumption more than women. Therefore, men are willing to give up less consumption in exchange for leisure as women would do. We also observe a positive impact of age on

[11] As often happens in this literature, we set the discount factor equal to 0.97. Though the discount factor is in principle identifiable, there is not sufficient variation in the data to effectively estimate the discount factor.

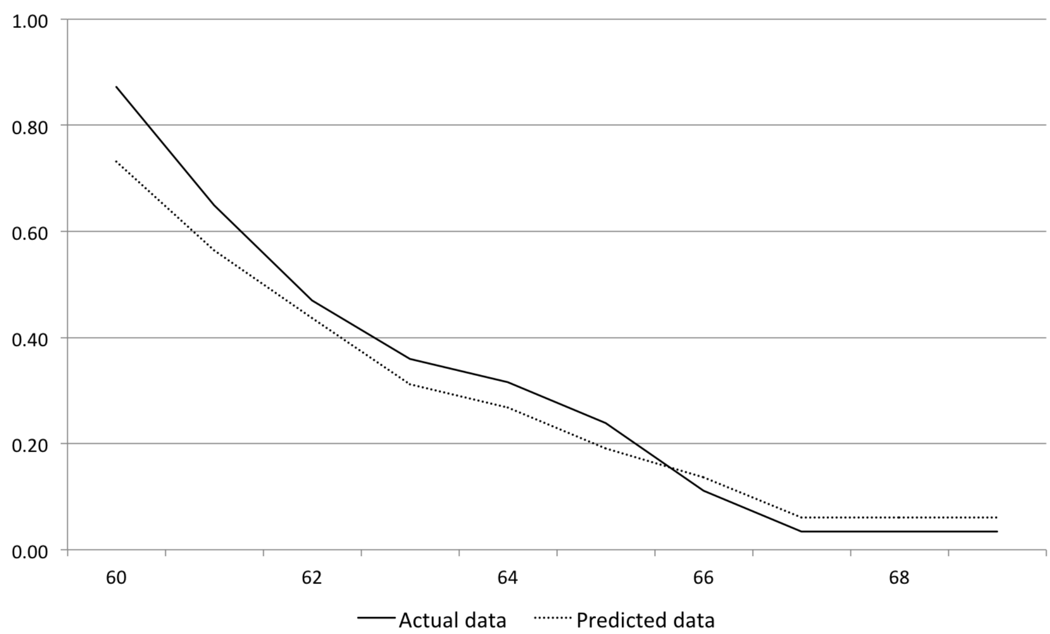
Table 2.8: Model estimation result

Parameters	Estimate	Standard errors
α_0 (constant)	-0.0714	0.9698
α_1 (male)	0.2126	1.3715
α_2 (age)	1.4120	2.7431
Loglikelihood	-1280.0179	-

utilities. This somewhat counterintuitive effect may be explained by the fact that the age range of the observations in our study is much smaller than the age range typically observed in labor supply studies of prime age workers. Note that the standard errors are only indicative given the nonlinearity of the DP model. As demonstrated by Gregory and Veall 1985, the outcome of a Wald test depends on the particular parameterization of the hypothesis under study. As a result, to analyze the joint significance of the parameters associated with age and gender for the decision to retire, we performed a likelihood ratio test where the unrestricted model is the one with a constant and age and gender parameters, whereas the restricted model is a constant only model, where age and gender do not influence the retirement decision. The test statistic is equal to 24 and is to be compared with the critical value of 5.99, which comes from a chi-squared distribution with two degrees of freedom. We thus strongly reject the null hypothesis and conclude that age and gender jointly influence the retirement behavior of individuals.

Figure 2.2 plots the observed and predicted cumulative probability functions of labor force participation for all individuals. We observe that our estimated parameters allow us to plot a predicted probability that captures the main pattern in the data. However, the model turns out to underpredict (overpredict) the probability to continue working for cohorts below (above) 65.

Figure 2.2: Cumulative distribution of labor force participation



In the analysis by gender, we observe that the model is able to predict the labor participation of men better than the women's. Given their preferences, men face a larger trade off between leisure and consumption, which makes them better off when they continue working. Women, on the contrary, turn

Table 2.9: Actual and predicted nonparticipation rates (percentages)

Age 2007	Actual	Predicted
60-64	21.2	15.8
65-69	55.9	28.8
70+	66.7	82.5

out to be better off by retiring and enjoying more leisure given their preferences. This behavior is quite well predicted by the model in the case of men. However, in the case of women, the model underpredicts the probability to work. The reason is that we do not have enough observations and variation by age to properly capture their retirement behavior.

Shifting attention to nonparticipation, the model predicts increasing nonparticipation rates as individuals get older, which is in line with the observed data (see Table 2.9). However, the model predicts lower nonparticipation rates compared to the actual data for cohorts below age 69 and higher retirement rates for cohorts equal or above age 70. Recall that individuals above 70 years old are imposed to be retired because there is not enough information for the model to correct predict behavior. This is because the model is able to capture the main pattern of the data but not the exact number of individuals retiring in each age cell. This might be related to the fact that we could not disentangle between full-time and part-time workers. It might be the case that pension entitlements for those individuals who work part time are not enough to compensate them to quit their job.

In the analysis by health status, we observe that healthy individuals tend to stay longer in the labor force than individuals who have a bad health status. Given their preferences, individuals in good health face a larger trade off between leisure and consumption, which makes them better off if they continue working. Individuals in bad health, on the contrary, turn out to be better off by stop working and enjoying more leisure given their health condition. This behavior is quite well predicted by the model using only estimates for age and gender (see Figures 2.3 and 2.4, and Table 2.10 for nonparticipation rates). We do not estimate a parameter for health status since age is probably correlated with health. Considering our definition of bad health, our results also indicate that those who are receiving disability benefits are less likely to participate in the labor force across all ages and they start to retire much earlier than those who do not receive this benefit. Heyma 2004 finds similar results in the sense that restricting eligibility for disability benefits hardly increases Dutch elderly labor force participation because individuals in bad health still retire early through the unemployment route.

In short, we observe that as individuals get older their labor supply declines considerably and this varies by age and gender. It is important to recall that our results are only valid for singles and it is difficult to extend them to individuals living in couples. As it is acknowledged in the literature of family retirement behavior, there is an association between the retirement decision of husbands and wives. More specifically, the retirement status of one member has an impact on the probability to retire of the other (Blau 1998; Gustman and Steinmeier 2000). Spouses may also have different preferences and thus react differently to a policy change relative to singles. For instance, Mastrogiacomo, Alessie, and Lindeboom 2004 estimate retirement models for singles and married couples using SEP data and they find that there are large variations in the retirement patterns of different types of households in the Netherlands. Coefficients associated with the financial incentives for both singles and couples are significant but they differ in magnitude and sign. Singles have lower participation rates and higher exit rates out of work than married individuals. Among singles, the divorced and the widowed remain longer in the labor force as compared to those never married. Among couples retirement seems to be related.

Figure 2.3: Cumulative distribution of labor force participation by health status: Actual

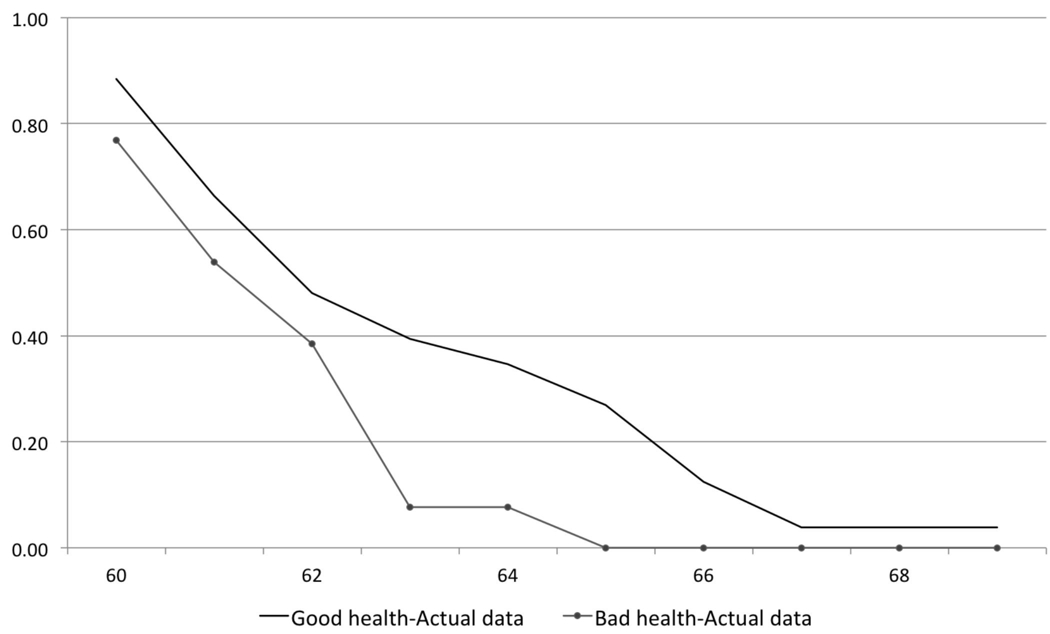


Figure 2.4: Cumulative distribution of labor force participation by health status: Predicted

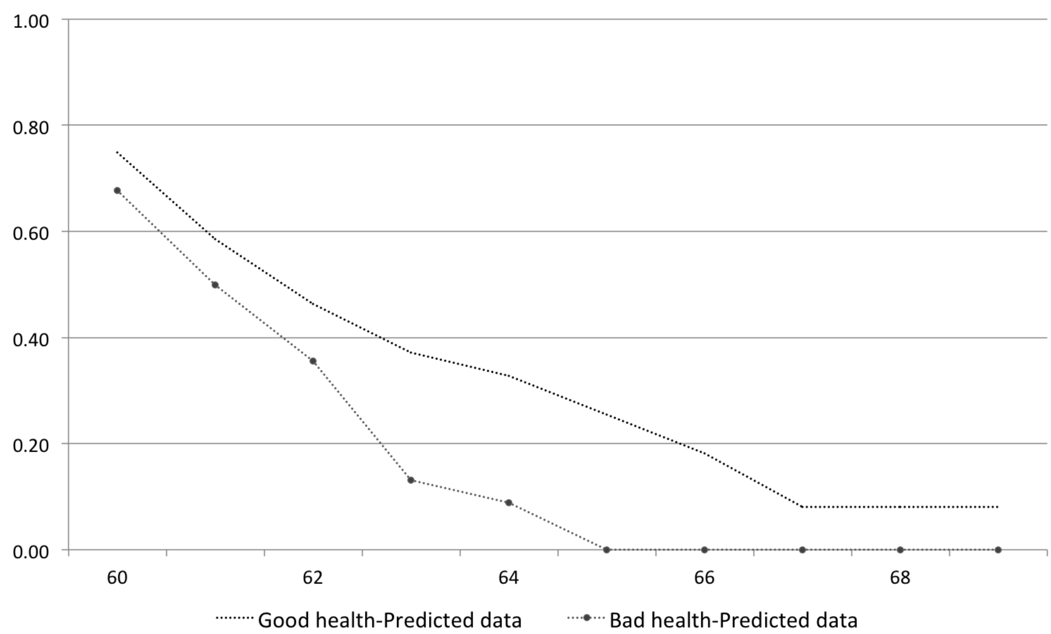


Table 2.10: Actual and predicted non employment rates by health status (percentages)

Age 2007	Good health		Bad health	
	Actual	Predicted	Actual	Predicted
60-64	19.2	11.6	52.2	80.6
65-69	56.1	26.7	50.0	89.6
70+	66.7	82.5	-	-

It is also important to highlight that our findings are specific for the Netherlands. In this respect, it is interesting to mention Heyma 2004 who also uses a DP model and Dutch data to evaluate the relevance and interaction of additional pathways into retirement (i.e. disability insurance, unemployment insurance). The author also simulates three examples of labor force participation policies for the Netherlands: restriction of disability benefits, flexible pension schemes, and a combination of lower wages and easier working conditions. Simulation results show that only the restriction on disability benefits has an effect on labor force participation, though the magnitude is very small. The other policies lead to ambiguous or no effects.

2.5 Simulation

On July 12, 2012, a broad coalition of Dutch political parties passed a law that aims at the gradual increase of the legal retirement age from 65 to 67. In this section, we use the estimated model to simulate the effects of this current policy reform. The content of the reform has been extensively discussed in the Netherlands in the past few years.

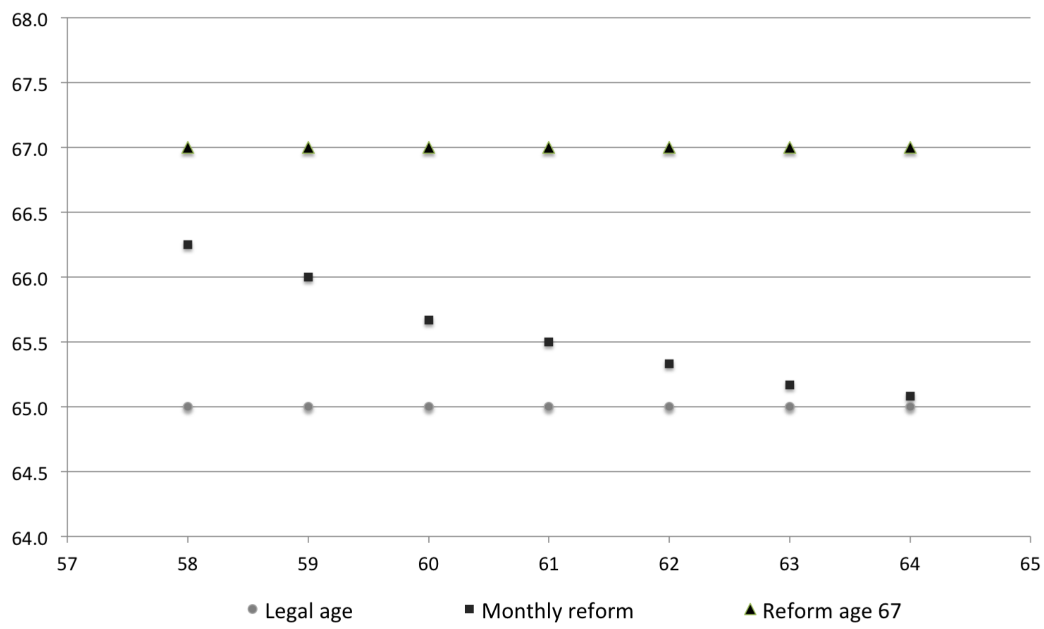
The basic idea of the reform is that the retirement age increases more for younger individuals than for older ones. For individuals who are close to their retirement (specifically, those who are aged 61 or more) it is planned that they have to wait a few months after their 65th birthday before they can claim a complete public pension, whereas for younger individuals (aged 60 or less) it is planned that they have to wait more time; around one year after their 65th birthday. For instance, an individual who is 64 years old (and therefore close to retirement) has to wait only one more month, whereas an individual who is 59 years old (and therefore relatively far from retirement) will have to wait one full year.[12] Figure 2.5 shows the proposed legal retirement ages associated with the pension reform (labeled as “Monthly reform” in the graph).

According to this reform, the retirement age would be increased even more for individuals below 58 years old (up to 67 years old). However, we are not able to capture this effect because we do not have individuals below 58 years old in our sample. Therefore, to have an idea about the possible impact of the reform when it is fully implemented and individuals have to wait until 67 years old to receive the public pension, we also simulate a hypothetical reform to increase the legal retirement age from 65 to 67 (labeled as “Reform age 67” in Figure 2.5). In this hypothetical reform all individuals below or equal to age 64 are immediately affected by the policy change and individuals above this age are not affected.

We simulate both reforms by evaluating the effects on the labor force participation of the workers in the sample. To model the reforms we assume that an individual’s retirement behavior is solely affected

[12] The retirement age is increased even more for individuals below 58 years old. However, these cohorts are not included in the sample.

Figure 2.5: Legal retirement age in pre- and post-reform scenarios



by the economic incentives implied by the regulation of the legal retirement age. This means that the only change compared with our baseline model (discussed in the previous section) is that we increase the age at which individuals start to receive the complete public pension. We thus leave the level of the pension benefits unaffected. To be consistent, individuals also contribute to the public pension system until they are able to receive the pension. We also assume they continue accumulating entitlements in the second pillar. In our model, the impact of the reforms takes place through the non-labor income in the budget constraint, which in turn affects the decision whether to work or retire. Our exercises differ from the ones made by Heyma 2004 in which policies were oriented to reduce benefits (i.e. disability benefits) or to increase labor participation through changes in wages and working conditions. In our case, we are interested in measuring the impact of changing eligibility rules through the retirement age.

Following the current reform rules, we find that there is little change in individual retirement behavior: individuals postpone their retirement by less than one month on average. Table 2.11 shows that in absence of the reform (baseline scenario), the expected retirement age is 64.53, whereas in the simulation of the reform that gradually increases the retirement age ("Monthly reform"), the expected retirement age increases only to 64.57. This result slightly varies by gender. Women's optimal behavior is to continue working for a bit more than men, but none of them postpone retirement for more than one month.

On the other hand, in the case of the hypothetical reform in which individuals have to wait until 67 to receive the public pension ("Reform age 67"), results show a bigger change in retirement behavior. As we can observe in Table 2.11, on average, individuals postpone retirement by 7 months (the difference in the expected ages of retirement under the hypothetical reform and baseline scenarios is 0.56 years) and this result varies by gender. Men expect to postpone retirement for around 10 months whereas women only 5 months, which implies that the hypothetical reform has stronger effects on men's retirement behavior relative to women's.

Table 2.12 gives the expected retirement age by health status computed on the basis of the baseline and simulations results. According to the "Monthly reform" simulation scenario, individuals in good

Table 2.11: Expected retirement age by gender

Singles	Baseline (Legal age: 65)	Monthly reform (Monthly increase up to 67)	Reform age 67 (Legal age: 67)
Total	64.53	64.57	65.08
	(1.35)	(1.38)	(0.62)
Men	64.13	64.15	64.98
	(1.56)	(1.54)	(0.35)
Women	64.68	64.73	65.11
	(1.23)	(1.29)	(0.66)

Note: Standard deviations in parentheses.

Table 2.12: Expected retirement age by health status

Singles	Baseline (Legal age: 65)	Monthly reform (Monthly increase up to 67)	Reform age 67 (Legal age: 67)
Good health	64.73	64.77	65.09
	(1.09)	(1.14)	0.60
Bad health	62.37	62.38	64.07
	(1.92)	(1.92)	1.70

Note: Standard deviations in parentheses.

health decide to work half a month more than in the baseline scenario. For individuals in bad health, the simulation results show that the alternative to retire continues to be very attractive, so they do not decide to postpone retirement with virtually no change in their expected retirement age as a consequence. In the case of the hypothetical reform, the effects are again stronger. Healthy individuals optimally postpone retirement for around 4 months and as we already explained above the reason is that health status turns out to be a key determinant of the labor supply response, so by postponing the age of retirement, the alternative to retire becomes less attractive in comparison with the alternative to work. By facing a bigger trade off, healthy individuals are better off if they continue working. In the case of bad health status, the results are not significant because we only observe few individuals in this status.

This type of policy change has typically been studied from the point of view of its labor supply consequences. Empirical evidence suggests that reforms in the rules of Social Security and, in particular, in the retirement age have effects on labor force behavior. However, the estimates of the effect vary.

In line with the U.S. literature on the ex-ante evaluation of the Social Security reform of 1983, we find that this type of reform indeed encourages individuals to work longer since the alternative to retire is less attractive given the benefit reduction caused by postponing the age of retirement. However, in most of the literature the response is small. Mitchell and Fields 984a, 984b, predict that a three-year increase in the normal retirement age from 65 to 68 would increase the actual retirement age by about 1.6 months. Similarly, Gustman and Steinmeier 1985 estimate the effect of raising the normal retirement age from 65 to 67 and they find that the two-year increase would rise the actual retirement age by about 2 months; which is somewhat larger than Mitchell and Fields 984a, 984b. In their exercise, Coile and Gruber 2000 find there is a modest effect of raising the normal age of retirement from 65 to 67 on labor force participation basically because they account only for the financial implications of this reform and they argue they do not consider the "norms" effect which might move the spike at age 65 to the right as the legal retirement age increases. Further, Panis et al. 2002 also simulate an increase in the normal age of retirement (to age 66 and gradually to age 68) and find that the magnitude of the effect on the incentives to work at any given age is small.

Other authors have found more significant effects. In their exercise for Sweden, Karlstrom et al. 2004 find also a upward shift in the cumulative distribution function of labor supply meaning that more individuals decide to continue working instead of retiring. In their model, however, they include both the effect of delaying the age of retirement and the change in the pension benefit. van der Klaauw and Wolpin 2008 also find that annual hours of work and earnings increase for single individuals when benefits are postponed until 70 years old. However, in their model, since they consider both consumption and savings decisions, consumption and net assets also fall after the age of 62, meaning that the adjustment of labor supply is not enough to compensate the fall in consumption and savings levels produced by postponing pension benefits. Rust and Phelan 1997 perform a counterfactual prediction of the impact of eliminating Social Security. They find that the optimal decision without benefits implies that individuals continue to work after the age of 65 and they interpret these results as evidence that Social Security rules have a strong incentive effect on individual behavior. Blau and Goodstein 2010 find evidence that Social Security rules matter, in particular the increases in the Delay Retirement Credit (DRC; actuarial adjustment of Social Security benefits that workers receive if they delay claiming after the normal retirement age) and normal retirement age account for between 25 and 50 percent of the increase in the labor force participation of older men. Other factors such as incentives for married women to continue working and changes in educational composition of the older male population contribute to the increase as well. However, the estimate of these reforms does not disentangle the effect of increasing the normal retirement age and the DRC.

There is also evidence of no impact on labor supply when the model accounts for borrowing constraints. In his analysis, French 2005 finds that shifting the early retirement age from 62 to 63 has almost no effect on labor force participation. The reason is because borrowing constraints do not bind for several individuals, so there is little disincentive effect on working produced by a retirement age of 62, so the change to 63 has practically no impact on retirement behavior.

Thus, it is not surprising to observe different sizes of the impact on labor supply depending on the type of the reform and the model used. In our case, we find that the reform that gradually increases the age of retirement has a rather small impact on the effective retirement age but a reform that immediately increases the legal age has a more significant impact. We also find that healthy individuals are those who are most affected by both reforms and they decide to continue working for longer time. The small impact in case of the current reform is partly explained by the design of the reform which basically increases legal age only in the first pillar of the pension system and aims to affect individuals on a gradual basis. By design, the reform aims to affect younger generations more whereas it leaves the older ones (almost) unaffected. With the data we have we are not able to capture the effect on the cohorts who are younger than 58 years old and, therefore, our results are not capturing the total effect. Thus, we also perform a hypothetical simulation to immediately increase the legal age of retirement to 67. In this scenario, we find a more significant impact on labor force participation, however is still difficult to conclude that this would be the total effect of the planned reform. To do that we would need to take into account that individual's behavior is not solely affected by economic incentives (as we do in our model where the change in the legal retirement age implies a present value benefit cut because individuals start to receive public pensions later and it enters in the model through the budget constraint) but also by non-economic incentives such as social norms and framing of behavioral responses (i.e. normal retirement age as a focal point). This could be an avenue for future research. See Mastrobuoni 2009 and Behaghel and Blau 2012 for a more detailed discussion.[13]

2.6 Conclusion

This paper uses a dynamic programming model to provide an empirical analysis of how pension system rules affect the labor force participation of older single individuals in the Netherlands. We model these labor supply responses in the presence of uncertainty on income, health status and lifespan. We use a panel based on administrative data which has the main advantage of having new and accurate information on pension entitlements. As far as we know, an analysis based on administrative micro data on pension entitlements has not been undertaken yet, because it has become only recently available in the last years.

Our model is able to capture the main patterns of the sample data. Overall we observe that as individuals become older they are more willing to sacrifice income for leisure which translates into more individuals deciding to leave the labor force. We also find that gender and health status are key determinants for the labor force participation (or retirement behavior). Not very surprisingly perhaps, men and individuals in good health tend to stay longer in the labor force than women and individuals in bad health.

The paper also discusses the simulation of the impact on retirement behavior of a current reform that gradually increases the legal retirement age. The idea of the reform is that the legal retirement age increases more for younger individuals than for older ones. Our simulation results show that there is very small impact on the effective retirement age. An individual's optimal behavior is to postpone retirement by less than one month on average. A second simulation that immediately increases the age of retirement to 67 years old is performed to have an idea about the long run effect on the planned reform. In this case, the impact is larger as expected and it is around 7 months. There are differences by gender and health status. Men and individuals in good health are those who are most affected by the reform and they decide to continue working for somewhat longer.

Although the model performs relatively well given the available information, several extensions of the model seem worthwhile to explore. Data limitations prevented us though to analyze these issues further. Firstly, one could consider more alternative labor supply choices. Some individuals might want to work only part-time to enjoy more leisure especially when they are close to retirement (see, e.g., Kantarci and Soest 2008, on the issue of partial retirement). This might bring better approximations to actual behavior of older individuals. Secondly, one could consider more health status categories. Our current definition of health status might underestimate the proportion of unhealthy individuals, so a more detailed health variable might be useful. Third, the savings decision as a second control variable could be introduced. To allow for savings decisions is an important aspect in life cycle models, since they allow individuals to smooth consumption and protect themselves against future shocks. The level of

[13] Mastrobuoni 2009 finds that increasing the Normal Retirement Age (NRA) each year by 2 months (U.S. reform), has an effect of 50% for both men and women, which means that the average retirement age increases by 1 month every year. His identification strategy assumes that after controlling for labor, financial and demographic characteristics, any observed trend-discontinuity in the average retirement is due to the change in the NRA. This strategy captures not only the financial or wealth effect (response to the benefit cut implied by the increase in the NRA) but also the effect of social norms such as the fact that some workers look at the NRA as a focal point. Behaghel and Blau 2012 provides evidence of framing effects in retirement behavior by using a reform that increases the NRA from 65 to 66 in two-month increments per year of birth. They find a relatively large impact on benefit claiming but a small impact on labor force exit behavior and self-reported retirement. The results, however, consider both the wealth effect and the behavioral effect.

one's savings might also be a determinant for the early retirement decision in the sense that wealthier individuals might have enough savings to compensate reductions in their retirement income when leaving the labor force before the legal retirement age. Fourth, the small effects we found might be (partially) explained by the absence of social norms and framing effects. This could be incorporated in future versions of the model. Finally, another extension of our model could be to consider the intra-household decision making process in which we can distinguish between decisions made by one-person (single) and two-person (couple) households, since the latter were not included in the current analysis.

Chapter 3

The effects of access to health insurance for informally employed individuals in Peru

This chapter is a coauthored work with Miguel A. Carpio and Tobias J. Klein.[1]

3.1 Introduction

In developing countries, a large number of individuals is not covered by health insurance (Banerjee et al., 2004; Banerjee and Duflo, 2007). The reasons for this are manifold. On the one hand, individuals are often used to relying on informal forms of risk-sharing instead of being covered by formal health insurance and therefore do not demand insurance.[2] On the other hand, it has in the past not been seen as the role of the government to provide health insurance. Moreover, the World Health Organization and the World Bank stress that even when there is public health insurance then it often does not reach large parts of the population and especially not the poorest families because it is only provided to the minority of employees in the formal sector (WHO, 2010; Hsiao and Shaw, 2007). For instance, until recently, less than 20 percent of the individuals in Peru have been covered by health insurance programs.

This may be a cause of concern, because health insurance does not only protect individuals against catastrophically high health expenditures (Wagstaff and Doorslaer, 2003). It may also encourage them to see a doctor instead of simply buying medication, and thereby promotes appropriate treatment of illnesses that is often argued to be lacking (Commission on Macroeconomics and Health, 2001; International Labour Office et al., 2006).

In reaction, many low and middle income countries have recently introduced Social Health Insurance (SHI) targeted to the poor, with the goal to improve their health and to provide them with financial

[1]We are grateful to Matin Salm and seminar participants at the First Annual Congress of the Peruvian Economic Association, Diego Portales University, Vanderbilt University, Erasmus University Rotterdam and in Tilburg for helpful comments. Maria Eugenia Guerrero provided excellent research assistance. We also thank Juan Pichihua from the Peruvian Ministry of Economics and functionaries of SIS and MINSA for providing useful information and for their comments and suggestions. Bernal: University of Piura, Netspar, CentER, Tilburg University; e-mail: noelia.bernal@udep.pe. Carpio: Universidad de Piura; e-mail: miguel.carpio@udep.pe. Klein: Netspar, CentER, Tilburg University; e-mail: T.J.Klein@uvt.nl. The first author is grateful for financial support from Netspar and the Sociale Verzekeringsbank.

[2]See for instance Fafchamps (1999), Jowett (2003), Chankova et al. (2008), Giné et al. (2008) and Dercon et al. (2008).

protection against the financial consequences of health shocks. Typically, coverage by SHI may or may not be free and implies that individuals receive medical attention from a service provider. The costs are usually paid out of a designated government budget that is completely or partially funded by taxes.

However, to date, it is not well understood through which channels health insurance coverage contributes to the well-being of individuals and how this relates to the incentives provided to health care providers and patients.[3] In particular, it is not well understood to what extent it is possible to encourage individuals to invest into preventive care, and to seek medical attention rather than simply buying medication, and what the effects of preventive care and medical attention are on health outcomes.

One reason why we lack a deeper understanding is because it is challenging to quantify the effects of insurance coverage at the individual level. There are two main reasons for this. First, we lack detailed data on health care utilization and health outcomes, and second, it is not easy to control for selection into insurance. The second problem means that a regression of utilization or outcome measures on insurance coverage will yield biased results and will not estimate the causal effects of health insurance. In this paper, we make progress in both directions. We use rich survey data from the National Household Survey of Peru ("Encuesta Nacional de Hogares", ENAHO) for the year 2011 to evaluate the impact of access to the Peruvian Social Health Insurance called "Seguro Integral de Salud" (SIS) for individuals outside the formal labor market on a variety of measures for health care utilization and health indicators.

The Peruvian case is interesting because SIS resembles European public health insurance systems in that it covers health care expenditures, but does not strongly incentivice individuals to invest into preventive care. Coverage is for free for eligible individuals, and those who are not covered by SIS typically lack insurance coverage.[4] SIS was created in 2001 and subsequently reformed. *Prima facie*, these reforms have been successful, as coverage by SIS is substantial and enrollment has increased from 20 percent in 2006 to almost 50 percent of the total population in 2011, reaching a relatively high enrollment rate among the SHI programs in low and middle income countries (Acharya et al., 2013). Yet, even though aggregate data suggest that some health outcomes improved since the program has been implemented—between 2000 and 2010 total maternal and child mortality rates decreased from 185 to 93 and 33 to 17, per 100,000 and 1,000 thousands of children born alive, respectively[5]—to date there is no study evaluating the effects of insurance coverage on preventive care, health care utilization and health outcomes at the micro level that controls at the same time for selection into insurance.[6]

In this paper, we use rich individual-level data to provide such an evaluation. We control for selective uptake of insurance by exploiting the institutional setup in Peru that gives rise to a Regression Disconti-

[3] See for instance Abel-Smith (1992), International Labour Office et al. (2006), Pauly et al. (2006), and Acharya et al. (2013).

[4] The latter may, however, seek medical attention on a pay-as-you-go basis and buy medication without a prescription.

[5] National Institute of Statistics and Informatics (INEI)-National series, http://series.inei.gob.pe:8080/sirtod-series/. Dow and Schmeer (2003) perform an analysis of the effect of health insurance in Costa Rica on infant and child mortality. They use aggregate level data at the county level and control for fixed effects. As in Peru, increases in insurance coverage over time went along with decreases in infant and child mortality.

[6] There are other studies relating enrollment to health care utilization and outcomes. For instance, Parodi (2005) finds that SIS enrollment increases the probability that poor pregnant women give birth in a formal institution. However, he does not control for selection into insurance. Bitrán and Asociados (2009) find that SIS increases utilization for both preventive and curative services (with biggest impacts on treatments for diarrhea and acute respiratory infections for children) and that SIS reduces the likelihood that insured individuals incur in out of pocket health expenditures. The authors control for selection into insurance but they do not use the mean test used by SIS at the period of analysis. Instead, they use consumption per capita to evaluate eligibility. On the other hand, there are also studies that are more public policy oriented. For example, Arróspide et al. (2009) explore the design and effectiveness of the SIS's institutional budget and provide policy recommendations; whereas Francke (2013) analyzes whether the implementation of the SIS program has played a role in extending health coverage in Peru.

nuity Design (RDD). The reform was passed in 2009 and, since the end of 2010, a household is eligible for the program if a welfare index called Household Targeting Index (Índice de Focalización de Hogares, IFH) that is calculated by Peruvian authorities from a number of variables is below a specific threshold. Variation in this index around the threshold provides a natural experiment that we exploit to conduct our analysis. Importantly, households do not know how the index is calculated, and hence the incentive to manipulate it—a common threat to studies based on such a RDD—is not present here. We, however, have access to this information and use it to re-calculate the composite index of economic welfare.

Our analysis is for individuals working in the informal sector. As in many other developing countries, formally employed individuals constitute a smaller group and are covered by a different scheme. For informally employed individuals the IFH index is the most important criterion to determine eligibility. The analysis focuses on individuals from the Lima Province because the regulatory framework mandates that the eligibility evaluation using the IFH index should be first applied in this area. In 2012, almost one third of the population lived in the Lima Province and half of Peru's GDP was generated there. This part of the country is very densely populated and therefore there are enough health care centers so that we can exclude that either a large distance or absence of the staff explain that individuals do not demand health care.[7]

Exploiting the unusually rich data from the ENAHO of Peru on health care utilization and health outcomes, as well as the discontinuity generated by the institutional rules, we find that insurance coverage has positive effects on the utilization of health services. Being insured increases the probabilities of visiting a doctor by 51.5 percentage points, of receiving medicines by 52.7 percentage points, and of requiring medical analysis by 20.6 percentage points. Regarding curative use, we find that insured individuals are 56.4 percentage points more likely to seek medical attention (i.e. in public hospitals and health care centers) and 25.7 percentage points more likely to have access to a surgical procedure. SIS does not provide strong incentives to invest into preventive care. Nevertheless, we find that insured women of childbearing age are more likely to control their pregnancy than uninsured women and individuals are more likely to be vaccinated. This is in line with the stark decrease in maternal and child mortality that was observed after the program was introduced. At the same time, as could be expected, we find no effects of insurance coverage on other forms of preventive care. As for health expenditures, we find that health insurance coverage goes along with increases in health expenditures and their variability. Moreover, using an estimator of quantile treatment effects, we find that the effect is particularly pronounced in the top end of the distribution. Our interpretation of this finding is that individuals health insurance coverage results in individuals seeking professional medical advice more often and then become convinced that they also should spend more on their health themselves. Finally, as is common in such studies, we do not find clear effects on health outcomes at the micro level. Our interpretation of this, in part, is that on the one hand these are longer term effects that are not measurable yet. On the other hand, it has to do with the subjectivity of the health report that may be influenced by the increased

[7] According to Banerjee et al. (2004) these are two prime reasons why households in Rajasthan in India spend a considerable fraction of their budget on health care, essentially buying drugs. In other parts of Peru, utilization of health services has been limited by supply constraints. The Office of the Ombudsman reports that most of the 4,500 health care centers around the country are not sufficiently equipped to provide inpatient care (Defensoría del Pueblo, 2013). An official technical committee concludes that the biggest challenge faced by the Peruvian health system between 2009 and 2011 is the shortage of supply of health services in many parts of the country, because it lacks adequate capacity infrastructure, equipment and human resources (Comité Técnico Implementador del AUS, 2010). Finally, also statistics from the World Bank shows that, while the average of hospital beds per 1,000 people is 1.83 for Latin America, it is only 1.55 for Peru. This also occurs with other measures of supply health services, including the number of health workers such as physicians, nurses and midwives (World Bank, 2013).

inclination of insured individuals to see a doctor. We interpret our findings in more detail by looking at them through the lens of a simple conceptual framework, or model, that we present in Section 3.2 below.

The literature on the impact of SHI for informally employed individuals in low and middle income countries is scarce, but growing.[8] Table 3.1 provides an overview over a selection of related studies, ordered by country, that are most closely related to ours. Our overall interpretation of the evidence on the effects of insurance is that as of now, more is known about the potential pitfalls than about the effects of a successful SHI program and in particular on how they depend on details of the implementation. The results presented in this paper suggest that SIS in Peru is an exception and belongs to the latter category, as does the Colombian program.[9] Interestingly, the supply-side incentives between those two countries differ in important ways. For that reason, it will be particularly interesting to compare our findings to the ones for Colombia.

Turning first to the other countries, Thornton et al. (2010) find that initial take-up of subsidized, but for-pay insurance "Seguro Facultativo de Salud" among informally employed individuals in Nicaragua was as low as 20 percent. Moreover, after the subsidy expired most who previously signed up cancelled their insurance. The specific reason they give for this is that convenience and quality of care were not adequately addressed, which means that at the margin, the price of insurance—the cost side from the perspective of individuals—plays a role, but that the bulk of individuals does not buy insurance because the associated benefits are too low. This could also be because resources were wasted either in the administration or at the health care providers. Another reason why the program did not reach its goal was that over the course of the evaluation of the program, there was a drastic change in government, and with it the design of the program. The results for the few who did sign up and kept their insurance suggest that insurance could have a positive effect in the sense that average health care expenditures, which are generally seen as too low, increased. This could, however, also be the case because those who bought insurance and kept it constitute a negative selection of risks for whom the effect of insurance is particularly high.

All three papers for Mexico investigate the effects of the "Seguro Popular" program, whose aim it is—as the SIS's in Peru—to improve access to health insurance for the poor. Unlike in the Peruvian, but like in the Nicaragua program, coverage in the Mexican program is not for free. Turning to the effects of introducing the program in Mexico, it is remarkable that the findings in all three papers consistently suggest that the demand for medical care has shifted to providers that are part of the system, and in line with this, individuals health care expenditures have been reduced, including catastrophic health expenditures. In that sense, the program was successful in being a transfer program, but less so in encouraging individuals to seek care when ill. Interestingly, as it is the case in Peru with the SIS program, policy makers have also targeted pregnant mothers, and consequently, as in Peru, there is a positive effect on obstetric utilization. At the same time, the findings do not suggest that utilization has increased for

[8] The selection of papers we discuss here is necessarily incomplete, but we believe it is to some extent representative. Acharya et al. (2013) systematically examine 64 papers on the effects of health insurance and present a review on the 19 papers that correct for selection into insurance. The review concludes that there is little evidence on the impact of insurance on health status, some evidence on utilization, weak evidence on out-of-pocket health expenditures, and unclear effects for the poorest. However, arguably, given the large variation in incentives provided by the respective institutions, it is not surprising that there is heterogeneity in the effect across countries. Giedion et al. (2013) also provide a comprehensive review classifying papers according to findings and research design. They also conclude that specific features of the design have a large impact on the likelihood that specific goals, such as increasing access or improving health, are reached. See also Abel-Smith (1992), International Labour Office et al. (2006), Pauly et al. (2006) and Dercon et al. (2008), and the references therein, for a review of the more policy-oriented literature.

[9] We provide a more in-depth discussion of the institutional details in Section 3.3.

Table 3.1: Selected Studies on the Effects of Health Insurance for Informally Employed Individuals in Developing Countries

	country	research design	findings
Thornton et al. (2010)	Nicaragua	random assignment of premiums and enrollment location, then instrumental variables estimation	low take-up, substitution towards services provided at covered facilities, reduction in out-of-pocket expenditures, but increase in total individual health expenditures
Barros (2008)	Mexico	use variation in program intensity across time and space	reduction in out-of-pocket expenditures, shift from private to public providers, negligible effect on health
King et al. (2009)	Mexico	random assignment, encouragement to enroll into health insurance program	negative effects on medical spending, no effects on medication spending, utilization and health outcomes; reduction in catastrophic expenditures
Sosa-Rubi et al. (2009)	Mexico	latent class model, parametric identification	positive effect on obstetric utilization; negative effect on utilization in non-accredited state-run clinics, negative effect on private clinics, positive effect on utilization in accredited state-run clinics
Wagstaff (2010)	Vietnam	triple-differencing	reduction of out-of-pocket spending, no impact on utilization
Bauhoff et al. (2011)	Georgia	sharp discontinuities at two regional eligibility thresholds	no effects on utilization, health behavior, management of chronic illnesses, and patient satisfaction; decrease in out-of-pocket expenditures, no reduction of risk of high outpatient expenditures, but reduction of risk of high inpatient expenditures
Miller et al. (2013)	Colombia	fuzzy regression discontinuity design	positive effect on preventive care and health, reduction of financial risk

other types of care.

The design of the program in Georgia is very similar to the one in Peru. However, and in contrast to our findings, Bauhoff et al. (2011) find no effect of insurance coverage on utilization. They argue that this is due to the fact that individuals were not aware of the fact that they were covered or that there were administrative problems that caused them to indeed not be covered, that they did not make use of the services because the program did not cover drugs, and because the perceived quality of the services was low. Therefore, it is not surprising that their findings are different from ours for Peru.

Turning to Colombia, and comparing the results to the ones in this paper for Peru, it becomes clear that the effects of insurance coverage depend on the design of the system. In Colombia, private insurers mainly receive a capitation fee and therefore have incentives to increase preventive services on the one hand and to limit total medical expenditures on the other. And indeed, Miller et al. (2013) mainly find effects on preventive care. In Peru, SIS covers both preventive and curative services and doctors are reimbursed on the basis of the treatments they provide. Hence, participating hospitals and health care facilities do not have an incentive to discourage curative treatments or medical procedures in favor of preventive services. This explains why in Peru most of the effects are on curative use.

We proceed as follows. After outlining our conceptual framework in Section 3.2, Section 3.3 discusses the institutional background and provides details on the SIS program. In Section 3.4 we provide information on our data and in Section 3.5 we formally describe the econometric approach. Results are presented in Section 3.6 and results of a sensitivity analysis are presented in Section 3.7. Section 3.8 concludes that on the one hand, the evidence suggests that the program was well-designed in the sense that—unlike in most other countries—enrollment was high and the effects on utilization were positive and sizable, but that on the other hand, measuring the effect of the program on health remains a challenge—as it also is in the western world.

3.2 Conceptual Framework

In this section, we lay out a simple framework, or model, that we use to interpret our results. It is inspired by the model of moral hazard and consumer incentives in health care by Zweifel and Manning (2000), but tailored towards our setup.[10] Our framework is also related to the Grossman (1972) model of health investment, the model of health behavior by Gilleskie (1998), and the dynamic panel data model by Adams et al. (2003) who find a causal effect of health on wealth for elderly health-insured Americans, but no effect of wealth on health. We keep the presentation informal.

At any point in time, individuals are endowed with a health stock and face the risk of being hit by a negative health shock. The corresponding arrival rate and intensity, respectively, depend on whether individuals have invested into their health by means of healthy behavior, their level of health, as well as their life style, including which job they work in. Arrival rate and intensity also depend on the level of care they exercise, for example to prevent accidents from happening.[11]

[10] Zweifel and Manning (2000) provide a more formal model. See also Cutler and Zeckhauser (2000) on the optimal design of health insurance. Both papers provide excellent reviews of the respective relevant, partially overlapping literature.

[11] A reduction of preventive effort or care that is due to them being covered by health insurance is commonly termed *ex ante* moral hazard. Conversely, the increase in the demand for medical care once we control for the risk is termed *ex post* moral hazard. If higher risk types, in the absence of moral hazard, buy insurance, then one speaks of adverse selection in the Akerlof (1970) sense. See for instance Zweifel and Manning (2000). The empirical literature on moral hazard and adverse selection is still scarce, but growing. Arguably, this is because it is very hard to measure either of the two. Chiappori (2000) provides a

Individuals may enroll into social health insurance. If they are sufficiently poor, i.e. if a welfare index is below a certain threshold, then this is for free. Otherwise, they can buy coverage for a monthly premium. Although there is no economic reason why there should be a substantial difference between a zero price and a small positive price, this may have important behavioral implications, as pointed out by Shampanier et al. (2007).[12]

Social insurance covers a list of treatments at specified locations. The prime reason for buying insurance is that it provides access to care and changes its price.[13] Individuals can always buy private insurance that may or may not be more generous. Regular dependent employees are covered by another social insurance scheme, independent of whether or not they are poor.

One reason not to enroll is the perception that even though health insurance buys individuals access to doctors this is is not valuable because advice obtained from them is often of low quality, and therefore insurance is not worth its (opportunity) cost, including the time it takes to enroll.[14] But individuals may also choose not to enroll for other, non-economic reasons.[15]

Individuals may not know themselves which treatment is optimal. They can seek medical attention at a doctor's office or in a hospital. Certain treatments are covered by the social health insurance, which means that then they pay nothing for the visit. But there are also services that are not covered. In that case, going to the doctor may go along with an increase in out-of-pocket expenditures.[16] This is a form of what has been termed supplier-induced demand (McGuire, 2000)—something that may or may not be beneficial to the individual. In Peru, doctors are reimbursed for the treatments they provide. In that sense, there is no explicit incentive for them to encourage the individuals to invest into preventive care—possibly even to the contrary. In contrast, in Colombia, doctors mainly receive a capitation and therefore have a higher incentive to invest in preventive care.

Importantly, and in contrast to what is common in developed countries, individuals can buy all drugs at the pharmacy. That is, there are no prescription drugs. Not seeing a doctor may be reasonable if individuals know about their condition and which drugs will help them. However, individuals may be

broad review of the early literature. Chiappori and Salanié (2000), Abbring et al. (2003), and Abbring et al. (2003) investigate moral hazard in the market for car insurance. Finkelstein and Poterba (2004), Bajari et al. (2006), Fang et al. (2006), Aron-Dine et al. (2012) and Einav et al. (2011) study adverse selection and moral hazard in the context of health insurance in developed countries.

[12]This could also be part of the reason why take-up was low in Colombia, for instance, as pointed out above. If this is indeed the case, then there is a clear policy implication: if it is desired to have high enrollment rates, then small fees are likely dominated by zero fees, because small fees will not help finance the insurance scheme, but will have a substantial negative effect on enrollment.

[13]Another reason to enroll is risk-aversion. Alderman and Paxson (1992) provide an early synthesis of the related literature. Gertler and Gruber (2002) analyze the extent to which poor households in Indonesia are able to smooth consumption when they are hit by a health shock. They infer that health problems have large welfare costs, and conclude that public disability programs and subsidized healthcare could improve consumption insurance. Chetty and Looney (2006) present a model that illustrates that consumption fluctuations can underestimate the welfare costs of health shocks if households are highly risk averse. Pauly et al. (2008) use data from the World Health Survey for 14 developing countries and show that risk averse individuals may benefit from having access to health insurance, out of a pure consumption motive. Mohanan (2013) shows that households faced with shock-related expenditures are able to smooth consumption on food, housing, and festivals, with small reductions in educational spending, and that debt was the principal mitigating mechanism households used, leading to significantly larger levels of indebtedness.

[14]Das et al. (2008) provide evidence pointing towards such low quality advice, at least in other low-income countries.

[15]Non-enrollment into free (net of the opportunity cost of time) state-provided schemes is a well-documented phenomenon in the U.S. See, for instance, Blank and Card (1991), Blank and Ruggles (1996), and Currie and Gruber (1996). Also in other contexts, it is argued that individuals make dominated choices (see for example Choi et al., 2011, and the references therein).

[16]Wagstaff and Lindelow (2008) focus on the effects of health insurance on financial risk in China and find that health insurance coverage increases the risk of incurring high and catastrophic spending, respectively. They argue that this is because insurance encourages individuals to seek care and this ultimately leads to higher expenditures that they then cover themselves.

wrong or lack a diagnosis to buy the right drugs, and the pharmacist may not be able to help them with their choice. Therefore, not seeing a doctor has potentially adverse effects on health.[17] Conversely, if they do see a doctor and he prescribes a drug, then the individual will obtain it for free if he has insurance coverage and the drug is in the list of drugs that are covered.

Finally, when asked about their health, individuals may answer that they are of worse health when covered by the insurance. Strauss and Thomas (1998) argue that the reason for this is that insurance coverage encourages them to see a doctor more often, and that he then makes them more aware of their health problems. Sen (2002) distinguishes in this context between "internal" and "external" views of health and stresses that "the patient's internal assessment may be seriously limited by his or her social experience", such as seeing a doctor or not.[18]

To summarize, in the simple model outlined above, not all individuals may enroll into health insurance. Once covered, they are likely to see a doctor more often, which is a pure price effect because the price for doing so is either unchanged for the doctors where they cannot receive treatment for free, or the treatment is now free, which increases demand for this service. By the same token, we also expect utilization of other services to increase, including inpatient care. We expect out-of-pocket expenditures to decrease for covered treatments and medication, but it may be that it increases or decrease for non-covered treatments and medication, because of supplier-induced demand. Finally, for the reasons given above, preventive care may increase or decrease, and also health reports may be affected in either way.

3.3 Institutional Background

3.3.1 The Bigger Picture

Before 2001, health services were provided by the Ministry of Health (MINSA), the social security system ("EsSalud"), as well as private clinics and practices. Generally speaking, these providers catered to different groups of the population and did not cooperate with one another (Cetrangolo et al., 2013; Francke, 2013).[19]

MINSA runs a network of hospitals and health care centers that serve the general public. These are the services poor individuals demand and pay for if they are not insured. Next to that, EsSalud provides health insurance to formally employed individuals and maintains its own facilities for the provision of care. Enrollment into health insurance, either EsSalud or private insurance, is mandatory for dependent employees and voluntary for self-employed. Finally, the private sector offers services at relatively high prices. Consequently, these services are only affordable to more wealthy individuals who are also able to buy private health insurance.

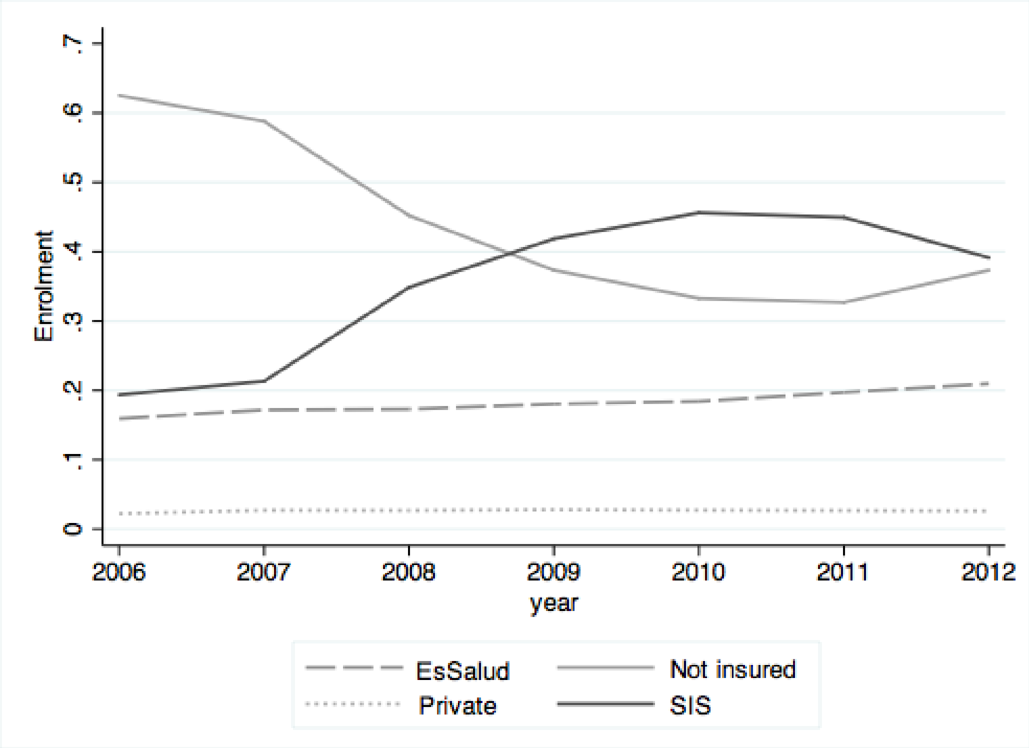
The welfare program "Seguro Integral de Salud" (SIS), whose effect we evaluate in this paper, was introduced in 2001. Its goal is to improve access to health care services for individuals who lack health insurance, giving priority to vulnerable population groups that live in extreme poverty (Arróspide et al., 2009). In 2009, an important reform took place. There were two goals. The first was to improve the eligibility evaluation process. The second was to provide health insurance to a larger part of the popu-

[17] Laing et al. (2001) discuss the scarce evidence on this and provide suggestions on how to improve the use of medicines in developing countries.

[18] See also the discussion of various biases in self-assessed health measures that are discussed in Murray and Chen (1992).

[19] In principle, MINSA is responsible for the regulation of the whole health system. However, in practice, it does so in a relatively passive way (World Bank, 2006).

Figure 3.1: Health Insurance Coverage in Peru over Time



Notes: Own calculations based on ENAHO survey for the years 2006-2012. See Section 3.4 for details on the data set and in particular our estimation sample for the year 2011. Here, we use the entire sample.

lation. To achieve these goals, among others, the budget dedicated to SIS was increased and eligibility rules were changed.[20]

The creation of SIS and subsequent reforms led to a substantial increase of health insurance coverage over time. Bitrán and Asociados (2009) and Francke (2013) provide an interesting analysis of the SIS's coverage evolution and its relevance within the Peruvian health system in general. In our case, we used data from the ENAHO to characterize the evolution over time. Figure 3.1 shows that SIS coverage increased from 20.0 percent of the population in 2006 to 44.7 percent in 2011, which means that by then SIS was the main health insurance provider. In contrast, the coverage of EsSalud and private providers remained stable over the years. However, 32.4 percent of the population did still not have any type of insurance coverage in 2011.[21]

[20]Before April 2009, in principle, SIS used a Household Welfare Index ("Índice de Bienestar de Hogares", IBEH) to determine eligibility. However, the IBEH criterion was not strictly applied in practice.

[21]There are at least three reasons why the uptake in SIS is not 100 percent. First, perception of low quality might play a role in the sense that despite the insurance is for free advices obtained from doctors might be perceived as of low quality, and therefore insurance is not worth its cost, including the time it takes to enroll. Second, there could be a non-economic reasons not to enroll such as the distance between individuals and the health care facilities or cultural differences (Parodi, 2005). This is an important issue especially in rural areas. A third reason is that there has been administrative constraints such as the fact that individuals need an ID to apply for the insurance, however, there are many individuals who lack of it. This issue is (again) particularly important in rural areas.

3.3.2 Seguro Integral de Salud

If eligible, individuals have the possibility to enroll into SIS at a number of places, including MINSA facilities. They are covered as soon as eligibility is confirmed, which is usually a matter of days. Then, they receive the health services that are offered at MINSA facilities and that are part of the benefit package.

The aim of the government was to target particular, poor groups in the population. Ideally, eligibility should be based on accurate information on income at the level of the individual or family. However, such information is typically not available in developing countries because a large part of the population works outside the formal sector and therefore does not pay income taxes and social security contributions. Eligibility for SIS is therefore based on the so-called Household Targeting System ("Sistema de Focalización de Hogares", SISFOH). For this, a unified household registry is maintained and is used to calculate targeting indicators at the level of the family (see SISFOH, 2010). Data are collected by government officials using a standardized form. It includes questions on, amongst other things, housing characteristics, asset possessions, human capital endowments and other factors.

The most important targeting indicator for SIS is the IFH index.[22] It is a linear combination of the variables in the household registry that takes on lower values for households that are more poor. Appendix C explains in detail how the IFH is constructed, including the complete list of variables and their weights.

A household is eligible for SIS if the IFH index, water expenditures and electricity expenditures are all below respective regional-specific thresholds.[23] If no information for water and electricity expenditures is available, then a household is eligible if its IFH index is below the threshold. In case one of the household members works in the formal sector, then eligibility is related to income. Moreover, if the monthly wage is greater than 1,500 Soles, or 570 U.S. dollars, then the household is not eligible for a social program, unless either water or electricity service expenditures are below their thresholds.[24]

Importantly, potential beneficiaries are not aware of the exact details of the eligibility rules. Whereas they intuit the importance of their answers to the questions of the government official, they do not know how exactly the IFH index is calculated and what their cutoff value for eligibility is. SISFOH does not inform households about the value of their index and only provides the result of the eligibility evaluation.

SIS offers a comprehensive package of health care benefits. It is estimated that SIS covers 65 percent of the total disease burden in the country (Francke, 2013). Table 3.11 and 3.12 in the Appendix provide a

[22] Something important to mention is that SISFOH was established in 2004 and, by 2008, three main results were expected: i) a national, complete and updated Household Registry with the corresponding eligibility status using the IFH index; ii) three social programs (including SIS) would fully adopt this criterion to select their beneficiaries and; iii) the rest of social programs would begin using it. However, administrative and political barriers postponed reaching these results as planned. Only in the year of 2010, the Household Registry and eligibility status (including index's weights) were finished and became available for authorities. At the end of that year, SIS was the first social program to adopt the new criterion (see Llanos and Rosas, 2010 and Regulation RJ-N063-2011 for more details).

[23] For Lima, these thresholds are 55 for the IFH, 20 Soles for water expenditures and 25 Soles for electricity expenditures. This corresponds to 7.6 and 9.5 U.S. dollars, respectively. Table 3.17 in the Appendix provides the complete set of thresholds by geographic areas.

[24] One may wonder whether the SIS program creates incentives to transit between formal and informal status. We do not find evidence of that. We have explored our sample data and run some OLS regressions to analyze this potential issue in two ways. First, following Card and Shore-Sheppard (2004), we explore whether there has been crowding out from private providers or EsSalud to SIS (which would be consistent to the idea of incentives to leave formality due to SIS). Second, we analyze whether enrollment to SIS has a significant effect on informality. No significant estimates are found. Furthermore, formality is a complex decision made by firms taking into account cost-benefit analysis of several variables (i.e. taxes, formal health insurance for workers, financial credit). Thus, individuals who work in these firms might have little influence on this decision.

detailed list of services covered by SIS together with the maximum levels of coverage. Coverage includes obstetric and gynecology interventions, pediatric interventions, neoplasm or tumor interventions, transmittable and non-transmittable disease's interventions, chronic and degenerative disease's interventions and emergency care. It also includes outpatient medical-surgical intervention and hospitalization, as well as coverage of high-cost diseases. There are no waiting times or latent periods. But there are maximum levels of coverage in terms of the number of medical attentions. For instance, for preventive care, SIS covers up to 10 treatments to control pregnancy, ultrasounds, lab tests and supplements of iron and folic acid. Regarding curative use of outpatient services, doctor visits and minor surgeries are covered without any limit (including its medications). In the case of inpatient services (with or without surgeries), extra diagnosis and maximum levels are applied.

There are two additional plans for self-employed individuals and to employees of small firms, respectively. The latter are not seen as dependent employees and therefore do not have to be enrolled in EsSalud. Both plans are not free of charge, but involve enrollment at a rate below the actual cost. Moreover, they involve a slightly different benefit package. However, these two additional plans are not important in practice. Administrative statistics from SIS show that the main plan targeted to the poor reaches 12.7 million individuals, or 99.8% of the entire SIS population.[25] In this paper, we focus on the effects of the first plan and refer to it simply as the SIS plan.

MINSA is reimbursed for the services it provides. This is done out of the SIS budget and at fixed rates that are based on estimates of the costs plus a markup. The rates are approved by MINSA in the form of regulation that is updated on a regular basis. This means that, as opposed to Colombia, the system offers no incentives to health care providers that are related to preventive care. At the same time, it does also not provide incentives that limit curative use.

In our study period, some of the treatments and services that are covered by SIS suffered from a number of substantial supply limitations. First, there was a lack of equipment in MINSA hospitals. According to Defensoría del Pueblo (2013), which performed a supervision of a sample of hospitals at a national level in 2012, 20 percent of them lack at least one piece of equipment required for inpatient surgery and 15 percent report to have problems with at least one other input needed for performing surgery. Second, there has been a shortage of dentists and ophthalmologists. The rate of odontologists per ten thousand inhabitants is one of the lowest among all medical professionals (Giovanella et al., 2012) and it is even lower when they work as providers for SIS (Defensoría del Pueblo, 2013). Likewise, only a small number of ophthalmologists provides services to SIS participants, which in turn limits the use of ophthalmological care. Only recently, and after our study period, the National Ophthalmological Institute, the largest provider in Peru, joined the list of SIS providers. Third, even though drugs are officially covered by SIS, according to the information in the ENAHO 2011, 37 percent of the covered individuals report to have paid for drugs received at the hospital level and 9.7 percent report to have paid for it at the health care centers level (Defensoría del Pueblo, 2013). This may be related to a cut that SIS experienced in its budget, which resulted in a failure to transfer resources to MINSA, which in turn motivated some hospitals to charge for hospitalization, regardless of insurance status. Patients are referred from health care centers to hospitals when the formers do not have specific medical specialties to perform proper diagnosis or treatments. Once at the hospitals, patients are less aware about the services they are freely entitled to as participants of SIS or they are not able to find all the medications they need.

[25] See SIS Statistic Report, available at http://www.sis.gob.pe/Portal/estadisticas/index.html, accessed September 2013.

Taken together, the supply limitations imply that some patients were not able to receive some treatments and may have been asked to pay for other treatments that were actually formally included in the SIS package, especially when they received treatment in a hospital.

3.4 Data

The paper uses cross-sectional data from the ENAHO for the year 2011, which is representative at the level of each of the 24 departments that comprise the country. This survey fits our purpose because it provides information on health care utilization, health expenditures, health outcomes, insurance status, and the information needed to re-compute the IFH index. Information is collected using face-to-face interviews with one or more respondents per household, who are also asked to provide information on the other household members.

SIS is targeted to individuals who work in the informal sector. Therefore, for our analysis, we select individuals that belong to a household in which no member is formally employed.[26] This group comprises approximately 60 percent of the entire sample. Second, we focus on individuals from the Lima Province because, as described in Section 3.3, the regulatory framework mandates that the IFH targeting rule should be applied in this area in 2011 and afterwards to the rest of the country. Our sample contains information on 4,161 individuals after the two exclusions criteria are applied.

We construct our treatment variable using information on enrollment in SIS and in EsSalud. The reason is that some individuals who were actually enrolled in SIS may have wrongly stated to have been enrolled in EsSalud, because both are public insurance programs. While in principle SIS enrollment is at the household level, there are households in our data in which some members state that they are enrolled and other members state that they are not. For the results presented here we use this information as stated by the individuals, because we believe that this corresponds most closely to what individuals actually base their decisions on.[27] Participation in EsSalud is also recorded in the survey. Similar as in the case of SIS, we consider individuals (not households) enrolled into EsSalud as it is reported in the survey.

Table 3.2 and 3.3 provide summary statistics for the main variables that we use in the analysis. We distinguish between three sets of variables. The first one is the participation variable defined as having public health insurance. The second set contains variables related to utilization of health services including health expenditures, and the third set comprises variables of health report. The columns in the two tables contain the summary statistics for the whole sample and for the sample broken down by participation status and eligibility.

In 2011, 38.0 percent of the sample population was either enrolled in SIS or EsSalud. On average,

[26] We define formality as having monetary income from any wage activity. This does not include any monetary income or income from self-employment. This definition is closest to the one used by the authorities. They distinguish between those individuals whose wage is observed, who are mainly employees with a formal contract, and others. We have also explored other definitions, including being a wage worker in the main occupation, any indication of having a formal contract in the main occupation, and working in an enterprise that keeps accounting books and is affiliated to a pension system. Results remain qualitatively the same.

[27] We also explored another variable for participation status in SIS. The variable was constructed at the household level and was a dummy equal to one for individuals that belong to a household where at least one member reported to be enrolled to SIS. The coverage of SIS increased from 13 percent to 28 percent with this second variable. The main results, which we discuss in Section 3.6 below, did not change qualitatively. However, the magnitude was smaller. This is related to the econometric approach, which basically calculates the local average treatment effect as the change in the outcome divided by the change in the fraction of individuals who were insured. See also Section 3.5.

Table 3.2: Descriptive Statistics

Variable	Dummy	(1) Total $N = 4,161$		(2) Participants $N = 1,581$		(3) Non-participants $N = 2,580$		(4) Eligibles $N = 1,786$		(5) Ineligibles $N = 2,375$	
		Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
Participation											
Health Insurance	D	0.380	-	1.000	-	0.000	-	0.400	-	0.365	-
Demographics											
Woman	D	0.511	-	0.533	-	0.498	-	0.507	-	0.514	-
Age		33.014	22.250	34.366	24.737	32.185	20.540	28.292	20.695	36.564	22.718
Years of education		8.126	4.854	7.758	5.068	8.351	4.705	6.633	4.485	9.248	4.819
Number household members		4.607	2.101	4.491	1.992	4.678	2.163	4.661	1.917	4.566	2.229
Woman head of household	D	0.251	-	0.256	-	0.248	-	0.254	-	0.250	-
Annual household income (thousand Soles) 1/.		30.62	27.07	31.94	28.69	29.74	25.93	20.33	14.40	38.19	31.39
Utilization											
Any doctor visits	D	0.319	-	0.372	-	0.287	-	0.339	-	0.305	-
Medicines	D	0.456	-	0.507	-	0.426	-	0.465	-	0.450	-
Analysis	D	0.063	-	0.091	-	0.047	-	0.059	-	0.067	-
X-rays	D	0.037	-	0.054	-	0.028	-	0.033	-	0.041	-
Other tests	D	0.013	-	0.019	-	0.009	-	0.010	-	0.016	-
Dental care	D	0.118	-	0.125	-	0.113	-	0.096	-	0.134	-
Ophthalmological care	D	0.054	-	0.054	-	0.053	-	0.025	-	0.075	-
Glasses	D	0.041	-	0.040	-	0.041	-	0.019	-	0.058	-
Vaccines	D	0.109	-	0.133	-	0.094	-	0.138	-	0.087	-
Kids check 2/.	D	0.263	-	0.270	-	0.258	-	0.253	-	0.276	-
Birth control	D	0.060	-	0.063	-	0.058	-	0.065	-	0.056	-
Other treatments	D	0.234	-	0.255	-	0.222	-	0.201	-	0.259	-
Hospital	D	0.060	-	0.088	-	0.042	-	0.057	-	0.062	-
Intervention/Surgery	D	0.041	-	0.055	-	0.032	-	0.039	-	0.042	-
Pregnancy care 3/.	D	0.074	-	0.129	-	0.044	-	0.102	-	0.052	-
Child birth 3/.	D	0.033	-	0.067	-	0.014	-	0.045	-	0.023	-
Any of the above	D	0.687	-	0.739	-	0.655	-	0.677	-	0.695	-
Other medical attention	D	0.199	-	0.258	-	0.162	-	0.195	-	0.201	-

Notes: Data from the ENAHO 2011. See Table 3.13 for variable definitions. 1/. Question applied at household level: total $N = 1,129$, $N = 449$ participants, $N = 680$ non-participants, $N = 479$ eligible, $N = 650$ ineligible. 2/. Question applied for kids under 10: total $N = 649$, $N = 289$ participants, $N = 360$ non-participants, $N = 363$ eligible, $N = 286$ ineligible. 3/. Question applied for women in fertile age: total $N = 1,182$ (total), $N = 417$ participants, $N = 765$ non-participants, $N = 532$ eligible, $N = 650$ ineligible.

Table 3.3: Descriptive Statistics (continued)

Variable	Dummy	(1) Total		(2) Participants		(3) Non-participants		(4) Eligibles		(5) Ineligibles	
		Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
Health report											
Any symptom	D	0.396	-	0.394	-	0.397	-	0.444	-	0.356	-
Illness	D	0.144	-	0.156	-	0.136	-	0.147	-	0.141	-
Chronic illness	D	0.415	-	0.457	-	0.390	-	0.351	-	0.464	-
Relapse	D	0.097	-	0.123	-	0.080	-	0.086	-	0.104	-
Accident	D	0.023	-	0.025	-	0.022	-	0.026	-	0.020	-
num. days with symptom		0.134	1.122	0.159	1.299	0.118	0.998	0.162	1.263	0.112	1.003
num. days with illness		0.144	1.099	0.154	1.126	0.137	1.083	0.151	1.069	0.138	1.122
num. days with relapse		0.250	2.295	0.345	2.701	0.191	2.004	0.208	1.987	0.281	2.501
num. days with accident		0.069	1.123	0.124	1.567	0.035	0.727	0.079	1.111	0.061	1.133
Health expenditures											
Any health expenditures	D	0.571	-	0.547	-	0.586	-	0.548	-	0.588	-
Health expenditures		401.133	1154.340	0.547	1294.957	394.735	1059.202	248.033	710.470	516.265	1387.277
Var expenditures		539.212	1020.595	568.610	1163.354	521.197	922.040	429.187	586.629	621.951	1245.203
Abs expenditures		530.172	1007.187	559.612	1144.685	512.132	912.521	324.440	629.826	684.883	1193.124
Sqre expenditures		1295264	1.16e+07	1622640	1.52e+07	1094651	8778272	501719	5000706	1892010	1.47e+07
Expenditures 50	D	0.495	-	0.488	-	0.499	-	0.448	-	0.530	-
Expenditures 75	D	0.250	-	0.250	-	0.249	-	0.196	-	0.290	-
Share expenditures		0.057	0.187	0.057	0.191	0.057	0.184	0.056	0.187	0.058	.187
Var share		0.076	0.170	0.077	0.174	0.075	0.168	0.076	0.171	0.076	.170
Abs share		0.076	0.170	0.077	0.174	0.075	0.168	0.073	0.172	0.078	.170
Sqre share		0.035	0.478	0.036	0.488	0.034	0.472	0.035	0.483	0.035	.475
Share 50	D	0.500	-	0.500	-	0.500	-	0.485	-	0.511	-
Share 75	D	0.250	-	0.250	-	0.250	-	0.246	-	0.253	-
Catastrophic 5%	D	0.231	-	0.223	-	0.235	-	0.227	-	0.233	-
Catastrophic 10%	D	0.136	-	0.131	-	0.140	-	0.135	-	0.137	-
Catastrophic 15%	D	0.096	-	0.094	-	0.098	-	0.092	-	0.100	-
Catastrophic 20%	D	0.069	-	0.067	-	0.071	-	0.065	-	0.072	-
Catastrophic 25%	D	0.051	-	0.051	-	0.051	-	0.046	-	0.055	-

Notes: Data from the ENAHO 2011. See Table 3.14 and Section 3.6.2.3 for variable definitions.

individuals in the sample are 33.0 years old, half of them are woman, individuals have around 8 years of education, and average annual household income is 30,620 Soles, or 11,636 U.S. dollars. Participants are slightly older, more likely to be female, and are less educated than nonparticipants. This is not surprising since the SIS program is targeted to the poor. When we compare eligibles to ineligibles, we find similar patterns.

Turning to utilization of health services, we find that, on average, 31.9 percent of the individuals has visited a doctor in the last month, 45.6 percent have received medicines and 6.3 percent have had medical analysis in the same period. 4.1 percent of the individuals have received an intervention or have undergone surgery in the last 12 months. Focusing on women, we observe that those who received pregnancy care in the last 12 months represent 7.4 percent of the sample of the women who are in fertile age. Utilization is generally higher for individuals who are covered by health insurance and for eligible individuals.

Shifting attention to health reports, when individuals in the full sample are asked if they experienced any symptom in the last month, 39.6 percent provide an affirmative answer. At the same time, only 14.4 of the individuals report that they suffered from illnesses. However, as already pointed out in Section 3.2, we should be cautious when interpreting this finding. After all, such reports can depend on whether or not individuals are being told by a doctor about their health. Therefore, even if they are objectively less healthy, they may report to be of better health if they do not see a doctor.

Regarding health expenditures, Table 3.3 shows that 57.1 percent of the individuals had some health expenditures in the last 12 months. The average annual expenditures are around 401.1 Soles, or 152 U.S. dollars.

3.5 Econometric Approach

In this paper, we estimate the impact of SIS coverage on a host of variables characterizing health care utilization, expenditures and health. Based on the institutional setup described in Section 3.3.2 we do this by means of a fuzzy RDD using the IFH index as the continuous forcing variable.[28] An individual is eligible for public insurance if she lives under poor conditions, which is measured at the household level. In Lima Province, the condition for this is that the IFH index is below or equal to a value of 55. The usual assumption we will make is that variation in this variable around its threshold provides a natural experiment that randomly assigns eligibility to households and thereby individuals. This assumption is obviously motivated by the cutoff value of 55 for the index and the institutional rules in general. We will formalize this assumption below.

As explained in Section 3.4, our treatment is coverage by public health insurance, which is defined as being enrolled in either SIS or EsSalud. It follows from the institutional rules that there is no reason to expect EsSalud coverage to change discontinuously when the threshold is crossed. Based on this, we will attribute such discontinuous changes to enrollment in SIS.

As described in Section 3.3.2, the IFH index is not the only variable that is related to eligibility. Other variables that are important in that respect are labor income, as well as water and electricity consumption. However, the IFH index is the most important criterion for eligibility. Moreover, and importantly, as for Essalud enrollment, we do not expect a discontinuity in any of those variables when crossing the

[28] This approach goes back to at least Thistlethwaite and Campbell (1960). See Hahn et al. (2001) for a more modern exposition and Imbens and Lemieux (2008) for a discussion of practical issues.

eligibility threshold for the IFH index. Therefore, discontinuities around the eligibility threshold are plausibly related to the IFH index only.

Once we impose linearity, we can estimate the effects using the standard two-stage least squares instrumental variables estimator. Formally, we specify the first-stage equation that describes the relationship between enrollment into health insurance for individual i, d_i, as a linear probability model

$$d_i = \beta_0^d + \beta_1^d z_i^c + \beta_2^d elig_i + \beta_3^d z_i^c elig_i + \varepsilon_i^d,$$

where z_i^c is the IFH index centered at its threshold and $elig_i$ is an indicator for eligibility. The second-stage equation for outcome variables y_i is, accordingly,

$$y_i = \beta_0^y + \beta_1^y z_i^c + \beta_2^y elig_i + \beta_3^y z_i^c elig_i + \varepsilon_i^y.$$

When we use the two-stage least squares instrumental variables estimator with $elig_i$ as the instrument for d_i and controlling for the index z_i^c and its interaction $z_i^c elig_i$ with eligibility, then we will estimate the ratio β_2^y/β_2^d. This can then be interpreted as a local average treatment effect, as proposed by Imbens and Angrist (1994), provided that three assumptions hold. The local average treatment effect is the average effect of insurance coverage on the outcome, for those individuals who enroll when becoming eligible by crossing the threshold.

The first assumption we need to make is that if no insurance would be assigned to everybody around the threshold, then the distribution of the outcome conditional on the index would be smooth in the index z_i around zero.[29] This assumption cannot be tested directly and is therefore the main assumption we will make. As we have argued before, the institutional rules suggest that it holds. We provide further, supportive evidence below.

The second assumption is that insurance status is monotone in eligibility. This holds by construction, as changing from a value of the index slightly higher than the threshold value to a value lower than the threshold value will make an individual eligible for insurance coverage.[30] The final, third assumption is an exclusion restriction. It is that the value of the index, z_i, is independent of the outcomes, and in particular ε_i^y.[31] It would be violated if households would manipulate their answers to the government official in order to influence the value of the IFH index. As discussed in Section 3.3 this is unlikely to be the case. We nevertheless test for manipulation in Section 3.7.1.

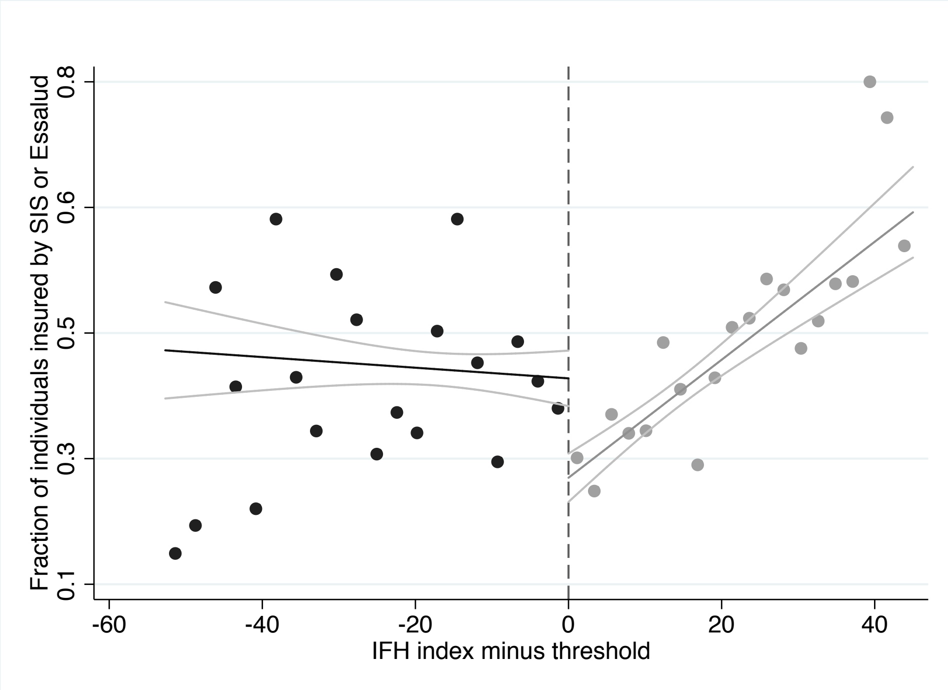
Under the same assumptions, it is also possible to estimate quantile treatment effects, as described in Frandsen et al. (2012). In Section 3.6.2.3 we estimate the quantiles of the distribution of expenditures with and without insurance. The underlying idea is straightforward. While the local average treatment effect is an average, the quantile treatment effect is the change in, say, the median of the distribution an outcome that results from being covered by public health insurance for those who select to enroll when becoming eligible.

[29] This is slightly stronger than needed. Usually, it is enough to assume that the conditional expectation of y_i given z_i is smooth around the threshold. We make a slightly stronger assumption here in order to be able to estimate quantile treatment effects as well, as described below.

[30] The assumption would be violated if an individual would buy insurance if she is not eligible, but not if she is eligible. See Battistin and Rettore (2008a) and Klein (2010) for related discussions.

[31] Again, for the same reason as above, mean independence usually suffices, but we make a stronger assumption in order to also estimate quantile treatment effects.

Figure 3.2: Health Insurance Coverage



Notes: This and the following figures are based on ENAHO data for the year 2011 for Lima Province. See Section 3.4 and Appendix C for details on the data and on how the IFH index is computed.

3.6 Results

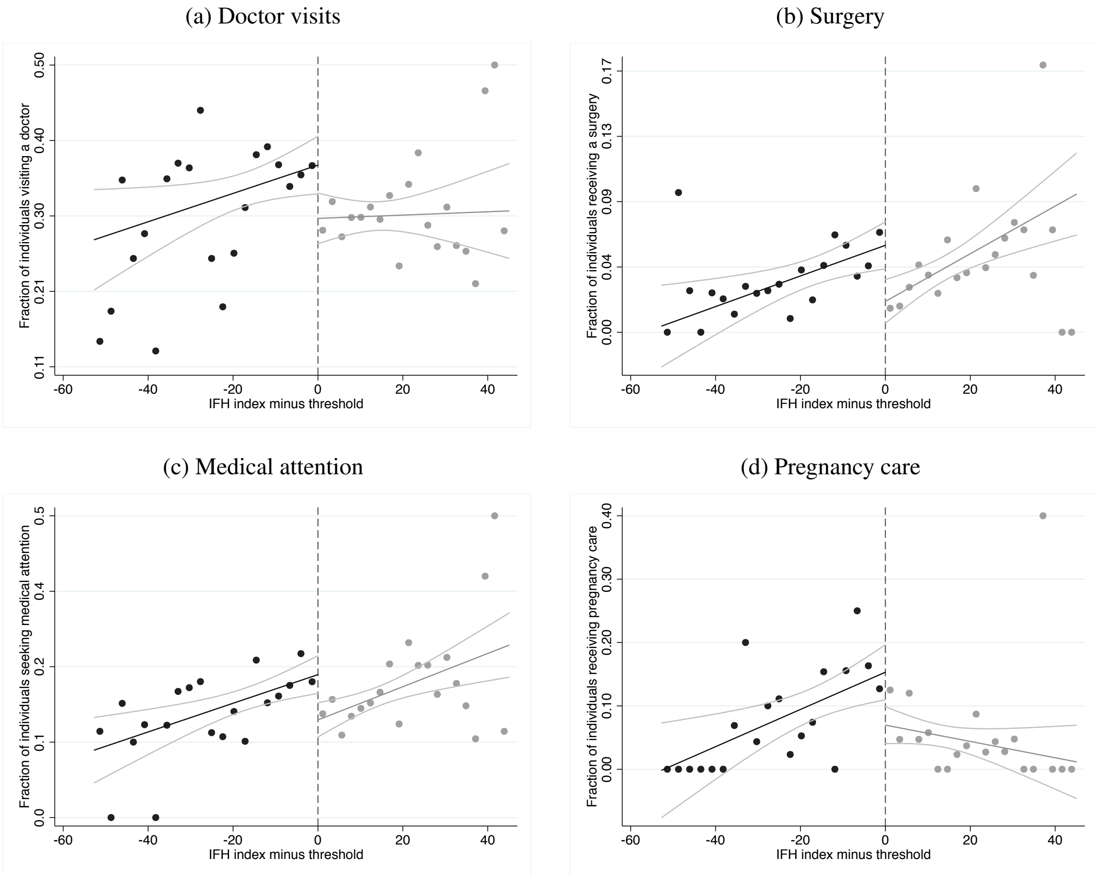
3.6.1 Graphical Analysis

We first graphically examine how enrollment into public health insurance is related to the IFH index. Figure 3.2 shows the fraction of individuals enrolled into either SIS or EsSalud plotted against the IFH index centered at its threshold. The figure shows a discrete increase in the probability to be covered at the threshold, when moving from the right to the left, providing evidence on the importance of the IFH index as a criterion to determine whether an individual is eligible for the SIS program.[32]

Besides, the figure shows that the probability to be enrolled into a public insurance is slightly decreasing in the welfare index among eligible individual to the left of the threshold. This means that poorer individuals might be slightly more likely to be enrolled, which is in line with the government's goal to target the poor. To the right of the threshold, we see that the probability to be covered by public

[32] As explained before, we use this definition because individuals may have confused those two public insurance programs when answering the respective survey questions. It follows from the institutional rules that any discontinuity in the probability to be enrolled in either of those, at the threshold, can be attributed to individuals becoming eligible for SIS. It is, however, likely that even if insurance status was perfectly measured we would not observe that the probability to be insured in SIS is zero for individuals with a welfare index above the threshold. There are two reasons for this. First, there is a certain level of leakage in the targeting strategy of SIS, which means that some individuals who are formally ineligible may still be able to obtain insurance. What is important for our identification strategy is that there is a discontinuity in the probability to be insured at the threshold. This is not a concern in that respect if at least some individuals are properly classified according to our index. Second, we construct the IFH index using survey data from the ENAHO rather than using the official data collected by SISFOH that is used to determine eligibility in practice. This may give rise to measurement error in the running variable. It is not a cause of concern as long as there is a positive probability for each individual that the index is measured correctly. Battistin and Rettore (2008b) show that then, the observed discontinuity can be attributed to those individuals for whom the index is observed without error. See also Hullegie and Klein (2010) for an alternative parametric approach to estimating treatment effects in a regression discontinuity design with measurement error.

Figure 3.3: Health Care Utilization



insurance is increasing in the welfare index. This is due to the fact that dependent employees are more likely to have a higher value of the index and are more likely to be covered by EsSalud. Besides, EsSalud offers voluntary paid plans for self-employed, which is a more common choice among individuals with a higher value of the welfare index.

Next, we investigate how four of the most important measures of health care utilization are related to insurance status.[33] Figure 3.3a plots the probability that an individual has visited a doctor in the last four weeks against the welfare index. We see that becoming eligible for health insurance, that is moving from the right to the left of the threshold, is related to an increase in utilization. Figure 3.3b, 3.3c and 3.3d show that also the probability to undergo surgery, to receive medical attention and to receive pregnancy care increase, respectively.

3.6.2 Main Analysis

Next, we analyze more formally how insurance status and outcome variables are related to eligibility. For this, as described in Section 3.5 above, we use two-stage least squares instrumental variables regression. Throughout, we control for age, gender, whether the head of the household is female, the number of household members, and years of education.[34] We first use the full sample and control for separate

[33] The survey contains a wealth of variables related to health care utilization and outcomes. We provide a more comprehensive analysis using regressions below.

[34] See Section 3.7.4 for results without controlling for covariates.

Table 3.4: Effect of Health Insurance on Health Care Utilization

		Estimates	Ste.
Participation (first stage)			
0	Health Insurance	0.1403***	(0.0257)
			$F = 29.8023$
Utilization			
1	Any doctor visit	0.5149***	(0.1954)
2	Medicines	0.5271***	(0.2045)
3	Analysis	0.2056**	(0.0921)
4	X-rays	0.1297*	(0.0712)
5	Other tests	0.0508	(0.0413)
6	Dental care	0.0660	(0.1231)
7	Ophthalmological care	0.0356	(0.0841)
8	Glasses 1/.	-0.0305	(0.0693)
9	Vaccines	0.2884**	(0.1317)
10	Kids check 2/.	0.0678	(0.2610)
11	Birth control	-0.1443	(0.0934)
12	Other treatments	0.1763	(0.1616)
13	Hospital	0.1484	(0.0931)
14	Surgery	0.2567***	(0.0881)
15	Pregnancy care 3/.	0.6504**	(0.2931)
16	Child birth 3/.	0.1900	(0.1593)
1-16	Any of the above	0.4377**	(0.1860)

Notes: Except for kids check, pregnancy care and child birth $N = 4,161$. See Table 3.13 for variable definitions. 1/. Not covered by SIS. 2/. Question applied for kids under 10, $N = 649$. 3/. Question applied for women in fertile age, $N = 1,182$. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

linear relationships between insurance status and outcomes, respectively, to the left and to the right of the eligibility threshold. The endogenous variable is enrollment into public insurance and the instrument is eligibility according to the welfare index.

Table 3.4 shows the results.[35] We estimate the local effect of eligibility to be a 14 percent increase in insurance enrollment. This corresponds to the size of the discontinuity in Figure 3.2. The effect is highly statistically different from zero.

3.6.2.1 Health Care Utilization

We examine the effect of SIS on the use of 16 health services, including those in Figure 3.3. We find that it has a large and significant effect on six of them. In particular, being covered by health insurance increases the probability of visiting a doctor in the four weeks prior to the interview by 51.5 percentage points. The probability of obtaining medicines in the same four weeks increases by 52.7 percentage points. Moreover, health insurance increases the probability of performing at least some medical analysis by 20.6 percentage points. Taken together, these three results suggests that covered individuals are more likely to see a doctor who then performs an analysis or prescribes a drug, in line with the idea that covered individuals receive medical care that caters better to their needs. This is remarkable because Peru is a country in which poor individuals are accustomed to not receiving any professional diagnosis and where

[35] In Table 3.18 in the Appendix we provide ordinary least squares estimates corresponding to the ones reported here and in the following two tables.

drugs can also be bought in a pharmacy without a prescription.

We also find health insurance coverage to have significantly positive effects on two measures of preventive care. The probability of being vaccinated in the three months prior to the interview increases by 28.9 percentage points, and women at fertile age are 65.0 percentage points more likely to control their pregnancy in the previous twelve months.[36]

The effect on the likelihood to receive surgery is also positive. It increases by 25.7 percentage points. In Section 3.6.2.3 below we show that at least some individuals pay themselves for these surgeries, which suggests that health insurance coverage increases the likelihood that they find it worthwhile to do so.[37]

At the same time, Table 3.4 shows that health insurance coverage has no significant effects on utilization of dental and ophthalmological care during the previous three months, and also not on hospitalization. This can be explained by supply limitations. The health care centers of MINSA provide only basic services. Individuals are sent to hospitals in order to visit a specialist, which also includes dentists and ophthalmologists. This, together with the shortage of dentists and ophthalmologists described in Section 3.3.1 explains our finding. As for hospitalization, as described in the same section above, hospitals lacked equipment and there were budget problems that led to hospitals charging for services that are formally covered by the health insurance. This likely explains why we do not find any positive effect for hospitalization.

Eyeglasses are not included in the list of health insurance benefits. We nevertheless estimated the effects of insurance on the probability to obtain glasses, because in principle, being insured could have an effect because a doctor, for instance, could advise the individual to get new glasses when performing another treatment. We find that insurance coverage has no significant effect on this.[38]

It is interesting to complement these results with statistics on reasons stated by individuals for why they did not visit a health care center for those individuals who had a health incident. Table 3.5 shows that the most important reasons were that individuals do not have money, consider the health incident not big enough, and lack time. Instead, they seem to resort to self-medication, which likely means that they buy some drugs at the pharmacy. This suggests that coverage by SIS may directly affect the 14 percent of the individuals who state that they do not have money to visit a health care center and possibly also the 43 percent who state that the health incident is not big enough. It may have less of an impact on the individuals who state that they lack time to seek medical attention, as SIS does not cover foregone wages.

3.6.2.2 Curative versus Preventive Use

In Section 3.2 we have argued that health insurance coverage may have positive effects on curative and preventive care and that it depends on the institutional details where effects will be stronger. We have argued that we expect the effects on preventive care to be relatively modest because the system does not provide any incentive to do so.

Ideally, in order to shed light on this, we would observe whether, for instance, a doctor was visited

[36] We do not observe whether a woman is pregnant. Therefore, in principle, this includes the effect of insurance on becoming pregnant.

[37] Additionally, we conduct a reduced form analysis to see whether any health service jumps discontinuously at the threshold. Significance for the main variables we described before remain but their magnitude decreases, as expected. Recall that our IV-2SLS estimates are obtained by dividing these effects by the change in the probability of enrollment. Similar pattern is found for the reduced samples (women, men, 75 and 50 percent closest to the threshold) and the specification without controls.

[38] One can also see this as a placebo test in addition to the tests we perform in Section 3.7 below.

Table 3.5: Stated Reasons for not Visiting a Health Care Center

Stated reason	Percentage
Do not have money	0.1401
Live far	0.0088
Attention takes too much time	0.0641
Do not trust doctors	0.0320
Health incident not big enough	0.4322
Prefer using homemade medicines	0.0327
Do not have insurance	0.0182
Use self-medication	0.1677
Lack of time	0.1954
Abuse of health staff	0.0113
Other reasons	0.0333

Notes: Out of the 4,161 individuals in our sample 2,418 report of a health incident. The question was asked to the 1,592 individuals who did not visit a health care center. Multiple answers were possible.

for preventive or curative reasons. However, out of the 12 health services in Table 3.4, five may either have a curative purpose or a preventive one: doctor visits, medicines, analysis, X-rays and other tests. A second group of three variables is more likely related to curative use: hospitalization, receiving surgery and birth delivery.

An important question of the survey is whether the individual experienced any symptom of an illness or a health problem during the last 4 weeks. We will also use this question as an outcome in Table 3.8.[39] We also construct an indicator from this information and interact it with the first five variables in Table 3.4.[40] This means that the outcome is the joint event of experiencing a health problem and going to the doctor. Proceeding in that way allows us to only consider doctor visits, for instance, for those individuals with health problems, which we then interpret as curative use. Panel A in Table 3.6 shows the results. Insured individuals are 56.4 percentage points more likely to receive medical attention than uninsured ones. Coverage also increases the probability of visiting a doctor with curative purposes by 55.5, the probability of obtaining medicines by 51.4 percentage points and the probability to conduct medical analysis by 17.9 percentage points. When we group these variables together, then we find that insurance increases the probability of using at least one curative service by 74.0 percentage points.

A third group of four variables clearly has a preventive nature: reception of vaccines, growth controls of healthy children, reception of birth control methods and pregnancy care (variables 9-11 and 15 in Table 3.4). On top of that, the survey includes specific questions on preventive uses in the last 3 months. It is related to family planning for women at fertile age, reception of iron supplements for pregnant women and children under three years old, and information on prevention of sicknesses.

In line with our expectations, effects on preventive care are weaker. We do, however, find positive effects on pregnancy care and on receiving vaccines. We find that women of fertile age are 65.0 percent-

[39]For those who reported any problem, there is a question on where they went for help. The variable "0' Medical attention" in Table 3.6 is equal to 1 if the individual went to a health institution such as a MINSA hospital or a private doctor, and equal to 0 otherwise, for instance when the individual went to a drug store and basically did not receive any professional advice. The variable is also 0 if the individual did not report any health problem.

[40]To be precise, in the questionnaire, individuals are asked whether they saw a doctor, for instance. On top of that, they are asked whether they experienced health problems and then, if they answer with "yes", again whether they saw a doctor. In our data, the answer to the first, general question is always yes if the one for the more specific question is yes. This concerns outcomes 1 to 5 in Table 3.6.2.

Table 3.6: Effect of Health Insurance on Curative and Preventive Use

		Estimates	Ste.
A. Curative			
0’	Medical attention	0.5635***	(0.1741)
1’	Doctor visits	0.5554***	(0.1729)
2’	Medicines	0.5135***	(0.1676)
3’	Analysis	0.1788**	(0.0863)
4’	X-rays	0.0926	(0.0667)
5’	Other tests	0.0382	(0.0319)
13	Hospital	0.1484	(0.0931)
14	Surgery	0.2567***	(0.0881)
16	Child birth	0.1900	(0.1593)
1’-5’,13,14,16	Any of the above	0.7402***	(0.1981)
B. Preventive			
9	Vaccines	0.2884**	(0.1317)
10	Kids check	0.0678	(0.2610)
11	Birth control	-0.1443	(0.0934)
15	Pregnancy care	0.6504**	(0.2931)
6’	Planning 1/.	-0.0412	(0.2447)
7’	Iron 2/.	0.6127	(0.4954)
8’	Preventive campaign 3/.	0.0344	(0.0696)
6’-8’, 9-11,15	Any of the above	0.2743*	(0.1626)

Notes: Total: $N = 4,161$, kids check: $N = 649$, pregnancy care: $N = 1,182$, planning: $N = 1,181$, iron: $N = 343$. Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01. 1/. Family planning for women at fertile age. 2/. Reception of iron supplements for pregnant women and children less than three years old. 3/. Information on prevention of sickness.

age points more likely to control their pregnancy relative to their uninsured peers.[41] Moreover, we find a 28.9 percentage point increase in the probability to be vaccinated.[42]

The picture that emerges is—in line with expectations formed by the conceptual framework in Section 3.2 and the institutional details in Section 3.3—that insurance coverage has a strong positive effect on the use of curative services and a less strong positive effect on the use of preventive care. It is particularly interesting to compare these results to the ones by Miller et al. (2013) for Colombia, where the system provides larger incentives for preventive care, as already discussed in Section 3.1. And indeed, Miller et al. obtain a positive effect on preventive use and no effect on curative use, we obtain effects mainly in curative use. Nevertheless, we do find some effects on preventive care, in particular on the probability to be vaccinated and to receive pregnancy care.

3.6.2.3 Expenditures

Given our previous finding of positive effects in usage mainly for curative purposes, it is interesting to ask what the effect of health insurance coverage is on out-of-pocket health expenditures. We have

[41] Parodi (2005) finds positive effects of SIS on pregnant women and especially those who live in urban areas. However, his evaluation does not control for selection into insurance.

[42] The last variable indicates whether there was any preventive use. Clearly, in theory, the effect on this probability has to be at least as big as the effect on vaccines, say, because an effect on vaccines implies an effect on any use. We did not impose this here and indeed find that the effect on any use is slightly smaller than the effect on receiving vaccines. However, the difference could also be due to estimation error.

Table 3.7: Effect of Health Insurance on Health Expenditures

		Estimates	Ste.
1	Any health expenditures	0.2916	(0.1955)
2	Health expenditures	1018.8250**	(440.8071)
3	Absolute deviation expenditures	809.5140**	(385.2883)
4	Absolute value residual expenditures	608.7793*	(369.3996)
5	Sqre residual expenditures	8.555e+06*	(4.77E+06)
6	Expenses 50	0.2862	(0.1958)
7	Expenses 75	0.2716	(0.1655)
8	Share expenditures	0.1107	(0.0799)
9	Absolute deviation share	0.0702	(0.0730)
10	Absolute value residual share	0.0698	(0.0730)
11	Sqre residual expenditures	0.1422	(0.2277)
12	Share 50	0.5308**	(0.2107)
13	Share 75	0.3474**	(0.1760)
14	Catastrophic 5%	0.4059**	(0.1777)
15	Catastrophic 10%	0.2907**	(0.1407)
16	Catastrophic 15%	0.1750	(0.1148)
17	Catastrophic 20%	0.1448	(0.0998)
18	Catastrophic 25%	0.0485	(0.0856)

Notes: . Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01.

argued in Section 3.2 that it is unclear whether the effect is negative or positive. Obviously, it could be negative because coverage means that individuals do not have to pay for certain treatments anymore. But it could also be positive if medical attention convinces individuals to actually spend more on their health themselves.

The literature has used a number of measures of health expenditures. These either attempt to measure expected health expenditures, their variability—health risk—, or the likelihood to incur catastrophic health expenditures.

Table 3.7 presents the effect of SIS on a number of variables constructed from annual health expenditures at the individual level.[43] The first dependent variable is a dummy equal to one if the individual incurs in annual health expenditures. We find no significant effect.

The second variable is the level of annual health care expenditures. The results suggests that insurance actually increases the mean annual spending by about 1,000 Soles, which corresponds to around 380 U.S. dollars,—in line with the idea that individuals are motivated to spend more on their health when using medical services more often. However, this amount is not large in relative terms. For instance, if we compare it relative to the average income among the poor, we find that it is only around 5 percent. We also examine a possible effect on the variability of medical spending. Our variability measure in the third specification, similar to the one used by Miller et al. (2013), is the mean absolute deviation of health expenditures, calculated separately by insurance status. Specification 4 and 5 are based on resid-

[43] See also the variable descriptions in Table 3.14. We also experimented with more sophisticated variability measures and found similar results.

uals obtained from a regression of health expenditures on the value of the index, insurance status and the interaction of these two variables. The former uses the absolute value of the residual and the latter the square. Effects are only significant at the 10 percent level. We find no effects on the probability that health expenditures exceed the 50th or 75th percentile of the distribution of health expenditures in the entire population.

In order to control for a possible income difference between the control and treatment groups, we also analyze the effect of insurance on the share of annual health expenditures at the individual level on annual household income per capita. The results are presented in row 8 to 13 and correspond to those in row 2 to 7. Now we find a positive effect on the probability to incur high expenditures.

We also analyzed whether SIS changes the probability of an individual incurring catastrophic health expenditures. Health spending are defined as catastrophic if share expenditures exceeds a certain threshold. The cutoffs for this are manifold. On the one hand, we calculate the 50th and 75th percentile of the distribution of the share and find that SIS increases the probability that this share exceeds the 50th and 75th percentile by 53.1 and 34.7 percentage points respectively. On the other hand, following Wagstaff and Lindelow (2008), we use the thresholds 5, 10, 15, 20 and 25 percent. We find that health insurance coverage increases the probability that individual health expenditures exceed 5 and 10 percent of the per capita household income by 40.6 and 29.1 respectively. We do not find significant effects for higher cutoffs. These results are similar to those obtained by Wagstaff and Lindelow (2008) for China, who found that insurance increases the risk of incurring high and catastrophic spending.

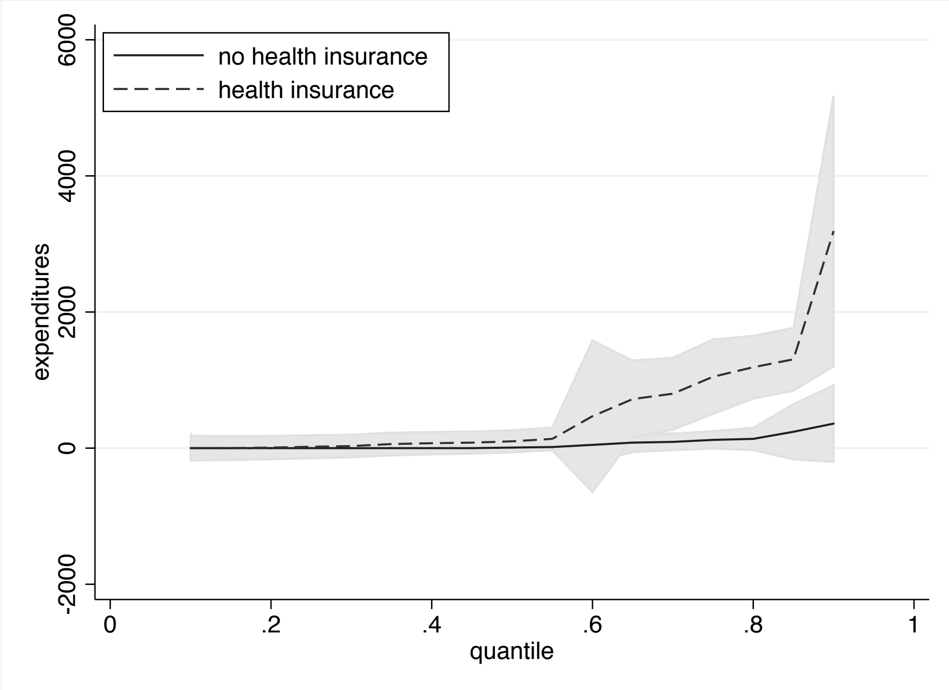
Overall, it is remarkable that we never find a negative effect on either expected health expenditures or measures of variability or risk of high expenditures. Miller et al. (2013), in contrast, find for Colombia that insurance lowers both mean inpatient medical spending and its variability.

In addition, we quantify the effects of health insurance coverage on the entire health expenditure distribution. We follow Frandsen et al. (2012) for this. Figure 3.4 shows the estimates of the quantiles of the distribution of health expenditures with and without health insurance coverage, as well as the confidence intervals. Overall, we find that insurance has positive effect only on the higher end of the distribution. This could be due to the fact that insured individuals usually receive free medical care from SIS and uninsured individuals are not aware of their health status or who might give up on care because of its price. In that sense, it is surprising that we do not see health expenditures to be higher for uninsured individuals. This finding, however, is in line with our finding of stark differences in health care utilization—uncovered individuals may simply not receive much attention or treatment of any kind.

Coming back to the finding that insurance coverage has a positive effect on the higher end of the distribution, one explanation could be that individuals pay for part of the medical services because SIS includes maximum levels of coverage or, as we have previously discussed in Section 3.3.2, because some MINSA hospitals have charged for some services that are formally covered by the insurance.

In order to explore further why the effect of SIS on health spending is positive only for individuals with high health expenditures, we select individuals whose welfare index is close to the threshold, the 20 percent closest to the left and the 20 percent closest to the right. We then divide individuals into four groups, those who are eligible and those who are not and at the same time into those with low health expenditures, defined as those below 50 percent, and those with high health expenditures, defined as those above 80 percent. The idea is that by comparing eligible to ineligible individuals with high expenditures, for instance, we can get an indication for which expenditures actually increased for the

Figure 3.4: Health Expenditures by Quantile



Notes: The figure shows the percentiles of the distribution of expenditures with and without health insurance, along with 95 percent confidence intervals. See Frandsen et al. (2012) for details on the implementation.

high-spenders.

In Table 3.22 in the Appendix we report statistics for those four subgroups.[44] First, consistently with our general results, in almost all cases the utilization of medical services is larger for eligible individuals, as compared to ineligible individuals. Second, we see that the differences between eligible and non-eligible individuals are larger for individuals with high expenditures as compared to those with low expenditures in the case of doctor visits, analysis, X-rays and surgery. This finding is consistent with the idea that individuals reach maximum levels of coverage and pay themselves for getting complex treatments, as already discussed in Section 3.2. Additionally, as explained in Section 3.3 above, some MINSA hospitals may have charged for services that are usually covered by SIS.

Such rises in health care expenditures are usually seen in a critical way. However, one may also argue that it is an open question whether this is justified here. On the one hand, the increase in expenditures can be seen as an additional burden to the individuals, possibly also increasing the volatility of expenditures. On the other hand, it could also indicate increased accessibility to health care, in response to them getting the idea of using medical services in response to being insured. Finally, as some treatments are at least partly covered by SIS, one may argue that the overall price of a treatment is lower when they insured by SIS. In that case, the law of demand would also predict an increase in usage.

3.6.2.4 Effects on Health

We have argued in Section 3.2 that it is unclear how the effect of health insurance on health measures that are reported by the individuals themselves can be interpreted. The reason for this is that individuals

[44] Birth control is excluded from the analysis because it contains only a few observations.

Table 3.8: Effect of Health Insurance on Health

		Estimates	Ste.
1	Symptom	0.2655	(0.1942)
2	Illness	0.3158**	(0.1465)
3	Chronic illness	0.0754	(0.1736)
4	Relapse	0.0601	(0.1113)
5	Accident	0.0714	(0.0591)
6	Num. days with symptom	0.4004	(0.4898)
7	Num. days with illness	0.6078*	(0.3607)
8	Num. days with relapse	0.8262	(0.9162)
9	Num. days with accident	0.5295	(0.4494)

Notes: $N = 4,161$. Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.01.

who are covered and who see a doctor more often are more aware of their health problems. Therefore, even if the effect on objective health measures is positive, it could be that the effect on subjective health measures is negative of not significantly different from zero.

Table 3.8 nevertheless reports our estimates of the effects of insurance coverage on health reports. We do find positive effects on reports of illnesses and a less strong effect on the number of days individuals could not perform normal activities due to an illness. These results are well in line with the literature (see for instance Acharya et al., 2013).

3.7 Sensitivity Analysis

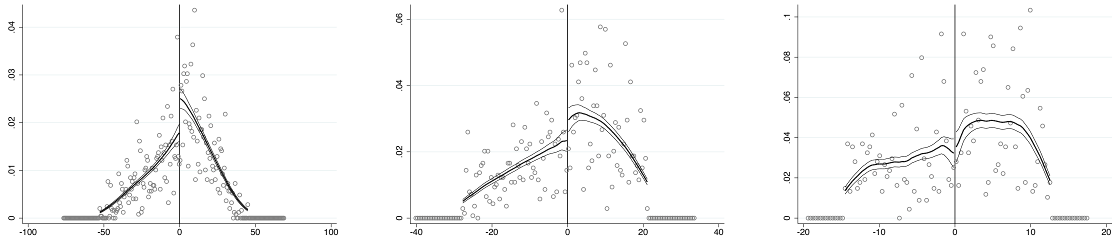
In this section, after having presented the main results, we assess whether the results are sensitive to the particular specifications we have and whether the assumptions we have made can be supported by additional empirical evidence. We start by examining whether individuals have manipulated the IFH index in order to become eligible for public insurance. Then, we assess whether there were discontinuities at other values of the welfare index. Third, we conduct more local analysis by selecting subsamples of observations that are closer to the threshold. After that, we conduct a non-parametric analysis. And finally, we assess whether other programs could challenge the validity of our results.

3.7.1 Manipulation Tests

A common threat to studies based on a RDD is the incentive to manipulate the running variable. In our case, this means that an important number of households has access to how the IFH is calculated and, as far as they are interested in being eligible, they may try to manipulate their answers to qualify for SIS. We believe this is not the case for two reasons. First, households do not know the complex algorithm behind IFH calculation. Second, the set of variables included in the IFH construction are verifiable by questionnaire takers and difficult to manipulate. In this context, the manipulation of the running variable would be at most partial, which typically does not lead to identification problems. However, this section analyzes this potential thread.

We use the McCrary (2008) test for this. If manipulation is possible, the running variable will be discontinuous at the cutoff. In our context, the density function would show many individuals barely

Figure 3.5: McCrary Test



(a) Full Sample (b) Sample 75 (c) Sample 50

Notes: The figures show estimates of the density of the IFH index around the threshold. The left figure is for the full sample. The figure in the middle is for the sample in which we keep the 75 percent of the observations that are closest to the threshold in terms of the IFH index, separately to the right and to the left. In the right figure we do the same for the 50 percent closest observations to the left and to the right. Full sample: bin size of 0.59 and bandwidth of 23; sample 75: bin size of 0.44 and bandwidth of 12 and sample 50: bin size of 0.32 and bandwidth of 4.8.

qualifying for SIS, that is, to the left of the cutoff, and surprisingly few failing to qualify, that is, to the right of the cutoff. The formal procedure is twofold: firstly a finely gridded histogram is obtained and then this histogram is smoothed with a local linear regression for each side of the cutoff.

Figure 3.5 presents the results. The three panels show the results of the McCrary test for the full sample, for a sample of the 75 and 50 percent individuals with an IFH index closest to the threshold, separately on each side. Formally, the test for the full sample rejects smoothness of the density around the threshold. However, the result is not robust to choosing smaller subsamples and in any case would hint at manipulation towards becoming ineligible, as the density is higher above the threshold.[45]

3.7.2 Jumps at Non-Discontinuity Points

If having public insurance (which we instrument it by using eligibility into SIS program) is associated with positive effects on health outcome indicators, we should not find effects by using other "thresholds". Since the threshold to determine eligibility is 55, we should find zero effects in settings where it is known that there are non-discontinuity points. Following Imbens and Lemieux (2008) we do this by conducting a parallel RDD analysis at the medians of the subsample distribution at either side of the official threshold. For example, the subsample at the left of the threshold would be comprised by those with $z_i(IFHindex) < 55$ and we test for a jump at the median. By only using data on the left of the official threshold, we avoid conducting the regressions at a point where it is known to have a discontinuity. We proceed similarly for the subsample at the right of the threshold. Splitting each subsample at its median increases the power to find discontinuities.

Results are presented in Tables 3.23 and 3.24 in the Appendix. In general, we observe no significant effects on health outcome variables when we run the regressions at the medians of the subsamples. The only exception is, however, the participation variable (health insurance) in the subsample at the right of the official threshold; there is a significant jump when we use the IV-2SLS regressions on the 75 percent observations closer to the median. However, this disappears when we use local linear regressions.[46]

[45] It could be that, for budgetary reasons, the government set the threshold in a way such that a bulk of individuals is just not eligible for SIS. We are, however, not able to test this hypothesis. Importantly, it would not threaten our identification strategy as long as the variation in the index around the threshold is still random.

[46] We also conduct a reduced form analysis (regressions of outcomes on the index, eligibility, its interaction and controls) to see whether any outcome jumps discontinuously at the fictitious thresholds described before. No significant effects are observed

3.7.3 More Local Analysis

It can be argued that the linearity assumption is strong and therefore the analysis should be conducted on the population with IFH index values closer to the threshold. To see whether results are sensitive to that, we reduce the sample to the 75 and 50 percent of the population with IFH index values closest to the threshold, separately for each side.

Tables 3.25, 3.26 and 3.27 show the results for these reduced samples. Some of the coefficient estimates increase in magnitude while the precision of the estimates decreases. For instance, for the 75 percent sample, we find that the effects on the likelihood to visit a doctor, receiving medicines, conducting analysis and having access to surgery increase from 51.5, 52.7, 20.6 and 25.7 reported in Table 3.4 to 76.1, 88.3, 36.3 and 44.1 percentage points, respectively. At the same time, due to the decreased number of observations, the precision of the estimates decreases, as expected. The estimates of the effects of insurance on receiving vaccines and pregnancy care are therefore no longer significantly different from zero.

3.7.4 Controlling for Covariates

It is standard practice to test whether the expectation of covariates such as age or gender is a continuous function in the welfare index around the eligibility threshold. When it it is found not to be, then one may be concerned that the assumptions underlying our analysis do not hold. This could be because there is selection on observables, which makes it more or less likely that data are observed for a given individual. While this could be addressed by controlling for covariates, one may then be concerned that there is also selection on unobservables, which could not easily be addressed. Likewise, one may then be concerned that there are other discontinuities at the same threshold and therefore the estimated effect cannot be attributed to SIS only.

We first conduct a graphical analysis and then a formal one in which we replace the dependent health variables by the observed covariates age, gender, whether the woman is the head of the household, the number of household members, years of education and household expenditures. In Section 3.6.2, we use the first five covariates as controls in order to be able to obtain more precise estimates.

Figure 3.6 and Table 3.9 summarize the results. The latter reports instrumental variables estimates of the effect of insurance on the covariates. We do not find evidence for a discontinuity in the expectation of the covariates except for one, which is the variable number of household members. Figure 3.6 shows that the expected number of households changes by about 0.5, or 10 percent, which (roughly) gives the estimated effect in Table 3.9 if we divide it by the change in the probability of about 0.14 reported in the first column of Table 3.25. This means that the effect is significantly different from zero and of substantial size.[47]

in general, except for vaccines. There is a negative effect on the subsample to the left and a positive one on the subsample at the right of the original threshold. However, these effects disappear when we use local linear regressions. The rest of the variables, especially those related to curative services, do not exhibit any significant jump at those thresholds.

[47] We also conduct a reduced form analysis of whether there is a jump on any of the covariates at the threshold. In general, they do not exhibit any significant jump, except for the expectation of the variable number of household members. The effect is negative as before.

Figure 3.6: Graphical analysis of covariates

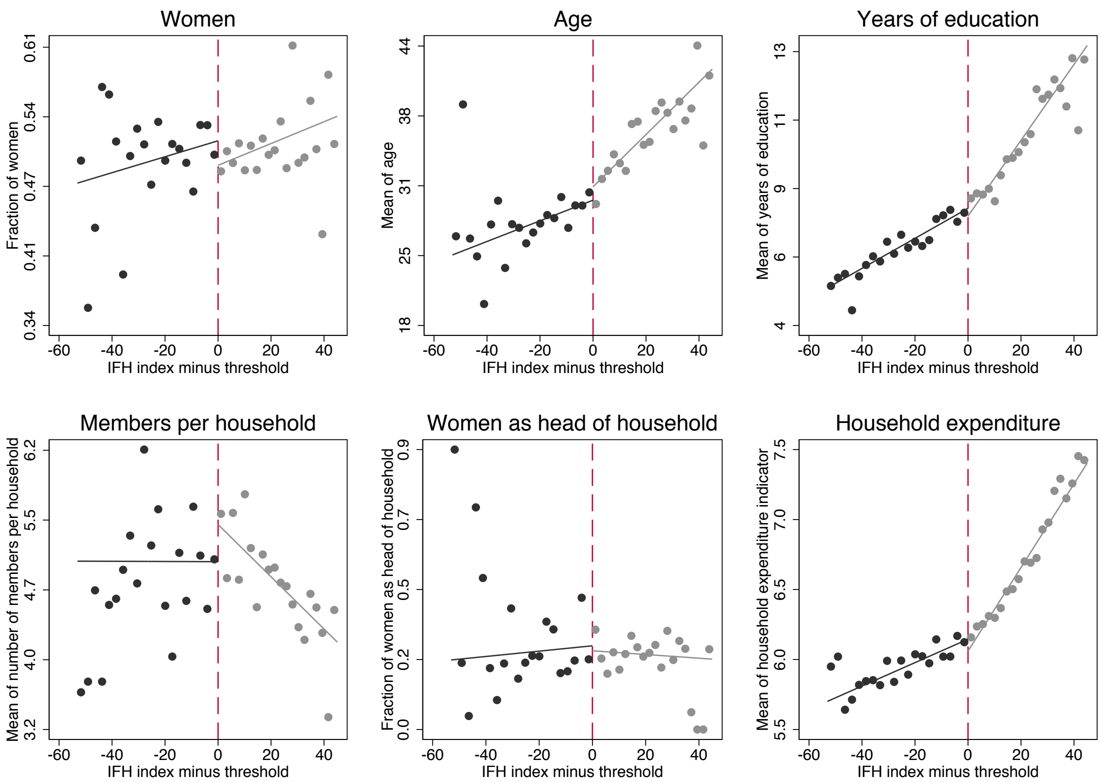


Table 3.9: Effect of Insurance Coverage on Covariates

IV-2SLS	(1) Full sample		(2) Sample 75%		(3) Sample 50%	
	Estimates	Ste.	Estimates	Ste.	Estimates	Ste.
Woman	-0.0438	(0.1956)	-0.2057	(0.3028)	0.0769	(0.4240)
Age	-7.3244	(8.4632)	6.9167	(12.6805)	-0.5141	(17.9161)
Years of education	2.1508	(1.8593)	0.1840	(2.7045)	-6.5433	(4.5075)
Number household members	-3.5275***	(1.0520)	-5.5418***	(1.9892)	-3.8927	(2.3943)
Women as head of household	-0.0149	(0.1692)	0.3951	(0.2793)	0.6886	(0.4523)
Household's expenditure 1/.	0.2645	(0.1736)	0.0281	(0.2403)	-0.5288	(0.4069)

Notes: $N = 4,161$. Standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.00.

If selection on observables is present, then we should control for it in the main analysis. However, we also conducted the main analysis without controlling for covariates, hence also not for the number of household members. Tables 3.25, 3.26 and 3.27 show that the main conclusions we have drawn remain the same. It is comforting to see that while we find a discontinuity in the number of household members, our results do not seem to be sensitive to whether or not we control for it in our analysis.[48]

3.7.5 Non-Parametric Analysis

To address the concern that linearity is too strong of an assumption we conduct a non-parametric analysis. For this, we use local linear and local quadratic regressions to predict the expected outcome and the probability to be covered by insurance using only data to the left or to the right of the discontinuity, respectively. We then calculate the difference between the prediction for the outcome from the right and from the left and divide it by the difference in the probability to be covered by SIS. This leads an estimate of the local average treatment effect that can be compared to the ones reported above.[49]

Table 3.10 shows the results. Generally speaking, estimates are less precise, but point estimates are similar. This suggests that the linear specification we use is appropriate.

3.7.6 Juntos and Food Aid Program

Our identification strategy is based on the assumption that discontinuities at the eligibility threshold can be attributed to SIS. There are some programs whose presence could in principle challenge this assumption.

One of them is Juntos, a conditional cash transfer program. It combines a geographic targeting of the poorest districts with individual targeting, based on the IFH index and the presence of children up to the age of 14. However, Juntos is a rural program and our study focuses on the Lima Province, and our data confirm that no individual in the sample belongs to Juntos.

Besides, there is a number of food aid programs oriented to the poor. To be precise, they are oriented to different groups of the population, such as mothers, children and school students. Our data show that 29 percent of the individuals of our sample receive at least support from one of them.[50] Importantly, since these programs do not use SISFOH's targeting rules and in particular not the IFH index, it is unlikely that a discontinuity at the eligibility threshold can be attributed to them. Our finding in Section 3.7.4 that household expenditures do not exhibit a discontinuity at the insurance threshold provides additional

[48] One may nevertheless wonder why we find such an effect. We could also think of the number of household members as an outcome that is negatively affected by having insurance because insurance has a positive effect on using birth control products, which leads to reduced fertility. We, however, do not find such effects that could explain the reduction of birth control methods, also not in the specifications that do not control for covariates. Taken together with the finding that results do not depend on whether or not we control for covariates including the number of household members, leads us to conclude that the number of household members does not play an important role here and that the effects we find are likely effects of insurance coverage on reporting behavior. It is possible that after being covered by insurance, respondents to the survey use a more strict definition of the household that includes only those members that are covered by health insurance.

[49] It is in principle possible to also control for covariates. This, however, would involve estimating partially linear models where we impose that they enter linearly. We do not do so here because this goes along with a large increase in the computational burden when we bootstrap the standard errors. Therefore, the results are closest to the ones in Tables 3.25, 3.26 and 3.27. Arguably, since these have in turn be close to the main results where we control for covariates and since we have found that only one covariate exhibits a moderate jump at the discontinuity, this seems a reasonable way to proceed given that this is meant to be a robustness check.

[50] The percentage of individuals that receive food aid is 29 percent among those not covered by SIS and 51 percent among those who are covered. There is no information on the reception of food aid for 874 individuals, or 20 percent of our sample.

Table 3.10: Local Linear Regressions

Variable	Estimated	Degree 1				Degree 2			
		bw 10	bw 20	bw 50	bw 100	bw 10	bw 20	bw 50	bw 100
Health Insurance	Coefficient	0.0831**	0.1282***	0.1373***	0.1382***	0.1171**	0.0986**	0.1033***	0.1032***
	Bootstrap Std. Err.	(0.0368)	(0.0280)	(0.0247)	(0.0248)	(0.0492)	(0.0400)	(0.0287)	(0.0327)
Doctor visits	Coefficient	0.7595	0.5358	0.5007***	0.4983**	0.4633	0.8347	0.7054	0.6970
	Bootstrap Std. Err.	(0.5882)	(0.3286)	(0.1938)	(0.2163)	(86.7429)	(0.7480)	(8.4927)	(0.4620)
Medicines	Coefficient	1.0387	0.6290***	0.5168**	0.5074**	0.5701	1.0279	0.9759	0.9744*
	Bootstrap Std. Err.	(2.1575)	(0.2328)	(0.2605)	(0.2141)	(0.6690)	(1.1001)	(0.7157)	(0.5811)
Analysis	Coefficient	0.3332	0.2225**	0.2088**	0.2069**	-0.0970	0.3367	0.3416	0.3429
	Bootstrap Std. Err.	(0.2437)	(0.1130)	(0.1010)	(0.0900)	(0.2369)	(1.2037)	(0.2940)	(3.4432)
Surgery	Coefficient	0.5280	0.3180***	0.2694**	0.2650***	0.3862	0.4717	0.4726	0.4745*
	Bootstrap Std. Err.	(1.4463)	(0.1063)	(0.1068)	(0.0980)	(1.3371)	(2.8475)	(0.8522)	(0.2608)
Vaccines	Coefficient	0.5348	0.3151*	0.2890**	0.2882**	0.5700	0.4987	0.3622	0.3534
	Bootstrap Std. Err.	(3.7619)	(0.1642)	(0.1319)	(0.1331)	(1.1554)	(2.2913)	(0.3966)	(1.3567)
Pregnancy care	Coefficient	0.7876	0.6095	0.6033	0.6030	0.0445	0.5770	0.5082	0.5066
	Bootstrap Std. Err.	(5.4355)	(1.6750)	(0.5286)	(0.5409)	(1.8262)	(3.0906)	(35.4400)	(6.5831)
Illness	Coefficient	0.4034	0.3207	0.3139**	0.3140*	0.5729	0.4906	0.3933	0.3852
	Bootstrap Std. Err.	(0.6860)	(0.2060)	(0.1374)	(0.1806)	(1.0985)	(0.6135)	(1.7819)	(0.4200)

Note: Bootstrap standard errors in parentheses. * p<0.10 ** p<0.05 *** p<0.00.

support for this interpretation.

3.8 Conclusions

Until recently, large parts of the population in developing countries did not have access to public health insurance. While it is commonly believed that the effects of health insurance coverage are positive, we still lack empirical evidence on its impact on health care utilization, health expenditures, and health outcomes. Besides, it is not yet understood enough through which channels health insurance coverage ultimately leads to better health outcomes and to what extent it is possible to encourage individuals to invest into preventive care.

In this paper, we use rich survey data from Peru to study the effects of the large-scale social health insurance program called "Seguro Integral de Salud" (SIS). The SIS program is targeted to poor individuals working in the informal labor market. Coverage has increased since 2006 and by now about 40 percent of the population are covered by SIS. We make use of the institutional details that give rise to a regression discontinuity design. We estimate the effect of insurance coverage on a wealth of measures for health care utilization, health expenditures and health.

We find strong effects of insurance coverage on measures of health care utilization, such as visiting a doctor, receiving medication and medical analysis. We also find effects on preventive care, but they are much less pronounced. We find positive effects on health care expenditures, most likely at the high end of the distribution, and no clear effects on self-reported health measures.

Our interpretation of these results is that the Peruvian health insurance program was able to encourage poor individuals to seek medical attention. They receive treatments when they need them, but are less inclined to invest in preventive care, with the exception of vaccination and pregnancy care. This is not surprising, as the system does not provide any incentives to actually do so.

The effect of insurance coverage on health care expenditures is small for most individuals. However, in light of the remaining findings this is not indicating that the program has no effects. To the contrary, individuals who are covered and can relatively easily be treated receive treatment at no or very low cost to them, while individuals who are not covered are simply not treated and therefore have low expenditures. Taken together with our finding that there is a positive effect on the health care expenditures at the higher end of the distribution, our results suggest that once individuals get in touch with the health care system, they are even willing to pay themselves for the services when they are important.

Overall, the evidence suggests that when compared to health care systems in other developing countries, the Peruvian one is a notable exception. It seems to reach its goal to provide access to medical care to a sizable fraction of the poor. As of now, there is no evidence on the effects it will have on health, but it is imaginable that increased access will ultimately lead to better health outcomes. We discuss in the paper why it remains a challenge for the future to measure those, but the institutional features make this a more promising endeavor than it is in many other countries.

Appendix

A Details on the Health Insurance Plan

Table 3.11: Basic Plan of Health Insurance - PEAS

Variables 1/.					Type	Treatment	SIS's tariff covers:	Maximum Coverage
					PREVENTIVE SERVICES			
MA		A	M	KC	1	CRED check on Children	Materials, supplies.	1 month 2 checks 1 year 11 checks 2 years 6 checks 4 years 8 checks
MA		A	I	KC	2	Check on newborn weighted less than 2,500 gr.	Consultations, dosage of hemoglobin, iron supplementation.	15 days 5 checks 3 months 4 checks 1 year 9 checks
			M	I	3	Micronutrient supplementation	Provision of Vitamin A, Iron supplement. Consultation, Printed educational material.	1 year 3 checks 2 years 4 checks
	OT	A		PC	4	Pregnancy diagnosis	Laboratory procedure.	No limit
MA			M	PC	5	Prenatal Care	Materials, supplies.	10 checks
	OT	A		PC	6	Complete laboratory tests of pregnant women	Full set of laboratory tests.	No limit
	OT	A		PC	7	Treatment for pregnant women w/ HIV	ELISA test for HIV during pregnancy, childbirth and postpartum. Prophylactic treatment to HIV positive pregnant women.	No limit
	X		M	PC	8	Obstetric ultrasound examinations	Materials, supplies.	No limit
MA		A	M	D	9	Oral health	Supplies.	2 checks/year
MA			M	D	10	Prevention of tooth decay	Materials, supplies.	Dental prophylaxis 2 checks Topical flour coating 4 checks Destartaje 1 check Topical flour gel 2 checks Sealants application 1 checks Restoration practice 4 pieces Ionomer inactivation 4 pieces
DV		BC	M	P	11	Family planning	Guidance and counseling session. Delivery of contraceptives.	Not decided 4 checks Decided checks
DV				O	12	Visual acuity impairment detection	Full benefit. Excludes provision of lenses. Children and Adolescents.	1 check/year
MA			M		13	Normal postpartum care	Checks. Includes supplies used in care.	2 checks
MA			M		14	Prophylactic treatment kids HIV	Provision of artificial milk for 6 months. Monitoring.	No limit

Notes: 1/. Variables observed in the ENAHO. Doctor Visits (DV); Medical Attention (MA); Medicines (M); Analysis (A); Kids Check (KC); Iron (I); Planning (P); Other tests (OT); Surgery (S); Pregnancy Care (PC); Birth Control (BC); Child Birth (CB); Dental (D); Ophthalmology (O); Hospital (H). See R.M. N° 240-2009/MINSA for more details.

Table 3.12: Basic Plan of Health Insurance - PEAS (continued)

Variables 1/.				Type	Treatment	SIS's tariff covers:	Maximum Coverage
				RECUPERATIVE AND REHABILITATION SERVICES			
MA		A	M	15	Immediate attention to the normal newborn	Supplies, drugs, lab tests.	No limit
MA	OT		M	H 16	Newborn's inpatient care without surgical procedure	Drugs, auxiliary tests, inputs during stay in the health facility.	No limit
MA	OT		M	H 17	Newborn's inpatient care with surgical procedure	Drugs, auxiliary tests, inputs during stay in the health facility.	No limit
MA			M	CB 18	Vaginal birth care	Drugs, materials, supplies.	No limit
MA			M	CB 19	Caesarean section	Drugs, auxiliary tests, supplies, materials.	No limit
DV			M	20	Specialized medical consultation	Drugs, supplies, diagnostic support.	No limit
DV			M	D 21	Ambulatory care: doctor	Drugs, supplies, diagnostic support in health facilities.	No limit
MA			M	D 22	Dental restoration	Materials, portion for replacement equipment and instrumentation.	3 dental restorations/year
MA			M	D 23	Dental extraction	Materials, portion for replacement equipment and instrumentation.	3 extractions/year
MA			M	24	Ambulatory care	Materials, supplies. In health facilities: Level I & II 2/.	No limit
MA			M	25	Emergency care	Drugs, auxiliary tests, materials, supplies.	No limit
		A	M	26	Diagnostic support	Diagnostic support. No diagnostic capabilities include support not tariffed.	No limit
MA			M	S 27	Medical outpatient surgery	Drugs, auxiliary tests, materials, supplies during surgery and patient's stay in the facility.	No limit
MA			M	28	Inpatient in health facility without surgery	Drugs, materials, supplies during surgery and patient's stay in the facility.	No limit
	OT		M	S 29	Inpatient with surgery	Auxiliary tests, drugs during surgical procedure, expenditures incurred during patience stay until discharge.	No limit
			M	H 30	Admission in ICU	Materials, supplies, drugs. Only in facilities where service can be verified.	No limit
MA				D 31	Specialized dental care	Procedures pulpectomy, pulpotomy access opening, direct and indirect pulp capping, fixation or splinting of the tooth with composite, Gingivectomy localized extraction of retained piece, enucleation or marsupialization.	3 checks/year
				32	Rehabilitation care	Rehabilitation of fracture or sprain in Level I care. Level II care only for enrolled population.	No limit
				ADMINISTRATIVE SERVICES			
				33	Emergency Transfer	Displacement road or air according to recognized medical indication. Unrecognized exam for the diagnosis in outpatients.	No limit
				34	Food Allocation	Recognized until a day after discharge.	No limit
				35	Burial	Niche services, casket, shroud, funeral chapel and transfer of the deceased to the cemetery.	"Directiva de Sepelios"

Notes: 1/. Variables observed in the ENAHO. 2/. Level I: Health facility & health center. Level II: Doctor Visits (DV); Medical Attention (MA); Medicines (M); Analysis (A); Kids Check (KC); Iron (I); Planning (P); Other tests (OT); Surgery (S); Pregnancy Care (PC); Birth Control (BC); Child Birth (CB); Dental (D); Ophthalmology (O); Hospital (H). See R.M. N° 240-2009/MINSA for more details.

B Variable Definitions

Table 3.13: Variable Definitions

Variable	Definition
Participation	
Health Insurance	Are you enrolled in SIS or EsSalud?
Demographics	
Woman	
Age	
Years of education	
Number household members	
Woman head of household	
Annual household income (thousand Soles)	
Utilization	
Any doctor visits	Have you visited the doctor in the last 4 weeks?
Medicines	Have you received medicines in the last 4 weeks?
Analysis	Have you had analysis in the last 4 weeks?
X-rays	Have you had X-rays in the last 4 weeks?
Other tests	Have you had other tests in the last 4 weeks?
Dental care	Have you had dental care in the last 3 months?
Ophthalmological care	Have you had ophthalmology care in the last 3 months?
Glasses	Have you bought glasses in the last 3 months?
Vaccines	Have you received vaccines in the last 3 months?
Kids check	Has your child's health been checked in the last 3 months?
Birth control	Have you received birth control products in the last 3 months?
Other treatments	Have you received other care in the last 3 months? (i.e. orthopedic services)
Hospital	Have you been hospitalized in the last 12 months?
Intervention/Surgery	Have you had a surgery in the last 12 months?
Pregnancy care	Have you received pregnancy care in the last 12 months?
Child birth	Have you had child birth care in the last 12 months?
Other medical attention	Have you had medical attention in the last 4 weeks?

Notes: Table 3.2 in the main text reports summary statistics.

Table 3.14: Variable Definitions (continued)

Variables	Definition
Health report	
Any symptom	Have you had a symptom or health problem in the last 4 weeks?
Illness	Have you been ill in the last 4 weeks?
Chronic illness	Do you have a chronic illness or health problem?
Relapse	Have you had a relapse in your chronic illness in the last 4 weeks?
Accident	Have you had an accident in the last 4 weeks?
Num. days with symptom	Number of days you could not perform normal activities because of a relapse
Num. days with illness	Number of days you could not perform normal activities because of a symptom
Num. days with relapse	Number of days you could not perform normal activities because of an illness
Num. days with accident	Number of days you could not perform normal activities because of an accident
Health expenditures	
Any health expenditures	Any annual health expenditures
Health expenditures	Annual health expenditures
Absolute deviation expenditures	Variability of annual health expenditures
Absolute value residual share	Absolute value of residual from regressions for annual health expenditures
Sqre residual expenditures	Square of residual from regressions for annual health expenditures
Expenditures 50	Annual health expenditures exceed 50th percentile (median)
Expenditures 75	Annual health expenditures exceed 75th percentile (third quartile)
Share expenditures	Share annual health expenditures of annual household per capita income
Absolute deviation share	Variability of Share annual health expenditures of annual household per capita income
Abs share	Absolute value of residuals from regression for Share annual health expenditures of annual household per capita income
Sqre share	Square of residuals from regression for share of annual health expenditures on annual household per capita income
Share 50	Share annual health expenditures of annual household per capita income exceed 50th percentile (median)
Share 75	Share annual health expenditures of annual household per capita income exceed 75th percentile (third quartile)
Catastrophic 5%	Share annual health expenditures of annual household per capita income exceed 5%
Catastrophic 10%	Share annual health expenditures of annual household per capita income exceed 10%
Catastrophic 15%	Share annual health expenditures of annual household per capita income exceed 15%
Catastrophic 20%	Share annual health expenditures of annual household per capita income exceed 20%
Catastrophic 25%	Share annual health expenditures of annual household per capita income exceed 25%

Notes: See also Section 3.6.2.3 for further explanations. Table 3.3 in the main text reports summary statistics.

C IFH Index

C.1 Variables and Weights for IFH Construction

The IFH index is constructed such that it takes on values between 0 and 100. Higher values indicate better living conditions. In the following, we explain how the index is calculated. SISFOH (2010) provides more details.

First, the ENAHO for the year 2009 was used to determine the set of variables that enters into the IFH computation. The Sommers test was used to identify correlation between candidate explanatory variables and a measure of poverty. Then, significant variables were selected and a Principal Component analysis for discrete variables was applied to reduce dimensions and to focus on those variables that mainly explain the variability of the data. The weights that are used to construct the index correspond to the contribution of the respective variables to the first principal component. This was done separately for three geographic areas, the Lima Province, the other urban areas, and all rural areas.

Table 3.15 and 3.16 show the variables, the mutually exclusive alternatives and the corresponding weights. There are three independent sets of weight that correspond to households living in different geographic areas. For instance, consider a household from Lima that cooks with carbon, uses water from outside the house and lives in a house with brick walls. Then, the first three addends of the IFX index are -0.33, -0.35 and 0.10.[51]

Using those weights a raw index ifh_{ij} is calculated as a linear combination of household characteristics with cluster-specific weights. Then, it is standardized so that it lies between 0 and 100 in each cluster. The standardized index is

$$ifh'_{ij} = 100 * \frac{ifh_{ij} - ifh_j^{min}}{ifh_j^{max} - ifh_j^{min}},$$

where ifh'_{ij} is the adjusted IFH that lies in the interval $[0,100]$ and ifh_j^{min} and ifh_j^{max} are the minimum and the maximum values of the original IFH index in cluster j, respectively.

C.2 Thresholds for IFH by Cluster

To determine eligibility, there are thresholds for the IFH index by cluster. Individuals and households with an index below or equal to the threshold are eligible for SIS. Table 3.17 shows the thresholds by cluster. The 15 clusters were defined by identifying areas with similar monetary poverty in the year 2009. In general, each cluster includes several unconnected geographic areas.[52] As an example, consider cluster 2, which includes the rural areas of the jungle of the departments of Ayacucho, Junin, Loreto, Puno, San Martin and Ucayali; and also the rural areas of the northern highlands of the departments of Cajamarca and Lambayeque. The thresholds were determined such that poor individuals, in some sense that is not spelled out, were eligible. They are conservative in the sense that they allow for type 2 errors

[51] Importantly, the number of members of the household with health insurance does not include those with either SIS or EsSalud. This is important because otherwise, our third assumption in Section 3.5, the exclusion restriction, would likely be violated.

[52] Only clusters 1, 14 and 15 include connected geographic areas.

Table 3.15: Variables and weights for IFH construction

Variables	Metropolitan Lima	remaining urban areas	rural areas
Fuel used to cook			
Do not cook	-0.49	-0.67	-0.76
Other	-0.40	-0.50	-0.38
Firewood	-0.37	-0.33	0.05
Carbon	-0.33	-0.22	0.36
Kerosine	-0.29	-0.19	0.37
Gas	0.02	0.12	0.52
Electricity	0.43	0.69	0.52
Water supply in the home			
Other	-0.78	-0.58	
River	-0.65	-0.42	
Well	-0.62	-0.37	
Water tanker	-0.51	-0.34	
Pipe	-0.41	-0.32	
Outside	-0.35	-0.25	
Inside	0.10	0.12	
Wall material			
Other	-0.70	-0.80	
Wood or mat	-0.48	-0.55	
Stone with mud	-0.44	-0.46	
Rushes covered with mud	-0.41	-0.43	
Clay	-0.39	-0.38	
Sun-dried brick or adobe	-0.37	-0.20	
Stones, lime or concrete	-0.33	-0.07	
Brick	0.10	0.25	
Type of drainage			
None	-0.89	-0.68	
River	-0.75	-0.49	
Sinkhole	-0.59	-0.40	
Septic tank	-0.46	-0.30	
Drainage system outside the house	-0.39	-0.21	
Drainage system inside the house	0.10	0.20	
Number of members with health insurance			
None	-0.26	-0.25	-0.10
One	-0.04	0.06	0.50
Two	0.06	0.17	0.59
Three	0.14	0.27	0.66
More than three	0.32	0.48	0.86
Goods that identify household wealth			
None	-0.47	-0.35	-0.11
One	-0.17	0.05	0.64
Two	0.02	0.25	0.83
Three	0.15	0.40	0.90
Four	0.25	0.52	1.09
Five	0.47	0.75	1.09
Has fixed phone			
Yes	-0.32		
No	0.20		

Notes: Taken from SISFOH (2010).

Table 3.16: Variables and weights for IFH construction (continued)

Variables	Metropolitan Lima	remaining urban areas	rural areas
Roof material			
Other	-0.86	-0.90	
Straw	-0.74	-0.72	
Mat	-0.67	-0.62	
Woven cane	-0.38	-0.23	
Tiles	-0.23	0.03	
Wood or mat	-0.21	0.07	
Concrete	0.17	0.32	
Education of the Household head			
None	-0.51	-0.57	-0.59
Preschool	-0.43	-0.25	-0.08
Primary	-0.28	0.01	0.35
Secondary	-0.06	0.19	0.59
Vocational education (VET)	0.10	0.33	0.68
Undergraduate	0.22	0.55	0.88
Postgraduate	0.40	0.55	0.88
Floor material			
Other	-0.97	-1.12	
Land	-0.60	-0.47	
Concrete	-0.16	-0.01	
Wood	0.08	0.30	
Tiles	0.16	0.40	
Vinyl sheets	0.28	0.51	
Parquet	0.51	0.71	
Overcrowding			
More than six	-0.68		
Between four and six	-0.51		
Between two and four	-0.31		
Between one and two	-0.07		
Less than one	0.24		
Highest level of education in the house			
None			-0.35
Primary			0.11
Secondary			0.41
Vocational education (VET)			0.62
Undergraduate			0.83
Electricity			
No			-0.29
Yes			0.22
Floor made of earth			
Yes			-0.17
No			0.47

Notes: Taken from SISFOH (2010).

Table 3.17: Eligibility Thresholds by Cluster

Cluster	Threshold	Population	Per capita income 1/.	Per capita spending 1/.	Poverty status
1	33	208,101	2,184	1,815	0.5159
2	36	1,907,122	2,116	1,697	0.5994
3	34	2,284,876	2,332	1,937	0.5404
4	38	2,646,680	2,282	1,916	0.5389
5	35	634,472	2,067	1,595	0.6410
6	34	212,723	5,941	4,045	0.2606
7	52	2,544,448	5,141	4,260	0.2565
8	42	2,134,993	5,667	4,428	0.2397
9	44	3,740,611	6,403	5,050	0.1352
10	50	2,229,638	5,997	4,673	0.1620
11	44	490,207	5,498	4,015	0.2725
12	43	101,993	8,632	4,638	0.1645
13	43	1,636,740	5,045	4,024	0.2116
14	33	93,527	8,961	6,178	0.0261
15	55	9,342,700	8,712	6,612	0.1546
Peru	-	30,208,831	5,793	4,501	0.2764

Notes: Based on SISFOH (2010), own calculations using the ENAHO 2011. There is no threshold at the national level. 1/. Soles.

in the sense that an individual might be declared as eligible even though, according to the criteria that are used, is not part of the target population.[53]

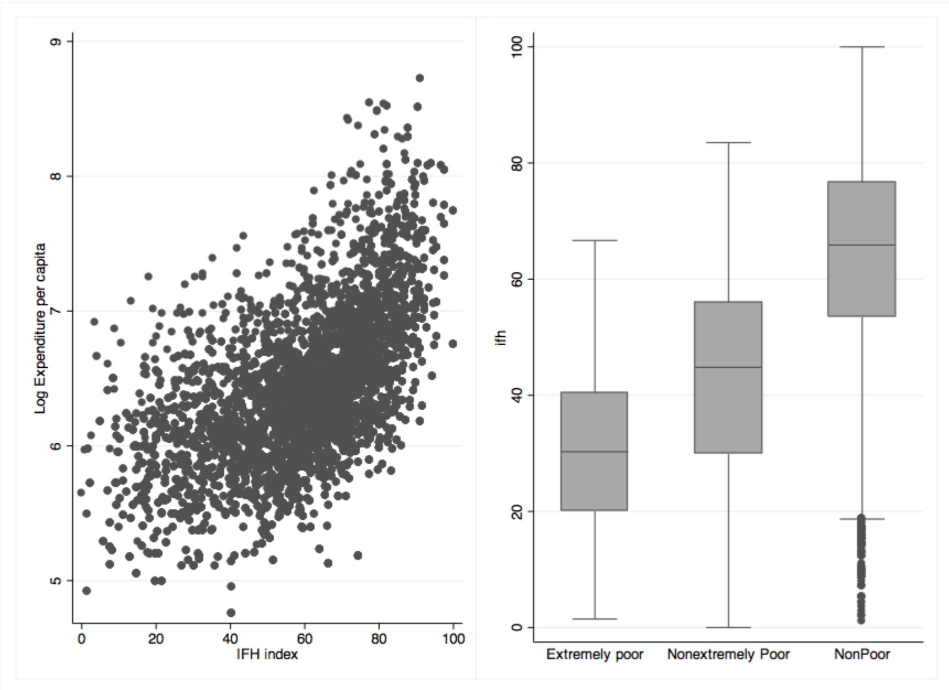
Table 3.17 also provides some economic indicators obtained from the ENAHO for the year 2011. The variation of the thresholds across clusters reflects the variation in income within Peru. The lower thresholds correspond to the poorer clusters, that is, those with the lowest levels of per capita monetary income (or spending) and the highest proportions of poor individuals.[54] The Lima Province, the city under analysis, is in cluster 15, with a cutoff of 55.

We use ENAHO data for the year 2011 as well as the actual weights to re-compute the IFH index for individuals and households in our sample. We cannot directly assess how strongly our index is correlated with the one that was used by the government to determine eligibility. However, as an informal test, we re-produced figures illustrating the correlations between the IFH index and expenditures per capita in SISFOH (2010). Figure 3.7 shows the figure we obtain for the Lima Province. Generally speaking, the reproduced figures resemble the official ones.

[53] The thresholds are set such that the marginal benefit of expanding five percentage points of coverage of the eligible population generated a marginal increase of one percentage point in that error.

[54] Cluster 14, which corresponds to the urban areas of the jungle of Madre de Dios, is an interesting exception. Informal mining and illegal drugs production have increased income levels during the past years.

Figure 3.7: Relationship between IFH and Expenditures Per Capita in Lima Province



Notes: Based on ENAHO data for the year 2011, See Appendix C for details on how the IFH index is computed. The right figure shows box plots for expenditures by poverty status.

D Additional Results

D.1 Ordinary Least Squares Estimates

Table 3.18: OLS Results for the Full Sample and by Gender

		(1) Full sample		(2) Women		(3) Men	
		Estimates	Ste.	Estimates	Ste.	Estimates	Ste.
Utilization							
1	Doctor visits	0.0733***	(0.0150)	0.0634***	(0.0212)	0.0785***	(0.0213)
2	Medicines	0.0664***	(0.0157)	0.0510**	(0.0219)	0.0785***	(0.0227)
3	Analysis	0.0388***	(0.0083)	0.0321**	(0.0125)	0.0440***	(0.0107)
4	X-rays	0.0232***	(0.0065)	0.0147	(0.0097)	0.0301***	(0.0083)
5	Other tests	0.0080**	(0.0038)	0.0079	(0.0058)	0.0077	(0.0050)
6	Dental care	0.0151	(0.0105)	-0.0062	(0.0144)	0.0372**	(0.0153)
7	Ophthalmology	-0.0008	(0.0072)	-0.0035	(0.0102)	0.0020	(0.0102)
8	Glasses	-0.0010	(0.0062)	-0.0040	(0.0087)	0.0035	(0.0090)
9	Vaccines	0.0369***	(0.0101)	0.0430***	(0.0146)	0.0313**	(0.0138)
10	Kids check	0.0058	(0.0292)	-0.0054	(0.0392)	0.0179	(0.0432)
11	Birth control	0.0110	(0.0076)	0.0311***	(0.0117)	-0.0108	(0.0094)
12	Others	0.0283**	(0.0136)	0.0229	(0.0195)	0.0303	(0.0190)
13	Hospital	0.0439***	(0.0081)	0.0552***	(0.0128)	0.0293***	(0.0095)
14	Surgery	0.0214***	(0.0067)	0.0240**	(0.0104)	0.0163**	(0.0080)
15	Pregnancy care	0.0856***	(0.0180)	0.0856***	(0.0180)		
16	Child birth	0.0531***	(0.0130)	0.0531***	(0.0130)		
0'	Medical attention	0.0841***	(0.0131)	0.0795***	(0.0189)	0.0834***	(0.0179)
1'	Doctor visits	0.0834***	(0.0130)	0.0795***	(0.0188)	0.0821***	(0.0179)
2'	Medicines	0.0819***	(0.0128)	0.0798***	(0.0185)	0.0793***	(0.0176)
3'	Analysis	0.0338***	(0.0079)	0.0261**	(0.0118)	0.0400***	(0.0101)
4'	X-rays	0.0157***	(0.0061)	0.0060	(0.0091)	0.0241***	(0.0078)
5'	Other tests	0.0067**	(0.0032)	0.0076*	(0.0046)	0.0057	(0.0043)
6'	Planning	0.0654***	(0.0209)	0.0654***	(0.0209)		
7'	Iron	0.0196	(0.0383)	0.0520	(0.0431)	-0.0839	(0.0829)
8'	Preventive campaign	0.0140**	(0.0063)	0.0238**	(0.0097)	0.0023	(0.0079)
Health report							
1	Symptom	-0.0093	(0.0157)	-0.0155	(0.0221)	-0.0049	(0.0223)
2	Illness	0.0171	(0.0113)	0.0275*	(0.0162)	0.0037	(0.0160)
3	Chronic illness	0.0423***	(0.0144)	0.0237	(0.0197)	0.0582***	(0.0212)
4	Relapse	0.0333***	(0.0097)	0.0146	(0.0140)	0.0509***	(0.0133)
5	Accident	0.0031	(0.0048)	0.0035	(0.0064)	0.0021	(0.0074)
6	Num. days with symptom	0.0322	(0.0361)	0.0109	(0.0491)	0.0535	(0.0580)
7	Num. days with illness	0.0103	(0.0347)	0.0196	(0.0567)	-0.0026	(0.0383)
8	Num. days with relapse	0.1092	(0.0806)	0.0983	(0.1197)	0.0969	(0.1039)
9	Num. days with accident	0.0846**	(0.0420)	0.1024	(0.0716)	0.0608	(0.0379)

Notes: OLS regressions of outcome variables on health insurance and covariates (i.e woman, age, years of education, number household members and woman as head of household). Standard errors are denoted by Ste. and reported in parentheses. "* p<0.10 ** p<0.05 *** p<0.01. Full: N=4,161 (total); N=649 (kids check); N=1.182 (pregnancy care); N=1,182 (child birth); N=1,181 (planning); N=343 (iron). Sample 75: N=3,124 (total); N=499 (kids check); N=892 (pregnancy care) N=892 (child birth); N=891 (planning); N=264 (iron). Sample 50: N=2,078 (total); N=347 (kids check); N=618 (pregnancy care) N=618 (child birth); N=617 (planning); N=189 (iron).

Table 3.19: Effect of Health Insurance on Participation and Utilization by Gender

		Women		Men	
		Estimates	Ste.	Estimates	Ste.
First stage: Participation					
0	Health Insurance	0.1415***	(0.0364)	0.1399***	(0.0363)
			$F = 15.1116$		$F = 14.8533$
Second stage: Utilization					
1	Doctor visits	0.4448*	(0.2657)	0.6016**	(0.2881)
2	Medicines	0.6602**	(0.2961)	0.4045	(0.2835)
3	Analysis	0.1705	(0.1331)	0.2413*	(0.1262)
4	X-rays	0.1583	(0.1098)	0.1006	(0.0899)
5	Other tests	-0.0253	(0.0614)	0.1321**	(0.0619)
6	Dental	0.0555	(0.1703)	0.0767	(0.1771)
7	Ophthalmology	0.0773	(0.1213)	-0.0114	(0.1167)
8	Glasses 1/.	-0.0593	(0.0945)	0.0004	(0.1024)
9	Vaccines	0.2027	(0.1847)	0.3862**	(0.1908)
10	Kids check	-0.6652	(0.6071)	0.4167	(0.3630)
11	Birth control	0.0274	(0.1344)	-0.3181**	(0.1394)
12	Others	0.3174	(0.2464)	0.0363	(0.2134)
13	Hospital	0.2172	(0.1563)	0.0845	(0.0972)
14	Surgery	0.4347***	(0.1649)	0.0735	(0.0845)
15	Pregnancy care	0.6504**	(0.2931)		
16	Child birth	0.1900	(0.1593)		
(1-16)	Any of the above	0.4198*	(0.2428)	0.4653*	(0.2823)

Notes: IV-2SLS regressions. 1/. Not covered by SIS. 2/. Women: N=2,127 (total); N=314 (kids check); N=1,182 (pregnancy care) N=1,182 (child birth). 3/. Men: N=2,034 (total); N=335 (kids check). 4/. Standard errors in parentheses * p<0.10 ** p<0.05 *** p<0.01

D.2 Differences by Gender

In Tables 3.19, 3.20 and 3.21 we conduct the IV-2SLS regressions but reducing the sample to two subgroups, women and men. In general, we lose significance due to the number of observations but we are able to know more about where effects come from.

Table 3.19 shows that the positive effects on the probabilities to receive medicines, surgery and pregnancy care are driven by women, whereas the impacts on the probability of being vaccinated comes from the men (probably children). The likelihood of visiting doctor is associated with both men and women.

Table 3.20 indicates that, conditional on having had a health problem, both women and men, publicly insured, are more likely to seek for medical attention in public hospitals and health care centers and to receive professional attention and medication (estimates for variables medical attention, doctor and medicines are significant at conventional levels). If we disentangle curative and preventive uses, we observe no effects on preventive services whereas we do find effects on curative services for both women and men.

Shifting attention to health report, in general we find no significant effects (see Table 3.21), but in the case on women we find positive and significant effect on one variable: illness. As we already explained,

Table 3.20: Effect of Health Insurance on Curative and Preventive Use by Gender

		Women		Men	
		Estimates	Ste.	Estimates	Ste.
Second stage: Utilization					
A. Curative (for individuals who had health problems)					
0’	Medical attention	0.6257**	(0.2529)	0.5070**	(0.2377)
1’	Doctor visits	0.6118**	(0.2501)	0.5045**	(0.2374)
2’	Medicines	0.5785**	(0.2433)	0.4543**	(0.2290)
3’	Analysis	0.1427	(0.1266)	0.2167*	(0.1161)
4’	X-rays	0.1429	(0.1054)	0.0397	(0.0823)
5’	Other tests	-0.0131	(0.0427)	0.0935*	(0.0512)
13	Hospital	0.2172	(0.1563)	0.0845	(0.0972)
14	Surgery	0.4347***	(0.1649)	0.0735	(0.0845)
16	Child birth	0.1900	(0.1593)		
(1’-5’,13,14,16)	Any of the above	0.9011***	(0.3039)	0.5868**	(0.2553)
B. Preventive (for specific groups of individuals)					
9	Vaccines	0.2027	(0.1847)	0.3862**	(0.1908)
10	Kids check	-0.6652	(0.6071)	0.4167	(0.3630)
11	Birth control	0.0274	(0.1344)	-0.3181**	(0.1394)
15	Pregnancy care	0.6504**	(0.2931)		
6’	Planning 1/.	-0.0412	(0.2447)		
7’	Iron 2/.	1.1696	(1.1375)	-0.0862	(0.5180)
8’	Preventive campaign 3/.	0.0515	(0.1094)	0.0178	(0.0844)
(6’-8’,9-11,15)	Any of the above	0.2911	(0.2404)	0.2783	(0.2160)

Notes: IV-2SLS regressions. 1/. Family planning for women at fertile age. 2/. Reception of iron supplements for pregnant women and children under three years old. 3/. Information on prevention of sickness. 4/. Women: N=2,127 (total); N=314 (kids check); N=1,182 (pregnancy care); N=1,181 (planning); N=255 (iron). 5/. Men: N=2,034 (total); N=335 (kids check); N=88 (iron). 6/. Standard errors in parentheses * p<0.10 ** p<0.05 *** p<0.01

Table 3.21: Effect of Health Insurance on Health by Gender

		Women		Men	
		Estimates	Ste.	Estimates	Ste.
Second stage: Health report					
1	Symptom	0.1164	(0.2670)	0.4327	(0.2871)
2	Illness	0.4833**	(0.2215)	0.1400	(0.1960)
3	Chronic illness	0.1366	(0.2399)	0.0105	(0.2504)
4	Relapse	0.1307	(0.1662)	-0.0097	(0.1485)
5	Accident	-0.0020	(0.0700)	0.1439	(0.1000)
6	Num. days with symptom	0.0950	(0.4995)	0.6927	(0.8642)
7	Num. days with illness	0.8062	(0.5478)	0.3940	(0.4673)
8	Num. days with relapse	-0.1836	(1.1663)	1.8964	(1.4563)
9	Num. days with accident	1.0086	(0.8235)	0.0057	(0.3664)

Notes: IV-2SLS regressions. 1/. Women: N=2,127. 2/. Men: N=2,034. 3/. Standard errors in parentheses * p<0.10 ** p<0.05 *** p<0.01

the public insurance implies a closer relationship between individuals and the health system, hence we argue that women in our sample seems to be more aware they have an illness and report it (Strauss and Thomas, 1998; Dow et al., 1997).

D.3 Health expenditures

Table 3.22: Health outcome variables by expenditure groups

	Low Z1<0	Low Z1>=0	High Z1<0	High Z1>=0		Low Z1<0	Low Z1>=0	High Z1<0	High Z1>=0
Doctor visit	0.1373	0.0998	0.7289	0.6000	Medical attention	0.0892	0.0560	0.5783	0.4970
	0.3446	0.3000	0.4459	0.4914		0.2853	0.2301	0.4953	0.5015
Medicines	0.2193	0.1557	0.8614	0.7939	Doctor visit 1	0.0892	0.0560	0.5663	0.4909
	0.4143	0.3630	0.3465	0.4057		0.2853	0.2301	0.4971	0.5014
Analysis	0.0361	0.0146	0.2229	0.1697	Medicines 1	0.0867	0.0560	0.5542	0.4909
	0.1869	0.1201	0.4174	0.3765		0.2818	0.2301	0.4986	0.5014
X-Rays	0.0145	0.0073	0.1627	0.1152	Analysis1	0.0337	0.0122	0.1988	0.1636
	0.1195	0.0852	0.3702	0.3202		0.1808	0.1098	0.4003	0.3711
Tests	0.0024	0.0024	0.0542	0.0364	X-Rays 1	0.0120	0.0073	0.1506	0.1152
	0.0491	0.0493	0.2271	0.1878		0.1092	0.0852	0.3587	0.3202
Dental	0.0458	0.0341	0.2831	0.2727	Tests 1	0.0000	0.0000	0.0361	0.0242
	0.2093	0.1816	0.4519	0.4467		0.0000	0.0000	0.1872	0.1543
Eyes	0.0193	0.0122	0.1265	0.1697	Curative	0.1301	0.1022	0.6867	0.5636
	0.1377	0.1098	0.3334	0.3765		0.3368	0.3033	0.4652	0.4974
Glasses	0.0096	0.0024	0.0723	0.1455	Planning	0.1188	0.0813	0.1509	0.1020
	0.0978	0.0493	0.2597	0.3536		0.3252	0.2744	0.3614	0.3058
Vaccines	0.1422	0.0876	0.1024	0.1273	Iron	0.1111	0.0294	0.2143	0.3333
	0.3496	0.2830	0.3041	0.3343		0.3187	0.1715	0.4258	0.5000
Kids check	0.1932	0.2424	0.4286	0.1923	Preventive campaign	0.0313	0.0268	0.0482	0.0485
	0.3971	0.4318	0.5040	0.4019		0.1744	0.1616	0.2148	0.2154
Birth control	0.0289	0.0195	0.0663	0.0848	Preventive	0.2169	0.1557	0.2590	0.2606
	0.1678	0.1383	0.2495	0.2795		0.4126	0.3630	0.4394	0.4403
Others	0.1084	0.0900	0.2952	0.4303	Symptom	0.2964	0.2968	0.5602	0.4667
	0.3113	0.2866	0.4575	0.4966		0.4572	0.4574	0.4979	0.5004
Hospital	0.0434	0.0462	0.1325	0.1152	Illness	0.0964	0.0365	0.2349	0.2364
	0.2039	0.2102	0.3401	0.3202		0.2955	0.1878	0.4252	0.4261
Surgery	0.0265	0.0243	0.1265	0.0727	Chronic	0.2964	0.2968	0.5843	0.6303
	0.1608	0.1543	0.3334	0.2605		0.4572	0.4574	0.4943	0.4842
Pregnancy care	0.1287	0.0813	0.1509	0.1020	Relapse	0.0506	0.0511	0.2108	0.2121
	0.3366	0.2744	0.3614	0.3058		0.2194	0.2205	0.4091	0.4101
Child birth	0.0693	0.0569	0.0755	0.0408	Accident	0.0145	0.0024	0.0663	0.0303
	0.2552	0.2326	0.2667	0.1999		0.1195	0.0493	0.2495	0.1719
Use	0.4410	0.3528	1.0000	1.0000	Symptom Num. days	0.1084	0.0973	0.1867	0.1879
	0.4971	0.4784	0.0000	0.0000		1.5085	1.0384	0.7909	0.8943
					Illness Num. days	0.0651	0.0146	0.4036	0.2545
						0.5367	0.1705	1.5530	1.1876
					Relapse Num. days	0.2651	0.1338	0.7831	0.6424
						2.6480	1.6789	3.8849	4.0439
					Accident Num. days	0.0169	0.0000	0.4096	0.1030
						0.2641	0.0000	2.8817	0.9476
					Health expenditure (Soles)	4.3735	2.4161	1432.1270	1324.7330

D.4 Additional Tables for Sensitivity Analysis

Table 3.23: IV-2SLS at the medians of the subsample distributions

	Median Z<55	(1) Full sample		(2) Sample 75%		(3) Sample 50%	
		Estimates	Ste.	Estimates	Ste.	Estimates	Ste.
First stage: Participation							
0	Health Insurance	-0.0160	(0.0455)	-0.0067	(0.0538)	0.0209	(0.0651)
			$F = 0.1237$		$F = 0.0155$		$F = 0.1031$
Second stage: Utilization							
1	Doctor visits	3.1152	(9.0213)	14.2173	(113.2961)	-1.5376	(5.9184)
2	Medicines	2.5642	(7.5926)	8.2319	(65.6629)	-1.1515	(4.9309)
3	Analysis	0.5863	(2.1066)	1.6053	(13.1504)	0.6894	(2.5525)
4	X-rays	0.7143	(2.2662)	0.3760	(4.1790)	0.6777	(2.3516)
5	Other tests	0.0669	(0.6350)	-0.3273	(3.2590)	-0.2170	(1.0048)
6	Dental care	0.4442	(2.0624)	-0.1616	(5.0548)	2.1758	(6.9219)
7	Ophthalmology	1.6162	(4.6851)	4.4831	(35.9662)	-0.5749	(1.9599)
8	Glasses	1.4392	(4.2278)	1.7585	(14.4648)	-0.0345	(0.9222)
9	Vaccines	4.0881	(11.6414)	22.4286	(179.3428)	-6.8304	(21.2996)
10	Kids check	1.3285	(6.1547)	-0.9031	(4.3801)	0.2555	(1.6658)
11	Birth control	-1.6099	(4.7842)	-3.0300	(24.6963)	1.2799	(4.1810)
12	Others	4.7598	(13.7206)	10.1690	(81.5841)	-2.3858	(7.8533)
13	Hospital	1.3865	(3.9999)	3.4710	(27.5809)	-1.2934	(4.3790)
14	Surgery	1.4760	(4.2762)	4.5179	(36.0962)	-1.3853	(4.5133)
15	Pregnancy care	-12.3856	(356.4444)	1.0199	(3.6983)	1.3988	(12.6485)
16	Child birth	3.9812	(113.6240)	-0.5121	(2.2735)	-0.2288	(4.2888)
0'	Medical attention	1.3966	(4.2963)	6.2757	(49.5992)	-2.8409	(9.6498)
1'	Doctor visits	1.8136	(5.3320)	6.4686	(51.1275)	-2.7256	(9.3072)
2'	Medicines	2.0428	(5.9121)	5.6401	(44.5245)	-2.8328	(9.6257)
3'	Analysis	0.5004	(1.8910)	0.8785	(7.8034)	0.8804	(3.0105)
4'	X-rays	0.7582	(2.3646)	0.3034	(3.7348)	0.8660	(2.8609)
5'	Other tests	-0.1090	(0.4980)	-0.5459	(4.5190)	-0.0242	(0.4522)
6'	Planning	14.7303	(419.9662)	-2.6319	(9.5069)	7.4002	(65.7071)
7'	Iron	-1.1360	(1.4227)	-0.7489	(1.4188)	-0.2569	(0.7720)
8'	Preventive campaign	0.5337	(1.9841)	1.1240	(9.6639)	0.8012	(2.8689)
Health report							
1	Symptom	-0.8470	(3.8124)	0.9297	(10.6142)	1.5909	(5.5726)
2	Illness	0.2594	(2.1987)	3.1431	(25.3804)	-0.4516	(2.8994)
3	Chronic illness	1.4699	(4.7893)	9.9956	(80.3271)	-3.3579	(10.7153)
4	Relapse	-1.0055	(3.2326)	1.4927	(12.6977)	-1.9782	(6.3177)
5	Accident	1.1493	(3.4220)	2.3733	(19.2548)	-0.7489	(2.5050)
6	Num. days with symptom	2.8030	(9.5805)	17.3124	(139.2717)	-5.2107	(16.9078)
7	Num. days with illness	-8.0916	(24.2102)	-29.8136	(240.3652)	10.7701	(34.5336)
8	Num. days with relapse	-3.4676	(12.0192)	-22.5220	(182.5997)	0.9482	(9.7698)
9	Num. days with accident	5.3389	(15.9987)	18.3468	(146.8399)	-10.6549	(34.3236)

Notes: IV-2SLS regressions. Standard errors are denoted by Ste. and reported in parentheses. "* p<0.10 ** p<0.05 *** p<0.01. Full: N=1,786 (total); N=363 (kids check); N=532 (pregnancy care); N=532 (child birth); N=532 (planning); N=177 (iron). Sample 75: N=1,333 (total); N=269 (kids check); N=392 (pregnancy care) N=392 (child birth); N=392 (planning); N=130 (iron). Sample 50: N=902 (total); N=174 (kids check); N=266 (pregnancy care) N=266 (child birth); N=266 (planning); N=84 (iron).

Table 3.24: IV-2SLS at the medians of the subsample distributions

	Median Z≥55	(1) Full sample		(2) Sample 75%		(3) Sample 50%	
		Estimates	Ste.	Estimates	Ste.	Estimates	Ste.
First stage: Participation							
0	Health Insurance	0.0565	(0.0376)	0.0962**	(0.0448)	0.0201	(0.0605)
			$F = 2.2580$		$F = 4.6110$		$F = 0.1104$
Second stage: Utilization							
1	Doctor visits	0.4775	(0.6780)	0.5318	(0.4824)	3.3836	(10.2383)
2	Medicines	-0.2016	(0.6993)	-0.0018	(0.4704)	0.1145	(2.9544)
3	Analysis	-0.5745	(0.5287)	-0.3626	(0.3069)	0.6739	(2.4458)
4	X-rays	-0.4274	(0.4173)	-0.0856	(0.2040)	0.2626	(1.4581)
5	Other tests	0.0862	(0.1825)	0.1591	(0.1449)	0.0559	(0.8215)
6	Dental care	-0.4177	(0.5419)	-0.3954	(0.3718)	-0.8443	(3.2882)
7	Ophthalmology	-0.5347	(0.4869)	-0.4431	(0.3073)	-2.5184	(7.6159)
8	Glasses	-0.2632	(0.3561)	-0.2924	(0.2547)	-0.5562	(2.1578)
9	Vaccines	1.1538	(0.8391)	1.0150*	(0.5260)	4.1314	(12.3479)
10	Kids check	0.4217	(1.5673)	0.0167	(0.6780)	0.1586	(1.6473)
11	Birth control	0.2812	(0.3760)	0.2137	(0.2499)	1.8521	(5.7011)
12	Others	0.5690	(0.7082)	0.6265	(0.5072)	2.0475	(6.7097)
13	Hospital	-0.0852	(0.3378)	-0.2331	(0.2598)	-2.5987	(8.0320)
14	Surgery	-0.1892	(0.2907)	-0.1578	(0.1944)	-1.6656	(5.1437)
15	Pregnancy care	-0.3562	(1.9939)	0.1614	(2.1909)	-0.6366	(2.1904)
16	Child birth	0.0468	(0.7438)	-0.6018	(4.1688)	0.0444	(0.6071)
0'	Medical attention	-0.5308	(0.6836)	-0.1483	(0.3968)	0.0169	(2.3616)
1'	Doctor visits	-0.4659	(0.6575)	-0.1038	(0.3908)	0.2919	(2.4170)
2'	Medicines	-0.5996	(0.7035)	-0.2370	(0.4010)	-0.3743	(2.6905)
3'	Analysis	-0.4596	(0.4584)	-0.2994	(0.2751)	0.7427	(2.5640)
4'	X-rays	-0.2538	(0.3328)	0.0032	(0.1912)	0.4809	(1.8283)
5'	Other tests	0.0666	(0.1452)	0.0735	(0.1009)	0.1070	(0.6901)
6'	Planning	-1.9868	(8.2431)	3.0745	(18.4645)	-2.2867	(7.3510)
7'	Iron	0.6271	(1.5691)	-1.0186	(3.1152)	0.4311	(0.6005)
8'	Preventive campaign	0.1187	(0.2777)	0.1202	(0.1928)	-1.3088	(4.2166)
Health report							
1	Symptom	-0.3881	(0.7074)	-0.4038	(0.5022)	-0.5615	(3.3525)
2	Illness	0.3262	(0.5334)	0.1931	(0.3438)	1.2619	(4.3061)
3	Chronic illness	0.1146	(0.6412)	0.0351	(0.4484)	2.4965	(8.0458)
4	Relapse	-0.3406	(0.5205)	-0.3980	(0.3831)	-0.9860	(3.8291)
5	Accident	-0.1475	(0.2292)	0.0225	(0.1384)	0.6733	(2.1438)
6	Num. days with symptom	0.9274	(1.0469)	0.9754	(1.0353)	-2.3397	(7.5884)
7	Num. days with illness	-1.8098	(1.7281)	-1.3920	(1.0875)	-10.3284	(31.8735)
8	Num. days with relapse	-2.5108	(4.1129)	0.0739	(2.7562)	-6.1205	(24.5066)
9	Num. days with accident	-2.6958	(2.3248)	-1.7203	(1.3669)	-2.9640	(12.0069)

Notes: IV-2SLS regressions. Standard errors are denoted by Ste. and reported in parentheses. "* p<0.10 ** p<0.05 *** p<0.01. Full: N=2,375 (total); N=286 (kids check); N=650 (pregnancy care); N=650 (child birth); N=649 (planning); N=166 (iron). Sample 75: N=1,788 (total); N=215 (kids check); N=478 (pregnancy care) N=478 (child birth); N=478 (planning); N=129 (iron). Sample 50: N=1,176 (total); N=140 (kids check); N=306 (pregnancy care) N=306 (child birth); N=306 (planning); N=78 (iron).

Table 3.25: Effect of Health Insurance on Utilization: No Controls and Reduced Samples

		(1)		(2)		(3)	
		Full sample no controls		Sample 75%		Sample 50%	
		Estimates	Ste.	Estimates	Ste.	Estimates	Ste.
First stage: Participation							
0	Health Insurance	0.1385***	(0.0257)	0.1100***	(0.0314)	0.0910**	(0.0409)
Second stage: Utilization			$F = 29.0425$		$F = 12.2723$		$F = 4.9504$
1	Doctor visits	0.4975**	(0.1965)	0.7604**	(0.3398)	0.6378	(0.5000)
2	Medicines	0.5044**	(0.2072)	0.8826**	(0.3689)	0.9097	(0.5781)
3	Analysis	0.2063**	(0.0941)	0.3631**	(0.1640)	0.1077	(0.2096)
4	X-rays	0.1220*	(0.0715)	0.2896**	(0.1314)	0.2117	(0.1781)
5	Other tests	0.0476	(0.0420)	-0.0134	(0.0636)	0.0147	(0.1097)
6	Dental	0.0818	(0.1249)	0.2933	(0.2079)	0.1092	(0.3005)
7	Ophthalmology	0.0269	(0.0850)	0.0255	(0.1314)	-0.2501	(0.2416)
8	Glasses 1/.	-0.0405	(0.0705)	0.0042	(0.1026)	-0.2307	(0.1891)
9	Vaccines	0.2880**	(0.1364)	0.3220	(0.2110)	0.4440	(0.3667)
10	Kids check	0.1645	(0.2955)	0.4880	(1.5819)	-0.8043	(2.9582)
11	Birth control	-0.1127	(0.0941)	-0.1493	(0.1500)	-0.0092	(0.2232)
12	Others	0.1859	(0.1653)	-0.0896	(0.2475)	-0.6426	(0.4753)
13	Hospital	0.1347	(0.0952)	0.3110*	(0.1590)	0.3505	(0.2574)
14	Surgery	0.2637***	(0.0902)	0.4407***	(0.1684)	0.4062	(0.2521)
15	Pregnancy care	0.6434**	(0.2942)	0.8070	(0.5415)	0.8604	(1.0486)
16	Child birth	0.1787	(0.1615)	0.0628	(0.2654)	0.1559	(0.5088)
(1-16)	Any of the above	0.4282**	(0.1887)	0.7161**	(0.3274)	0.3727	(0.4498)

Notes: 1/. Not covered by SIS. 2/. Full: N=4,161 (total); N=649 (kids check); N=1.182 (pregnancy care); N=1,182 (child birth). 3/. Sample 75: N=3,124 (total); N=499 (kids check); N=892 (pregnancy care) N=892 (child birth). 4/. Sample 50: N=2,078 (total); N=347 (kids check); N=618 (pregnancy care) N=618 (child birth). 5/. Standard errors in parentheses * p<0.10 ** p<0.05 *** p<0.01

Table 3.26: Effect of Health Insurance on Curative and Preventive Uses: No Controls and Reduced Samples

		(1)		(2)		(3)	
		Full sample no controls		Sample 75%		Sample 50%	
		Estimates	Ste.	Estimates	Ste.	Estimates	Ste.
Second stage: Utilization							
A. Curative (for individuals who had health problems)							
0'	Medical attention	0.5424***	(0.1747)	0.7631**	(0.3076)	0.6714	(0.4532)
1'	Doctor visits	0.5339***	(0.1736)	0.7463**	(0.3038)	0.6081	(0.4373)
2'	Medicines	0.4929***	(0.1683)	0.6930**	(0.2930)	0.5155	(0.4150)
3'	Analysis	0.1794**	(0.0881)	0.2919**	(0.1476)	0.0163	(0.1980)
4'	X-rays	0.0868	(0.0673)	0.2072*	(0.1160)	0.1259	(0.1594)
5'	Other tests	0.0377	(0.0324)	-0.0096	(0.0485)	0.0313	(0.0810)
13	Hospital	0.1347	(0.0952)	0.3110*	(0.1590)	0.3505	(0.2574)
14	Surgery	0.2637***	(0.0902)	0.4407***	(0.1684)	0.4062	(0.2521)
16	Child birth	0.1787	(0.1615)	0.0628	(0.2654)	0.1559	(0.5088)
(1'-5',6,7,8)	Any of the above	0.7069***	(0.1974)	1.0279***	(0.3638)	0.8655*	(0.5161)
B. Preventive (for specific groups of individuals)							
9	Vaccines	0.2880**	(0.1364)	0.3220	(0.2110)	0.4440	(0.3667)
10	Kids check	0.1645	(0.2955)	0.4880	(1.5819)	-0.8043	(2.9582)
11	Birth control	-0.1127	(0.0941)	-0.1493	(0.1500)	-0.0092	(0.2232)
15	Pregnancy care	0.6434**	(0.2942)	0.8070	(0.5415)	0.8604	(1.0486)
6'	Planning 1/.	-0.0270	(0.2455)	0.0426	(0.3875)	0.5890	(0.8563)
7'	Iron 2/.	0.5821	(0.4075)	0.8659	(1.0467)	0.0934	(1.0081)
8'	Preventive campaign 3/.	0.0403	(0.0699)	-0.1115	(0.1046)	-0.3091	(0.2045)
(6'-8',9-11,15)	Any of the above	0.2963*	(0.1693)	0.2075	(0.2518)	0.1286	(0.3956)

Table 3.27: Effect of Health Insurance on Health: No Controls and Reduced Samples

		(1)		(2)		(3)	
		Full sample no controls		Sample 75%		Sample 50%	
		Estimates	Ste.	Estimates	Ste.	Estimates	Ste.
Second stage: Health report							
1	Symptom	0.2655	(0.1977)	0.3459	(0.3118)	0.4221	(0.4981)
2	Illness	0.3140**	(0.1475)	0.4533*	(0.2464)	0.4254	(0.3835)
3	Chronic illness	0.0116	(0.1904)	0.1986	(0.2755)	0.1592	(0.4342)
4	Relapse	0.0295	(0.1157)	0.0756	(0.1804)	0.1869	(0.2917)
5	Accident	0.0773	(0.0603)	0.1947*	(0.1054)	0.1381	(0.1536)
6	Num. days with symptom	0.3740	(0.4603)	0.8116	(0.8134)	1.4127	(1.4355)
7	Num. days with illness	0.6131*	(0.3713)	0.7287	(0.5268)	0.6967	(0.7140)
8	Num. days with relapse	0.7297	(0.9491)	1.3831	(1.5312)	2.2356	(2.5425)
9	Num. days with accident	0.5432	(0.4562)	1.5373*	(0.8913)	1.4919	(1.4427)

Chapter 4

Is utility informative about happiness?

This chapter is a coauthored work with Arthur van Soest and Frederic Vermeulen.[1]

4.1 Introduction

Two disconnected literatures can be distinguished that focus on concepts like happiness, life satisfaction, (subjective) well-being, (individual) preferences, and (individual) utility. On the one hand, there is the blossoming literature that mainly concentrates on the relationship between survey-based answers on individuals' subjective well-being and their (relative) income. This literature is characterized by its rather loose connection with economic theory and by reduced form empirical analyses that focus on the identification of the impact of (relative) income and various other characteristics on subjective well-being. See the overview studies by Frey and Stutzer (2002), Kahneman and Krueger (2006), Van Praag and Ferrer-i Carbonell (2008) and Clark et al. (2008) for detailed discussions and examples. On the other hand, there is the literature on the intra-household allocation of time and resources that is based on seminal work by Chiappori (1988). This literature is characterized by a close connection between economic theory and data and its structural form empirical analyses (see Browning and Chiappori, 1998, Cherchye et al., 2012, and Dunbar et al., 2013, for only a few examples). One of the aims of this literature is the identification of the mechanism that governs the intra-household allocation of time and resources and the identification of individual preferences on the basis of their observed choice behavior.

In this paper, our intention is to close the gap between these two literatures. To do this, we first estimate a structural model along the lines of Chiappori et al. (2002) that explains the intra-household allocation of time and resources in couples and allows identifying individual preferences. Secondly, we relate individual utilities to measures of subjective well-being to analyze whether the former are informative for the latter.

The paper uses novel and unique data from the Longitudinal Internet Studies for the Social Sciences (LISS), which is a representative panel for the Dutch adult population. The panel does not only contain detailed information about the intra-household allocation of time use and resources (i.e. food consump-

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tion expenditure, private expenditure, leisure time, time spent with children and household work) but also has extensive information on individual well-being (i.e. happiness) and life and domain-specific satisfaction (i.e., satisfaction with leisure, work, and the financial situation).

We use two definitions of leisure time. The first definition is called "pure leisure" and it is the time spent on leisure activities like watching TV, doing sports, traveling and hobbies. The second definition is called "constructed leisure" and it is defined as the leisure usually focused on in labor supply models applied to data without detailed information on time use. We compute it by subtracting hours worked on the labor market from the total hours available minus an assumed amount of time spent on sleeping and personal care. In the latter definition, time spent on home production activities is defined as leisure time. We use both definitions to explore whether any specific measure of leisure works best and what is missed when we focus on an alternative measure.

Results favor the use of the "pure leisure" definition versus the "constructed leisure" one, in line with the notion that the distinction between leisure and household production matters for welfare analysis (cf., e.g., Apps and Rees, 2009). Overall, the evidence suggests that individuals' responses to general questions of happiness and satisfaction are less correlated with individual utility measures than responses to more specific questions on domain satisfaction (i.e. related to leisure, work, or the financial situation). Our interpretation is that when we use a more appropriate definition of leisure (pure leisure), we are able to identify individual preferences over leisure and consumption which are represented by utility measures that are more informative about specific aspects of life, in particular in the domains of leisure, work, and financial situation. By using constructed leisure we only capture this relationship partially, because this measure does not disentangle genuine leisure from time allocated to children or housework, which might have different effects on utility and thus leads to different conclusions about the relationship between well-being and utility.

Ideally, one would expect a positive correlation between utilities and general measures of well-being. However, the correlation will never be perfect. This is what we find in our analysis. Our individual's utility measures use just two inputs: consumption (of food and private personal goods) and leisure. Both can be argued to be very important inputs for the well-being but they are not the only factors.

Our results are well in line with the literature on the relationship between well-being survey measures and choices. For instance, Benjamin et al. (2012) provide evidence that individual's subjective well-being predictions help to predict their choices and that the strength of this relationship varies depending on, for example, the nature of the choice situations and the subject population. Our results are in line with this evidence. Our estimation and computation of utilities rely basically on observed choices of consumption and leisure on the basis of utility maximization. By finding significant relationships between these utilities and specific satisfaction variables, we contribute to linking well-being measures to choices. One important difference with the Benjamin et al. (2012) study is that we focus on observed choices from real situations rather than predicted choices in hypothetical scenarios.

To interpret our results it is also important to note that there could be factors influencing individual's responses to well-being questions. For instance, Kahneman and Krueger (2006) have found that happiness reports depend on contexts where questions take place, on the mood of the individuals, on specific situations individuals experience, memory, and the reference provided. Dolan and Kahneman (2008) show that, although individuals tend to adapt to changes in their circumstances, they often fail to predict to which degree they will adapt. Together this evidence implies for our research that the general well-being variables we use might include the effect of other factors and life events that are taking place in the lives of the respondents. Then, naturally, it is more difficult to find significant correlations between these general reports and our utility measures. A clearer picture arises if we consider satisfaction with several domains of life, which can be seen as the building blocks of satisfaction with life as a whole (Ferrer-i Carbonell and Van Praag, 2002, Van Praag et al., 2003). Some of these domains more directly relate to the arguments of our utility function, and it is there that we indeed find significant positive correlations with our utility measures.

We proceed as follows. After discussing our conceptual framework in Section 4.2, Section 4.3 provides information on our data and explores the main statistics. In Section 4.4 we formally describe the empirical approach and the results are presented in Section 4.5. Section 4.6 conducts an analysis to assess whether the results are sensitive to the particular specifications we use. Section 4.7 concludes and discusses some limitations of our study.

4.2 Theoretical model

Our aim in this study is to relate individual subjective well-being measures to individual utilities. Many social surveys nowadays contain questions about individual life satisfaction, happiness or well-being. The survey we will make use of is one of the numerous examples in this respect. Much more difficult is obtaining information on individuals's utilities as cardinal representations of their preferences. An often used approach is to make use of observed choice behavior to identify preferences. For example, it is a standard result in microeconomics that one can identify a decision maker's preferences over leisure and consumption goods by means of observed labor supply and consumption choices as functions of the decision maker's resources, wages and prices.

A first problem is raised with respect to the definition of the decision makers in multi-person households. In the standard unitary model, a household is seen as the decision maker. This household then is assumed to have rational preferences over the household members' leisure and household consumption, which are represented by a well-behaved household utility function. The household's choices then are the result from the maximization of its utility function subject to a household budget constraint. One difficulty with this approach is that there is a lot of empirical evidence that this unitary model does not fit the data for multi-person households very well. The unitary model's theoretical implications are often rejected when they are tested on data that are related to multi-person households (see, for example, Browning and Chiappori, 1998, Cherchye and Vermeulen, 2008, Cherchye et al., 2009, and Cherchye et al., 2011). Given that the unitary model works well to model singles' labor supply and consumption behavior (see Browning and Chiappori, 1998, and Cherchye et al., 2009), the evidence suggests that the aggregation of rational individual preferences into household preferences is problematic.

This brings us immediately to a second problem given our research question. Measures of subjective well-being are by default individual-specific. Utilities obtained through the above discussed standard microeconomic approach are household specific. Only when the household consists of a single individual, preferences, and the utility function that represents the latter, are individual specific. Note that this is a general problem: even in the case when the unitary model would work well for multi-person households, there is the issue that one cannot say anything about the household members' preferences on the basis of the household's preferences without overly strong assumptions (like the often made assumption that every household member is equally well-off).

A particularly interesting alternative approach to the unitary model has been proposed by Chiappori (1988, 1992). This alternative, the so-called collective model, explicitly accounts of the fact that a multi-person household consists of several individuals who have their own rational preferences. These individuals are assumed to be involved in some intra-household bargaining process that gives rise to Pareto-efficient intra-household allocations. As demonstrated by Chiappori (1988), individual preferences and the sharing rule (which governs the allocation of the household's resources to its members) can be identified if there is one "exclusive good" per household member, affecting utility of that member only (see Chiappori and Ekeland, 2009, for identification results in more general settings).

The importance of the identification results associated with the collective model is that they in principle allow to identify individual utilities (as a representation of individual preferences) on the basis of household level data under some exclusivity assumption. It is exactly in these utilities that we are interested given our research question.

Let us next demonstrate how we will proceed in practice. In what follows, we will focus on couples. Female and male spouses are assumed to have egoistic (or Beckerian caring preferences; see Chiappori, 1992) over the own leisure and the own private consumption of a Hicksian good. Let us denote the female and male spouses' own leisure by respectively l^f and l^m, while the consumption of the Hicksian good is denoted by respectively c^f and c^m. The spouses' preferences are assumed to be represented by the utility functions:

$$u^f = \upsilon^f(l^f, c^f)$$

$$u^m = \upsilon^m(l^m, c^m).$$

Each spouse is faced with the following time constraint:

$$l^f + h^f = T^f$$

$$l^m + h^m = T^m.$$

where h^i is hours worked on the labor market and T^i is the total available time of spouse i ($i = f, m$). As mentioned in the introduction, we will focus on two types of leisure in the empirical analysis. The first type (pure leisure) will be the time that remains after subtracting all hours worked (both market work as well as household work) from the physical time T available (where $T^i = T - k^i$ with k^i spouse i's time spent on household work, which is supposed to be fixed).[2] The amount of pure leisure is recorded in our data and contains time spent on leisure activities like watching TV, doing sports, traveling and hobbies. The second type of leisure (constructed leisure) is the leisure usually focused on in labor supply models applied to data without detailed time use. It is obtained by subtracting hours worked on the labor market from the total hours available minus an assumed amount of time spent on sleeping and personal care (where $T^i = T$).

[2] See Cherchye et al. (2012) for a model with completely endogenous time use.

As it is standard, we will assume that the opportunity cost for an hour of leisure is equal to the spouses' hourly wage rates, which are denoted by w^f and w^m respectively. Further, the couple may have some nonlabor income that is denoted by y. This results in a household budget constraint that is equal to:

$$c^f + c^m + w^f l^f + w^m l^m = y + w^f T^f + w^m T^m.$$

As mentioned earlier, the collective model assumes that spouses' choose Pareto-efficient intra-household allocations. Given the assumptions made thus far, this implies that the household's choices result from the following maximization programme (see Chiappori, 1988):

$$\max_{c^f, c^m, l^f, l^m} \upsilon^f(l^f, c^f) + \mu(w^f, w^m, y, \mathbf{z})\upsilon^{wm}(l^m, c^m) \tag{4.1}$$

subject to

$$c^f + c^m + w^f l^f + w^m l^m = y + w^f T^f + w^m T^m$$

$$l^f + h^f = T^f$$

$$l^m + h^m = T^m.$$

The function $\mu(w^f, w^m, y, \mathbf{z})$ is spouse m's relative Pareto weight, which will in general depend on the wages, the non-labor income and, possibly, a set of so-called distribution factors $\mathbf{z}$ that are variables that by definition only affect the Pareto weight and not the preferences or the budget constraint (see, e.g., Chiappori et al., 2002).

Solving the above optimization programme results in the following demand functions:

$$l^f = g^{l^f}(w^f, w^m, y, \mathbf{z}) \tag{4.2}$$

$$c^f = g^{c^f}(w^f, w^m, y, \mathbf{z})$$

$$l^m = g^{l^m}(w^f, w^m, y, \mathbf{z})$$

$$c^m = g^{c^m}(w^f, w^m, y, \mathbf{z})$$

Given the particular assumptions about the individual preferences and the exclusivity of the goods, this leads to the following demand functions:

$$l^f = \tilde{g}^{l^f}(w^f, y^f + w^f T^f)$$

$$c^f = \tilde{g}^{c^f}(w^f, y^f + w^f T^f)$$

$$l^m = \tilde{g}^{l^m}(w^m, y^m + w^m T^m)$$

$$c^m = \tilde{g}^{c^m}(w^m, y^m + w^m T^m)$$

where $y^f + y^m = y$ and where y^i is spouse i's share of the household's nonlabor income y. This share is actually a function that depends on the variables w^f, w^m, y and $\mathbf{z}$, and it is directly related to the Pareto weight. The variable $y^i + w^i T^i$ is then spouse i's share of the household's full income.[3] The solution can also be obtained in two stages, where full expenditure shares are determined in the first stage and individual choices in the second stage. The above demand functions basically come from the following individual maximization programmes in the second stage ($i = f, m$):

$$\max_{c^i, l^i} \upsilon^i(l^i, c^i) \tag{4.3}$$

subject to

$$c^i + w^i l^i = y^i + w^i T^i$$

$$l^i + h^i = T^i.$$

The equivalence between the results that come from these individual maximization programmes and the optimization programme (1) at the couple's level is basically an application of the Second Fundamental Theorem of Welfare Economics.

Chiappori (1988) demonstrated that one can identify the individual preferences, as represented by υ^f and υ^m, up to a translation, and the sharing rule, given by y^f and $y^m = y - y^f$, up to a constant, on the basis of the observable functions $l^f = g^{l^f}(w^f, w^m, y, \mathbf{z})$ and $l^m = g^{l^m}(w^f, w^m, y, \mathbf{z})$ alone.[4]

Given the data we have (where also c^f and c^m are observable functions; see Section 3), we obtain complete identification without any unobserved constant (see Cherchye et al., 2012). The intuition of this result is that we observe all the variables needed to bring the individual optimization programmes (3) to the data (in particular l^i, c^i, w^i and $y^i + w^i T^i$). This allows us to identify the spouses' preferences in a standard (unitary model's) way. A particular issue here though will be that the variable $y^i + w^i T^i$ ($i = f, m$) is endogenous. However, as demonstrated by Cherchye et al. (2014), theory and empirical analysis are nicely linked to each other here, since we can make use of the natural instruments y and $\mathbf{z}$ to account for this endogeneity issue.

To sum up, the data at hand (discussed in detail in the next section) allow us to identify the individual utility functions $\upsilon^f(l^f, c^f)$ and $\upsilon^m(l^m, c^m)$, which will give us individual utilities for particular leisure-consumption combinations. The latter will be associated with individual well-being measures. It should be clear that these utility functions are only one cardinal representation of the spouses' preferences. Any other positive monotonic transformation of these utility functions gives rise to exactly the same demand equations. As a result, we will experiment a bit in the empirical application with different utility functions (that represent the same preferences) and check whether they are associated with individual well-being

[3] We use the full income representation here because it is naturally linked to the empirical model of Section 4.4.

[4] See Chiappori et al. (2002) for the case with distribution factors $\mathbf{z}$.

measures.

As a final note, let us point to an important caveat. In our empirical application, we will check whether individual utilities are associated with individual subjective well-being measures. Although one would expect a positive correlation between the two measures, this correlation will never be perfect, even if choice behavior with respect to consumption and leisure is perfectly in line with the above theory. The main reason of this is that utility is derived from only two inputs: leisure and consumption. Both inputs can be argued to be very important. Still, an individual's subjective well-being will also be affected by variables that are not directly captured by the individuals' utilities, or that can only be potentially captured in a very indirect way, such as an individual's health or social interactions. However, all that we can do by means of the above approach is to identify conditional preferences and no unconditional preferences over leisure, consumption, health, the amount of social interactions and so forth. Note that this is basically a similar problem that is faced by the equivalence scale literature (see Pollak and Wales, 1979). Incorporating these domains is beyond the scope of our analysis and is left for further research.

4.3 Data

In this paper we use data from the Longitudinal Internet Studies for the Social Sciences (LISS). The panel consists of a sample of 5000 households that are randomly drawn from the population in the Netherlands. Panel members complete online questionnaires. Households that could not otherwise participate are provided with a computer and Internet connection. The main part of the LISS panel is the LISS Core Study, which contains information about changes in people's lives, reactions to life events, and the effects of social changes and policy measures. For instance, variables related to demographics, health, work, politics, economic situation, happiness and satisfaction are gathered. After 2009 questions on time use and household consumption have been added to the panel, and they are asked to members who are at least sixteen years old.

We select the years 2009, 2010, and 2012 of the panel because in these years we have all the information we need to bring the individual optimization programmes to the data (see equation (4.3) of Section 4.2).[5] We make the following selections. First, we define couples as female and male individuals who are (married or unmarried) cohabitants and both between 25 and 60 years old (for simplicity, we will refer to them as spouses in the rest of the paper). This selection is done to avoid including students and retirees. Second, we consider couples in which both spouses perform paid work with positive hours of work and observed income. Third, we consider couples with and without children. Fourth, we restrict the sample to those who reported to be head or partner in the household (97 percent of the individuals in the sample) and those households where both members report information. Finally, we exclude outliers from the values of consumption, income and leisure.[6] Our final sample consists of 456 couples (163 couples in 2009, 142 couples in 2010 and 151 couples in 2012).

All the variables are measured per month. The variable hours worked is defined as the monthly average hours performed on the job reported in the LISS questionnaire Work and Schooling. There is some missing information in this variable that we complete by using the hours of work specified in the

[5] Specifically we use information from the following modules: Background, Time Use and Consumption, Work and Schooling, Personality, Social Integration and Leisure and Economic Situation (Income).

[6] We drop information for couples with values below centile 2.5 and above centile 97.5 on these variables (around 10 percent of the sample).

labor contract. We also define a labor income variable that considers the gross wage variable reported in the LISS Income questionnaire and for some missing values that we find, we use a follow-up question where individuals are asked to place their gross wage in specific intervals.[7] The individual's wage rate per hour is then computed as the ratio of labor income and hours worked.[8]

Regarding consumption of the household members, the LISS data provides very detailed information on expenditures which makes it a unique source (see the module Time Use and Consumption). The module is based on survey questions on normal individual and household nondurable expenditures per week. Even though this kind of measure is more noisy than diary based measures, it contains a useful signal on consumption behavior of household members (see Browning et al., 2003). Specifically, the questionnaire focuses on two types of consumption: goods and services that can be publicly consumed by the household as a whole and goods and services that can be privately consumed by the members of the household. We focus on the latter. We define (individual) private consumption as the sum of those expenditures made on goods and services related to food and private expenditures in the past month. The questionnaire has a question where respondents have to indicate how much of the household's food and drink expenditures they personally consume. We use this variable. Regarding the personal private expenditures, we aggregate the categories available in the questionnaire such as food and drinks outside home, clothing, personal care, schooling and so forth.[9]

Leisure is defined in two ways. Pure leisure is the time spent on leisure activities like watching TV, doing sports, traveling and hobbies (thus, does not contain time spent on market work nor household work). This information is gathered in the LISS data.[10] The questionnaire explains and defines different time use categories and a number of activities as examples. The categories are for instance: paid work, commuting, home work, personal care, activities with children, leisure activities, schooling, administrative tasks, and others. The sum of individual's responses to the time spent on all the activities must add up to 168 hours per week.[11] We use the category named leisure activities to define our variable of pure leisure per month.[12] Our second measure of leisure is called constructed leisure and it is defined as the

[7] 7 intervals that go from less than 8,000 to 60,000 euros or more per year. We use this information for 14 percent of the sample.

[8] Note that the division bias is not a concern here. Hours worked and labor income information comes from the Work and Schooling and Income questionnaires whereas leisure information comes from the Time Use and Consumption questionnaire. See Cherchye, De Rock, and Vermeulen (2012) for a similar approach.

[9] The private good categories are the following: (1) food and drinks outside home (restaurant, pub, company restaurant, but no expenditures consumed with (part of) the family; (2) cigarettes and other tobacco products; (3) clothing (clothing, shoes, jewelry); (4) personal care and services (hair care, body care, manicure, hair dresser's, but no medical expenditures); (5) medical expenditures not covered by an insurance (medicines, doctor, dentist, hospital, maternity grant, glasses, hearing device); (6) leisure activities (film, theater, hobbies, sports, photography, books, CD's, DVD's, expenditures related to traveling without the family); (7) schooling (courses, tuition fees); (8) gifts (to family members, friends, charity); and (9) other expenditures not mentioned above.

[10] See the module Time Use and Consumption.

[11] The precise time use categories used in the questionnaire are as follows: (1) paid work (excluding time spent on commuting); (2) commuting (for work or school); (3) home work (cleaning, doing the dishes, cooking, shopping, gardening, do it yourself, but no tasks related to caring for children or other persons); (4) personal care (washing, dressing, eating, going to the hairdresser, going to the doctor); (5) activities with children (washing, dressing, playing, reading, going to the doctor); (6) helping parents (administrative tasks, washing, dressing, going to the doctor); (7) helping other family members (administrative tasks, washing, dressing, going to the doctor); (8) helping other persons who are not family members (administrative tasks, washing, dressing, going to the doctor); (9) leisure activities (watching TV, reading, sports, hobbies, visiting friends or family, traveling, going out); (10) schooling (day or evening education, vocational training, language training); (11) administrative tasks related to the own household; (12) sleeping and relaxing (sleeping, thinking, meditating); and (13) other activities not mentioned above.

[12] Although we do not focus on this, the questionnaire has also information which investigates the joint time spent by spouses on leisure activities.

leisure usually focused on in labor supply models applied to data without detailed information on time use. We compute it by subtracting hours worked on the labor market from the total hours available minus an assumed amount of time spent on sleeping and personal care, 70 hours per week (see Browning and Gortz, 2012 for an example of this type of measure).

Total expenditure is then defined as the sum (in euros) of private consumption and the value of leisure time. Both definitions of leisure lead to a set of two total expenditure options as well. For simplicity, we suppose that consumption is the numeraire good for which the price is 1 euro and the price of leisure is the wage rate defined above. This allows us to model choices between these two commodities: consumption and leisure, depending on simple relative prices. Following the notation of Section 4.2, total expenditure for each spouse would be: $x^i = c^i + w^i l^i$ with $i = f, m$, and it is assumed to be equal to the (individual) full income, defined as the sum of nonlabor income and the income if total available time would be use to work $(y^i + w^i T^i)$. We treat this variable as endogenous in our regression analysis and we use two instruments for it.

The first instrument is the full household income defined as the sum of each spouse full income $(w^f + w^m)T$ and the second instrument (our distribution factor $\mathbf{z}$) is the male spouse' share of asset income.[13] We compute the latter by using information about the male spouse' individually assignable income from the total asset income for the household. Specifically this income comes from interest received from sources such as savings accounts, stocks, bonds, investment accounts and dividends (see the Income questionnaire).[14]

The main descriptives are shown in Table 4.1. On average, for the year 2012, we observe that female spouses are 44.7 years old. A large fraction of them have secondary or college education. Male spouses are older on average (46.7 years) with similar schooling. Female spouses consume slightly more private goods and services than male spouses, work fewer hours, have lower wage-rates, and spend less time on pure leisure (this pattern is similar for all the years). Interestingly, when shifting attention to our measure of constructed leisure, we observe the opposite. Female spouses have more (constructed) leisure time than male spouses. The difference is explained mainly by the time spent on children and house work.[15] The pure leisure time measure does not include these activities whereas the constructed leisure measure does. Both definitions will be used in our empirical approach in Section 4.4.

Note also that we observe a set of two total expenditure values in line with the two leisure definitions. Female spouses have lower (higher) total expenditures than male spouses when we use the pure (constructed) leisure definition. This pattern is observed for all years. Regarding household composition during the period of analysis, we observe that between 59.9 to 68.2 percent of the couples have children, and that, on average, around 2 children live at home. The male spouse's asset income and full household income are around 244.9 and 15,762.2 euros per month in the last year of analysis, respectively.

Focusing attention on variables related to well-being, the LISS panel provides several variables from different questionnaires (Personality, Social Integration and Leisure, Work and Schooling and Economic

[13]Nonlabor y is not included in our measure of full income. We explore this variable and observe that only around 70 percent of the sample report this information. So, our measure of full income is equivalent to full earnings.

[14]To handle missing values, we first use follow-up questions where individuals are asked to place the amounts in an interval instead of reporting specific values (choosing among 7 intervals that go from less than 1,000 to more than 60,000 euros per year). For the remaining missing values, we use predicted values from an OLS regression of asset income on a set of exogenous regressors (polynomials of age, labor income and education, as well as gender, household composition and a dummy variable for benefit receipt).

[15]On average, female spouses spend 19.0 hours per week on children and 20.6 hours in house work; whereas male spouses spend 11.6 hours per week on children and 11.2 hours in different tasks at home.

Table 4.1: Descriptive statistics

	2009				2010				2012			
	Mean	St. D.	Minimum	Maximum	Mean	St. D.	Minimum	Maximum	Mean	St. D.	Minimum	Maximum
					A. Female spouses							
Hours of work 1/.	106.72	39.52	12.86	235.71	113.51	42.08	17.14	214.29	114.81	40.96	21.43	214.29
Wage-rate	15.99	6.08	1.29	34.03	16.55	6.14	1.26	34.31	16.89	6.41	1.26	34.46
Consumption	368.45	165.82	100.00	930.00	373.40	160.95	97.00	1000.00	381.12	179.89	117.00	1050.00
Pure leisure	123.36	65.69	12.86	342.86	135.60	73.27	17.14	325.71	131.56	63.20	12.86	312.86
Constructed leisure	313.28	39.52	184.29	407.14	306.49	42.08	205.71	402.86	305.19	40.96	205.71	398.57
Total expenditures (pure) 1/.	2280.74	1128.77	242.98	7492.50	2661.69	1588.39	378.75	7314.88	2643.71	1515.03	405.17	9510.00
Total expenditures (constr.) 1/.	5294.05	1836.81	585.94	12305.00	5476.46	2136.23	695.26	12376.76	5560.19	2086.39	970.00	12960.21
Age	42.50	9.10	25.00	60.00	43.77	9.47	25.00	59.00	44.75	8.22	27.00	60.00
Dummy secondary education	0.29	0.45	0	1	0.33	0.47	0	1	0.36	0.48	0	1
Dummy college education	0.37	0.48	0	1	0.30	0.46	0	1	0.32	0.47	0	1
					B. Male spouses							
Hours of work 1/.	175.50	29.42	64.29	257.14	175.56	31.62	77.14	300.00	175.57	32.72	51.43	257.14
Wage-rate	19.85	6.94	1.62	38.89	19.87	6.82	1.64	37.33	20.63	6.44	4.20	38.89
Consumption	333.77	179.24	55.00	800.00	360.41	172.06	60.00	920.00	359.74	188.35	66.00	935.00
Pure leisure	135.24	84.53	8.57	462.86	137.96	75.18	8.57	428.57	136.28	67.48	8.57	450.00
Constructed leisure	244.50	29.42	162.86	355.71	244.44	31.62	120.00	342.86	244.43	32.72	162.86	368.57
Total expenditures (pure) 2/.	3023.25	2100.31	302.63	15403.41	3092.39	1838.54	510.94	9446.02	3179.29	1764.20	431.67	13020.00
Total expenditures (constr.) 2/.	5143.79	1790.00	553.88	9683.13	5196.42	1857.49	764.06	10765.00	5443.52	1735.28	1329.10	10216.67
Age	44.48	8.88	27.00	59.00	45.59	9.47	27.00	60.00	46.74	7.99	27.00	60.00
Dummy secondary education	0.33	0.47	0	1	0.34	0.47	0	1	0.44	0.50	0	1
Dummy college education	0.39	0.49	0	1	0.35	0.48	0	1	0.32	0.47	0	1
					C. Households							
Children 2/	1.96	0.67	1.00	3.00	1.92	0.66	1.00	3.00	1.98	0.77	1.00	4.00
Male' share of asset income	174.42	114.33	4.17	666.67	168.76	106.52	8.33	626.17	244.86	694.74	1.67	6208.33
Full household income	15053.49	4188.95	5390.00	28328.13	15298.82	4155.40	3164.58	24961.27	15762.15	3990.87	5454.17	25239.96
	Freq.	Percent			Freq.	Percent			Freq.	Percent		
Couples without children	120	36.81			114	40.14			96	31.79		
Couples with children	206	63.19			170	59.86			206	68.21		

Notes:
1/. Hours of work are per month; expenditures are in euros per month

2/. Descriptives for households with children.

Table 4.2: Definitions of well-being variables

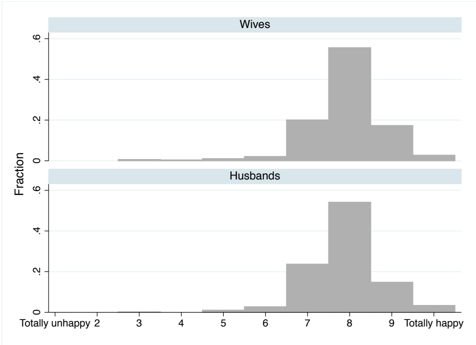
A. General variables of happiness		Scale
Happy 1/.	On the whole, how happy would you say you are?	1-10
Satisfied with life at the moment 2/.	How satisfied are you with the life you lead at the moment?	1-10
Life is ideal 3/.	"..In most ways my life is close to my ideal"	1-7
Life is excellent 3/.	"..The conditions of my life are excellent"	1-7
Satisfied with life 3/.	"..I am satisfied with my life"	1-7
Got important things in life 3/.	"..So far I have gotten the important things I want in life"	1-7
No changes in life 3/.	"..If I could live my life over, I would change almost nothing"	1-7
Best life 4/.	"..On what step would you place yourself?"	1-10
B. Domain-specific variables of satisfaction 5/.		
Leisure time	How satisfied are you with the amount of leisure time that you have?	0-10
Way of enjoying leisure	How satisfied are you with the way in which you spend your leisure time?	0-10
Work	How satisfied are you with your current work?	0-10
Type of work	How satisfied are you with the type of work that you do?	0-10
Hours of work	How satisfied are you with your working hours?	0-10
Wage	How satisfied are you with your wages or salary or profit earnings?	0-10
Financial situation	How satisfied are you with your financial situation?	0-10
Colleagues	How satisfied are you with the general atmosphere among your colleagues?	0-10
Schooling	How satisfied are you with the schooling that you have followed?	0-10
Career	How satisfied are you with your career so far?	0-10

Notes:
1/. 1 corresponds to totally unhappy and 10 to totally happy.
2/. 1 corresponds to not at all satisfied and 10 to completely satisfied.
3/. The questions are preceded by the following: "Below are five statements with which you may agree or disagree. Using the 1-7 scale, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding..." Number 1 corresponds to strongly disagree, 2 to disagree, 3 to slightly disagree, 4 to neither agree nor disagree, 5 to slightly agree, 6 to agree, and 7 to strongly agree.
4/. The question is preceded by the following: "If you imagine a "ladder of life", where the first step represents the worst possible life and the tenth step the best possible life, where 1 corresponds to the worst possible and 10 to the best possible life..".

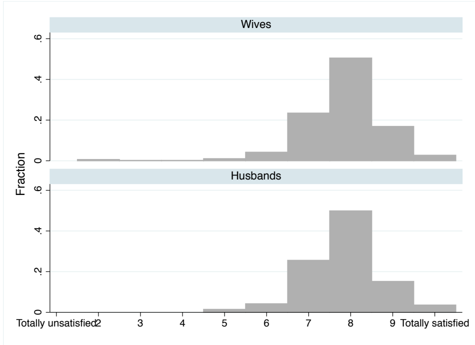
5/. Responses go from 0 to 10 where 1 corresponds to not at all satisfied and 10 completely (or fully) satisfied.

Figure 4.1: General variables of happiness

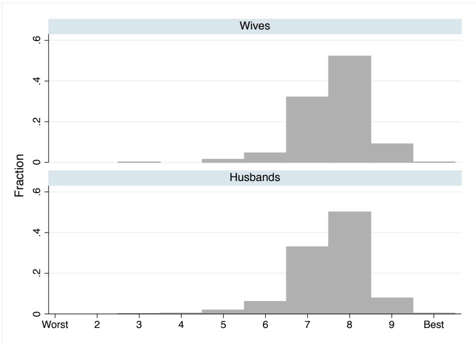
(a) How happy would you say you are?



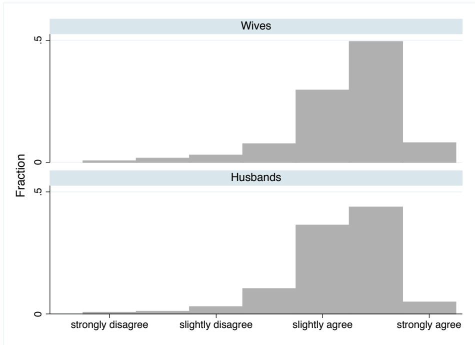
(b) How satisfied are you with your life?



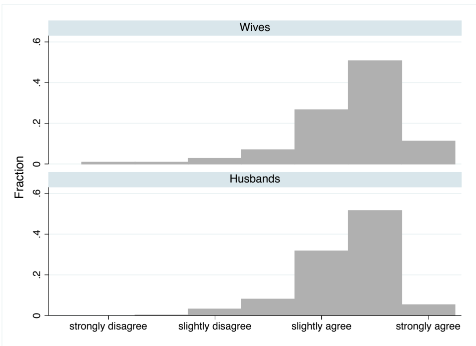
(c) On what step would you place your life?



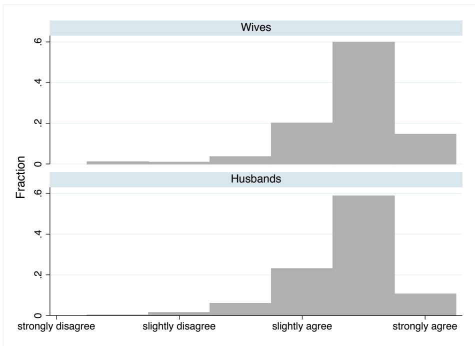
(d) In most ways my life is close to my ideal



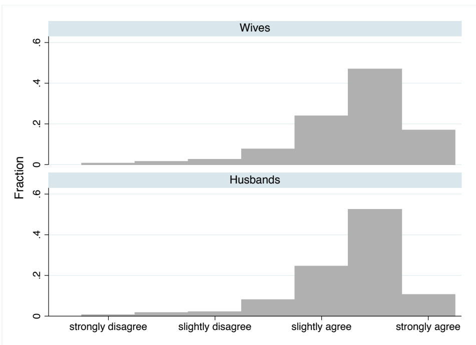
(e) The conditions of my life are excellent



(f) I am satisfied with my life



(g) I have gotten the important things in life



(h) I would change almost nothing in my life

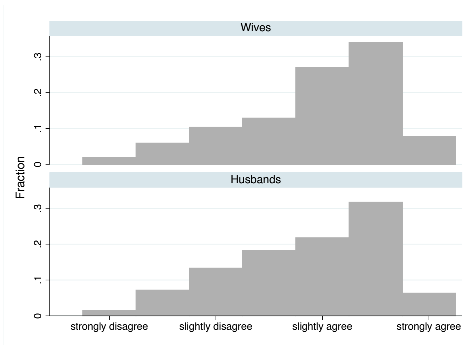
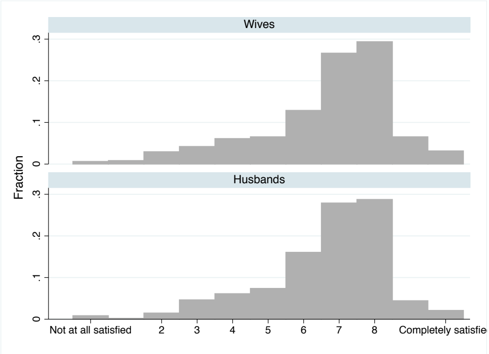
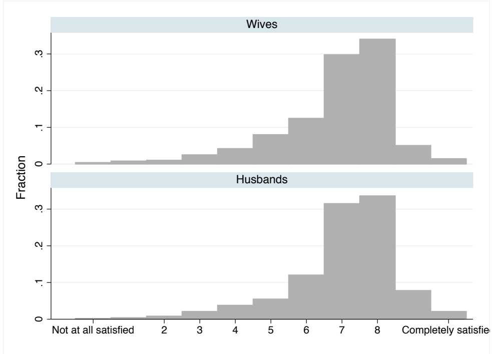


Figure 4.2: Domain-specific variables of satisfaction

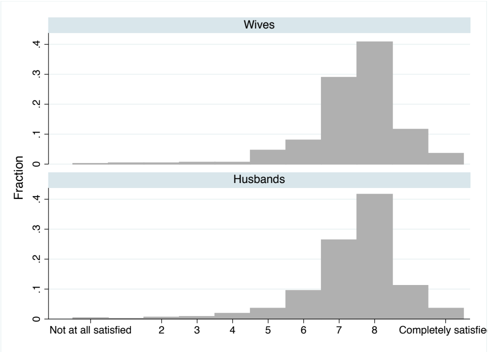
(a) How satisfied are you with your leisure time?



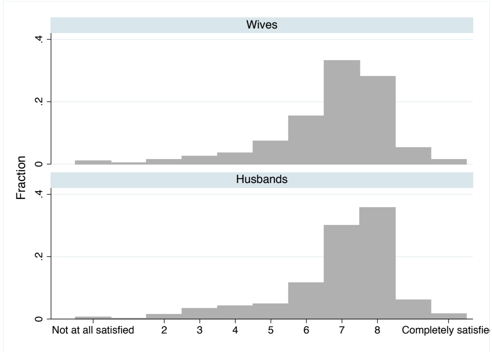
(b) How satisfied are you with the way you spend leisure?



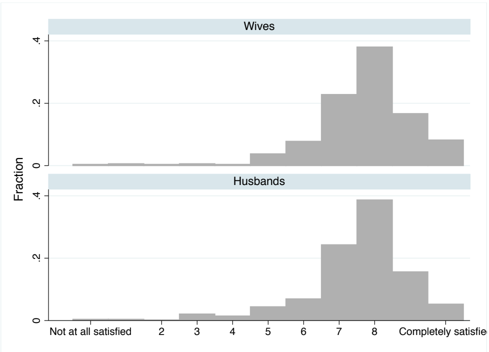
(c) How satisfied are you with your current work?



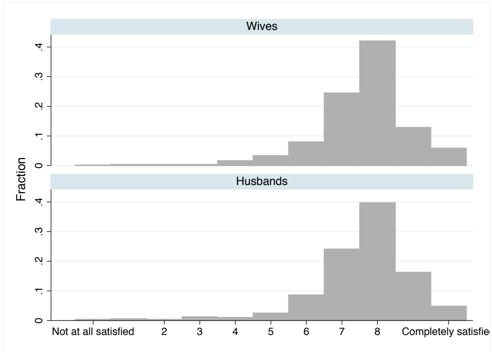
(d) How satisfied are you with your wage?



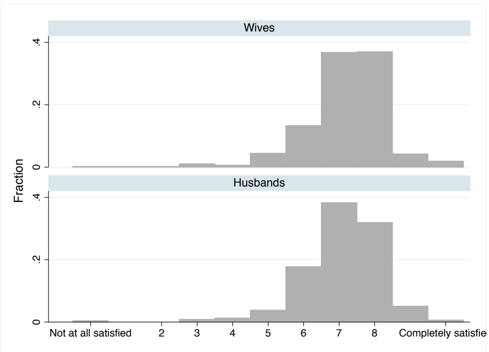
(e) How satisfied are you with your working hours?



(f) How satisfied are you with the type of work that you do?



(g) How satisfied are you with your financial situation?



(h) How satisfied are you with your career?

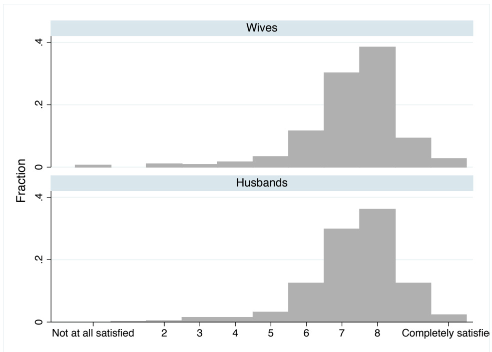
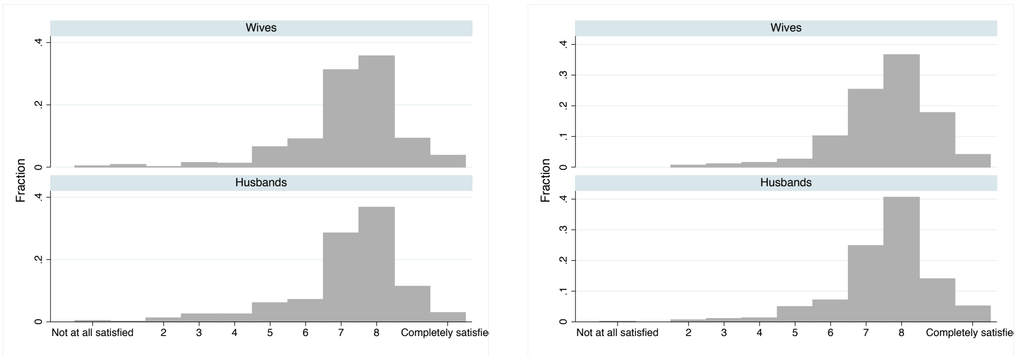


Figure 4.3: Domain-specific variables of satisfaction (continued)

(a) How satisfied are you with the schooling that you have followed?

(b) How satisfied are you with the atmosphere among your colleagues?



Situation - Income). We define two sets of variables: one set that we call “general variables of happiness” and another set that we call “domain-specific variables of satisfaction”. The specific questions and the range for the answers are given in Table 4.2.

Figures 4.1, 4.2 and 4.3 describe these well-being measures. For most of them, we observe a very similar pattern for female and male spouses, with no significant differences between them. Both report to be quite happy or satisfied with life in general (approximately 75 percent reports answers in categories 7, 8, 9 or 10), as is also reflected by the scores they give on agreeing or disagreeing with given statements. More variation in responses is observed in the variable related to the possibility to change something in life. It seems that individuals are generally quite happy or satisfied but if it were possible, they would change some aspects of their life. See Table 4.9 in the Appendix for more descriptives.

For the domain-specific variables, we observe that most individuals report to be very satisfied in the domains they are asked about. In the domain of leisure, the majority report to be satisfied with the time they have and the way they spend it. Regarding work and education, they seem satisfied with their wages, the type of work, working hours, education, and the career they have. A slight difference between female and male spouses' answers arises when they are asked about their financial situation though.[16]

4.4 Empirical Approach

In this paper, we want to relate individual utilities to measures of subjective well-being to analyze whether the former are informative for the latter. Thus, we first estimate a structural model along the lines of the model presented in Section 4.2 and obtain measures of individual utilities. We then relate these measures to those of subjective well-being that we have in our data. We apply the model to the sample of 456 couples. Now, we explain the empirical approach we follow.

We first estimate the demand functions described in equation (4.2) of Section 4.2. As we already explained, these functions are the results of the individual optimization programmes which are equivalent to the results of the household maximization programme under particular assumptions. We are able to do this because we observe in our data all the variables needed in the programmes, in particular, consumption, leisure, hours worked on the labor market and wages (denoted as c^i, l^i, h^i, and w^i with $i = f,m$; f for female and m for male). Private consumption c^i is defined as the sum of expenditures

[16]The average score for female spouses is 7.20 and 7.09 for male spouses. See Table 4.9 in the Appendix for more details.

made on food (personally consumed) and private expenditures on goods such as food and drinks outside home, clothing, personal care and schooling. Leisure l^i is defined in two ways. Pure leisure is the time spent on leisure activities like watching TV, doing sports, traveling and hobbies. Constructed leisure is computed by subtracting hours worked on the labor market from the total hours available minus an assumed amount of time spent on sleeping and personal care. The variable hours worked h^i is defined as the average hours performed on the job and wage w^i is defined as the wage rate per hour worked computed as the ratio between labor income and hours worked. Price of private consumption is assumed to be 1 (numeraire good) and the price of leisure time is assumed to be the wage rate. We choose the following functional specifications:

$$c^i = \gamma_c^i + \beta_c^i(x^i - \gamma_c^i - w^i\gamma_l^i) \tag{4.4}$$

$$w^i l^i = w^i\gamma_l^i + \beta_l^i(x^i - \gamma_c^i - w^i\gamma_l^i)$$

where γ_j^i $(j = c, l)$ would be interpreted as quantities of private consumption and leisure time to which female and male spouses are in some sense committed (often called subsistence levels). β_j^i are the proportions of the total expenditure x^i, net of total committed expenditure, that are spread over the commodities. These constants sum up to one. Total expenditure for each spouse x^i is the sum of private consumption and leisure expenditures $(c^i + w^i l^i)$ and it is assumed to be equal to full income $(y^i + w^i T^i)$. Note that this is linked to the individual budget constraint, equation (4.3), of the theoretical model of Section 4.2, where full income is defined as full earnings if total available time would be use to work. The intuition is that the expenditure, for instance, on food and private goods (which we define as private consumption) is equal to a certain "base amount" (γ_j^i), plus a certain proportion (β_j^i) of the supernumerary income (here total expenditure x^i) after subtracting the expenditure needed to purchase the base amount of all commodities.

This system of demand functions is known in the literature as the Linear Expenditure System - LES (see Stone, 1954 and Pollak and Wales, 1969) and is appealing to our purpose for three reasons. First, it has a straightforward and simple interpretation. Second, it is derived from a utility maximization programme as the one stated in our theoretical model in Section 4.2. And third, it satisfies three conditions frequently imposed on demand systems in theoretical work (Stone, 1954). The first one is the additivity condition, which implies that the sum of the expenditures as given by the system is equal to total expenditure on private consumption and leisure time. The second condition is homogeneity, which means that for both, consumption and leisure, the sum of the total expenditure elasticity and all the price elasticities is zero. The third condition is symmetry of the substitution matrix (Slutsky condition). In our empirical analysis, to make these conditions hold, it might be assumed that β_j^i's are non-negative, sum up to one and $c^i \geq \gamma_c^i$ and $l^i \geq \gamma_l^i$ for all individuals. These restrictions ensure that the system in (4) can be derived from a utility maximization.[17]

[17] We are using the general form of the LES Model (see Stone, 1954 for a more detailed exposition). The idea is that expenditures on individual commodities are expressed as linear functions of total expenditure and prices. But the model might take a special form. For instance, the expenditure on any commodity could be a fixed proportion of total expenditure regardless of its price; whereas in the general form each price is introduced into each demand equation. However, it has been demonstrated in the literature that we could expect the general form gives better results than the special form in situations where quantities demanded are not below certain levels. See Stone (1954) and Pollak and Wales (1969) for a more detailed explanation and a discussion of practical issues.

As we already discussed in Section 4.2, a particular issue here is that the variable $y^i + w^i T^i$ is endogenous (and consequently the variable total expenditure x^i). We make use of the natural instruments y and $\mathbf{z}$ to account of this endogeneity issue. Full household labor income and the male spouse' share of asset income are used, respectively.[18]

These are natural instruments because they are related to the individual total income and we argue they are exogenous. Full household labor income is correlated to the individual total income by construction whereas we can imagine that variations in the share of asset income imply variations in the individual total income. Exogeneity is verified by getting a p-value of 0.11 for the J-statistic. The main assumption though is that these instruments do not directly affect preferences. They only have an effect through consumption. We can argue that variations in the full household labor income and on the share of asset income are driven by economic circumstances like labor market or financial market events which might affect consumption levels but not tastes. This assumption is also used, for instance, by Browning and Gortz (2012) and Browning et al. (1994).[19]

Observables such as the number of children (ch^i), age (a^i), and two dummies for education (s^i for intermediate and g^i for college) are assumed to be taste shifter variables of the subsistence levels γ_j^i. Linear specifications are chosen. We rewrite γ_j^i $(j = c, l)$ as follows:

$$\gamma_c^i = \gamma_{c0}^i + \gamma_{c1}^i ch^i + \gamma_{c2}^i a^i + \gamma_{c3}^i s^i + \gamma_{c4}^i g^i \tag{4.5}$$

$$\gamma_l^i = \gamma_{l0}^i + \gamma_{l1}^i ch^i + \gamma_{l2}^i a^i + \gamma_{l3}^i s^i + \gamma_{l4}^i g^i$$

After replacing (4.5) in (4.4) and rearranging we have:

$$c^i = \alpha_0^i + \alpha_1^i x^i + \alpha_2^i w^i + \alpha_3^i ch^i + \alpha_4^i ch^i w^i + \alpha_5^i a^i + \alpha_6^i a^i w^i + \alpha_7^i s^i + \alpha_8^i s^i w^i + \alpha_9^i g^i + \alpha_{10}^i g^i w^i \tag{4.6}$$

$$w^i l^i = \tilde{\alpha}_0^i + \tilde{\alpha}_1^i x^i + \tilde{\alpha}_2^i w^i + \tilde{\alpha}_3^i ch^i + \tilde{\alpha}_4^i ch^i w^i + \tilde{\alpha}_5^i a^i + \tilde{\alpha}_6^i a^i w^i + \tilde{\alpha}_7^i s^i + \tilde{\alpha}_8^i s^i w^i + \tilde{\alpha}_9^i g^i + \tilde{\alpha}_{10}^i g^i w^i$$

where $\beta_c^i = \alpha_1^i$, $\gamma_{c0}^i = \frac{\alpha_0^i}{1-\beta_c^i}$, $\gamma_{c1}^i = \frac{\alpha_3^i}{1-\beta_c^i}$, $\gamma_{c2}^i = \frac{\alpha_5^i}{1-\beta_c^i}$, $\gamma_{c3}^i = \frac{\alpha_7^i}{1-\beta_c^i}$, $\gamma_{c4}^i = \frac{\alpha_9^i}{1-\beta_c^i}$ are all the parameters we are interested on from the consumption demand equation and $\beta_l^i = 1 - \alpha_1^i$, $\gamma_{l0}^i = -\frac{\alpha_2^i}{\beta_c^i}$, $\gamma_{l1}^i = -\frac{\alpha_4^i}{\beta_c^i}$, $\gamma_{l2}^i = -\frac{\alpha_6^i}{\beta_c^i}$, $\gamma_{l3}^i = -\frac{\alpha_8^i}{\beta_c^i}$, $\gamma_{l4}^i = -\frac{\alpha_{10}^i}{\beta_c^i}$ are all the parameters we need from the leisure demand equation.[20] Estimations are done with the Generalized Method of Moments (GMM) and we put special attention to evaluate if the conditions from our model hold i.e. $c^i \geq \gamma_c^i$, $l^i \geq \gamma_l^i$, $\beta_j^i \geq 0$ and $\sum \beta_j^i = 1$.

[18] Full household labor income is defined as $(w^f + w^m)T$ and male spouse's share is the asset income assigned to the husband. See Section 4.3 for details on the asset income computation.

[19] The latter have investigated whether wages have an impact on the demand for clothing by single people, controlling for total expenditure and labor supply. They do not find any significant effect for this potential relationship.

[20] Note that we only need to estimate one of these equations since we obtain all the parameters we are interested on. For instance, if we use the consumption demand equation, we analytically and computationally verify that we get the same estimates using the leisure equation. Intuitively, for given prices and income, any change in consumption demand has to be compensated by an opposite change in the leisure demand to satisfy the budget constraint (since we only have two goods in our setting).

We then compute the utility functions that correspond to our empirical model. Two specifications that represent the same preferences are explored[21]:

$$\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i} \tag{4.7}$$
$$\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$$

Note first that under these specifications individuals are assumed to have utilities for different combinations of consumption and leisure. Second, note that individuals perceive utilities from the quantities that exceed the subsistence levels. Thus, for instance, when $c^i \geq \gamma_c^i$ does not hold, individual utility functions will not be identified. This could be a particular issue for individuals with extremely low levels of private consumption or leisure time and that is why we restrict our data to individuals with minimum levels (see Table 4.1 in Section 4.3). Besides that, we also decide to experiment a bit by restricting our empirical model and imposing the mentioned conditions. So, for example, during the estimation of the first equation in (4.6) we add another moment condition stating that the difference between the observed consumption and its subsistence level is positive ($c^i - \gamma_c^i \geq 0$).[22]

The reason to do this is twofold. First, methodologically speaking, when $c^i \geq \gamma_c^i$ does not hold, the unrestricted model predicts negative consumption and therefore this makes nonsense and utilities cannot be computed. To find the true demand functions corresponding to the given wages and expenditures for which the LES functions predicts reasonable consumption, we decide to impose the mentioned condition during the estimation process in the restricted model. By doing so, we restrict our attention to a region in which goods are consumed in strictly positive quantities and utilities of many more individuals can be computed. The second reason is empirical. It seems that imposing this condition plays an important role for estimating the level of the proportion of the supernumerary expenditure and for some of the covariates. See Section 4.5 which describes the results for both, the unrestricted model, in which we do not impose any condition, and the restricted model in which we impose the condition described before.

Finally, following Ferrer-i Carbonell and Frijters (2004), we use OLS regressions to analyze whether the values of the two specifications of the individual utility functions have a relationship with the measures of individual well-being. The relationship with individual domain-specific satisfaction variables is also explored.[23]

To summarize, the described model and the data at hand allow us to identify the individual utility functions $\upsilon_A^i(l^i, c^i)$ and $\upsilon_B^i(l^i, c^i)$, which give us the utilities we need for particular leisure-consumption combinations for male and female spouses. We then are able to explore whether there is a relationship between these utilities and individual well-being measures. Although one would expect a positive correlation between the two measures, this correlation might not be perfect. As we already pointed out in Section 4.2, one reason is that utility is derived from only two inputs: leisure and consumption. No other domains such as individual's health or social interactions are captured in our utility specifications. Another reason could be that our empirical model has a functional form that is restrictive in the sense

[21]Recall that a utility function that represents a preference relation is not unique and that any increasing transformation of the original utility function also represents that preference relation. Thus, for our analysis it should not matter whether we use the original utility function or a positive monotone transformation. We can perfectly choose one of them. This means that both specifications in equation (4.7) represent the same rational preference relation over own consumption and own leisure (under the assumption of egoistic preferences).

[22]In particular, we impose the following conditions: $c^i - \gamma_c^i = exp(\gamma_c^i)$ and $l^i - \gamma_l^i = exp(\gamma_l^i)$.

[23]The authors state that assuming ordinality or cardinality of happiness scores makes little difference, thus estimation results through a latent-variable model are close to those of OLS.

that we impose linearity in the consumption and leisure variables or that the controls we use (i.e. number of children, age, dummies for education) might also affect the β_j^i's. This would mean that β_j^i will not be fixed proportion (for all female or male spouses in our sample) but it will be an individual specific proportion in the demand equations. This is beyond the scope of our analysis and is left for future research.

4.5 Results

In this section we analyze how variables of well-being are related to utilities. For this, as described in Section 4.4 above, we first estimate the parameters of the demand system for female and male spouses by using GMM. Throughout, we control for the number of children living in the household, age and two dummies for education levels. We also estimate the parameters imposing the conditions described in the previous section. We then compute utilities using the estimated parameters and conduct OLS regressions of well-being measures on the computed utilities. We perform all the analysis using two definitions of leisure: pure leisure and constructed leisure.

4.5.1 Pure leisure

Pure leisure is the defined as the time spent on leisure activities like watching TV, doing sports, traveling and hobbies (thus, does not contain time spent on market work nor household work). We use this definition and estimate the parameters of the demand system for female and male spouses given in equation (4.6) of Section 4.4. Results are shown in Table 4.3. The columns contain the results for female and male spouses as well as for each commodity i.e., private consumption and leisure time. Two versions of the empirical model are presented: unrestricted and restricted. The unrestricted version does not impose any condition to the estimation technique, whereas in the restricted version we impose the conditions described in the previous section. The rows show the results for each parameter controlling for the number of children living in the household, age and two dummies for education levels.

Let us begin by discussing the unrestricted estimates of private consumption. As we can observe, the committed levels of consumption of male spouses has a significant part explained by a constant, while the rest of the observables do not seem to play a role. In the case of the subsistence levels of female's private consumption the intercept does not play a role but the number of children does. It seems that the number of children decreases their basic amount of private consumption. The unrestricted estimates of leisure time demand are consistent with the previous results. They are exactly the opposite to those of private consumption and together β_c^i and β_l^i are non-negative and sum up to one. With these estimates, we obtain average values of the subsistence levels of 337.4 euros for female and 288.7 euros for male spouses. Note that the conditions ($c^i \geq \gamma_c^i$ and $l^i \geq \gamma_l^i$) hold for 162 female spouses and 205 male spouses (see the last rows of Tables 4.4 and 4.5).

If we shift attention to the restricted version, we observe that now the variables number of children and college education play an important role on explaining the consumption of male spouses (see the last two columns of Table 4.3). For them, having more children living at home reduces the basic amount of consumption and having higher education increases it. In the case of female spouses the presence of children also decreases the subsistence consumption level but the age increases it. Note that the constant term plays a smaller role for both spouses whereas the values of β_c^i increase significantly (from 0.07 to

0.34 for females and from 0.05 to 0.22 for males). Note also that with these estimates, the average values of the subsistence levels are lower than before and that the conditions hold for the majority of individuals (324 female spouses and 353 male spouses).

Next, we examine the relationship between individual utilities and measures of well-being. We compute individual utilities using the estimated parameters shown in Table 4.3 and equations (4.7). Two specifications of the utilities are used: $\upsilon_A^i(l^i, c^i)$ and $\upsilon_B^i(l^i, c^i)$. The first specification strictly corresponds to our empirical model whereas the second specification is just a positive monotonic transformation that represents the same preferences. The different measures of well-being are divided in two groups. The first group contains 8 measures that we call general variables of happiness and the second group contains 10 measures of well-being that we call domain-specific variables of satisfaction (see Table 4.2 for the exact definitions). We conduct OLS regressions of all these measures on the computed utilities and explore whether there is an association between them. Tables 4.4 and 4.5 provide the results.[24]

Let discuss first the results for the general variables of happiness. Table 4.4 shows that, in general, there is no clear evidence of significant relationship between utilities and general measures of happiness. This is true for both versions of the model: unrestricted and restricted. The specific way the questions are formulated in the survey, either in a direct or indirect way, makes little difference to the results. For instance, individual's responses to direct questions such as: "on the whole, how happy would you say you are?", or "how satisfied are you with the life you lead at the moment?" seem not to be related to the different specifications of utilities. The only exception arises for female spouses. Utilities (under the two specifications and versions of the model) seem to be positively correlated to their scores of satisfaction with the life at the moment. On the other hand, when questions are formulated in a more indirect way such that the individual gives a number that indicates how much she (he) agrees with given statements (for instance, "in most ways my life is close to my ideal"), we find similar patterns: no significant correlations between utilities and these measures.[25]

Ideally, one would have expected a positive correlation between utilities and measures of well-being. On the one hand, since the measures of well-being comes from a representative survey and from individual's responses to direct questions, these measures should contain indications of individual's evaluation of her (his) own happiness and satisfaction (see for example Frey and Stutzer (2002)). On the other hand, our computed utilities, by using two very important inputs such as consumption (of food and private personal goods) and leisure, are a good instrument to assign a numeric measure associated to preferences. However, the correlation between these two good measures is not necessarily perfect. The main reason of this is that an individual's subjective well-being might also be affected by variables that are not directly captured by the individuals' utilities, or that can only be potentially captured in a very indirect way. For example, an individual's health status or personal relationships may affect her or his choices with respect

Table 4.3: Private consumption and leisure time (pure) - Demand system

Pure leisure 1/.	Unrestricted				Restricted 2/.			
	Female		Male		Female		Male	
	Consumption	Leisure	Consumption	Leisure	Consumption	Leisure	Consumption	Leisure
$\hat{\alpha}_0^i$ (constant)	286.6960*	-286.6960*	625.4842***	-625.4842***	3.7965***	-3.7965***	4.5801***	-4.5801***
	(149.4164)	(149.4164)	(183.3323)	(183.3323)	(0.4584)	(0.4584)	(0.4768)	(0.4768)
$\hat{\alpha}_1^i = \beta_j^i$(total expenditure)	0.0734	0.9266***	0.0564	0.9436***	0.3409***	0.6591***	0.2269***	0.7731***
	(0.0688)	(0.0688)	(0.0678)	(0.0678)	(0.0786)	(0.0786)	(0.0785)	(0.0785)
$\hat{\alpha}_2^i$(wage)	-6.9291	6.9291	-21.5250	21.5250	-20.5507*	20.5507*	-19.5546	19.5546
	(9.0233)	(9.0233)	(17.5137)	(17.5137)	(11.8134)	(11.8134)	(16.7458)	(16.7458)
$\hat{\alpha}_3^i$(children)	-42.6081**	42.6081**	-18.7064	18.7064	-0.0460***	0.0460***	-0.0634***	0.0634***
	(21.5902)	(21.5902)	(25.3485)	(25.3485)	(0.0143)	(0.0143)	(0.0185)	(0.0185)
$\hat{\alpha}_4^i$(children*wage)	1.9662	-1.9662	0.5183	-0.5183	3.0717**	-3.0717**	2.2295	-2.2295
	(1.7033)	(1.7033)	(1.6985)	(1.6985)	(1.4100)	(1.4100)	(1.4130)	(1.4130)
$\hat{\alpha}_5^i$(age)	2.6925	-2.6925	-5.6739	5.6739	0.0034**	-0.0034**	-0.0008	0.0008
	(3.0924)	(3.0924)	(3.6360)	(3.6360)	(0.0016)	(0.0016)	(0.0020)	(0.0020)
$\hat{\alpha}_6^i$(age*wage)	-0.1286	0.1286	0.2420	-0.2420	-0.3235**	0.3235**	-0.0645	0.0645
	(0.2210)	(0.2210)	(0.1891)	(0.1891)	(0.1454)	(0.1454)	(0.1113)	(0.1113)
$\hat{\alpha}_7^i$(second. educ.)	-63.7091	63.7092	-127.3928	127.3928	0.0032	-0.0032	0.0217	-0.0217
	(71.8909)	(71.8909)	(91.2717)	(91.2716)	(0.0342)	(0.0342)	(0.0487)	(0.0487)
$\hat{\alpha}_8^i$(second. educ.*wage)	5.1092	-5.1092	7.8060	-7.8060	4.6211	-4.6211	3.6851	-3.6851
	(5.3555)	(5.3555)	(5.4537)	(5.4537)	(3.3644)	(3.3644)	(2.9580)	(2.9580)
$\hat{\alpha}_9^i$(college educ.)	-53.1834	53.1834	-69.0992	69.0992	-0.0001	0.0001	0.1033**	-0.1033**
	(70.3764)	(70.3764)	(83.3515)	(83.3515)	(0.0344)	(0.0344)	(0.0482)	(0.0482)
$\hat{\alpha}_{10}^i$(college educ.*wage)	2.6775	-2.6775	5.2732	-5.2732	-3.5840	3.5840	-0.0278	0.0278
	(4.0397)	(4.0397)	(4.0654)	(4.0654)	(2.7572)	(2.7572)	(2.3683)	(2.3683)
Hansen's J chi2(2)	$(p = 0.1155)$							
γ_j^i (subsistence level) 3/.	337.3822	102.7256	288.6494	90.7069	5.8984	89.5536	5.8311	80.9855
	(71.2596)	48.5049	(76.3929)	66.8064	(0.0937)	16.9876	(0.1058)	13.9507

Notes:

1/. Model using pure leisure definition, iterative gmm estimator, male's share of asset income and full household income as instruments for total expenditure, all other regressors as instruments for themselves, standard errors in parenthesis. For simplicity we use the same notation for α_k^i and $\tilde{\alpha}_k^i$ for $k = 0,..,10$. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/. Average value and standard deviations in parenthesis.

Table 4.4: OLS regressions of general happiness on utility (pure)

Pure leisure 1/.	Unrestricted				Restricted 2/.			
	Female		Male		Female		Male	
3/.	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B
Happy	0.0004	0.1159	0.0013	0.0688	0.0006	0.0653	0.0002	0.0056
	(0.0018)	(0.0868)	(0.0008)	(0.0475)	(0.0010)	(0.0713)	(0.0007)	(0.0583)
Satisfied with life at the moment	0.0036**	0.2645***	0.0001	0.0241	0.0022**	0.1881**	0.0002	0.0463
	(0.0016)	(0.0991)	(0.0008)	(0.0487)	(0.0010)	(0.0841)	(0.0006)	(0.0560)
Life is ideal	0.0007	0.1075	0.0003	0.0157	0.0006	0.0454	-0.0006	-0.0327
	(0.0015)	(0.0825)	(0.0009)	(0.0587)	(0.0009)	(0.0752)	(0.0007)	(0.0673)
Life is excellent	0.0018	0.1030	0.0012	0.0372	0.0016*	0.1428*	0.0002	0.0439
	(0.0016)	(0.0920)	(0.0008)	(0.0581)	(0.0009)	(0.0744)	(0.0008)	(0.0604)
Satisfied with life	0.0012	0.1423*	0.0010	0.0648	0.0011	0.0895	-0.0001	-0.0193
	(0.0014)	(0.0792)	(0.0007)	(0.0615)	(0.0008)	(0.0653)	(0.0005)	(0.0497)
Got important things in life	0.0000	0.0074	0.0007	0.0718	-0.0004	0.0148	-0.0016	-0.1364**
	(0.0018)	(0.0857)	(0.0010)	(0.0834)	(0.0010)	(0.0876)	(0.0010)	(0.0672)
No changes in life	0.0022	0.1254	-0.0004	0.0368	0.0010	0.0826	-0.0028***	-0.1786*
	(0.0018)	(0.1198)	(0.0014)	(0.0910)	(0.0011)	(0.0966)	(0.0011)	(0.0960)
Best life	0.0019	0.1679**	-0.0003	-0.0146	0.0010	0.0815	-0.0002	-0.0040
	(0.0013)	(0.0742)	(0.0009)	(0.0570)	(0.0007)	(0.0587)	(0.0008)	(0.0624)
N	162	162	205	205	324	324	353	353

Notes:

1/. OLS regressions without controls, pure leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/ Utilities specifications are: $\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

Table 4.5: OLS regressions of domain-specific satisfaction on utility (pure)

Pure leisure 1/.	Unrestricted				Restricted 2/.			
	Female		Male		Female		Male	
3/.	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B
Leisure time	0.0061***	0.2537**	0.0048***	0.1801	0.0063***	0.5314***	0.0013	0.1279
	(0.0022)	(0.1099)	(0.0016)	(0.1101)	(0.0015)	(0.1637)	(0.0015)	(0.1339)
Way of enjoying leisure	0.0038**	0.0763	0.0040***	0.1068	0.0053***	0.5506***	0.0030***	0.2403**
	(0.0018)	(0.0850)	(0.0012)	(0.0935)	(0.0014)	(0.1537)	(0.0011)	(0.1182)
Work	-0.0007	-0.0292	0.0018	0.1049	0.0028**	0.1755	-0.0001	-0.0568
	(0.0016)	(0.0723)	(0.0014)	(0.0829)	(0.0011)	(0.1076)	(0.0009)	(0.0827)
Type of work	-0.0002	0.0053	0.0011	0.0462	0.0027**	0.1661	-0.0006	-0.1117
	(0.0015)	(0.0815)	(0.0015)	(0.0921)	(0.0011)	(0.1057)	(0.0009)	(0.0809)
Hours of work	-0.0010	0.0450	-0.0005	-0.0610	0.0004	0.0264	0.0002	0.0633
	(0.0026)	(0.1146)	(0.0016)	(0.1032)	(0.0015)	(0.1209)	(0.0016)	(0.1030)
Wage	-0.0010	0.0450	-0.0001	0.0276	0.0004	0.0264	-0.0011	-0.1579
	(0.0026)	(0.1146)	(0.0017)	(0.1151)	(0.0015)	(0.1209)	(0.0012)	(0.1053)
Financial situation	0.0005	0.0582	0.0027**	0.1923**	0.0018*	0.2109**	0.0010	0.0251
	(0.0018)	(0.0997)	(0.0011)	(0.0829)	(0.0011)	(0.0908)	(0.0008)	(0.0692)
Colleagues	-0.0004	0.0179	-0.0937	-6.6595	0.0012	0.1168	0.0041	1.4325
	(0.0023)	(0.1068)	(0.0891)	(8.1926)	(0.0013)	(0.1180)	(0.0049)	(1.4378)
Schooling	0.0045**	0.2070**	0.0005	-0.0120	0.0018*	0.0527	-0.0004	0.0443
	(0.0019)	(0.0975)	(0.0017)	(0.0960)	(0.0010)	(0.0982)	(0.0016)	(0.1171)
Career	-0.0006	-0.0146	0.0014	0.1135	0.0011	0.0017	-0.0010	-0.1049
	(0.0016)	(0.0814)	(0.0014)	(0.0869)	(0.0011)	(0.1042)	(0.0012)	(0.0903)
N	162	162	205	205	324	324	353	353

Notes:

1/. OLS regressions without controls, pure leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/ Utilities specifications are: $\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

to leisure and consumption. Our model is unable to capture that.

The story becomes much more interesting when we explore the well-being of individuals in specific situations. Table 4.5 reports the results. We observe a positive and significant correlation between our utility measures and some domain-specific variables of satisfaction, in particular, the domains of leisure, work and financial situation. In the domain of leisure, both specifications of utility for both male and female spouses seem to be positively correlated to their scores of satisfaction with the amount of leisure time and of the way to spend it. There are some small differences by specification of the model and utility though. In the unrestricted version, the first specification of utility performs better than the second specification (in logarithms), whereas in the restricted version there is little difference between them.[26] In the latter, there seems to be a difference between female and male spouses regarding satisfaction with the amount of leisure time. The significant correlation found for male spouses in the unrestricted version disappears; although the sign remains positive.

Shifting attention to the domain of financial situation, there is some evidence that our utility measures are significantly and positively correlated with responses to the question: "How satisfied are you with your financial situation?" for both male and female spouses. Under the unrestricted model, utilities of male spouses seem to be informative about their responses about satisfaction with their financial situation. For female spouses, utilities do not seem to be informative. Only in the restricted version this seems to be the case.

In the domain of work, there are some evidence of positive correlations for female spouses. In particular, our measures of utilities using the first specification in the restricted model seem to have a positive and significant relationship with responses related to the following questions: "how satisfied are you with your current work?", and "how satisfied are you with the type of work that you do?". No evidence is found for male spouses. There are also some positive correlation between our utility measures and the level of education attained by female spouses, but it seems to be significant only when we use the unrestricted model.

To summarize, the evidence we found suggests that individuals' responses to questions of general well-being (e.g., happiness) are less likely to be correlated with our individual utility measures; whereas responses to more specific questions of satisfaction (for instance, those in the domains of leisure, work and financial situation) are more likely to be associated to utilities.

4.5.2 Constructed leisure

The picture that emerged in the previous analysis might depend on the particular definition of leisure we have used e.g., pure leisure. Thus, we construct another measure of leisure. This second measure

[24] We do not include controls in these regressions but in Section 4.6 we explore them controlling for the number of children living in the household, age and two dummies for education levels. Other controls are explored as well. In principle, the inclusion of controls should not matter for the estimation of the relationship (if there is any) between well-being and utilities. However, if the estimates do change in an important way it might indicate that something else is going on. We verify that this is not an problem in our case. Significances, magnitudes and signs of almost all variables remain.

[25] Note that we also find a negative correlation result between utilities and the variable called "No changes in life" for male spouses in the restricted model. Recall that the latter contains numbers that represent the level of agreement to the following statement: "if I could live my life over, I would change almost nothing". Although this result might sound counterintuitive, we interpret it through the lens of our theoretical model which suggests that this subjective well-being measure is probably affected by variables that are not directly captured by our measures of utility, or that can only be potentially captured in a very indirect way.

[26] See equation (4.7) in Section 4.4. First specification: $\upsilon^i_A(c^i,l^i) = (c^i-\gamma^i_c)^{\beta^i_c}(l^i-\gamma^i_l)^{\beta^i_l}$. Second specification: $\upsilon^i_B(c^i,l^i) = \beta^i_c ln(c^i-\gamma^i_c)+\beta^i_l ln(l^i-\gamma^i_l)$.

(constructed leisure) is the leisure usually focused on in labor supply models applied to data without detailed time use. We compute it by subtracting hours worked on the labor market from the total hours available minus an assumed amount of time spent on sleeping and personal care. This might shed some light on which measure of leisure works best and what is missed when we focus on an inappropriate measure. Tables 4.6, 4.7, and 4.8 show the results.

Let us start with the results of the demand system estimation (Table 4.6). Similar to the case of pure leisure, in the unrestricted version of the model, the base level of consumption of male spouses has a significant part explained by a constant. Controls such as the number of children, age and education do not seem to have a significant impact on it. In the case of female's private consumption, nothing seems to play an important role. Regarding the conditions: $\beta_j^i \geq 0$ and $\sum \beta_j^f = 1$ ($\beta_j^m = 1$) with ($i = f, m$) and ($j = c, l$), we verify that they hold but we observe a change in the size. They are relatively larger than the corresponding estimate results in Table 4.3, especially for female spouses. It seems that, when we use the measure of constructed leisure, female spouses show a larger proportion of their consumption explained by the supernumerary expenditure. Similar as before, we verify that the conditions $c^i \geq \gamma_c^i$ and $l^i \geq \gamma_l^i$ holds only for a relatively small sample of our data. Thus, in the restricted model we impose these conditions and verify that they hold for a larger number of individuals (see last rows of Tables 4.7 and 4.8). Now (and similar to the case of pure leisure), having more children living at home reduces the basic amount of consumption of both female and male spouses. Consistently with the new way of measuring leisure, the γ_l^i's associated with the demand of leisure are also larger than the ones in Table 4.3, which suggests relatively larger committed expenditures on leisure.

Let us now focus our attention on the relationship between utilities obtained using these estimates and the measures of well-being. Similar as before, Table 4.7 shows that there is hardly any significant relationship between utility values and general variables of happiness. The only exception seems to be -for male spouses in the unrestricted model- the variable that measures in what step of a "ladder of life" individuals place themselves. It seems that there is a positive association between their responses and our measures of utilities. No conclusive results are found for the rest of variables under both specifications of the model and utilities (see Table 4.2 in Section 4.3 for more details on the definitions of the variables).

Table 4.8 shows the OLS regressions of domain-specific variables of satisfaction on our measures of utilities. We find that utilities under both specifications are informative about satisfaction with leisure time, for both female and male spouses, under the unrestricted version of the model. In the restricted version, only utilities of female spouses are correlated to satisfaction with leisure.[27]

To sum up, our results using the second measure of leisure suggest that satisfaction with leisure time is the only well-being variable that is associated with our utility measures.

Taken together, our interpretation (of both analysis using pure leisure and constructed leisure) is that when we use more appropriate definitions of leisure (e.g., pure), we are able to have utility measures that are more informative about the well-being of individuals in specific situations, in particular in the domains of leisure, work and financial situation. On the contrary, by using a constructed measure of leisure we are only able to capture this relationship in a partial way. In the domain of leisure, note for instance that we only have significant correlation for leisure time and not for the way individuals enjoy it. This is probably explained because the constructed measure does not disentangle time allocated to

[27] Note that there seems to be a negative correlation between utilities and satisfaction with respect to career for female spouses in the restricted model. We argue that this subjective measure is affected by variables that are not captured by our utility measures.

Table 4.6: Private consumption and leisure time (constructed) - Demand system

Constructed leisure 1/.	Unrestricted				Restricted 2/.			
	Female		Male		Female		Male	
	Consumption	Leisure	Consumption	Leisure	Consumption	Leisure	Consumption	Leisure
$\hat{\alpha}_0^i$ (constant)	212.9031	-212.9030	461.0664**	-461.0665**	2.1753***	-2.1753***	3.6887***	-3.6887***
	(185.2380)	(185.2379)	(207.3717)	(207.3718)	(0.7800)	(0.7800)	(0.5277)	(0.5277)
$\hat{\alpha}_1^i = \beta_j^i$(total expenditure)	0.2146	0.7854***	0.0846	0.9154***	0.6241***	0.3759***	0.3813***	0.6187***
	(0.1452)	(0.1452)	(0.0850)	(0.0850)	(0.1348)	(0.1348)	(0.0884)	(0.0884)
$\hat{\alpha}_2^i$(wage)	-52.2242	52.2242	-22.4516	22.4516	-150.2916***	150.2916***	-67.5303***	67.5303***
	(34.7784)	(34.7784)	(16.5925)	(16.5925)	(38.0584)	(38.0584)	(22.0097)	(22.0097)
$\hat{\alpha}_3^i$(children)	-8.4185	8.4185	-18.8517	18.8517	-0.0306**	0.0306**	-0.0536***	0.0536***
	(34.2245)	(34.2245)	(23.0623)	(23.0623)	(0.0130)	(0.0130)	(0.0158)	(0.0158)
$\hat{\alpha}_4^i$(children*wage)	-3.7468	3.7468	-0.2524	0.2524	-9.1939***	9.1939***	-0.2220	0.2220
	(3.5112)	(3.5112)	(1.1543)	(1.1543)	(1.9840)	(1.9840)	(0.5726)	(0.5726)
$\hat{\alpha}_5^i$(age)	1.1864	-1.1864	-3.1167	3.1168	0.0020*	-0.0020*	-0.0012	0.0012
	(3.0578)	(3.0578)	(3.9529)	(3.9529)	(0.0011)	(0.0011)	(0.0016)	(0.0016)
$\hat{\alpha}_6^j$(age*wage)	-0.1607	0.1607	0.0548	-0.0548	-0.5523***	0.5523***	-0.3283***	0.3283***
	(0.2282)	(0.2282)	(0.2236)	(0.2236)	(0.1725)	(0.1725)	(0.0784)	(0.0784)
$\hat{\alpha}_7^i$(second. educ.)	62.4428	-62.4429	-42.2431	42.2431	-0.0050	0.0050	0.0157	-0.0157
	(82.0477)	(82.0477)	(71.3487)	(71.3487)	(0.0192)	(0.0192)	(0.0388)	(0.0388)
$\hat{\alpha}_8^i$(second. educ.*wage)	-5.4056	5.4056	2.3994	-2.3994	-5.3522*	5.3522*	-0.9044	0.9044
	(5.6732)	(5.6732)	(3.7989)	(3.7989)	(2.8645)	(2.8645)	(1.5857)	(1.5857)
$\hat{\alpha}_9^i$(college educ.)	46.6149	-46.6149	-38.3254	38.3254	-0.0041	0.0041	0.0885**	-0.0885**
	(83.0366)	(83.0366)	(74.5835)	(74.5835)	(0.0193)	(0.0193)	(0.0395)	(0.0395)
$\hat{\alpha}_{10}^i$(college educ.*wage)	0.3987	-0.3987	3.6471	-3.6471	8.0027*	-8.0027*	0.3729	-0.3729
	(3.9600)	(3.9600)	(3.7542)	(3.7542)	(4.0948)	(4.0948)	(1.6191)	(1.6191)
Hansen's J chi2(2)	(p = 0.3061)							
γ_j^i (subsistence level) 3/.	369.4560	305.4929	291.3381	213.9716	5.9074	296.3232	5.8230	217.4836
	(35.3249)	(24.0150)	(41.2267)	(18.4101)	(0.1067)	(20.0469)	(0.1136)	(7.6472)

Notes:

1/. Model using constructed leisure definition, iterative gmm estimator, male's share of asset income and full household income as instruments for total expenditure, all other regressors as instruments for themselves, standard errors in parenthesis. For simplicity we use the same notation for α_k^i and $\tilde{\alpha}_k^i$ for $k = 0, .., 10$. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/. Average value and standard deviations in parenthesis.

Table 4.7: OLS regressions of general happiness on utility (constructed)

Constructed leisure 1/.	Unrestricted				Restricted 2/.			
	Female		Male		Female		Male	
3/.	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B
Happy	-0.0065	-0.1594	0.0033	0.1288**	-0.0014	-0.1317	0.0003	0.0591
	(0.0058)	(0.1337)	(0.0022)	(0.0602)	(0.0013)	(0.1232)	(0.0016)	(0.0845)
Satisfied with life at the moment	-0.0003	-0.0152	0.0030	0.1324**	-0.0007	-0.0738	-0.0001	0.0354
	(0.0067)	(0.1464)	(0.0024)	(0.0629)	(0.0015)	(0.1412)	(0.0016)	(0.0912)
Life is ideal	-0.0085	-0.2220*	0.0031	0.1020	-0.0012	-0.0994	-0.0002	-0.0568
	(0.0053)	(0.1256)	(0.0025)	(0.0704)	(0.0013)	(0.1289)	(0.0015)	(0.0805)
Life is excellent	-0.0074	-0.1739	0.0026	0.1424*	-0.0014	-0.0703	-0.0013	-0.1177*
	(0.0057)	(0.1532)	(0.0024)	(0.0781)	(0.0013)	(0.1434)	(0.0013)	(0.0634)
Satisfied with life	-0.0041	-0.1453	0.0020	0.0855	0.0000	0.0160	-0.0019	-0.1149
	(0.0046)	(0.0921)	(0.0024)	(0.0612)	(0.0011)	(0.1093)	(0.0013)	(0.0744)
Got important things in life	-0.0055	-0.1831	0.0027	0.0970	-0.0003	0.0821	-0.0019	-0.0855
	(0.0040)	(0.1203)	(0.0027)	(0.0918)	(0.0012)	(0.1464)	(0.0018)	(0.1125)
No changes in life	-0.0075	-0.2501	0.0040	0.1012	-0.0025	-0.2360	-0.0039*	-0.2775**
	(0.0069)	(0.1707)	(0.0037)	(0.1190)	(0.0016)	(0.1802)	(0.0023)	(0.1350)
Best life	0.0006	0.0185	0.0063***	0.2439***	-0.0006	-0.0921	-0.0014	-0.0975
	(0.0045)	(0.0938)	(0.0021)	(0.0745)	(0.0010)	(0.0994)	(0.0013)	(0.0743)
N	102	102	217	217	293	293	376	376

Notes:

1/. OLS regressions without controls, constructed leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/ Utilities specifications are: $\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

Table 4.8: OLS regressions of domain-specific satisfaction on utility (constructed)

Constructed leisure 1/.	Unrestricted				Restricted 2/.			
	Female		Male		Female		Male	
3/.	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B	Utility A	Utility B
Leisure time	0.0155***	0.3619**	0.0169***	0.4206***	0.0059***	0.6310***	0.0006	0.0690
	(0.0054)	(0.1518)	(0.0049)	(0.1569)	(0.0018)	(0.2315)	(0.0029)	(0.1537)
Way of enjoying leisure	0.0030	0.0361	0.0037	0.0918	0.0014	0.2321	-0.0009	-0.0009
	(0.0046)	(0.1257)	(0.0044)	(0.0966)	(0.0016)	(0.2071)	(0.0027)	(0.1304)
Work	-0.0034	-0.1617	0.0055	0.0699	-0.0012	-0.0928	-0.0027	-0.1227
	(0.0055)	(0.1293)	(0.0042)	(0.1111)	(0.0015)	(0.1674)	(0.0029)	(0.1606)
Type of work	-0.0016	-0.1307	0.0027	-0.0271	-0.0024	-0.2143	-0.0027	-0.1533
	(0.0058)	(0.1351)	(0.0041)	(0.1047)	(0.0015)	(0.1749)	(0.0028)	(0.1304)
Hours of work	-0.0021	0.0163	0.0089*	0.2941*	-0.0004	-0.0461	-0.0002	0.0350
	(0.0071)	(0.2238)	(0.0048)	(0.1636)	(0.0019)	(0.2096)	(0.0031)	(0.1357)
Wage	-0.0021	0.0163	0.0001	0.0662	-0.0004	-0.0461	-0.0007	0.0477
	(0.0071)	(0.2238)	(0.0050)	(0.1356)	(0.0019)	(0.2096)	(0.0031)	(0.1711)
Financial situation	-0.0126	-0.3438**	0.0042	0.1221	-0.0023	-0.2505	-0.0033	-0.0738
	(0.0076)	(0.1598)	(0.0029)	(0.0832)	(0.0018)	(0.1703)	(0.0023)	(0.1139)
Colleagues	-0.0009	-0.0982	-0.0563	0.2812	-0.0006	-0.0730	-0.0015	1.9561
	(0.0044)	(0.1109)	(0.0616)	(0.4286)	(0.0013)	(0.1584)	(0.0233)	(1.8077)
Schooling	0.0015	-0.0462	0.0097**	0.2704**	-0.0018	-0.2388	-0.0021	-0.1179
	(0.0068)	(0.1661)	(0.0039)	(0.1371)	(0.0016)	(0.1769)	(0.0025)	(0.1477)
Career	-0.0059	-0.2365*	0.0062	0.1544	-0.0033**	-0.3747**	-0.0029	-0.1523
	(0.0059)	(0.1360)	(0.0038)	(0.1167)	(0.0015)	(0.1609)	(0.0021)	(0.1203)
N	102	102	217	217	293	293	376	376

Notes:

1/. OLS regressions without controls, constructed leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/ Utilities specifications are: $\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

children or to house work, which might have different effects on utility and then in the relationship with happiness. Time spent on children might increase utility and be positively correlated to happiness and satisfaction, whereas time allocated to house work might decrease utility and be negatively correlated to happiness. Whether the first effect is bigger or smaller than the second one remains unknown. Thus, since our pure leisure definition is not affected by these effects, we argue it works better than the constructed one when we want to evaluate behavior and satisfaction of the households. Note also that by using the constructed measure of leisure we fail to capture the effects in the domains of work and financial situation. In the case of the more general variables of well-being, it seems that this is more difficult to capture their relationship with utilities irrespective of the definitions of leisure we use.

4.6 Sensitivity analysis

In this section, after having presented the main results, we assess whether the results are sensitive to the particular specifications we have used. We start by including two additional control variables in the demand system estimation. We then explore the OLS regression of well-being variables on utilities (computed using the new estimates) controlling for different sets of variables which lead to different specifications for these regressions as well. For simplicity, we only conduct the analysis using the pure leisure definition and show the results for the consumption equation.

Tables 4.10 and 4.11 in the Appendix show the results for the demand system estimation. Both versions of the model are considered: unrestricted and restricted. Specification (1) is the same specification we have used in Table 4.3 in which we control for the number of children living in the household, age and two dummies for education levels. We keep it here for the purpose of comparison. In the second specification (2) we add a dummy that indicates whether both spouses work full time in the labor market, whereas in the third specification (3) we consider another dummy that indicates whether the couple has children below eight years old living at home. Results indicate that none of these additional variables seem to play a role in the unrestricted model (see Table 4.10) whereas working full-time seems to be important for the basic demand of consumption for both spouses in the restricted model (see Table 4.11). The rest of our main results remain qualitatively the same.

Shifting attention to the well-being variables, Tables 4.12 and 4.13 in the Appendix show the results for the OLS regressions of general variables of happiness on utilities (computed using the new estimates found in Tables 4.10 and 4.11, respectively). We do not include controls yet. What we observe is that, as in our main analysis, there is no clear evidence of significant relationship between utilities and general measures of happiness. This is true for both versions of the model: unrestricted and restricted. A notable exception seems to be the variable satisfaction with life at the moment for female spouses. Utilities (under both versions of the model) seem to be positively correlated to their scores on this variable. When we include controls in these regressions (see Tables 4.14 and 4.15) we find basically similar results.

We then explore the OLS regressions of domain-specific variables of satisfaction on our computed utilities. Tables 4.16, 4.17, 4.18 and 4.19 in the Appendix report the results for the unrestricted and restricted version of the model and without and with controls, respectively. We confirm our main results. There seems to be positive and significant correlations between our utility measures and some domain-specific variables of satisfaction, in particular, variables on the domains of leisure, work and financial situation. Note that this correlations remain for the different specifications we explored ((1), (2) and (3)) and different versions of the model. Although the results are slightly better in the restricted model. There are also some positive correlation between our utility measures and the level of education of female spouses, but it seems to be significant only when we use the unrestricted model. When we include controls we see that the main conclusions we have drawn remain the same (see Tables 4.18 and 4.19), which would indicate that our results do not seem to be sensitive to whether or not we control for it in our analysis.

It is important to relate our main findings to the literature. Usually, in the literature that use well-being survey data, it is assumed that subjective well-being measures are an empirical proxy for utility, and that individual's responses reveal what they would choose if they were well informed about the consequences of their choices. For instance, Benjamin et al. (2012) provide evidence that individual's subjective well-being predictions are predictor of their choices and that the strength of this relationship varies depending on, for example, choice situations and subject populations. Our results are in line with this evidence. Recall that our estimation and computation of utilities relies basically on observed choices of consumption and leisure, and those choices come from a utility maximization, therefore by finding significant relationships between these utilities and specific satisfaction variables, we contribute to link well-being measures to choices. Importantly for us, the study of Benjamin et al. (2012) also finds that the life satisfaction measure is a better predictor of choice than the happiness measure, which is similar to our case because we find stronger relationships between utilities and specific variables of satisfaction than the relationships between utilities and general happiness. One important difference with this study is that we focus on observed choices from real situations rather than predicted choices in hypothetical scenarios (see also Benjamin et al., 2013 for a recent analysis on the relationship between preference-based marginal rates of substitution and well-being survey data).

Related to this literature, it is also important to note that there could be factors influencing individual's responses to well-being questions. For instance, Kahneman and Krueger (2006) have found that happiness reports depend on contexts where questions take place, on the mood of the individuals, specific situations individuals experience, memory, and the reference provided (see also Diener et al., 1985 for more details on how individuals create references to respond to life satisfaction questions). Dolan and Kahneman (2008) show that, although individual's tend to adapt to changes in their circumstances, they often fail to predict in which degree they will adapt. This evidence will imply for our case that the well-being variables we use might include the effect of other factors and life events that are taking place in the lives of the respondents.[28] If that is true, then it would be more difficult for our utility measures to be significantly correlated to these general reports. The authors also point out to be careful when exploiting individual's satisfaction ratings because they are somehow likely to come from whatever the respondent's attention is drawn at the time of the assessment. Relating this to our results, perhaps, for these type of reasons our measures of utility fail to be strongly informative about the general variables of well-being which are directly influenced by these factors. On the contrary, as we find, when individuals are forced to think their well-being answers within specific domains (i.e. leisure, work and financial circumstances), our utility measures are more informative.

As a final note, it seems that incorporating alternative methods to measure the subjective well-being has been in the scope of the literature. For instance, Knabe et al. (2010) suggest that instead of asking about their life satisfaction one could ask about the strength of emotions that individuals face in spe-

[28]For example, Lucas et al. (2003) find that, on average, individuals experience an increase in happiness in the years close to marriage but after some time they appear to return to their baseline. Related to our utility measures, this effect is not necessarily reflected in their choices about consumption and leisure.

cific situations in a day-to-day basis. This is called "The Day Reconstruction Method (DRM)". The authors argue that this tool, based on concrete activities, reduce the presence of abstract issues such as the transcendental purpose of life or social comparisons.[29] It is probably more natural to expect some relationship between these type of new measures and our utilities which are also constructed based on concrete choices on consumption and leisure.[30] This all seem very appealing and is left for future research.

4.7 Conclusions

In this paper we want to relate individual subjective well-being measures and individual utilities. The measures of subjective well-being are by default individual specific and are available in the LISS data. The utility measures instead need to be constructed. To do that, we estimate a structural model along the lines of the collective model of Chiappori et al. (2002). This approach allows us to identify individual preferences and represent them by individual utilities on the basis of household level data and some specific assumptions. We use exactly these individual utilities to explore whether they are correlated with well-being measures. Our estimations are done with GMM for the model, and OLS regressions for the relationship between utilities and well-being.

We exploit two definitions of leisure time. Pure leisure is the time spent on leisure activities like watching TV, doing sports, traveling and hobbies, whereas constructed leisure is the leisure usually focused on in labor supply models applied to data without detailed information on time use.

Overall, we find that when we use more appropriate definitions of leisure (pure), we are able to identify individual preferences over leisure and consumption which are represented by utility measures that are more informative about specific situations, in particular in the domains of leisure, work and financial situation. By using a constructed measure we are only able to capture this relationship in a partial way. This finding sheds light on how important it is to accurately measure the leisure variable in microeconomic and labor supply models. It seems that, when we do not use a genuine measure, we cannot fully capture behavior of individuals because this measure does not disentangle pure leisure from time allocated to children or housework; whereas, when we use an accurate measure, we are able to identify individual preferences and have different conclusions about their relationship with well-being.

Our results are well in line with the literature of well-being and choices (see for instance Benjamin et al., 2012 and Benjamin et al., 2013). Our estimation and computation of utilities relies basically on observed choices of consumption and leisure, and since these choices come from a utility maximization, therefore, we contribute to link well-being measures to choices. It seems that when individuals are forced to think their well-being answers within specific domains (i.e. leisure, work and financial circumstances), utility measures obtained through their choices are more informative about their satisfaction.

[29]They use this tool in Germany for both employed and unemployed individuals. Results show that unemployed persons report lower levels of satisfaction with their lives in general. Employed people rank working and work-related activities among the least enjoyable activities but experience more positive feelings than the unemployed when performing similar activities. However, when comparing utilities, not much difference is found. They use different measures of experienced utility (proposed byDolan and Kahneman, 2008 and which requires people to state how they feel when performing various activities on the previous day). Unemployed seem to compensate the gap from the time spent on similar activities by using doing more enjoyable activities (during the time which the employed have to work).

[30]Kahneman and Deaton (2010) also provide an interesting study which distinguishes two aspects of well-being. The first one is emotional well-being that comes from everyday individual's experience and the second one is life evaluation in general. Interestingly for us, one of their findings is that high income buys life satisfaction but not happiness and that low income is associated with low life satisfaction and low emotional well-being.

In the case of the relationship between utilities and general variables of well-being, it seems that this is more difficult to capture irrespective of the definitions of leisure we use. The main reason to have only an imperfect correlation is that our individual's utility measures use just two inputs: consumption and leisure. Another reason could be that there are some factors influencing individual's responses to well-being questions. The literature in this respect have found that happiness reports depend on factors such as contexts where questions take place, on the mood of the individuals, and so on (see for instance Kahneman and Krueger, 2006 and Dolan and Kahneman, 2008). This implies for our case that the well-being variables we use might include the effect of other factors and life events that are taking place in the lives of the respondents. Then, naturally, it is more difficult for our utility measures to be significantly correlated to these general reports.

To incorporate new domains in our utility functions (such as health or social interactions) and to explore new measures of the subjective well-being (for example using data from DRM approach suggested by Knabe et al., 2010) seems appealing but it is beyond the scope of our analysis and is left for future research.

Appendix

A Descriptive statistics of well-being

Table 4.9: Descriptive statistics of well-being variables

	Female				Male			
	Mean	St. D.	Min.	Max.	Mean	St. D.	Min.	Max.
A. General variables of happiness								
Happy 1/.	7.905702	0.9174082	3	10	7.881579	0.8740524	3	10
Satisfied with life at the moment 2/.	7.817982	1.011899	2	10	7.848684	0.9097267	5	10
Life is ideal 3/.	5.453947	1.008789	1	7	5.317982	0.9708867	1	7
Life is excellent 3/.	5.550439	1.010755	1	7	5.482456	0.8410611	2	7
Satisfied with life 3/.	5.809211	0.8232892	2	7	5.714912	0.7913524	2	7
Got important things in life 3/.	5.609649	1.095964	1	7	5.535088	1.028643	1	7
No changes in life 3/.	4.91886	1.407982	1	7	4.72807	1.428348	1	7
Best life 4/.	7.633772	0.7757873	5	10	7.546053	0.8758455	3	10
B. Domain-specific variables of satisfaction 5/.								
Leisure time	6.651316	1.930415	0	10	6.622807	1.747289	0	10
Way of enjoying leisure	6.822368	1.635198	0	10	7.050439	1.485342	1	10
Work	7.460526	1.32871	0	10	7.399123	1.429178	0	10
Type of work	7.565789	1.389147	0	10	7.554825	1.491831	0	10
Hours of work	7.66886	1.50676	0	10	7.497807	1.557681	0	10
Wage	6.75	1.647842	0	10	6.91886	1.668057	0	10
Financial situation	7.201754	1.155435	1	10	7.087719	1.119744	0	10
Colleagues	7.576577	1.335736	2	10	7.525727	1.421688	0	10
Schooling	7.25	1.5173	0	10	7.219298	1.598124	0	10
Career	7.278509	1.430922	0	10	7.339912	1.331209	1	10

Notes:
1/. 1 corresponds to totally unhappy and 10 to totally happy.
2/. 1 corresponds to not at all satisfied and 10 to completely satisfied.
3/. The questions are preceded by the following: “Below are five statements with which you may agree or disagree. Using the 1-7 scale, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding...” Number 1 corresponds to strongly disagree, 2 to disagree, 3 to slightly disagree, 4 to neither agree nor disagree, 5 to slightly agree, 6 to agree, and 7 to strongly agree.
4/. The question is preceded by the following: “If you imagine a "ladder of life", where the first step represents the worst possible life and the tenth step the best possible life, where 1 corresponds to the worst possible and 10 to the best possible life..”.

5/. Responses go from 0 to 10 where 1 corresponds to not at all satisfied and 10 completely (or fully) satisfied.

B Additional Demand System Estimations

Table 4.10: Private consumption equation (pure leisure) - Unrestricted specifications

Pure leisure 1/.	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
$\hat{\alpha}_0^i$ (constant)	286.6960*	220.1555	268.2416	625.4842***	611.9720***	712.2892***
	(149.4164)	(151.3284)	(180.1246)	(183.3323)	(186.6574)	(211.3274)
$\hat{\alpha}_1^i = \beta_j^i$(total expenditure)	0.0734	0.0972	0.0886	0.0564	0.0456	0.0540
	(0.0688)	(0.0759)	(0.0998)	(0.0678)	(0.0600)	(0.0490)
$\hat{\alpha}_2^i$(wage)	-6.9291	-8.5755	-13.8992	-21.5250	-20.3526	-27.0003*
	(9.0233)	(11.4349)	(21.4208)	(17.5137)	(17.8938)	(15.3113)
$\hat{\alpha}_3^i$(children)	-42.6081**	-29.7623	-29.0587	-18.7064	-9.1715	-2.4378
	(21.5902)	(23.6837)	(24.8895)	(25.3485)	(24.8090)	(28.2662)
$\hat{\alpha}_4^i$(children*wage)	1.9662	2.0536	1.6177	0.5183	0.1899	0.0278
	(1.7033)	(2.0307)	(2.1312)	(1.6985)	(1.6713)	(1.7099)
$\hat{\alpha}_5^i$(age)	2.6925	3.2383	2.4413	-5.6739	-6.0537*	-7.8830**
	(3.0924)	(3.0710)	(3.6229)	(3.6360)	(3.5843)	(3.9264)
$\hat{\alpha}_6^i$(age*wage)	-0.1286	-0.1753	-0.0507	0.2420	0.2635	0.3570*
	(0.2210)	(0.2135)	(0.2000)	(0.1891)	(0.1889)	(0.2009)
$\hat{\alpha}_7^i$(second. educ.)	-63.7091	-108.5082	-110.8378	-127.3928	-113.9724	-123.9519
	(71.8909)	(78.0835)	(98.4106)	(91.2717)	(86.4136)	(81.0747)
$\hat{\alpha}_8^i$(second. educ.*wage)	5.1092	8.0454	8.2180	7.8060	6.8557	7.4631
	(5.3555)	(5.8544)	(7.9028)	(5.4537)	(5.0743)	(4.6234)
$\hat{\alpha}_9^i$(college educ.)	-53.1834	-69.1515	-69.3271	-69.0992	-76.3135	-79.6792
	(70.3764)	(70.6230)	(73.4668)	(83.3515)	(78.2000)	(83.3581)
$\hat{\alpha}_{10}^i$(college educ.*wage)	2.6775	2.8644	2.9446	5.2732	5.3655	5.4763
	(4.0397)	(3.9356)	(4.1003)	(4.0654)	(3.8570)	(4.0807)
$\hat{\alpha}_{11}^i$(full-time)		101.7381*	105.3169*		48.3190	36.4836
		(57.9891)	(59.5350)		(72.6047)	(65.2911)
$\hat{\alpha}_{12}^i$(full-time*wage)		-0.6385	-0.6576		0.7824	1.4737
		(4.3445)	(5.3511)		(4.2942)	(3.7080)
$\hat{\alpha}_{13}^i$(children8)			-15.6806			-63.6067
			(74.1726)			(82.3891)
$\hat{\alpha}_{14}^i$(children8*wage)			3.4310			3.1906
			(5.9728)			(3.7538)
Hansen's J chi2(2)	p = 0.1155	p = 0.1416	p = 0.0920	p = 0.1155	p = 0.1416	p = 0.0920
γ_j^i (subsistence level) 2/.	337.3822	331.0603	338.9559	288.6494	284.3220	285.3359
	(71.2596)	(96.2520)	(97.1756)	(76.3929)	(77.7507)	(83.8547)

Notes:

1/. Model using pure leisure definition, iterative gmm estimator, male's share of asset income and full household income as instruments for total expenditure, all other regressors as instruments for themselves, standard errors in parenthesis. 2/. Average value and standard deviations in parenthesis.

Table 4.11: Private consumption equation (pure leisure) - Restricted specifications

Pure leisure 1/.	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
$\hat{\alpha}_0^i$ (constant)	3.7965***	3.6469***	3.7472***	4.5801***	4.6699***	4.7838***
	(0.4584)	(0.4586)	(0.5088)	(0.4768)	(0.3781)	(0.3437)
$\hat{\alpha}_1^i = \beta_j^i$(total expenditure)	0.3409***	0.3588***	0.3484***	0.2269***	0.2009***	0.1965***
	(0.0786)	(0.0795)	(0.0870)	(0.0785)	(0.0617)	(0.0536)
$\hat{\alpha}_2^i$(wage)	-20.5507*	-29.1713**	-44.3055**	-19.5546	-18.2849	-23.1646
	(11.8134)	(12.9774)	(19.3242)	(16.7458)	(14.1274)	(14.2485)
$\hat{\alpha}_3^i$(children)	-0.0460***	-0.0362***	-0.0332**	-0.0634***	-0.0559***	-0.0480**
	(0.0143)	(0.0138)	(0.0145)	(0.0185)	(0.0188)	(0.0197)
$\hat{\alpha}_4^i$(children*wage)	3.0717**	4.3839***	3.0410**	2.2295	2.3906*	1.8981*
	(1.4100)	(1.5866)	(1.3901)	(1.4130)	(1.2593)	(1.0809)
$\hat{\alpha}_5^i$(age)	0.0034**	0.0036**	0.0028	-0.0008	-0.0005	-0.0021
	(0.0016)	(0.0016)	(0.0019)	(0.0020)	(0.0021)	(0.0024)
$\hat{\alpha}_6^i$(age*wage)	-0.3235**	-0.2976**	0.0271	-0.0645	-0.0466	0.0594
	(0.1454)	(0.1440)	(0.1429)	(0.1113)	(0.1001)	(0.1227)
$\hat{\alpha}_7^i$(second. educ.)	0.0032	-0.0009	-0.0005	0.0217	0.0235	0.0178
	(0.0342)	(0.0330)	(0.0336)	(0.0487)	(0.0501)	(0.0504)
$\hat{\alpha}_8^i$(second. educ.*wage)	4.6211	5.1119	5.6188	3.6851	3.0371	3.2017
	(3.3644)	(3.4336)	(3.5655)	(2.9580)	(2.5300)	(2.4450)
$\hat{\alpha}_9^i$(college educ.)	-0.0001	-0.0159	-0.0128	0.1033**	0.1054**	0.1027**
	(0.0344)	(0.0337)	(0.0343)	(0.0482)	(0.0490)	(0.0491)
$\hat{\alpha}_{10}^i$(college educ.*wage)	-3.5840	-5.7028**	-6.0286**	-0.0278	-0.3933	-0.5253
	(2.7572)	(2.7717)	(2.6513)	(2.3683)	(2.0956)	(2.0401)
$\hat{\alpha}_{11}^i$(full-time)		0.0854***	0.0800**		0.0987**	0.0879**
		(0.0301)	(0.0315)		(0.0402)	(0.0412)
$\hat{\alpha}_{12}^i$(full-time*wage)		11.8857***	13.3477***		6.5881***	6.9850***
		(3.1624)	(3.6829)		(2.1612)	(2.1279)
$\hat{\alpha}_{13}^i$(children8)			-0.0342			-0.0664
			(0.0422)			(0.0561)
$\hat{\alpha}_{14}^i$(children8*wage)			11.4253**			4.4101*
			(4.7368)			(2.5601)
γ_j^i (subsistence level) 2/.	5.8984	5.8977	5.8959	5.8311	5.8285	5.8276
	(0.0937)	(0.1123)	(0.1140)	(0.1058)	(0.1200)	(0.1225)

Notes:

1/. Model using pure leisure definition, iterative gmm estimator, male's share of asset income and full household income as instruments for total expenditure, all other regressors as instruments for themselves, standard errors in parenthesis. Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 2/. Average value and standard deviations in parenthesis.

C Additional OLS regressions of general variables of happiness without controls

Table 4.12: More regressions of general happiness on utility - Unrestricted specifications

Pure leisure / No controls 1/.	Utility A 2/.						Utility B 2/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Happy	0.0004	-0.0007	-0.0003	0.0013	0.0012	0.0015*	0.1159	0.0075	0.0510	0.0688	0.0861	0.1272*
	(0.0018)	(0.0017)	(0.0017)	(0.0008)	(0.0008)	(0.0008)	(0.0868)	(0.0722)	(0.0587)	(0.0475)	(0.0845)	(0.0701)
Satisfied with life at the moment	0.0036**	0.0019	0.0017	0.0001	0.0000	0.0008	0.2645***	0.1133	0.1629***	0.0241	-0.0046	0.0849
	(0.0016)	(0.0015)	(0.0014)	(0.0008)	(0.0007)	(0.0008)	(0.0991)	(0.0903)	(0.0601)	(0.0487)	(0.0789)	(0.0601)
Life is ideal	0.0007	-0.0006	-0.0001	0.0003	0.0004	0.0004	0.1075	-0.0389	0.0562	0.0157	0.0316	0.0288
	(0.0015)	(0.0014)	(0.0015)	(0.0009)	(0.0008)	(0.0009)	(0.0825)	(0.0633)	(0.0669)	(0.0587)	(0.0793)	(0.0763)
Life is excellent	0.0018	0.0013	0.0020	0.0012	0.0010	0.0013*	0.1030	0.0165	0.0442	0.0372	0.0496	0.0560
	(0.0016)	(0.0015)	(0.0015)	(0.0008)	(0.0007)	(0.0007)	(0.0920)	(0.0694)	(0.0662)	(0.0581)	(0.0755)	(0.0658)
Satisfied with life	0.0012	0.0001	0.0009	0.0010	0.0007	0.0008	0.1423*	0.0070	0.0842*	0.0648	0.0611	0.0444
	(0.0014)	(0.0012)	(0.0012)	(0.0007)	(0.0007)	(0.0007)	(0.0792)	(0.0575)	(0.0452)	(0.0615)	(0.0744)	(0.0662)
Got important things in life	0.0000	-0.0013	0.0000	0.0007	0.0007	0.0005	0.0074	-0.1012	0.0003	0.0718	0.0311	0.0122
	(0.0018)	(0.0017)	(0.0018)	(0.0010)	(0.0008)	(0.0008)	(0.0857)	(0.0805)	(0.0720)	(0.0834)	(0.0897)	(0.0703)
No changes in life	0.0022	0.0024	0.0029	-0.0004	-0.0008	-0.0013	0.1254	0.0777	0.1499	0.0368	-0.0873	-0.1397
	(0.0018)	(0.0019)	(0.0019)	(0.0014)	(0.0013)	(0.0013)	(0.1198)	(0.1207)	(0.0988)	(0.0910)	(0.1194)	(0.1016)
Best life	0.0019	0.0013	0.0020	-0.0003	0.0000	0.0001	0.1679**	0.0592	0.1283**	-0.0146	0.0160	0.0559
	(0.0013)	(0.0012)	(0.0013)	(0.0009)	(0.0008)	(0.0008)	(0.0742)	(0.0625)	(0.0498)	(0.0570)	(0.0728)	(0.0642)
N	162	164	160	205	222	214	162	164	160	205	222	214

Notes:

1/. OLS regressions without controls, pure leisure definition, standard errors in parenthesis. 2/ Utilities specifications are: $\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

Table 4.13: More regressions of general happiness on utility - Restricted specifications

Pure leisure / No controls 1/. 2/.	Utility A 3/.						Utility B 3/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Happy	0.0006	0.0003	0.0007	0.0002	0.0003	0.0004	0.0653	0.0439	0.1052	0.0056	0.0304	0.0264
	(0.0010)	(0.0010)	(0.0010)	(0.0007)	(0.0007)	(0.0007)	(0.0713)	(0.0701)	(0.0725)	(0.0583)	(0.0537)	(0.0521)
Satisfied with life at the moment	0.0022**	0.0018*	0.0019**	0.0002	0.0003	0.0003	0.1881**	0.1547**	0.1738**	0.0463	0.0449	0.0334
	(0.0010)	(0.0009)	(0.0009)	(0.0006)	(0.0006)	(0.0006)	(0.0841)	(0.0755)	(0.0730)	(0.0560)	(0.0504)	(0.0490)
Life is ideal	0.0006	0.0007	0.0004	-0.0006	-0.0006	-0.0006	0.0454	0.1020	0.0379	-0.0327	-0.0114	-0.0222
	(0.0009)	(0.0009)	(0.0009)	(0.0007)	(0.0007)	(0.0007)	(0.0752)	(0.0856)	(0.0707)	(0.0673)	(0.0612)	(0.0606)
Life is excellent	0.0016*	0.0012	0.0008	0.0002	0.0004	0.0006	0.1428*	0.1140	0.0526	0.0439	0.0500	0.0895
	(0.0009)	(0.0009)	(0.0009)	(0.0008)	(0.0008)	(0.0008)	(0.0744)	(0.0764)	(0.0791)	(0.0604)	(0.0477)	(0.0602)
Satisfied with life	0.0011	0.0012	0.0010	-0.0001	0.0002	0.0003	0.0895	0.1336**	0.0885	-0.0193	0.0168	0.0208
	(0.0008)	(0.0008)	(0.0008)	(0.0005)	(0.0005)	(0.0005)	(0.0653)	(0.0595)	(0.0641)	(0.0497)	(0.0432)	(0.0499)
Got important things in life	-0.0004	-0.0011	-0.0006	-0.0016	-0.0014	-0.0011	0.0148	-0.1018	-0.0413	-0.1364**	-0.0648	-0.0303
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0876)	(0.0811)	(0.0915)	(0.0672)	(0.0632)	(0.0739)
No changes in life	0.0010	0.0018	0.0007	-0.0028***	-0.0026**	-0.0025**	0.0826	0.1962*	0.0651	-0.1786*	-0.0997	-0.0724
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0966)	(0.1016)	(0.0954)	(0.0960)	(0.0956)	(0.0943)
Best life	0.0010	0.0010	0.0006	-0.0002	-0.0001	0.0002	0.0815	0.0961*	0.0571	-0.0040	0.0184	0.0577
	(0.0007)	(0.0008)	(0.0008)	(0.0008)	(0.0007)	(0.0007)	(0.0587)	(0.0575)	(0.0628)	(0.0624)	(0.0609)	(0.0599)
N	324	320	316	353	371	374	324	320	316	353	371	374

Notes:

1/. OLS regressions without controls, pure leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/ Utilities specifications are: $\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

D Additional OLS regressions of general variables of happiness with controls

Table 4.14: More regressions of general happiness on utility - Unrestricted specifications with controls

Pure leisure / Controls 1/.2/.	Utility A 3/.						Utility B 3/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Happy	0.0000	-0.0006	-0.0004	0.0009	0.0006	0.0010	0.0956	0.0080	0.0589	0.0523	0.0285	0.0918
	(0.0018)	(0.0017)	(0.0017)	(0.0008)	(0.0008)	(0.0008)	(0.0858)	(0.0750)	(0.0645)	(0.0441)	(0.0855)	(0.0640)
Satisfied with life at the moment	0.0032**	0.0019	0.0015	0.0000	-0.0004	0.0005	0.2450***	0.1146	0.1597**	0.0186	-0.0442	0.0741
	(0.0015)	(0.0014)	(0.0015)	(0.0008)	(0.0008)	(0.0008)	(0.0847)	(0.0883)	(0.0681)	(0.0498)	(0.0843)	(0.0644)
Life is ideal	0.0005	-0.0005	-0.0005	-0.0001	-0.0004	-0.0004	0.0963	-0.0342	0.0444	-0.0070	-0.0407	-0.0337
	(0.0015)	(0.0015)	(0.0016)	(0.0009)	(0.0008)	(0.0008)	(0.0765)	(0.0666)	(0.0768)	(0.0599)	(0.0824)	(0.0747)
Life is excellent	0.0016	0.0015	0.0019	0.0007	0.0001	0.0006	0.0866	0.0160	0.0379	0.0205	-0.0264	-0.0103
	(0.0015)	(0.0015)	(0.0016)	(0.0008)	(0.0008)	(0.0008)	(0.0817)	(0.0723)	(0.0662)	(0.0578)	(0.0800)	(0.0701)
Satisfied with life	0.0010	-0.0002	0.0004	0.0009	0.0002	0.0004	0.1360*	-0.0123	0.0685	0.0741	0.0396	0.0200
	(0.0013)	(0.0012)	(0.0013)	(0.0007)	(0.0007)	(0.0007)	(0.0734)	(0.0584)	(0.0495)	(0.0602)	(0.0722)	(0.0631)
Got important things in life	0.0001	-0.0014	-0.0008	-0.0001	-0.0006	-0.0006	0.0111	-0.1134	-0.0359	0.0388	-0.0866	-0.0964
	(0.0018)	(0.0018)	(0.0019)	(0.0010)	(0.0009)	(0.0010)	(0.0878)	(0.0893)	(0.0796)	(0.0851)	(0.0960)	(0.0833)
No changes in life	0.0016	0.0013	0.0009	-0.0011	-0.0019	-0.0024*	0.0934	0.0310	0.0399	0.0134	-0.2017	-0.2436**
	(0.0018)	(0.0019)	(0.0020)	(0.0014)	(0.0014)	(0.0014)	(0.1277)	(0.1192)	(0.1027)	(0.0984)	(0.1257)	(0.1107)
Best life	0.0015	0.0012	0.0018	-0.0012	-0.0012	-0.0011	0.1499**	0.0599	0.1207**	-0.0650	-0.0935	-0.0338
	(0.0013)	(0.0012)	(0.0014)	(0.0008)	(0.0008)	(0.0008)	(0.0749)	(0.0623)	(0.0557)	(0.0528)	(0.0732)	(0.0724)
N	162	164	160	205	222	214	162	164	160	205	222	214

Notes:

1/. OLS regressions with controls, pure leisure definition, standard errors in parenthesis. 2/ Specification (1) controls for the number of children living in the household, age and two dummies for education levels (same specification used in Table 4.3). Specification (2) adds a dummy that indicates whether both spouses work full time in the labor market. Specification (3) adds another dummy that indicates whether the couple has children below eight years old. 3/. Utilities specifications are: $\upsilon_A^i(c^i,l^i) = (c^i-\gamma_c^i)^{\beta_c^i}(l^i-\gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i,l^i) = \beta_c^i ln(c^i-\gamma_c^i)+\beta_l^i ln(l^i-\gamma_l^i)$.

Table 4.15: More regressions of general happiness on utility - Restricted specifications with controls

Pure leisure / Controls 1/. 2/. 3/.	Utility A 4/.						Utility B 4/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Happy	0.0006	0.0004	0.0010	0.0002	0.0004	0.0006	0.0664	0.0441	0.1165	0.0114	0.0339	0.0365
	(0.0010)	(0.0010)	(0.0010)	(0.0007)	(0.0007)	(0.0007)	(0.0711)	(0.0693)	(0.0707)	(0.0590)	(0.0549)	(0.0539)
Satisfied with life at the moment	0.0020**	0.0018**	0.0019**	0.0002	0.0003	0.0004	0.1704**	0.1490**	0.1723**	0.0464	0.0479	0.0436
	(0.0009)	(0.0009)	(0.0009)	(0.0007)	(0.0006)	(0.0006)	(0.0821)	(0.0723)	(0.0719)	(0.0574)	(0.0515)	(0.0510)
Life is ideal	0.0005	0.0007	0.0003	-0.0004	-0.0005	-0.0003	0.0349	0.0947	0.0278	-0.0195	0.0012	-0.0001
	(0.0009)	(0.0009)	(0.0009)	(0.0007)	(0.0007)	(0.0007)	(0.0739)	(0.0838)	(0.0694)	(0.0656)	(0.0602)	(0.0609)
Life is excellent	0.0016*	0.0013	0.0008	0.0002	0.0005	0.0008	0.1376*	0.1214	0.0447	0.0475	0.0517	0.1048*
	(0.0009)	(0.0009)	(0.0009)	(0.0008)	(0.0008)	(0.0008)	(0.0735)	(0.0745)	(0.0763)	(0.0578)	(0.0481)	(0.0620)
Satisfied with life	0.0011	0.0012*	0.0011	-0.0001	0.0003	0.0004	0.0851	0.1358**	0.0845	-0.0148	0.0250	0.0382
	(0.0008)	(0.0007)	(0.0007)	(0.0005)	(0.0006)	(0.0006)	(0.0652)	(0.0591)	(0.0642)	(0.0494)	(0.0438)	(0.0527)
Got important things in life	-0.0000	-0.0005	-0.0000	-0.0013	-0.0011	-0.0007	0.0292	-0.0507	-0.0039	-0.1107*	-0.0484	0.0043
	(0.0010)	(0.0009)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0878)	(0.0800)	(0.0911)	(0.0657)	(0.0630)	(0.0736)
No changes in life	0.0013	0.0021*	0.0009	-0.0028**	-0.0026**	-0.0026**	0.1159	0.2167**	0.0688	-0.1733*	-0.1157	-0.0848
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0988)	(0.1003)	(0.0978)	(0.0969)	(0.0953)	(0.0965)
Best life	0.0009	0.0008	0.0005	-0.0002	-0.0001	0.0004	0.0749	0.0833	0.0516	-0.0039	0.0179	0.0702
	(0.0007)	(0.0007)	(0.0008)	(0.0008)	(0.0007)	(0.0007)	(0.0580)	(0.0566)	(0.0621)	(0.0616)	(0.0600)	(0.0593)
N	324	320	316	353	371	374	324	320	316	353	371	374

Notes:

1/. OLS regressions with controls, pure leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/. Specification (1) controls for the number of children living in the household, age and two dummies for education levels (same specification used in Table 4.3). Specification (2) adds a dummy that indicates whether both spouses work full time in the labor market. Specification (3) adds another dummy that indicates whether the couple has children below eight years old. 4/. Utilities specifications are: $\upsilon_A^i(c^i,l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i,l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

E Additional OLS regressions of domain-specific variables of satisfaction without controls

Table 4.16: More regressions of domain-specific happiness on utility - Unrestricted specifications

Pure leisure / No controls 1/.	Utility A 2/.						Utility B 2/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Leisure time	0.0061***	0.0047*	0.0027	0.0048***	0.0054***	0.0059***	0.2537**	0.2664*	0.1154	0.1801	0.3372**	0.3135**
	(0.0022)	(0.0024)	(0.0023)	(0.0016)	(0.0013)	(0.0014)	(0.1099)	(0.1485)	(0.1031)	(0.1101)	(0.1439)	(0.1487)
Way of enjoying leisure	0.0038**	0.0049**	0.0021	0.0040***	0.0032***	0.0041***	0.0763	0.2034	0.0343	0.1068	0.1279	0.2011*
	(0.0018)	(0.0021)	(0.0019)	(0.0012)	(0.0011)	(0.0011)	(0.0850)	(0.1316)	(0.0811)	(0.0935)	(0.1206)	(0.1090)
Work	-0.0007	0.0015	-0.0012	0.0018	0.0015	0.0021	-0.0292	0.1387	-0.0106	0.1049	0.0615	0.1820
	(0.0016)	(0.0019)	(0.0016)	(0.0014)	(0.0012)	(0.0014)	(0.0723)	(0.1224)	(0.0720)	(0.0829)	(0.1052)	(0.1203)
Type of work	-0.0002	0.0020	0.0000	0.0011	0.0007	0.0008	0.0053	0.1715	0.0638	0.0462	-0.0126	0.0626
	(0.0015)	(0.0018)	(0.0016)	(0.0015)	(0.0013)	(0.0015)	(0.0815)	(0.1140)	(0.0873)	(0.0921)	(0.1108)	(0.1108)
Hours of work	-0.0010	-0.0008	-0.0012	-0.0005	-0.0002	-0.0005	0.0450	0.0237	-0.0228	-0.0610	-0.0473	-0.0558
	(0.0026)	(0.0024)	(0.0029)	(0.0016)	(0.0013)	(0.0014)	(0.1146)	(0.1215)	(0.0970)	(0.1032)	(0.1153)	(0.1075)
Wage	-0.0010	-0.0008	-0.0012	-0.0001	0.0006	-0.0003	0.0450	0.0237	-0.0228	0.0276	0.0696	-0.0491
	(0.0026)	(0.0024)	(0.0029)	(0.0017)	(0.0015)	(0.0016)	(0.1146)	(0.1215)	(0.0970)	(0.1151)	(0.1343)	(0.1369)
Financial situation	0.0005	-0.0007	-0.0007	0.0027**	0.0024**	0.0019*	0.0582	-0.0682	-0.0353	0.1923**	0.1744	0.0772
	(0.0018)	(0.0018)	(0.0019)	(0.0011)	(0.0010)	(0.0011)	(0.0997)	(0.0898)	(0.0686)	(0.0829)	(0.1072)	(0.0989)
Colleagues	-0.0004	-0.0008	-0.0016	-0.0937	-0.0976	-0.0446	0.0179	-0.0392	-0.0397	-6.6595	-12.2450	-1.8011
	(0.0023)	(0.0020)	(0.0022)	(0.0891)	(0.0831)	(0.0479)	(0.1068)	(0.0961)	(0.0871)	(8.1926)	(12.5017)	(2.1669)
Schooling	0.0045**	0.0038**	0.0037*	0.0005	0.0010	0.0012	0.2070**	0.2051*	0.2116**	-0.0120	0.0668	0.0997
	(0.0019)	(0.0018)	(0.0020)	(0.0017)	(0.0015)	(0.0015)	(0.0975)	(0.1054)	(0.0908)	(0.0960)	(0.1394)	(0.1101)
Career	-0.0006	0.0012	-0.0004	0.0014	0.0011	0.0011	-0.0146	0.0710	0.0177	0.1135	0.0643	0.0714
	(0.0016)	(0.0019)	(0.0016)	(0.0014)	(0.0011)	(0.0012)	(0.0814)	(0.1168)	(0.0800)	(0.0869)	(0.1057)	(0.0882)
N	162	164	160	205	222	214	162	164	160	205	222	214

Notes:

1/. OLS regressions without controls, pure leisure definition, standard errors in parenthesis. 2/ Utilities specifications are: $\upsilon_A^i(c^i,l^i) = (c^i-\gamma_c^i)^{\beta_c^i}(l^i-\gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i,l^i) = \beta_c^i ln(c^i-\gamma_c^i)+\beta_l^i ln(l^i-\gamma_l^i)$.

Table 4.17: More regressions of domain-specific happiness on utility - Restricted specifications

Pure leisure / No controls 1/. 2/.	Utility A 3/.						Utility B 3/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Leisure time	0.0063***	0.0043***	0.0049***	0.0013	0.0007	0.0003	0.5314***	0.3368*	0.3642**	0.1279	0.0192	0.0143
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0014)	(0.1637)	(0.1752)	(0.1551)	(0.1339)	(0.1243)	(0.1142)
Way of enjoying leisure	0.0053***	0.0032***	0.0034***	0.0030***	0.0027***	0.0029***	0.5506***	0.2842*	0.2687**	0.2403**	0.1180	0.1837**
	(0.0014)	(0.0012)	(0.0013)	(0.0011)	(0.0010)	(0.0011)	(0.1537)	(0.1515)	(0.1303)	(0.1182)	(0.0959)	(0.0895)
Work	0.0028**	0.0027***	0.0028**	-0.0001	-0.0003	-0.0001	0.1755	0.2076**	0.2175**	-0.0568	-0.0488	0.0057
	(0.0011)	(0.0010)	(0.0011)	(0.0009)	(0.0009)	(0.0010)	(0.1076)	(0.0885)	(0.0915)	(0.0827)	(0.0809)	(0.1140)
Type of work	0.0027**	0.0029***	0.0025**	-0.0006	-0.0006	-0.0004	0.1661	0.2339**	0.1945**	-0.1117	-0.0704	-0.0120
	(0.0011)	(0.0010)	(0.0011)	(0.0009)	(0.0009)	(0.0010)	(0.1057)	(0.1001)	(0.0981)	(0.0809)	(0.0799)	(0.1157)
Hours of work	0.0004	0.0007	-0.0010	0.0002	0.0006	0.0011	0.0264	0.1501	-0.1337	0.0633	0.0467	0.1618
	(0.0015)	(0.0015)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.1209)	(0.1236)	(0.1307)	(0.1030)	(0.0882)	(0.1261)
Wage	0.0004	0.0007	-0.0010	-0.0011	-0.0017	-0.0012	0.0264	0.1501	-0.1337	-0.1579	-0.2144**	-0.1326
	(0.0015)	(0.0015)	(0.0016)	(0.0012)	(0.0012)	(0.0012)	(0.1209)	(0.1236)	(0.1307)	(0.1053)	(0.0892)	(0.1273)
Financial situation	0.0018*	0.0008	0.0010	0.0010	0.0010	0.0013	0.2109**	0.0127	0.0495	0.0251	0.0430	0.0915
	(0.0011)	(0.0010)	(0.0012)	(0.0008)	(0.0008)	(0.0008)	(0.0908)	(0.0886)	(0.1153)	(0.0692)	(0.0639)	(0.0828)
Colleagues	0.0012	0.0009	0.0003	0.0041	-0.0008	-0.0074	0.1168	0.0680	0.0191	1.4325	0.9735	0.4915
	(0.0013)	(0.0012)	(0.0012)	(0.0049)	(0.0025)	(0.0074)	(0.1180)	(0.0997)	(0.1012)	(1.4378)	(0.9655)	(0.5476)
Schooling	0.0018*	0.0021*	0.0012	-0.0004	-0.0007	-0.0007	0.0527	0.0604	-0.0168	0.0443	0.0042	-0.0159
	(0.0010)	(0.0011)	(0.0011)	(0.0016)	(0.0015)	(0.0015)	(0.0982)	(0.1004)	(0.0909)	(0.1171)	(0.1045)	(0.1060)
Career	0.0011	0.0012	0.0011	-0.0010	-0.0014	-0.0015	0.0017	0.0477	0.0112	-0.1049	-0.1080	-0.1114
	(0.0011)	(0.0011)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.1042)	(0.0919)	(0.0963)	(0.0903)	(0.0835)	(0.0915)
N	324	320	316	353	371	374	324	320	316	353	371	374

Notes:

1/. OLS regressions without controls, pure leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/ Utilities specifications are: $\upsilon_A^i(c^i, l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i, l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

F Additional OLS regressions of domain-specific variables of satisfaction with controls

Table 4.18: More regressions of domain-specific happiness on utility - Unrestricted specifications with controls

Pure leisure / Controls 1/. 2/.	Utility A 3/.						Utility B 3/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Leisure time	0.0069***	0.0032	0.0014	0.0029*	0.0024*	0.0027*	0.3002**	0.1693	0.0531	0.0455	0.0356	0.0685
	(0.0023)	(0.0023)	(0.0025)	(0.0015)	(0.0014)	(0.0015)	(0.1191)	(0.1327)	(0.0935)	(0.1060)	(0.1467)	(0.1558)
Way of enjoying leisure	0.0048**	0.0048**	0.0019	0.0042***	0.0030**	0.0035***	0.1253	0.1976	0.0113	0.0906	0.0862	0.1652
	(0.0019)	(0.0020)	(0.0020)	(0.0013)	(0.0012)	(0.0013)	(0.0949)	(0.1277)	(0.0934)	(0.1033)	(0.1388)	(0.1220)
Work	-0.0003	0.0021	-0.0006	0.0013	0.0004	0.0009	-0.0023	0.1722	0.0208	0.0723	-0.0479	0.1036
	(0.0016)	(0.0022)	(0.0018)	(0.0012)	(0.0011)	(0.0013)	(0.0775)	(0.1426)	(0.0800)	(0.0711)	(0.0984)	(0.1188)
Type of work	-0.0001	0.0023	-0.0001	0.0010	0.0002	0.0004	0.0029	0.1947	0.0635	0.0486	-0.0581	0.0338
	(0.0016)	(0.0021)	(0.0018)	(0.0013)	(0.0012)	(0.0014)	(0.0862)	(0.1368)	(0.0958)	(0.0781)	(0.1059)	(0.1022)
Hours of work	-0.0006	0.0001	-0.0003	-0.0004	-0.0006	-0.0009	0.0812	0.0764	0.0289	-0.0359	-0.0720	-0.0800
	(0.0028)	(0.0028)	(0.0035)	(0.0018)	(0.0017)	(0.0017)	(0.1195)	(0.1428)	(0.1185)	(0.1106)	(0.1435)	(0.1324)
Wage	-0.0006	0.0001	-0.0003	-0.0011	-0.0012	-0.0022	0.0812	0.0764	0.0289	-0.0457	-0.0974	-0.1791
	(0.0028)	(0.0028)	(0.0035)	(0.0016)	(0.0016)	(0.0016)	(0.1195)	(0.1428)	(0.1185)	(0.1097)	(0.1306)	(0.1510)
Financial situation	0.0003	0.0001	0.0000	0.0024**	0.0018*	0.0012	0.0326	-0.0313	-0.0188	0.1876**	0.1132	0.0272
	(0.0018)	(0.0018)	(0.0019)	(0.0011)	(0.0010)	(0.0010)	(0.1051)	(0.0947)	(0.0637)	(0.0872)	(0.1120)	(0.0935)
Colleagues	-0.0003	-0.0016	-0.0026	-0.0910	-0.0975	-0.0388	0.0254	-0.0828	-0.0843	-7.7083	-13.7935	-0.7676
	(0.0025)	(0.0022)	(0.0026)	(0.0926)	(0.0896)	(0.0423)	(0.1194)	(0.1026)	(0.0971)	(9.3220)	(15.0954)	(1.4658)
Schooling	0.0040**	0.0037**	0.0032	-0.0004	-0.0009	-0.0009	0.1735*	0.2381**	0.1562*	-0.0436	-0.0840	-0.0370
	(0.0020)	(0.0018)	(0.0020)	(0.0016)	(0.0015)	(0.0016)	(0.1016)	(0.1065)	(0.0842)	(0.0903)	(0.1384)	(0.1296)
Career	-0.0005	0.0009	-0.0009	0.0008	-0.0001	-0.0002	-0.0064	0.0682	-0.0138	0.0938	-0.0453	-0.0179
	(0.0017)	(0.0021)	(0.0018)	(0.0013)	(0.0012)	(0.0013)	(0.0907)	(0.1354)	(0.0899)	(0.0761)	(0.1105)	(0.1042)
N	162	164	160	205	222	214	162	164	160	205	222	214

Notes:

1/. OLS regressions with controls, pure leisure definition, standard errors in parenthesis. 2/ Specification (1) controls for the number of children living in the household, age and two dummies for education levels (same specification used in Table 4.3). Specification (2) adds a dummy that indicates whether both spouses work full time in the labor market. Specification (3) adds another dummy that indicates whether the couple has children below eight years old. 3/. Utilities specifications are: $\upsilon_A^i(c^i,l^i) = (c^i-\gamma_c^i)^{\beta_c^i}(l^i-\gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i,l^i) = \beta_c^i ln(c^i-\gamma_c^i)+\beta_l^i ln(l^i-\gamma_l^i)$.

Table 4.19: More regressions of domain-specific happiness on utility - Restricted specifications with controls

Pure leisure / Controls 1/. 2/. 3/.	Utility A 4/.						Utility B 4/.					
	Female			Male			Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Leisure time	0.0062***	0.0045***	0.0047***	0.0010	0.0007	0.0003	0.5086***	0.3749**	0.3323**	0.1011	0.0317	0.0479
	(0.0015)	(0.0015)	(0.0014)	(0.0015)	(0.0014)	(0.0014)	(0.1657)	(0.1822)	(0.1529)	(0.1315)	(0.1210)	(0.1134)
Way of enjoying leisure	0.0053***	0.0035***	0.0033***	0.0027**	0.0026**	0.0028**	0.5439***	0.3192**	0.2547**	0.2131*	0.1327	0.2032**
	(0.0014)	(0.0013)	(0.0013)	(0.0011)	(0.0011)	(0.0011)	(0.1531)	(0.1540)	(0.1282)	(0.1174)	(0.0933)	(0.0888)
Work	0.0025**	0.0025**	0.0025**	-0.0001	-0.0002	0.0001	0.1443	0.1823**	0.1944**	-0.0548	-0.0333	0.0339
	(0.0011)	(0.0011)	(0.0012)	(0.0009)	(0.0009)	(0.0010)	(0.1093)	(0.0925)	(0.0966)	(0.0830)	(0.0825)	(0.1167)
Type of work	0.0023**	0.0024**	0.0021*	-0.0005	-0.0004	-0.0001	0.1292	0.1920*	0.1703	-0.0974	-0.0520	0.0165
	(0.0011)	(0.0011)	(0.0012)	(0.0008)	(0.0009)	(0.0010)	(0.1079)	(0.1052)	(0.1053)	(0.0813)	(0.0791)	(0.1152)
Hours of work	0.0006	0.0010	-0.0008	0.0003	0.0007	0.0014	0.0495	0.1863	-0.1134	0.0686	0.0473	0.1770
	(0.0016)	(0.0016)	(0.0018)	(0.0016)	(0.0016)	(0.0016)	(0.1233)	(0.1293)	(0.1374)	(0.1023)	(0.0925)	(0.1270)
Wage	0.0006	0.0010	-0.0008	-0.0016	-0.0021*	-0.0016	0.0495	0.1863	-0.1134	-0.1915*	-0.2342***	-0.1574
	(0.0016)	(0.0016)	(0.0018)	(0.0012)	(0.0011)	(0.0012)	(0.1233)	(0.1293)	(0.1374)	(0.1021)	(0.0899)	(0.1292)
Financial situation	0.0015	0.0005	0.0008	0.0007	0.0008	0.0011	0.1776*	-0.0063	0.0413	-0.0021	0.0267	0.0798
	(0.0011)	(0.0010)	(0.0011)	(0.0008)	(0.0008)	(0.0008)	(0.0929)	(0.0840)	(0.1103)	(0.0670)	(0.0637)	(0.0849)
Colleagues	0.0012	0.0009	0.0003	0.0108	0.0050	-0.0050	0.1132	0.0733	0.0112	1.7931	1.4441	0.9352
	(0.0013)	(0.0013)	(0.0014)	(0.0113)	(0.0061)	(0.0069)	(0.1225)	(0.1067)	(0.1104)	(1.8107)	(1.4326)	(1.0151)
Schooling	0.0016	0.0015	0.0012	-0.0007	-0.0009	-0.0009	0.0608	0.0143	0.0044	0.0096	-0.0173	-0.0442
	(0.0010)	(0.0010)	(0.0011)	(0.0014)	(0.0013)	(0.0013)	(0.0966)	(0.0960)	(0.0945)	(0.1064)	(0.0984)	(0.1016)
Career	0.0008	0.0010	0.0010	-0.0011	-0.0013	-0.0014	-0.0195	0.0207	0.0097	-0.1114	-0.0983	-0.0909
	(0.0012)	(0.0011)	(0.0012)	(0.0012)	(0.0011)	(0.0011)	(0.1053)	(0.0970)	(0.1005)	(0.0874)	(0.0834)	(0.0939)
N	324	320	316	353	371	374	324	320	316	353	371	374

Notes:

1/. OLS regressions with controls, pure leisure definition, standard errors in parenthesis. 2/ Restricted version assumes: $\gamma_c^i = c^i - exp(\gamma_c^i)$ and $\gamma_l^i = l^i - exp(\gamma_l^i)$. 3/. Specification (1) controls for the number of children living in the household, age and two dummies for education levels (same specification used in Table 4.3). Specification (2) adds a dummy that indicates whether both spouses work full time in the labor market. Specification (3) adds another dummy that indicates whether the couple has children below eight years old. 4/. Utilities specifications are: $\upsilon_A^i(c^i,l^i) = (c^i - \gamma_c^i)^{\beta_c^i}(l^i - \gamma_l^i)^{\beta_l^i}$ and $\upsilon_B^i(c^i,l^i) = \beta_c^i ln(c^i - \gamma_c^i) + \beta_l^i ln(l^i - \gamma_l^i)$.

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