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Social Interaction in an Inter-Generational Model of Informal Care Giving

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Social interaction effects in an inter–generational model of informal care giving*

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Abstract

We study jointly the health perception of the elderly and the care giving decision of their adult children. We set up a non cooperative game among altruistic family members where children allocate their time to work, leisure or care, while parents can buy formal care on the market or commit to transfer a bequest. Social interactions play a crucial role: children make their care giving decisions strategically, meaning that each of them considers his/her siblings' decision. We test whether informal care provision is driven by altruism or by bequest using SHARE, the Survey on Health, Aging and Retirement. Such a survey contains information on health status of over–50 Europeans and details on their social and family relations. Its transnational feature allows to control for cultural and institutional differences. We estimate social interaction effects by means of methods taken from the spatial econometric literature, treating employment decisions as endogenous. The empirical evidence suggests that altruism dominates over bequest motives when individuals choose how much time to allocate to informal help to their parents.

JEL Classification: C31, D13, I11
Keywords: altruism, bequest, SHARE, care giving, social interactions

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1 Introduction

Aging is one of the main concerns in most European Countries. While this process is the result of scientific development and improved economic living conditions, it rises several policy issues. As an example, pension systems are under revision in many countries, in order to be sustainable in societies with a shrinking labor force compared to an expanding number of retired people. Health care, and in particular long term care systems must adapt to this changing society as well. The present paper deals with a particular aspect of long term care: we are interested in the decision process and in the interactions among adult children choosing whether and how much to care for their elderly parents. In doing so, we will take into account State provided health care and individual labor force participation decisions. Understanding informal care decisions is a relevant topic from a policy perspective: caring is a time–consuming activity which is not necessarily compatible with a full time occupation, thus policies aimed to augment labor force participation may have a negative impact on long term care. Moreover, if adult children take into account siblings' choices when allocating time to care and paid work, a government intervention may have an impact on individuals not directly targeted by the policy itself: augmenting labor force participation of daughters may have an impact on time spent working by their brothers, since someone has to step in and provide care to the parents. Further on, institutions can change the cost and availability of formal care, but the overall impact of different settings depends on the relation between formal and informal care provision. As an example: reducing the cost for formal care may reduce or increase the supply of informal one, depending on whether those services are substitutes or complements.

We will formalize adult children relations in a game–theoretic setting. In a nutshell: the amount of care provided by non co–residing siblings can be thought of as the equilibrium output between the supply and the demand for informal care in the 'family market'. This is not new in the literature: such an output has been obtained both from bargaining models (Pezzin and Steinberg Schone, 1999; Engers and Stern, 2002) and from non–cooperative games among family members. Within the latter class falls Hiedemann and Stern (1999), which is similar in spirit to the present paper. The authors look at the discrete choice whether to provide care or not taking into account siblings choices, while we model the time spent caring directly. Our modelling strategy is similar to Börsh-Supan et al. (1990) as well: children are altruistic and the total time spent caring for parents is the outcome of a game among siblings. The main difference is that we include the parent among the players, thus allowing for strategic bequest motive similar to Bernheim et al. (1985).

Care supply has already been studied as an endogenous choice on the labor decisions of siblings, in particular to explain gender differences in labor market participation and wages (Ettner, 1995, 1996; Wolf and Soldo, 1994; Crespo, 2007; Bolin et al., 2008). The present paper turns the attention to the informal care giving choice itself, controlling for endogenous labor supply. Such an approach allows us to concentrate on the strategic interaction among adult children: the choice to allocate hours to parent's care depends crucially on the same choice done by brothers and sisters.

As already stated, it is important to account for the relation between informal and formal care. Van Houtven and Norton (2004) set up a general framework to analyze formal and informal care utilization simultaneously, while Van Houtven and Norton (2008) relates informal care provision with Medicare expenditures, which in United States can end up to account for a large fraction of the elderly budget. The empirical analysis will be done using SHARE, a survey on people aged 50 and more across several European countries. Thus the role of formal

care can differ a lot across institutional setups[1]: again, we will concentrate on the informal care provision decision, but we will control as far as possible for formal care utilization.

A structural model for the demand for health care is beyond the scope of the paper. Following Grossman (1972), we assume the health status at a given age to be the output of an accumulation process. Moreover we will simplify the analysis assuming that the accumulation process for individuals in our sample can be considered as finished, relying on the fact that we focus on people older than 50. The idea is that even if healthy behavior, such as not smoking or a proper diet still improves objective health, important inputs in the health accumulation function as income, education, living arrangement depend on choices that can be safely considered to be predetermined at the age of 50. This assumption allows us to use self reported perceived health as a measure of utility derived from health and care. Measuring perceived health is not the same as measuring objective health (see Jürges, 2005 for a detailed discussion on health measures in SHARE). The self–perception of health status entails objective health conditions, but also individual preference or general attitude, social and family network determinants and cultural differences (Reher, 1998; Silverstein and Bengtson, 1997; Collins, 2004). Thus, we claim that self reported health is a proxy for well–being, not only a measure of physical health corrected by individual and sociological country differences. This is coherent with the World Health Organization[2] definition of health:

> [...] a state of complete physical, mental and social well–being and not merely the absence of disease or infirmity

The remaining of the paper is structured as follows: the next section outlines the economic model; the third one describes the SHARE dataset. Next we move to the econometric specification and estimation procedure. Fifth section reports and comments on the results, conclusions are drawn in the last section.

2 The Economic model

We model the caring decision as a one–shot non cooperative game among parents, P_1, P_2, and their adult children, $S_1, S_2, \ldots, S_n$. Each sibling i chooses how to allocate time among caring for his/her parents, I_i, leisure ℓ_i and working $T - I_i - \ell_i$. Parents can choose how much of their income to use to buy formal care hours, F, but they can also commit to transfer an amount of money to their children as a bequest, B. Further on, they can choose how to split such a bequest amongst their children: following Bernheim et al. (1985) notation, β stands for the sharing rule applied by parents. As in Sloan et al. (1997), we chose not to model caring decisions as a cooperative game since in such a model players should face an infinite number of periods. We think this assumption is unrealistic: parent's death is an event that can't be neglected in caring choices. Timing goes as follows: at the beginning of the period, parents announce how much they will transfer as a bequest and the sharing rule β to split it among siblings. Then parents buy F and children allocate time to care, leisure and work. At the end of the period bequest is transferred. In other words we are assuming parents write a testament and bequest is split among children according to it when they die.

As a starting point, we assume there is a single parent. We will discuss in section 2.2 the relevance of this assumption[3]. Children have all the same strategies, thus we can assume

[1] Bolin et al. (2008) provides a useful review of formal long term care systems across SHARE countries.

[2] Constitution of the World Health Organization, Geneva 1946

[3] Moreover, as we will see available data report only children help towards parents' household as a whole, thus this is the setting under which we are able to obtain testable implications

without loss of generality there are just two of them. Again, we will discuss implications of this simplifying assumption at length.

Players are altruistic: children want their parents to receive care, while P utility depends on children's utility. Formally, each child $i \in \{1,2\}$ faces the following maximization problem:

$$\begin{aligned}\max_{\{I_i,\ell_i\}} \quad & U^i\Big(V^Q(Q,H), V^C(C_i), V^\ell(\ell_i)\Big) \\ \text{s.t. } & Q = F + I_i + I_{-i} \\ & C_i = \omega(T - I_i - \ell_i) + B_i(\beta) \\ & I_i + \ell_i \leq T \\ & I_i \geq 0 \\ & \ell_i \geq 0\end{aligned} \tag{1}$$

Where ω is market wage, C_i stands for consumption and H is a measure of health status of the parent. U^i is weakly separable in care, consumption and leisure. $B_i(\beta)$ will be received only at the end of the period, thus we are implicitly assuming children can borrow at no cost against future bequest (or that these costs are certain and fully taken into account in the function $B_i(\cdot)$). Without loss of generality, we assume income is derived only from labor ω and bequest $B_i(\beta)$: any extra income source would have simply the effect of relaxing the budget constraint.

Utility derived from care, V^Q, depends on the health status of the parent: the healthier P, the lower is the marginal utility of time spent caring. Such an idea can be formalized restricting the cross–derivative of V^Q:

$$\frac{\partial^2 V^Q}{\partial Q \partial H} < 0 \tag{2}$$

For simplicity, we assume $U^Q(H)$ to be always decreasing, positive and convex. Parent P utility function is weakly separable as well:

$$\begin{aligned}\max_{\{F,B_1,B_2,\beta\}} \quad & U^P\Big(V^Q(Q,H); V^C(C_1), V^\ell(\ell_1); V^C(C_2), V^\ell(\ell_2); V^I(I_1+I_2)\Big) \\ \text{s.t. } & Q = F + I_1 + I_2 \\ & p^F F + B_1(\beta) + B_2(\beta) \leq Y^P\end{aligned} \tag{3}$$

Where p^F is the market price for formal care and Y^P is parent's income. Since we model the decision process as a one–shot game there are no savings. Parent's utility is assumed to depend only on care and children utilities but not on other goods' consumption. This is equivalent to assume strong separability of care from all other available goods. Y^P must be coherently interpreted as income net from expenditures on other (separable) goods.

Such a setup is similar to Bernheim et al. (1985): utility functions are somewhat more restrictive here since we are assuming weak separability, but labor force participation decision is now considered endogenous. The total amount of care, Q, is a public good partly produced within the family. Child i's utility is 'well behaved', i.e. concave, first increasing and then decreasing in I_i. $U^P(I_i)$, the parent's utility as a function of informal care, has the same shape. The difference is that U^P depends also on the additional term $V^I(I_1+I_2)$: P attaches a value to informal care per se, while children are indifferent on the type of care P receives as long as the amount Q is provided. Formally, these assumptions can be expressed in terms of utility's first derivatives. First, both U^i and U^P are increasing in each V^j, $j \in \{Q, C, \ell, I\}$:

$$\frac{\partial U^i}{\partial V^j} > 0 \quad \forall i,j; \qquad \frac{\partial U^P}{\partial V^j} > 0 \quad \forall j \tag{4}$$

Then, each $V^j(\cdot)$ is increasing in its argument:

$$\frac{\partial V^Q}{\partial Q} > 0, \quad \frac{\partial V^I}{\partial \sum_i I_i} > 0; \quad \frac{\partial V^C}{\partial C_i} > 0, \quad \frac{\partial V^\ell}{\partial \ell_i} > 0 \quad \forall i; \tag{5}$$

Since C_i, ℓ_i are decreasing in I_i the budget constraint in (1) determines each child i optimal provision of informal care. Assumptions (4) and (5) implies that at the children optimum the parent utility as a function of informal care is never maximized:

$$\forall i \quad \text{argmax}_{I_i} U^P > \text{argmax}_{I_i} U^i \tag{6}$$

Assumption 5 (in particular $\partial V^Q/\partial Q > 0$) implies that U^i is always increasing in F: since formal care is payed by the parent and children have no preference on the type of help their parent receive, F is a pure positive externality for each child. The same is not true for the marginal effect of other siblings' help I_{-i} on U^i: while V^Q is increasing in Q and therefore in I_{-i}, bequest B_i may be decreasing on I_{-i} via the sharing rule β. The sign of the net marginal effect $\partial U^i/\partial I_{-i}$ depends on the relative magnitude of those two effects.

2.1 Model solution and resulting equilibria

As a benchmark case, we first solve the model assuming no bequests. In this case, P maximizes only in F and since we assumed V^Q to be always increasing the budget constraint is binding. Thus, the maximization (3) simplifies to

$$\begin{aligned} \max_{\{F\}} \quad & U^P\Big(V^Q(F + \bar{I}_1 + \bar{I}_2; H); V^C(\bar{C}_1), V^\ell(\bar{\ell}_1); V^C(\bar{C}_2), V^\ell(\bar{\ell}_2); V^I(\bar{I}_1 + \bar{I}_2)\Big) \\ & \text{s.t. } pF = Y^P \end{aligned} \tag{7}$$

The best response to any I_1, I_2, ℓ_1, ℓ_2 for P is to allocate all his resources to F. Thus at equilibrium $\bar{F} = F(\bar{I}_1, \bar{\ell}_1, \bar{I}_2, \bar{\ell}_1) = Y^P/p$.

Without bequest ith child's maximization problem (1) can be rewritten as

$$\begin{aligned} \max_{\{I_1, \ell_1\}} \quad & U^i\Big(V^Q(\bar{F} + I_i + \bar{I}_{-i}; H), V^C(\omega(T - I_i - \ell_i)), V^\ell(\ell_i)\Big) \\ & \text{s.t. } I_i + \ell_i \leq T \\ & \quad\;\; I_i \geq 0 \\ & \quad\;\; \ell_i \geq 0 \end{aligned} \tag{8}$$

Corner solutions are not ruled out, thus the Kuhn–Tucker first order conditions are

$$-\omega \frac{\partial U^i}{\partial V^C}\frac{\partial V^C}{\partial C} + \frac{\partial U^i}{\partial V^Q}\frac{\partial V^Q}{\partial Q} - \lambda_1 + \lambda_2 = 0 \tag{9}$$

$$-\omega \frac{\partial U^i}{\partial V^C}\frac{\partial V^C}{\partial C} + \frac{\partial U^i}{\partial V^\ell}\frac{\partial V^\ell}{\partial \ell_i} - \lambda_1 + \lambda_3 = 0 \tag{10}$$

$$\lambda_1(T - I_i - \ell_i) = 0 \tag{11}$$

$$\lambda_2 I_i = 0 \tag{12}$$

$$\lambda_3 \ell_i = 0 \tag{13}$$

$$\lambda_1, \lambda_2, \lambda_3 \geq 0 \tag{14}$$

The Lagrange multipliers interpretation is the usual one: λ_1 is the reservation wage, λ_2 and λ_3 are the opportunity costs of care and leisure respectively. If the maximization has an internal solution, at the optimum wage equals the marginal rates of substitution:

$$\omega = \frac{\partial U^i / \partial Q}{\partial U^i / \partial C_i} = \frac{\partial U^i / \partial \ell_i}{\partial U^i / \partial C_i} \tag{15}$$

Which implies $\frac{\partial U^i}{\partial Q} = \frac{\partial U^i}{\partial \ell_i}$. If the marginal utility of care is higher than the marginal utility of leisure, T is split between working time and care. Vice versa, at the corner solution with no care $\frac{\partial U^i}{\partial Q} < \frac{\partial U^i}{\partial \ell_i}$ and the wage is equal to the marginal rate of substitution of consumption and leisure, as in the standard time allocation problem.

In general, children do not allocate time to care if its opportunity cost is too high. Therefore, corner solutions where i works but does not provide care are characterized by

$$\lambda_2 = \omega \frac{\partial U^i}{\partial C_i} - \frac{\partial U^i}{\partial Q} > 0 \tag{16}$$

Regardless of the time spent in leisure. If i do not work and allocates time either to leisure or to care, i.e. in at corner solutions where $\lambda_1 > 0$, i spends all his/her disposable time in leisure if

$$\lambda_2 = \frac{\partial U^i}{\partial \ell_i} - \frac{\partial U^i}{\partial Q} > 0 \tag{17}$$

This last case is usually ruled out assuming $\left.\frac{\partial V^C(C_i)}{\partial C_i}\right|_{C_i=0} = +\infty$. It makes little sense in this benchmark case as well, but since children can use future bequests to finance current consumption, we are not willing to assume this corner solution out. Both in (16) and in (17) the lower it is the marginal utility from care $\frac{\partial U^i}{\partial Q}$, the more likely it is child i do not provide any help to his/her parent. Thus, a simple comparative statics exercise tells us that since V^Q is concave in Q, the more care is provided by siblings $-i$ or bought on the market (i.e., the higher it is $\bar{F} + \bar{I}_{-i}$), the more likely it is that child i do not provide any help. Furthermore, assumption (2) implies that the probability of caring is decreasing in parent's health status.

Those allocations are Pareto efficient, i.e. at equilibrium neither the children nor the parent can modify their choice in such a way that either P, S_1 or S_2 is better off without reducing someone else's utility. Nevertheless since P prefers informal to formal care, U^P as a function of (I_1, I_2) is never maximized. This result motivates the introduction of a bequest: P can 'substitute' formal care with informal one committing to transfer $B_1 + B_2$ to his siblings. P's new maximization is:

$$\begin{aligned} &\max_{\{F, B_1, B_2, \beta\}} U^P \left(V^Q(F + \bar{\bar{I}}_1 + \bar{\bar{I}}_2; H); V^C(\bar{\bar{C}}_1), V^\ell(\bar{\bar{\ell}}_1); V^C(\bar{\bar{C}}_2), V^\ell(\bar{\bar{\ell}}_2); V^I(\bar{\bar{I}}_1, \bar{\bar{I}}_2) \right) \\ &\text{s.t. } p + B_1(\beta) + B_2(\beta) = Y^P \end{aligned} \tag{18}$$

The new budget constraint is tighter, but the amount of formal care is chosen exactly as in the previous case. Thus, $F(\bar{\bar{I}}_1, \bar{\bar{\ell}}_1, \bar{\bar{I}}_2, \bar{\bar{\ell}}_2) = \frac{Y^P}{p} - \bar{\bar{\delta}}(\bar{\bar{\beta}})$, where $\bar{\bar{\delta}} = \bar{\bar{B}}_1(\bar{\bar{\beta}}) + \bar{\bar{B}}_2(\bar{\bar{\beta}})$. The transfer $\bar{\bar{\delta}}$ is meant to induce children to provide an extra amount of care: the parent is willing to move to the new equilibrium only if the total amount of care is at least as high as without bequest:

$$\bar{\bar{Q}} \geq \bar{Q} \tag{19}$$

Moreover, since now P split his disposable income Y^P between formal care and bequest, F cannot be larger than in the equilibrium without bequest:

$$\bar{\bar{\delta}} > 0 \Longrightarrow \bar{\bar{F}} < \bar{F} \tag{20}$$

Since $Q = F + I_1 + I_2$, from (19) and (20) the introduction of a bequest must augment the total amount of informal care:

$$\bar{\bar{\delta}} > 0 \Longrightarrow \bar{\bar{I}}_1 + \bar{\bar{I}}_2 > \bar{I}_1 + \bar{I}_2 \tag{21}$$

Equation (21) holds only if children use the extra income from bequest to provide extra care and not to finance consumption or leisure. The ith child maximization problem with positive bequest is:

$$\begin{aligned} \max_{\{I_1,\ell_1\}} \quad & U^i\left(V^Q(\bar{\bar{F}} + I_i + \bar{\bar{I}}_{-i}; H), V^C\left(\omega(T - I_i - \ell_i) + \bar{\bar{B}}_i(\bar{\bar{\beta}})\right), V^\ell(\ell_i)\right) \\ \text{s.t. } & I_i + \ell_i \leq T \\ & I_i \geq 0 \\ & \ell_i \geq 0 \end{aligned} \tag{22}$$

A positive bequest relaxes the ith child budget constraint, therefore the previous optimal time allocation $(\bar{I}_i, \bar{\ell}_i)$ is still achievable. Nevertheless equation (20) implies that $V^Q(\bar{\bar{F}}, \bar{I}_i, \bar{\bar{I}}_{-i}) < V^Q(\bar{F}, \bar{I}_i, \bar{I}_{-i})$, and therefore $(\bar{I}_i, \bar{\ell}_i)$ is not optimal anymore.

Each child can use the extra income B_i to finance consumption, to increase leisure time keeping consumption constant, to provide more care still without changing consumption, or a combination of them. Without further constraints, the choice depend solely on the shape of U^i: it may be that altruism motivates children to use B_i to increase informal care provision, but a bequest per se do not guarantee that (21) holds. If consumption, leisure and informal care are normal goods they will all increase with the extra income provided by the bequest. Nevertheless P would like his children to use the bequest to finance extra informal care provision, regardless of the shape of the children's utility function. He can do it setting a proper sharing rule β:

$$B_i(\beta) = \begin{cases} B_i > 0 \quad \forall i & \text{if } \bar{\bar{I}}_1 + \bar{\bar{I}}_2 > \bar{I}_1 + \bar{I}_2 \\ B_i = 0 & \text{otherwise} \end{cases} \tag{23}$$

As already stated by Bernheim et al. (1985), (23) implies (21) since in this case β conditions the bequest to be positive only if there is an extra care provision with respect to the benchmark case. In order to have an operational sharing rule, assume B_i to be increasing and differentiable in I_i (if $B_i > 0$). In this case (22) can be solved again with Kuhn–Tucker. The first order conditions are:

$$\left(-\omega + \frac{\partial B_i}{\partial I_i}\right)\frac{\partial U^i}{\partial V^C}\frac{\partial V^C}{\partial C} + \frac{\partial U^i}{\partial V^Q}\frac{\partial V^Q}{\partial Q} - \lambda_1 + \lambda_2 = 0 \tag{24}$$

$$-\omega\frac{\partial U^i}{\partial V^C}\frac{\partial V^C}{\partial C} + \frac{\partial U^i}{\partial V^\ell}\frac{\partial V^\ell}{\partial \ell_i} - \lambda_1 + \lambda_3 = 0 \tag{25}$$

$$\lambda_1(T - I_i - \ell_i) = 0 \tag{26}$$

$$\lambda_2 I_i = 0 \tag{27}$$

$$\lambda_3 \ell_i = 0 \tag{28}$$

$$\lambda_1, \lambda_2, \lambda_3 \geq 0 \tag{29}$$

Comparing this set of equations with the first order conditions of the benchmark case, the only difference is between equation (9) and (24). At an internal solution,

$$\omega - \frac{\partial B_i}{\partial I_i} = \frac{\partial U^i/\partial Q}{\partial U^i/\partial C_i}, \quad \omega = \frac{\partial U^i/\partial \ell_i}{\partial U^i/\partial C_i} \tag{30}$$

Compared with the benchmark case, if consumption is kept constant then the time spent in leisure is unchanged. The first equation in (30) then implies that part of the time spent working is substituted with time spent caring. This is clearly still true if the optimal allocation is at the corner solution with no time allocated to leisure. As regards corner solutions where there is no care provision, equation (16) and (17) change into:

$$\lambda_2 = \left(\omega - \frac{\partial B_i}{\partial I_i}\right)\frac{\partial U^i}{\partial C_i} - \frac{\partial U^i}{\partial Q} > 0 \tag{31}$$

$$\lambda_2 = \frac{\partial U^i}{\partial \ell_i} - \frac{\partial U^i}{\partial Q} - \frac{\partial B_i}{\partial I_i}\frac{\partial U^i}{\partial C_i} > 0 \tag{32}$$

Therefore the opportunity cost of helping is always lower with a bequest, thus reducing the probability of being in a corner solution. Thus the marginal effect of a bequest on informal care provision is always positive, both at internal and corner solutions.

It is important to notice that each child's informal care allocation need not to be the same. As it was in the benchmark case, informal care provided by siblings is a substitute for individual help provision since it can only increase child's i utility via $V^Q(F + I_i + I_{-i})$. Moreover, given the sharing rule (23) B_i positiveness depends on I_{-i}, but conditional on $B_i > 0$ the bequest amount child i expects to receive is no more related to I_{-i}. Thus, the higher I_{-i}, the stronger is the incentive for child i to free ride on siblings' help and use B_i to increase consumption or leisure time.

The parent can avoid such a behavior setting a different sharing rule:

$$B_i(\beta) = \begin{cases} B_i \propto \frac{I_i}{I_1+I_2} \quad \forall i & \text{if } \bar{\bar{I}}_i > \bar{I}_i \\ B_i = 0 & \text{otherwise} \end{cases} \tag{33}$$

In words, the sharing rule is the following: if both i and $-i$ provide a level of care which is higher than the benchmark case, each one will receive a bequest proportional to the relative amount of care provided. If i provides an amount lower or equal to the benchmark case, the whole bequest at stake will be given to the 'most generous child'. This is what Bernheim et al. (1985) call strategic bequest, since now the parent induces his children to compete for the bequest. The effect of siblings' care provision on I_i changes: the substitution effect via $V^Q(F + I_i + I_{-i})$ is still present, but it is offset by an opposite effect on B_i. Whether the overall impact is positive or negative depends on the shape of $V^Q(Q)$ and $B_i(\beta)$.

2.2 Relaxing the assumptions: one child, two parents

We assumed at the beginning of this section that there are at least two children. With a single child and no bequest, the altruistic feature of child's utility function (can) lead to a positive provision of informal care, regardless of parent's choice of F. While it is meaningless to speak about sharing rules in this case, still P can induce a higher provision of I with respect to the 'altruistic' level committing to transfer a positive B to his child. From a welfare perspective, the presence of more than one child has the same effect as moving from a monopoly to an oligopoly: children - given the bequest amount and the sharing rule - compete á la Cournot on quantities of informal care to be sold to the unique client, the parent. Equilibrium characteristics are the usual one of Cournot–Nash outcomes, in particular the total amount $I_1 + I_2$ supplied is larger than in monopoly. In other words the individual

amount of informal care provided by each sibling depends crucially on the bargaining power of each sibling. If there is only one child, P can increase the level of informal care only transferring part of his disposable income to his child. If there are two (or more) children he can make them compete for the bequest obtaining an extra amount of care from each of them. Nevertheless, if there is no bequest, there are no gains moving from one to a higher number of children. From the son's point of view what matters is the sharing rule: without bequest or if the sharing rule is like in (23) siblings' help is a positive externality, while this is not true if the bequest amount depends on the relative supply of informal care.

The effect of the presence of a spouse depends on how parent's household decision process is modeled. A first choice (the so–called 'unitarian' model) is to assume that individuals have the same preferences and therefore the household as a whole can be considered the elementary decision unit with its own unique utility function. This approach is not fully satisfactory. An appealing alternative are models of 'collective' utility: they are characterized by two different utility functions and some decision rule to split resources. Chiappori (1992) provides a common framework for those models. In particular, coherently with the previous sections, we assume individuals to be altruistic: the father's utility depends on his own care consumption and on his partner's utility. The decision rule can be thought of as a two–stage procedure: first, parents share their income and informal care provided by the children, then each of them optimally chooses his or her own consumption. Chiappori (1992) result is that with collective utility functions any allocation that respect this process is Pareto efficient. Which particular allocation is reached depends on the shape of each parent's utility. Within this framework a very simple utility specification is consistent with saving choices (see Browning (2000) for details on the model and Alessie et al. (2006) for an application). As long as children are altruistic toward parents' household as a whole, any collective utility is consistent with the model developed in the previous sections. We just need to assume that informal care is supplied to the parent's household and not to each member separately; bequest to children is a different good from bequest to the surviving spouse and parents have a common budget constraint to abide by.

2.3 Empirical implications

The economic model gives us a number of empirical implications. In particular, we have three features to test on children choices: first, endogeneity of labor supply decision in informal care; second, the interactions among children when choosing how much time to devote to caring; third, the relevance of the strategic bequest motive in children's choices.

While the first point is clear, some words should be spent on the following two points, which are related. If the bequest motive is purely altruistic, or in general if expected bequest do not depend on children's behavior, parent's expected bequest or potential future transfers should have no role on children decision. Further, each child i enjoys the public good made up of formal care and informal care provided by each of his siblings. Therefore i's help provision either is not affected by help provided by his/her siblings', or it is crowded out by it. A complementary relationship is not consistent with such an explanation. Vice versa if the bequest motive is strategic, the marginal effect of parent's expected bequest on informal care choice should be positive and informal care of each child can be in a complementarity relation. Thus we can discriminate among bequest motives estimating the marginal effect on i's informal care supply of other sibling's help, as summarized in table 1.

On the parent's side, the key feature of the model is that P prefers informal to formal care, i.e. U^P depends on the additional term V^I. This assumption differentiates F and I in the parents utility: P preferences are such that formal and informal care are not perfect

Table 1: Empirical implications on Informal care provision

No bequest	pure altruism	strategic bequest
$\partial I_i/\partial E[B_i] = 0$	$\partial I_i/\partial E[B_i] = 0$	$\partial I_i/\partial E[B_i] > 0$
$\partial I_i/\partial I_{-i} \leq 0$	$\partial I_i/\partial I_{-i} \leq 0$	$\partial I_i/\partial I_{-i} \lesseqgtr 0$

substitutes. Moreover, it gives P an incentive to use future transfers B_i as a mean to obtain an extra amount of informal care $I_1 + I_2$. Therefore, strategic bequest can take place only if (6) is satisfied, i.e. if at any optimal allocation $\{C_1^*, \ell_1^*; C*_2, \ell_2^*\}$ the marginal parent's utility with respect to informal care is positive:

$$\forall \{C_1^*, \ell_1^*; C*_2, \ell_2^*\}, \quad \frac{\partial U^P}{\partial \sum_i I_i} > 0 \tag{34}$$

3 The SHARE dataset

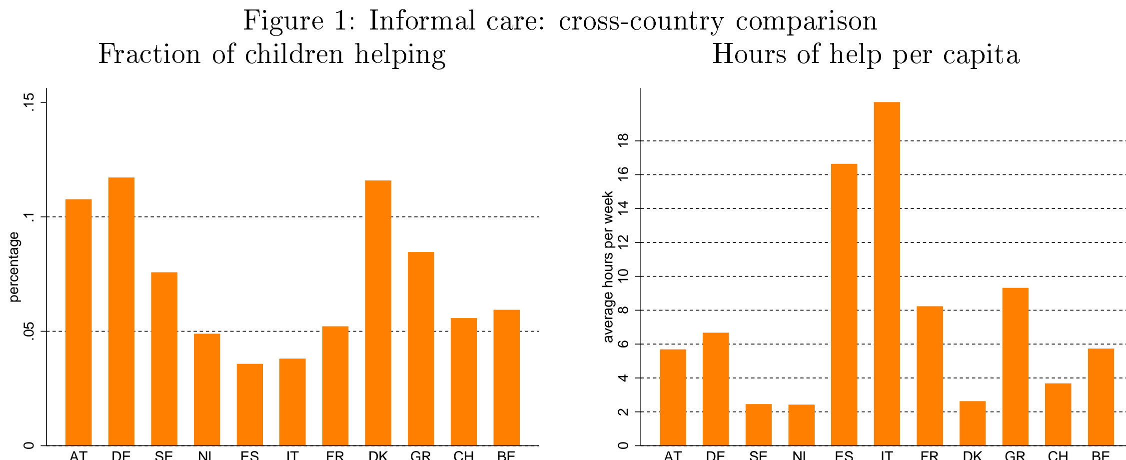
We use data from the 2004 wave of SHARE, the Survey of Health, Aging and Retirement in Europe. It collects cross-national interdisciplinary data on socio–economic characteristics, health status, family and social networks of persons aged 50 and over. SHARE collects details about respondent's health and about the provision of formal and informal care to the elderly people, together with information about individual and household income and wealth. The dataset has a number of characteristics that fit our problem. First of all, we have two different types of health status measures: self-reported perceived health and objective measures of health. Among the latter we consider two generated variables: the first describes the number of limitations with activities of daily living, adl[4]. The second is the number of chronic diseases reported by each individual[5]. We use both the subjective and the objective measures in our analysis: we claim that 'perceived health' is a measure of well–being that depends not only on the objective health status, but also on social supports and interactions between parents and children and thus we use it as a measure of utility derived from health and care, controlling for objective health. This is not the only advantage of SHARE: the dataset provides information on all our key variables, namely hours of informal care, hours of payed work, formal care and expected bequest. Informal care is measured in hours of care received by the respondents' household from each child per week. SHARE reports three types of help: personal care, help in housekeeping and paperwork. Most of the hours of help provided falls in the second category. There is a wide heterogeneity across different Countries (see table 5): while Central and Northern European countries are those with the higher level of care, Southern ones are those were there is the higher share devoted to personal care, conditional on providing a positive amount of care. This is in line with different institutional arrangements: Northern Countries, which have the most generous elders' support system, are those where children devote less time to personal care. Unfortunately the sample size do not allow us to exploit the differences among those three types of help: we are going to use the aggregate number of help hours across the three types of help. Thus, cross–country comparison, which is one

[4]Six activities are included: dressing, walking, bathing or showering, eating, getting in and out of bed and using the toilet

[5]The variable corresponds to the followings diseases: hearth attack, high blood pressure or hypertension, high blood cholesterol, a stroke or cerebral vascular disease, diabetes, chronic bronchitis or emphysema, asthma, arthritis, osteoporosis, cancer or malignant tumor, stomach or duodenal ulcer, Parkinson disease, cataracts and hip fracture or femoral fracture

of the main potentials of SHARE, will mix up institutional settings with cultural differences (see Reher (1998) for a discussion on North–South differences in family ties).

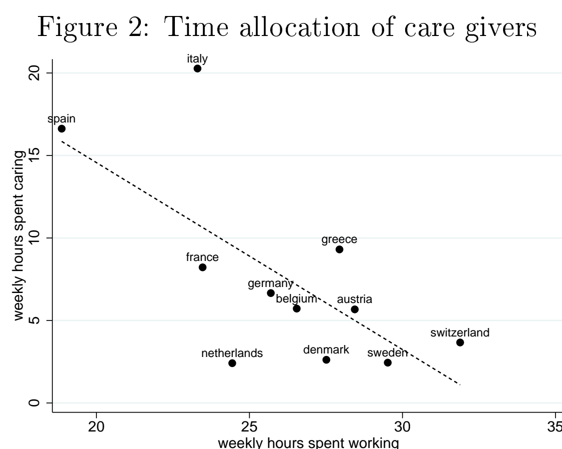
Figure 1: Informal care: cross-country comparison



Nevertheless even at the aggregate level cross–country differences are not averaged out: the left panel of figure 1 reports the fraction of children who report to provide some kind of care to parents, while the right panel reports per capita hours of help among those who provide care.

The second choice variable we need is hours of work, which are not directly surveyed in SHARE. Nevertheless we know whether each child does work or not, and if he/she works full time or part time. We used CESIFO tables (see table 4) on the average collectively agreed normal annual working time by Country and on the part–time average hours of work as a percentage of full–time hours to build the working hours variable we need. Figure 2 shows the time allocation of care givers who have to choose whether to spend time caring or working. There is a clear North-South gradient: on one side Italian and Spanish children spend more or less the same time working and caring; on the other, the Danish and the Swedish provide less than 5 hours of care per week and spend most of the time working.

Figure 2: Time allocation of care givers



Parent's first choice variable is formal care. Again, we have three measures of it: hours per week of professional nursing care, hours received of paid domestic help and number of weeks per year in which the respondent received meals on wheels. Even if we face the same

problem as with informal care data, we were not able to aggregate them due to the different units of measure. Thus we included the three variables separately despite the low number of observations.

Last but not least SHARE allows us to build a proper measure of expected bequest. Individuals are firstly asked whether they expect to leave more than 50.000 euros as a bequest. Conditional on this first question, they are asked whether they expect to leave any bequest, or if they expect to leave more than 150.000 euros. Using these answers we built an expected bequest measure[6] and we do not have to rely on proxies as current wealth which are more likely to suffer of endogeneity problems.

The data potentially provide information on three generations: respondents, their children and their parents. We focus on respondents and their children since health measures are available only for respondents. This choice may induce a bias: the sampling scheme is based on the respondents, thus results on their children decisions may not be representative for the population. The only author that tackled this sampling issue in SHARE is Crespo (2007), who uses SHARE to analyze the role of informal care activity on female labor supply. She exploits information on both samples, finding qualitatively similar results.

4 The Econometric specification

Before going to the specification of the econometric model we set up to test the empirical implications, some words must be spent on an undelying assumption of the model: throughout the previous sections we did not discuss the living arrangement choice of the children. Whether the child co–resides with his parents or not is likely to change caring choices. Living arrangements of the elderly has been previously studied by Börsh-Supan et al. (1988); Börsh-Supan et al. (1993) relate it to wealth and health while Alessie et al. (2006) to saving choices. In the present paper we assume living arrangement to be predetermined with respect to the caring choice. This is clearly a simplifying assumption, nevertheless it is not unreasonable: the hypothesis is that living arrangement depend on marital status, education or early job market decisions, which can be safely considered as predetermined with respect to the caring time allocation decision. Co–residing children are on average much younger than non cohabiting ones and they tend to help less. This difference in the two subsamples may be due to the fact that cohabiting children still have to decide about their adult life living arrangement and, at the same time, they have younger parents which do not need care. Descriptive statistics reported in table 6 support such a claim.

The first objective of the empirical analysis is to estimate how children allocate time to informal care, I_i, paid work WT_i and leisure ℓ_i. Looking at them as consumption goods, the aim is to estimate the following demand system for each child i:

$$\begin{cases} I_i &= \beta_{1,1} WT_i + \beta_{1,3} \sum_{j \neq i} I_j + X\boldsymbol{\beta}_{1,4} + X_I \boldsymbol{\beta}_{1,5} + u_1 \\ WT_i &= \beta_{2,2} I_i + X\boldsymbol{\beta}_{2,4} + X_{WT}\boldsymbol{\beta}_{2,6} + u_2 \end{cases} \quad (35)$$

Where the ℓ_i equation is omitted to preserve adding up, X is a matrix of n observations over k exogenous variables common to all equations (as an example Country dummies), X_I and X_{WT} are exogenous variables which appear only on the informal care equation and working hours equation respectively.

[6] We assumed the bequest distribution to be step–uniform within each interval determined by the questions' thresholds 0, 50 thousands and 150 thousands euros.

Given the economic model, each sibling choose simultaneously. Data are available for the oldest four children[7], thus the full system is

$$\begin{cases} I_1 &= \beta_{1,1}WT_1 + \beta_{1,3}\sum_{j\neq 1} I_j + X\boldsymbol{\beta}_{1,4} + X_I\boldsymbol{\beta}_{1,5} + u_1 \\ \vdots & \vdots \\ I_4 &= \beta_{4,1}WT_4 + \beta_{4,3}\sum_{j\neq 4} I_j + X\boldsymbol{\beta}_{4,4} + X_I\boldsymbol{\beta}_{4,5} + u_4 \\ WT_1 &= \beta_{5,2}I_1 + X\boldsymbol{\beta}_{5,4} + X_{WT}\boldsymbol{\beta}_{5,6} + u_5 \\ \vdots & \vdots \\ WT_4 &= \beta_{8,2}I_4 + X\boldsymbol{\beta}_{8,4} + X_{WT}\boldsymbol{\beta}_{8,6} + u_8 \end{cases} \tag{36}$$

The system is estimated in several steps:

1. First, the labor force participation choice of child i is endogenous only for i's informal care choice. In terms of system (36), WT_i appears as a regressor only on I_i, while the only endogenous regressor in each WT_i equation is I_i. Then if we assume $\boldsymbol{u}$ to be IID up to the household level, we can use the usual two step procedure: we instrument WT_i with i's sibling years of education and number of children, then we plug $\hat{WT}$s predictions in I_i equations:

$$\begin{cases} I_1 &= \beta_{1,1}\hat{WT}_1 + \beta_{1,3}\sum_{j\neq 1} I_j + X\boldsymbol{\beta}_{1,4} + X_I\boldsymbol{\beta}_{1,5} + u_1 \\ \vdots & \vdots \\ I_4 &= \beta_{4,1}\hat{WT}_4 + \beta_{4,3}\sum_{j\neq 4} I_j + X\boldsymbol{\beta}_{4,4} + X_I\boldsymbol{\beta}_{4,5} + u_4 \end{cases} \tag{37}$$

2. In each I_i equation informal care provided by i's siblings, $I_j\ \forall j \neq i$, enter only through $\sum_{j\neq i} I_j$. From an economic point of view this is the case since what matters on each child's decision is the aggregate supply of care by his/her siblings. This does not affect the endogeneity problem: $\sum_{j\neq i} I_j$ is a function of endogenous regressors. In order to deal with it properly we use the fact that children ordering is exogenous with respect to the informal care decision: siblings are ordered from 1 to 4 by age. Then, $I_i\ \forall i$ can be thought of as sampled from the same population. This fact allows us to stack I_i, WT_i and all the demographics in X which refers to each child. (37) can be rewritten as:

$$I = \beta_1\hat{WT} + \beta_3\Pi I + X\boldsymbol{\beta}_4 + X_I\boldsymbol{\beta}_5 + u \tag{38}$$

   Where $[\Pi]_{ij} = 1$ if $i \neq j$ and i, j are siblings. Equation (38) is linear in means: the endogeneity of ΠI has been addressed by Manski (1993), who call it 'reflection problem' since I appears on both sides of the equation. We use spatial econometrics methods to estimate the parameters: Kelejian and Prucha (1998) suggest a GMM estimator, which has been used in a simultaneous equations setting in Pasini (2006). The economic model developed in the previous sections leads us to assume u not to have any spatial structure similar to the autoregressive term ΠI. Therefore the GMM estimator turns out to be equal to a 2SLS estimator with instruments for ΠI chosen among ΠX and ΠX_I[8].

[7] This does not appear to be a strong limitation of the data: the fraction of the sampled families with more than four children old enough to provide informal care is small.

[8] Note that such an assumption simplifies the estimation procedure but do not affect consistency: neglecting the spatial correlation in the error term would at most lead to a loss in efficiency (see Anselin, 1988 for a general discussion on asymptotic properties of spatial estimators)

3. We do not restrict our sample in any way and therefore most of the parents we are looking at are in good health and do not need care. This reflects into the children file we use for the estimation: 25032 out of 26844 children do not provide any help. Therefore, corner solutions outlined in section 2 are particularly relevant. We therefore estimate (38) with a Tobit procedure. The endogeneity issues just outlined make convergence of maximum likelihood estimation difficult, thus we resort to a two–step procedure outlined by Blundell and Smith (1989). Such a two–step procedure has the advantage to provide an easy way to obtain a Hausman exogeneity test (see Smith and Blundell, 1986), but the drawback is that the computation of marginal effects and standard errors turns out to be more complicated. While the latter problem is solved bootstrapping variances and p–values both for the estimated parameters and for the over identification and exogeneity tests, we do not directly tackle the former. Nevertheless, as in all the limited dependent variables models, marginal effects are equal to the estimated parameters multiplied by a common correction factor which is bounded within the $(0, 1)$ interval. Thus, signs are directly interpretable and coefficients' ratios are equal to marginal effect ratios. Tobit method imposes the choice whether to provide help or not and the one on how many hours to spend caring to be part of the same decision process, i.e. it restricts the coefficients to be the same both for the censored and the uncensored observations. This is the correct procedure given the economic model of section 2, which motivates zero occurrences as corner solutions. As a robustness check we repeat the estimation with a Heckman twostep procedure, where individuals first choose whether to help or not, then how much time to spend caring. Results are qualitatively similar to the one discussed in the next section. Heckman method do not nest Tobit models since it requires either to rely on functional form to achieve identification, or to impose exclusion restrictions which are not necessary with a Tobit (see Dow and Norton, 2003 for a general discussion on Heckman and Tobit as estimators for models with corner solutions).

The second part of the empirical analysis is to estimate the parent's direct utility function in order to test (34). We claim that self–reported health is a good measure of utility derived from care consumption, and use it as a proxy for U^P. Children consumption and leisure are not available, thus we cannot estimate the function U^P as specified in (18): what we can do is to find an empirical counterpart for a sub–utility function:

$$U^P = f\left(V^Q(Q); V^I(I_1, \dots, I_4)\right) \tag{39}$$

Linearizing and adding individual characteristics:

$$U^P = \gamma_1 Q + \gamma_2 \sum_i I + X\boldsymbol{\gamma}_3 + X_P\boldsymbol{\gamma}_4 + \epsilon \tag{40}$$

Where X is the same matrix as in (38) and X_P are Parent's specific characteristics. As stated in section 2.2, X_P contains U^P_{SP}, utility (proxied by self–reported health) of the spouse. Since each parent enters the sample, U^P_i is the dependent variable for the ith observation, while it is U^P_{SP}, a regressor, for the ith spouse observation: $u_{1,i}, u_{1,j}$ are then correlated if i, j belong to the same household. Moreover, U^P_{SP} is likely to be endogenous and will be instrumented. As explained in section 3, we cannot aggregate the three formal care variables, and therefore we cannot even compute Q due to different units of measure. In particular, being F_1 hours of nursing care, F_2 hours of paid professional help and F_3 weeks in which the parent received meals–on–wheels, we introduce them separately in the regression:

$$U^P = \alpha_1 F_1 + \alpha_2 F_2 + \alpha_3 F_3 + \alpha_4 \sum_i I + X\boldsymbol{\alpha}_5 + X_P\boldsymbol{\alpha}_6 + \epsilon \tag{41}$$

Finally, parents' utility and children time allocation are determined simultaneously in the economic model outlined in the previous sections, therefore $\sum_i I$ is endogenous. Results from the estimation of (38) are used to provide a valid instrument: we compute predicted values of $\hat{I}_i$ and we replace $\sum_i I$ with $\sum_i \hat{I}_i$ in (41). Standard errors should be computed taking into account this procedure: in order not to impose further structure on the distribution of the (u, ϵ) vector and to account for potential unobserved heteroskedasticity, we used non parametric bootstrapping to obtain standard errors both for the parameters estimates in (38) and for those in (41).

5 Empirical Results

Results of the 'children' part of the estimation procedure, i.e. the Tobit estimates of equation (38) are reported in table 2 in the appendix. As already explained, estimates are obtained following the two–step procedure outlined by Blundell and Smith (1989) in order to avoid convergence problems of Maximum likelihood for simultaneous equations limited dependent variables models. Columns 2 and 3 of table 2 reports first stage regressions of the endogenous variables, namely WT and ΠI. The chosen instruments are *years of education*, *number of children*, $\Pi gender$ and Πage: they prove to be relevant, i.e. they are jointly significant in both first stage equations. Column 1 of table 2 reports the second stage estimates. They are obtained running a Tobit regression on the full set of regressors, plus the residuals from the two first stage equations, $\nu_{WT}, \nu_{\Pi I}$. The first important finding is that both labor force participation effect and siblings' help provision are significant and negative. WT and ΠI are confirmed to be endogenous: as suggested by Smith and Blundell (1986) we run a joint test of significance of the coefficients of the first stage regression residuals. We reject the null $H_0 : \nu_{WT} = \nu_{\Pi I} = 0$ ($F_{(2,26814)} = 4.89$), thus WT and ΠI joint exogeneity is rejected. We test $\Pi gender$ and Πage instruments exogeneity running a Sargan over identification test: under the maintained hypothesis that *years of education* and *number of children* are exogenous with respect to the informal care provision decision, we re-run the Tobit regression on the same set of regressors, plus the full set of instruments. $\Pi gender$ and Πage are jointly not significant ($F_{(2,26812)} = 0.26$), thus confirming their validity.

Labor force participation and informal care provision decisions are therefore confirmed to be simultaneous time allocation decisions. From a welfare perspective, this is a relevant result: any policy intervention on the labor market does have an effect on long term care as well. As an example, incentives schemes to increase female labor force participation simultaneously reduce the same individuals's informal care provision. Moreover, the impact of such a policy goes beyond the targeted population: siblings' help are found to be substitute, thus a higher female adult children labor force participation would induce their brothers to increase care provision and to reduce time spent working. While this is a simple example, the main message is that in the European aging society where long term care costs are increasing, social interactions should be taken into account in order to correctly evaluate policies that affect individual time allocation choices.

The negative sign of siblings help per se do not rule out bequest motive: a positive sign would have been consistent only with a sharing rule like (33), but bequest may still be an incentive to provide help if the amount B_i does not depend on I_{-i}. Nevertheless expected bequest is not significant, thus ruling out such a motive. The second result of the empirical analysis is therefore that it is altruism that drives informal care provision. Angelini (2007) found evidence supporting strategic bequest on the same SHARE dataset, but using phone contacts and visits as a measure of attention of adult children towards their parents. Such a difference depending on the outcome variable leads us to conclude that the strategic bequest

motive may be relevant for costless activities, but once the choice entails time consuming choices as taking care of a sick parent altruism prevail.

The cross–country nature of the dataset allows us to control for country fixed effects. We include a full set of country dummies that turn out to be all individually significant, but such an approach do not allow to fully appreciate country differences. As an example, parents can use bequest to induce extra care if the threat of disinheriting children is credible. In terms of the model, in order for equation (21) to be satisfied and to have $B_i > 0$ at equilibrium the disposable bequest must be large enough. Different countries typically have different bequest legislations that set statutory sharing rule. Thus the tighter the restrictions the lower the incentive parents have to set a bequest conditional on informal care provision. Country dummies control for such differences as well as other institutional settings and cultural attitudes towards family ties, but do not allow to disentangle them. Unfortunately, despite the relatively large overall sample (above 26500 observations on children) repeating the same analysis at a country or even at a macro area level turned out to be extremely difficult: only 1812 individuals throughout the sample report a positive informal care provision, thus at a finer disaggregation the uncensored sample is simply too small to have reliable results. Data limitations cast doubts on the poor significance of the gender dummy as well. The estimated coefficient suggests that daughters are more likely to provide help than sons as we expected, but the parameter is not statistically significant. Previous studies confirm the strong relation between gender and informal care (see Crespo, 2007 for evidence using SHARE), thus the poor significance of *gender* is at least unexpected. A possible reason is quasi–collinearity with country dummies and the constructed hours of work variable: as we explained in section 3, we know whether child i is not working or if he/she works full time or part time, and we use country level averages to turn it into hours of work.

Formal care coefficients are positive and (in two cases out of three) significant. Thus if any, formal and informal care in our data appear to be complements. Nevertheless this result should be interpreted with caution: the sample do not include parents living in a nursing home, and thus the role of formal care is likely to be underestimated. Other controls have the expected sign: the provision of care depends positively on the number of parent's health diseases and limitations on daily activities, as well as on age. Single children provide more help than those who have siblings, and there's a positive and significant relation between care and proximity to parent's house: the nearest child helps more than the child who lives far away. Parent's household income and wealth reduce hours of of help, and money gifts and support from parents towards children (*childfin*) induce a higher probability of providing care. This transfer must not be confused with expected bequest: transfers used as a mean to induce a higher provision of care by parents must take place after care provision.

Columns 1 and 2 in table 3 report the estimates of the parents' equation (41): the dependent variable is parents' self reported perceived health measured according to the US scale[9]. Perceived health and well being scales are such that the higher the variable, the worse is health. As we explained at the end of section 4, spouse's perceived health is likely to be endogenous, and therefore it is instrumented with *spouse age* and *spouse adl*[10]. The most important result is that the marginal effect of total provision of informal care on self reported health is positive (i.e. given the definition of the dependent variables the sign on the relevant parameter estimates are negative) thus confirming (34): a formal unilateral test of the null $H_{0:P} : \beta_{\Sigma I} \geq 0$ is rejected at the 1% level (t–statistic is -2.159). About other explanatory

[9]The American scale is: 1 Excellent, 2 Very good, 3 Good, 4 Fair and 5 Poor

[10]The instruments pass a Hansen J–test (test statistic 1.297) and the Hausman test for exogeneity is rejected. Column 1 in 3 shows the results of the first stage of regressions, which confirm that both age and ADL are relevant instruments.

variables, the perceived condition worsen for older parents while it is better for more educated. As expected, there is a high positive correlation between self–reported health and objective health, both in terms of *adl* and chronic diseases. We control for formal care–giving, household income and expected bequest. With respect to income and wealth, the perception of health condition is better the higher the family economic status. Spouse's perceived health has a positive marginal effect. Country dummies are all negative and significant, again in line with the observation that a large fraction of children who help are from Germany.

An important prerequisite for our empirical implications to be testable is to have a reliable measure of U^P, parent's utility from health and care consumption. As already mentioned, our claim is that self–reported health is a good proxy for U^P. A possible objection is that it may simply measure objective health status, with no relation to care consumption. If this was the case, once controlling for objective health and differences in response scales (captured by country dummies), other determinants of individual utility should not be significant. Results showed that this is not the case, thus confirming our claim that self reported health is not just another measure of objective health. Another potential objection is the reverse: perceived health may be a measure of overall utility, and not of utility from health and care only. SHARE provides a comparable measure of well–being, which can be safely interpreted as overall life satisfaction: columns 3 and 4 of table 3 report the same 2SLS regression of columns 1 and 2 where instead of perceived health the dependent variable is well–being. Since those variables are logically and statistically positively correlated, estimates in column 3 are similar to those run on perceived health, as we expected. Anyhow there are relevant differences: first of all, the instruments for the spouse's well being do not pass a Hansen J–test of overidentification (J–statistic 12.991; p–value 0.0003), nor the Hausman test for exogeneity is rejected: spouse's well being either is exogenous or at least requires a different set of instruments than spouse's perceived health. We chose to report the well being estimates with the same set of instruments in order to preserve comparability across regression: in terms of sign and significance, results are similar for OLS and for a statistically exogenous set of instrument. This is not the only difference: age reduces perceived health but increases self reported well being, France and Italy country dummies change sign preserving significance and most notably informal care provision is not significant anymore.

As a second robustness check, we regressed well being on perceived health and a number of other regressors, including informal care provision[11]. Results confirm the positive correlation between perceived health and well being, but a number of other variables are still significant, while informal care provision is not: again such an evidence support the idea that perceived health and well being are not two measures of the same object.

6 Conclusions

We developed a model for the interaction among parents and their children facing caring decisions. Children decide how to allocate time to paid work, informal care to their parents and leisure. Decision is taken strategically, i.e. each child's choice depends on his/her siblings' behavior. The main empirical finding for this first part of the model is that time devoted to informal care by child i and child j are substitutes. Parents' utility depends both on formal care bought on the market and informal care provided by his children. Parents value informal care more than children do, therefore at any equilibrium they would like to induce children to increase informal care supply. We tested for bequest as a possible mean for parents to induce such extra supply by children. Estimation results do not support the bequest motive:

[11] Results are not reported but are available upon request

the positive and heterogeneous informal care provision is due to altruism. We used self reported health as a measure of utility from health and care: after controlling for formal care and objective health status, such a measure is still informative and captures parent's utility derived from care. This has a relevant implication for empirical work: the good news are that we can extract more information than just health conditions from subjective questions, the bad news are that, once we rely on those measures instead of objectively measured health, results may be biased.

Finally, the model has a number of interesting policy implications: in particular, labor force participation interventions have an impact on informal care provision and vice versa. Moreover, the significant social interaction effect among children has the effect of a social multiplier: a policy targeted to a particular group of individuals impact on the rest of the population via the substitution effect on informal care provision. Last, but not least, institution can maximize the long term care provision by reducing price and augmenting availability of formal care, but this do not necessarily maximize the elderly population utility: parents prefer to be cared by their children rather than rely on State provided long term care.

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Table 2: Hours of work, tobit regression

	hours of help	WT	ΠI
	2nd stage	1st stage	
	(1)	(2)	(3)
WT (hours of work)	-.1954*		
	(.1092)		
ΠI	-1.9782**		
	(.8453)		
years of education		.7011***	-.0384***
		(.0327)	(.0134)
# children		-1.2783***	-.0884**
		(.1051)	(.0355)
Π gender		-.3253**	.2027***
		(.1405)	(.0592)
Π age		-.0057	.0071***
		(.0036)	(.0020)
gender	.2885	-7.9897***	.0516
	(1.0202)	(.1895)	(.0652)
E[bequest]	.0022	-.0518	.0091
	(.2222)	(.0863)	(.0316)
parents' HH wealth	-.1443**	.1403***	-.0054
	(.0718)	(.0292)	(.0135)
Austria	-1.9232*	4.7874***	-.2569**
	(1.1212)	(.4741)	(.1301)
Sweden	-5.2067***	3.1237***	-.6306***
	(1.0608)	(.4047)	(.1142)
Netherlands	-7.7757***	1.1893***	-.5161***
	(1.2490)	(.4057)	(.1035)
Spain	-13.5777***	4.3584***	-.3610**
	(1.7712)	(.4756)	(.1590)
Italy	-8.7304***	2.8398***	.4427*
	(1.4083)	(.4393)	(.2374)
France	-8.4679***	1.1168***	-.1687
	(1.2856)	(.4051)	(.1690)
Denmark	-0.0367	.0398	-.3127**
	(1.0584)	(.4737)	(.1386)
Greece	-5.4219***	1.9625***	-.0381
	(1.1647)	(.4461)	(.1256)
Switzerland	-4.4287**	5.7738***	-.2189
	(1.6400)	(.6703)	(.1831)
Belgium	-7.7392***	4.6170***	-.4143***
	(1.1641)	(.4012)	(.1346)
hours of nursing care	.2379*	-.0477*	.0760**
	(.1153)	(.0287)	(.0355)
hours of professional help	.0046	-.0109	.0026
	(.0532)	(.0270)	(.0170)
weeks received meals–on–wheels	.0753**	-.0418*	-.0049
	(.0327)	(.0246)	(.0054)
age	.5556***	.2621***	.0339***
	(.0630)	(.0146)	(.0065)
# adl	4.1207***	-.7573***	.7452***
	(.7982)	(.1802)	(.1608)
# spouse's adl	2.3804***	-.8118***	.3956*

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	2nd stage	1st stage	
	(1)	(2)	(3)
	(.7981)	(.2169)	(.2191)
# of chronic diseases	1.1384***	.1138	-.0358
	(.2017)	(.0692)	(.0339)
# of spouse's chronic diseases	.0599***	-.0014	.0025***
	(.0075)	(.0022)	(.0008)
single child	1.6957*	-1.3052***	-.0660
	(.9126)	(.3782)	(.1300)
past fin transfers	2.2697***	-3.1519***	.0130
	(.7125)	(.2629)	(.0434)
proximity	7.1477***	-5.2591***	.0925
	(1.2065)	(.3001)	(.0972)
single parent	-2.4117***	-3.7222***	.0217
	(.7135)	(.2401)	(.0777)
parents' HH income	-.8823***	-.1216*	-.0192
	(.2028)	(.0700)	(.0277)
ν_{WT}	.1487		
	(.1100)		
$\nu_{\Pi I}$	2.3141**		
	(.8554)		

Notes: Sample size is N=26844. Germany is the excluded country, parents' household income and wealth are in logs. Two–stage Tobit regression following Blundell and Smith (1989). A joint F test on ν_{WT} and $\nu_{\Pi I}$ is a test of exogeneity of WT and ΠI. The F statistic is equal to 0.2564, thus the test is rejected. A Hansen J test of over identification is run and the test statistic is equal to 4.8946. Such a test together with the significance of instruments on first stage equautions (first four reported coefficients in columns 2 and 3) confirm the validity of the instruments. Standard errors, p–values of both coefficients and test statistics are obtained by non–parametric bootstrap. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Parent's utility, 2SLS regression

	Perceived health		Well–being	
	1st stage	2nd stage	1st stage	2nd stage
	(1)	(2)	(3)	(4)
Spouse's perceived health (US scale)		.0520***		
		(.0169)		
Spouse's well–being				.0929**
				(.0442)
spouse's age	.0340***		.0143***	
	(.0008)		(.0008)	
spouse's # adl	.3787***		.1103***	
	(.0147)		(.0149)	
age	-.0085***	.0070***	-.0092***	-.0041***
	(.0008)	(.0008)	(.0007)	(.0007)
gender	-.1507***	.0188	-.0902***	.0147
	(.0139)	(.0137)	(.0105)	(.0119)
years of education	-.0218***	-.0274***	-.0073***	-.0077***
	(.0019)	(.0019)	(.0013)	(.0017)
partner	.5955***	-.0885*	.6855***	-.2653***
	(.0543)	(.0517)	(.0568)	(.0731)
Austria	-.2813***	-.2737***	-.0590***	-.0611**
	(.0306)	(.0332)	(.0220)	(.0264)
Sweden	-.6336***	-.7602***	-.1138***	-.0974***
	(.0279)	(.0294)	(.0211)	(.0242)
Netherlands	-.3153***	-.3422***	-.3098***	-.3318***
	(.0304)	(.0299)	(.0224)	(.0293)
Spain	-.1267***	-.2644***	-.0994***	-.1279***
	(.0364)	(.0349)	(.0310)	(.0359)
Italy	-.1094***	-.2190***	.1229***	.1348***
	(.0330)	(.0306)	(.0259)	(.0296)
France	-.2046***	-.2496***	.0708***	.1318***
	(.0293)	(.0286)	(.0217)	(.0285)
Denmark	-.4771***	-.6049***	-.3263***	-.4127***
	(.0349)	(.0365)	(.0222)	(.0309)
Greece	-.3257***	-.3666***	-.0729***	-.0698***
	(.0281)	(.0277)	(.0236)	(.0267)
Switzerland	-.3915***	-.3839***	-.1312***	-.1658***
	(.0384)	(.0416)	(.0293)	(.0367)
Belgium	-.2897***	-.3894***	-.1075***	-.1219***
	(.0272)	(.0264)	(.0208)	(.0241)
# adl	.0193	.2732***	.0470***	.1018***
	(.0130)	(.0120)	(.0102)	(.0131)
# of chronic diseases	.0294***	.2924***	.0091**	.0504***
	(.0054)	(.0053)	(.0039)	(.0047)
Total hours of informal care from children	-.0016	-.0095**	.0046	-.0033
	(.0041)	(.0044)	(.0028)	(.0049)
hours of nursing care	.0012	.0025	.0025	.0027
	(.0021)	(.0027)	(.0017)	(.0024)
hours of paid professional help	-.00006	.0007	-.0003	-.0019
	(.0016)	(.0027)	(.0014)	(.0032)
weeks received meals–on–wheels	.0016	.0020	-.0002	.0009
	(.0014)	(.0017)	(.0008)	(.0015)
parents' HH income	-.0091*	-.0181***	-.0048	-.0150***

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	1st stage (1)	2nd stage (2)	1st stage (3)	2nd stage (4)
	(.0054)	(.0054)	(.0040)	(.0050)
parents' HH wealth	-.0047***	-.0052**	-.0025**	-.0023
	(.0017)	(.0022)	(.0012)	(.0019)
E[bequest]	-.0408***	-.0393***	-.0262***	-.0311***
	(.0061)	(.0065)	(.0046)	(.0056)
single child	.0339**	.0614***	.0340***	.0507***
	(.0164)	(.0161)	(.0115)	(.0147)

Notes: Column (1) dependent variable is the Spouse's perceived health measured on the American scale, Column (2) is respondent's perceived health measured again on the American scale; column (3) is the spouse's well–being, column (4) is respondent's well–being. Germany is the excluded country. The regression includes also a constant, income and wealth are in logs. * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors and p–values are obtained by non parametric bootstrap.

Table 4: Average working time by SHARE countries

	weekly hours from a full-time job	weekly hours from a part-time job
Sweden	38.8	19.8
Denmark	37.0	20.0
The Netherlands	37.0	20.3
Germany	37.7	23.0
Belgium	38.0	20.9
France	35.0	20.6
Austria	38.8	24.0
Switzerland	45.0	26.1
Italy	38.0	23.9
Spain	38.5	19.2
Greece	40.0	20.0

Source: Full-time hours are average collectively agreed weekly working time collected by EIRO (European Industrial Relations Observatory), Working Time Developments 2005. Part-time hours as a fraction of full-time contractual hours come from OECD data.

Table 5: Types of Informal and Formal Care

	SE	DK	NL	DE	BE	FR	AT	CH	IT	ES	GR	Obs
	Informal care											
personal care	13	11	6	20	19	14	22	1	19	31	23	179
%	4.89	5.58	5.00	6.87	9.36	11.76	11.06	1.82	19.19	41.33	11.27	9.97
housekeeping	235	179	83	266	186	90	172	41	67	58	136	1513
%	88.35	90.86	69.17	91.41	91.63	75.63	86.43	74.55	67.68	77.33	66.67	82.77
paperwork	54	27	47	96	53	63	59	24	52	41	133	649
%	20.30	13.71	39.17	32.99	26.11	52.64	29.65	43.64	52.53	54.67	65.20	35.50
hours of help per week (hours>0)	1.93	2.74	2.12	4.80	5.73	10.82	5.73	3.86	17.65	14.62	7.21	
	Formal care											
nursing care	41	87	85	45	411	559	60	3	46	110	2	1449
%	1.35	5.10	2.86	1.53	10.84	17.72	3.23	0.30	1.82	4.79	0.07	5.14
hours per week	8.34	9.31	7.88	14.11	4.25	3.50	28.65	1.00	4.52	2.66	30.50	
paid domestic help	131	166	262	46	375	219	59	10	68	94	3	1433
%	4.30	9.72	8.80	1.56	9.89	6.94	3.17	1.00	2.70	4.09	0.10	5.09
hours per week	6.27	2.35	4.44	14.54	5.35	9.86	11.85	8.50	15.65	12.60	22.33	
meals on wheels	39	46	33	42	61	34	38	0	0	4	0	297
%	1.28	2.69	1.11	1.43	1.61	1.08	2.04	0.00	0.00	0.17	0.00	1.05
# of weeks	16.73	27.31	19.53	20.47	19.38	21.67	29.39	0.00	0.00	3.75	0.00	

Notes: informal Care givers % refers to children who give help. Formal Care givers % to all sample.

Table 6: Sample characteristics of children

	SE	DK	NL	DE	BE	FR	AT	CH	IT	ES	GR
# of observations	3,597	1,748	2,523	2,508	3608	2624	1832	945	2471	2270	2725
(tot 26844)											
% co–residing	5.95	5.55	12.72	10.41	15.58	13.61	11.30	13.86	34.80	30.62	33.61
average age:											
co–residents	21.87	23.14	23.14	26.59	26.41	24.44	29.54	23.48	28.70	29.62	25.91
non co-resident	37.36	37.75	36.03	38.13	38.56	37.58	38.69	37.78	38.54	38.79	38.67
men working:											
full-time	78.32	78.48	82.01	79.70	83.26	78.71	86.06	78.38	80.14	83.93	73.85
part-time	3.04	1.96	2.55	1.11	1.91	2.05	1.09	4.59	2.04	1.45	4.73
women working:											
full-time	60.26	62.12	41.36	45.73	58.43	63.04	53.06	41.46	52.05	55.58	47.55
part-time	12.41	9.78	31.57	21.90	16.46	9.28	20.02	27.08	6.60	5.12	8.95
years of education	12.42	13.83	13.19	14.52	11.36	12.56	12.66	13.48	11.74	10.69	12.74
single (%)	33.53	49.31	38.92	46.05	34.92	48.93	46.29	52.13	43.18	40.79	48.51
Proximity to parents (%):											
same building	0.50	0.69	0.48	7.54	1.03	0.69	8.52	3.09	7.49	3.30	9.28
less than 1 km	8.59	7.49	10.74	8.81	12.86	8.00	11.52	9.06	12.71	21.06	11.71
less than 5 km	16.24	15.10	24.02	16.95	20.81	12.12	17.90	14.93	14.12	13.88	11.34
less than 25 km	22.02	25.63	22.00	20.57	27.33	20.12	22.54	25.16	14.20	11.94	12.51
less than 100 km	17.60	22.43	16.69	13.60	15.47	16.43	12.77	17.70	6.48	7.36	4.59
less than 500 km	18.71	18.59	10.82	15.15	4.30	13.99	11.08	11.19	3.04	6.17	10.02
more than 500 km	10.40	4.52	2.54	6.98	2.63	15.05	4.37	5.01	7.16	5.68	6.94
only child (%)	7.53	8.01	6.42	15.03	12.14	11.01	13.86	8.85	11.41	8.50	9.54
help to parents (%)	7.40	11.16	4.76	11.60	5.60	4.54	10.86	5.86	4.01	3.30	7.49
help from daughter	40.23	41.03	49.17	54.30	55.45	57.98	53.77	61.82	63.64	65.33	57.84