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Marcén, Miriam and Molina, José Alberto

Universidad de Zaragoza

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Informal Caring-Time and Caregiver Satisfaction

Miriam Marcén^a and José Alberto Molina^{a,b,*}

^aDepartment of Economic Analysis, University of Zaragoza, Zaragoza, Spain.

^bInstitute for the Study of Labour-IZA, Bonn, Germany

Abstract

We study the effect that the care decision process has on the amount of caring-time and on informal caregiver satisfaction. We develop a theoretical framework in which we compare three two-stage sequential games, each of which corresponds to a different care decision (family, caregiver, and recipient). We find cases of overprovision of informal care in both the family and the recipient decision models, since the caregiver is obliged to spend more time than he/she would prefer. We then use the Spanish Survey of Informal Assistance for the Elderly (2004) to study the relationship between the care decision processes and the time that informal caregivers devote to care activities, with the results confirming our theoretical hypotheses. We also find that different care decision processes imply differences in the informal caregivers' satisfaction, with intensive caregivers being less likely to have greater satisfaction.

JEL Classification: I10, C70, J10.

Keywords: Informal Care, Informal Caregiver Satisfaction, Care Decision Process, Two-stage Sequential Game.

*Corresponding author: Miriam Marcén. Department of Economic Analysis, University of Zaragoza, Gran Vía 2, 50005 Zaragoza. Spain. Tel: 34 976 76 18 18. Fax: 34 976 76 19 96. E-mail addresses: mmarcen@unizar.es (M. Marcén), jamolina@unizar.es (J.A. Molina)

1 Introduction

The dependent population in 2000 comprised 4-5% of the global population, or 7-8% of the population of working-age. In developed countries, the number of dependent people is expected to increase, on average, by 31% by 2040, with this increase being up to 20% in Europe and Japan, and 60% in North America and Australasia (Harwood et al. 2004). This process will increase the demand for informal and formal care for the disabled population, with this increase being the result of growth in the proportion of elderly people during the last 30 years, and of changes in the health needs of the population, with noncommunicable diseases, mental illness and injuries becoming leading causes of disability (World Health Organization, 1999).

Simultaneously, female labour force participation has increased and family patterns have changed as a result of lower marriage rates, higher divorce rates and declining fertility. The growth in female labour force participation began in the Nordic countries and in the United States, reaching a level of 80% of women aged 25-54 in 2001, with this being later extended to other countries, where the participation rates of women aged 25-54 are about 60% in Mexico, Turkey and the majority of Southern European countries (OECD Labour Market Statistics). These changes have given rise to concerns about the future viability of a care pattern which relies on informal care. However, full-time workers have maintained or increased their efforts as primary caregivers (Spillman and Pezzin, 2000), which raises questions about the motivations of these individuals.

On the other hand, policy makers in some developed countries prefer that care for the sick and the elderly takes place "in the community", which is reliant on home-based care, following the recommendation of the World Health Organization, as opposed to "in an institution", to diminish the impact on social welfare provision. For instance, in Great Britain, there is an increased concern about the link between engaging in care and labour force participation, and a focus on developing policies to encourage flexible schedules (Carmichael and Charles, 2003; Heitmueller, 2007). In the USA, public policies are designed to support informal care (Van Houtven and Norton, 2004), and in Canada, public home care expenditure has increased (Stabile et al., 2006), with a growing concern about the relationship between formal and informal care.

In this paper, we examine how care arrangements affect informal caring-time and the caregiver's level of satisfaction. In our theoretical approach, we develop, under different care arrangements, three two-stage sequential games to capture the range of interactions between care recipients and informal caregivers, and we find cases of overprovision of informal care in both the family decision model and the care recipient decision model. In the first case, the informal caregiver can receive compensation, with this taking the form of an increase in the fraction of residual non-labour income allocated to the informal caregiver. In the second case, the care recipient decides the optimum informal caring-time, which, being considered as free, does not affect his/her budget constraint, and thus may result in the time demanded by the care recipient generating Pareto inferior solutions.

We then empirically study the impact of care decision processes on informal caring-time, and analyse changes in the informal caregiver's satisfaction, using the Spanish Survey of Informal Assistance for the Elderly 2004 (*Encuesta de Apoyo Informal a los Mayores*). The issue is of relevance in developed countries, and more specifically so in Spain, where the number of people requiring care has grown at an unprecedented rate. According to the Institute for the Elderly and Social Services (*Instituto de Mayores y Servicios Sociales*), there were about 1 million informal care-

givers in Spain, representing 6% of the population aged 18 or older, in 2004, and the number of elderly recipients of informal care is estimated at 1.3 million, 17% of the population aged 65 or older. This Spanish Survey specifically includes a question asking why informal caregivers engage in informal care activities, differentiating between the caregiver's own decision, a family decision and a recipient decision.¹

We find that informal caregivers devote more time to care activities when they are obliged to. The family decision has the largest effect on the selection of different amounts of caring-time. However, the care recipient decision has no significant impact.

The informal caregiver's decisions about whether to spend time caring for the elderly or the sick depend, in part, upon the informal caregiver's subjective evaluation of their current status. It is not always clear how, and by whom, informal care should be valued: the care recipient, the informal caregiver, or others. Registering changes in the well-being of informal caregivers constitutes a first source of evaluation. Our results show that being obligated to care, by way of the family decision, decreases the probability of being more satisfied, with the losses of satisfaction being greater for intensive informal caregivers.

This paper proceeds as follows. Section 2 briefly reviews the literature regarding the provision of informal care and household decision-making. Section 3 develops the theoretical framework. Section 4 presents the data used in the analysis. Section 5 shows our findings on informal caring-time, and Section 6 focuses on informal caregivers' satisfaction. Section 7 sets out our conclusions.

2 Literature

Even though informal care supply is relevant to all developed countries, existing research on this topic refers mainly to the US and the UK. Most of these studies analyse the influence of informal care responsibilities on the labour supply of informal caregivers, relative to non-caregivers, with the general conclusion being that informal caregivers are potentially more exposed to labour market disadvantage (see Carmichael and Charles, 1998, 2003; Heitmueller, 2007; Heitmueller and Inglis, 2007; Checkovic and Stern, 2002; Stern, 1995). As a consequence, the empirical literature is focused on studying the endogeneity of the caring decision with respect to labour market participation. As Heitmueller and Inglis (2007) ask "do caregivers choose to work fewer hours or do part time workers choose to provide informal care?". Carmichael and Charles (1998, 2003) and Barnby and Charles (1992) consider the provision of informal care to be an exogenous factor in the labour supply decision, since it is not possible to predict the state of dependency. Ettner (1995, 1996) and Stern (1995) use an instrumental variable approach to consider the potential endogeneity of informal care on the labour supply of women. Heitmueller (2007) shows that caring and labour market participation may be endogenous, and that not accounting for this endogeneity can overestimate the impact that care responsibilities have on the labour market decisions of caregivers.

With respect to the theoretical background, several papers focus on analyzing the different ways of modeling the care decision-making process, examining which family members participate in the decision-making process, and which types of care and/or living arrangements are considered, by analyzing parent-child relationships in which

¹Other Surveys, such as the HRS (Health and Retirement Study), do not include questions related to this issue. The SHARE (Survey of Health, Ageing and Retirement in Europe) does include some questions about the reasons, if any, caregivers engage in such activities, but only accounts for the difference between the caregiver's own decision (to meet other people, to contribute something useful, for personal achievement,...), and the caregiver's sense of obligation.

only one child is considered in the decision-making process (see, for the case of living care arrangements, Kotlikoff and Morris, 1990).

Others papers extend this framework, considering that several family members, such as all children, play a role in care decisions (see Engers and Stern, 2002; Checkovich and Stern, 2002; Pezzin et al. 2007). More recent work has used game-theoretic bargaining models to examine family care arrangements, which involve separate utility functions for each family member. Pezzin and Schone (1999, 2002) assume that intrahousehold allocation is determined as the solution to a cooperative Nash bargaining game, in which the threat point is the Cournot-Nash equilibrium of a noncooperative game. Hiedemann and Stern (1999) and Engers and Stern (2002) develop game theoretic models of family bargaining to analyse long-term care. In this sense, Pezzin and Schone (1997) and Pezzin, et al. (2007) find that incentives exist for family members to behave in a strategic manner.

Thus, care decisions are often the result of numerous individual and joint decisions by family members (Heitmueller, 2007), which justifies the study of the family decision-making process, when considering that "one model cannot capture all possible aspects of a family's long-term care and living arrangements" (Hiedemann and Stern, 1999). However, it is not well established whether care arrangements should be modeled as a cooperative or a noncooperative game. Modeling interactions as a cooperative game allows us to obtain Pareto efficient outcomes, without specifying the rules of the game. On the other hand, noncooperative game theory assumes that the rules of the game are often crucial determinants of the outcome, in that the sequence of moves and the information available to each player at each move affects the game equilibrium. As Pezzin et al. (2007) stress, this kind of social interaction is difficult to model, since it is "complex, and loosely structured", with the modeling of family interactions as cooperative or noncooperative being a "research strategy".

3 The Framework

Given that our purpose is to analyse how informal caring-time depends on how the informal care decision process takes place, we capture different interactions between care recipients and informal caregivers by considering three care decision models, with three participants: a disabled person and two potential caregivers.² In each of these models, we perform interactions as a two-stage game. Both stages may contain substages, for instance, living arrangements, although the analysis of these substages is beyond the scope of this paper.

The first stage of the game determines the optimum hours spent caring for disabled individuals. In the first model, the care recipient decides the hours that the caregiver devotes to care activities, *Care Recipient Decision*. In the second model, we consider that the caregiver takes the decision on his/her own, *Informal caregiver Decision*. Finally, in the third model, the care arrangement is obtained by way of a family decision, *Family Decision*. In the second stage of each of the three games, we determine the optimum behaviour of the other agents, and determine the resource allocation under each arrangement structure (see Table 1). These three two-stage sequential games are solved by backward induction.

²We do not study how families make decisions. This was analysed by Hiedemann and Stern (1999) using a strategic model of bargaining to determine how to care for an elderly parent.

Table 1: CARE DECISION PROCESSES

	First Stage	Second Stage
Process 1. <i>Care Recipient Decision</i>	Care Recipient	Potential Caregivers
Process 2. <i>Informal Caregiver Decision</i>	Potential Caregivers	Care Recipient
Process 3. <i>Family Decision</i>	Potential Caregivers	Care Recipient

Note: Agents involve in each stage of the Care Decision Processes.

We use the subscripts $\{1, 2, 3\}$ to indicate the decision process, and the subscripts $\{r, m1, m2\}$ to indicate the care recipient, r , and the potential caregivers, $\{m1, m2\}$, respectively. Thus, $C_{r,1}$ denotes private consumption by the recipient when the recipient is the one who decides the hours that the caregiver spends.

To construct the decision process, we begin by specifying the preferences of each of the agents.³ Let $U_{r,j}(u_{r,j}(\mathbf{C}_{r,j}), A_j)$ be the utility functions of the care recipient, where $u_r^j : \mathbb{R}_+^n \rightarrow \mathbb{R}$ is the care recipient's sub-utility function, and where \mathbb{R} is the set of real numbers. The argument $\mathbf{C}_{r,j} \in \mathbb{R}_+^n$ of the utility function is a vector of n goods consumed by the care recipient. A_j represents the ability of care recipients to perform activities of daily living (Stabile et al., 2006), and $U_{r,j}$ is twice continuously differentiable, strictly increasing, and strongly concave.

The care recipient's ability to perform activities is defined by:

$$A_j = A_j(A_{1,j}(H_j), A_{2,j}(t_{1,j}, t_{0,j}))$$

where H is the care recipient's health status, $t_{1,j}$ represents the hours that the informal caregiver spends on care activities, and $t_{0,j}$ indicates the hours of formal care. We also assume that the care recipient's health status is separable from the time dedicated to care. When the care recipient is healthy, she can perform by herself the activities of daily living, but if she is less healthy, others must perform those activities for her.⁴

We suppose that both potential caregivers derive utility from the private consumption, the leisure time and the ability of the care recipient to perform activities. Therefore, $U_{mi,j}(C_{mi,j}, l_{mi,j}, A_j)$, $i = 1, 2$ and $j = 1, 2, 3$, where $C_{mi,j}$ represents the private consumption of potential caregiver mi in j decision process, and $l_{mi,j}$ indicates the hours devoted to leisure activities of potential caregiver mi in j decision process. We assume that $U_{mi,j}$ is twice continuously differentiable, strictly increasing, and strongly concave. We suppose that each family member's utility function depends on the care recipient's health status by way of the effect of H_j on A_j , which also affects the care recipient's well-being. For the sake of simplicity, we assume that only one of the two potential caregivers is finally going to devote time to informal care activities, agent $m1$.

3.1 The Second Stage Game

As stated, each game is solved by backward induction. We begin by analysing the second stage of each game as a bargaining, or as a non-bargaining solution (see Table 2). Although we cannot directly observe the reasons why, the care decision is taken by a family decision, or by the care recipient decision, or by way of the caregiver decision. Using this two-stage game, we are able to compare the optimum solutions of these three care decision models, under the assumption that the informal caregiver has accepted the care decision process. We suppose that the informal caregiver accepts

³We suppose that each agent has perfect knowledge of the preferences of the other.

⁴This ability to perform activities is defined here differently than by Stabile et al. (2006). In our case, we concentrate on the allocation of time, whereas they study the use of publicly and privately financed home care services.

whatever caring-time is decided by the care recipient in the first stage of the first model, and that the care recipient accepts whatever the informal caregiver in the second model, or both potential caregivers in the third model, have decided in the first stage of the game (see Table 1).

This implies that the informal caregiver accepts the decision taken by others, since the utility obtained for her in these situations is at least equal to the utility she obtains when she decides on her own, $U_{m1,2} \leq U_{m1,1}$ and $U_{m1,2} \leq U_{m1,3}$. With $U_{m1,2}$ being the utility obtained by the informal caregiver when she decides by herself, and with $U_{m1,k}$, $k = 1, 3$, being the utility obtained by the informal caregiver under the care recipient decision, and under the family decision, respectively.

Depending on who decides at this stage, we determine the optimum level of private consumption and leisure time for the potential caregivers, or the optimum level of formal care in the case of the care recipient (see Table 2).

Table 2: SECOND STAGE

	Non-Bartaining Solution		A Collective Approach	
	Constraint	Decision	Constraint	Decision
Process 1. <i>Care Recipient Decision</i>	$t_{1,1}, A_1$	$C_{mi,1}, l_{mi,1}, h_{mi,1}$	$t_{1,1}, A_1$	$C_{mi,1}, l_{mi,1}, h_{mi,1}$
Process 2. <i>Informal Caregiver Decision</i>	$t_{1,2}$	$C_{r,2}, t_{0,2}$		
Process 3. <i>Family Decision</i>	$t_{1,3}$	$C_{r,3}, t_{0,3}$		

Note: $t_{1,j}$: Informal Caring Time and $t_{0,2}$: Formal Caring Time.

$C_{mi,j}$: Consumption; $l_{mi,j}$: Leisure Time and $h_{mi,j}$: Time spent in labour market

Care Recipient Decision Pezzin and Schone (1999, 2002) explain that when potential caregivers co-reside, their interactions are cooperative, but when they live independently there is no bargaining solution for the game. We here use those two approaches, a Non-Bargaining approach and a Collective Approach. In the first, decisions are taken independently and, in the second, decisions are taken in a bargaining framework. It is assumed that the informal caregiver accepts the decision taken by the care recipient in the first stage of the game. In this case, $t_{1,1}$ is fixed, since it is determined in the first stage of the game, thus A_1 is also fixed.

In both cases, we assume that only one of the two potential caregivers is going to devote time to informal care activities, agent $m1$. What we are interested in is studying the effects that an increase in $t_{1,1}$ has on both the hours spent in market work and leisure time, to see if the impact of the caring-time dictated by the care recipient is equal, in both a non-bargaining approach and a collective approach.

In the first approach, we suppose that the potential caregivers decide separately the private consumption, the labour supply and the leisure time. For example, the case of two potential caregivers, a mother and her daughter who live independently. At the equilibrium point, the individual's marginal rate of substitution (MRS) between individual i 's leisure and private consumption is equal to the wage rate. From that, we obtain the optimum levels of leisure time, private consumption and labour supply, $\hat{l}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$, $\hat{C}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$ and $\hat{h}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$ $i = 1, 2$, respectively, for each potential caregiver, which depends on the wage rate, w_{mi} , on the non-labour income, Y_{mi} , on the ability to perform activities of daily living of the care recipient, A_1 , and on the the total time the agent mi can devote to care and non-care activities, $T_{mi,1}$ (see Appendix A).

In the second approach, we consider the usual strategy of collective models (Chiappori 1988, 1992), where the decisions made by the potential caregivers are Pareto-efficient, and in which both potential caregivers share what is left after private con-

sumption. In this case, the caregiver can be the daughter of the disabled person, and the other potential caregiver can be her husband (see Appendix A).

The first-order conditions imply that the individual's marginal rate of substitution between individual i 's leisure and private consumption is equal to the wage rate in equilibrium, in line with the non-bargaining solution. Although, in the collective approach, the optimum levels of leisure time, labour supply and private consumption, for each agent, mi , $i = 1, 2$, are also functions of the wage rate, the non-labour income and the total time available of the other agent, mk , $k \neq i$, $k = 1, 2$.

In both cases, the non-bargaining solution and the collective approach, we obtain similar results for both the hours devoted to labour and to leisure activities (see Appendix A). Nevertheless, we also see that the impact of $t_{1,1}$ on $\hat{h}_{mi,1}$ is more likely to be greater, since the fraction of residual non-labour income allocated to the spouse $m1$, ρ_{m1} , considerably increases when the time devoted to caring increases, that is, agent $m2$ compensates $m1$ for devoting time to care activities, and thus the hours devoted to the labour market decrease more than in the non-bargaining approach.

With respect to the level of utility that the informal caregiver, $m1$, obtains from devoting time to informal care, $U_{m1,1}^C$, the utility derived from the argument A_1 , the care recipient's ability to perform daily activities, will not differ between the non-bargaining approach and the collective approach, since A_1 is fixed in both cases. However, informal caregivers are time constrained, which supposes that an increase in the time devoted to care activities could produce labour and leisure costs, which diminish the utility obtained from the arguments $C_{m1,1}$ and $l_{m1,1}$, and so decreases the utility derived from the care activities.

Nevertheless, the informal caregiver has to accept the care decision process, implying that the overall utility achieved by the informal caregiver has to be at least equal to the utility that she obtains when she decides the caring-time on her own, $U_{m1,1} \geq U_{m1,2}$, which depends on the level of caring-time determined by the care recipient in the first stage, but also, as we have seen, in the compensation that the informal caregiver can receive in the collective approach. Thus, the losses of utility derived from the imposed caring-time can be compensated for in the collective approach, but not in the non-bargaining approach, which can result in the informal caregiver rejecting the caring-time imposed by the care recipient (see First Stage Game).

Informal caregiver Decision and Family Decision We now consider that the care recipient accepts the decision taken by the informal caregiver, or the family decision, in the first stage of the game (see Table 1). In this case, $t_{1,2}$ is fixed, which is determined in the first stage of the game, although A_2 is not fixed (see Table 2). Therefore, the care recipient decides the optimum number of hours of formal care, and the level of her own private consumption. Given that $t_{1,2}$ is fixed, and that $T_{r,2}$ is also fixed, with $T_{r,2}$ being the total time needed to perform daily living activities, from $t_{1,2} + t_{0,2} = T_{r,2}$, we can easily obtain $\bar{t}_{0,2}$, that is, the formal caring-time in equilibrium. It is straightforward to obtain the level of private consumption in equilibrium, from the budget constraint, $\bar{C}_{r,2}$ (see Appendix A), in such a way that, the lower the informal caring-time, the higher the formal caring-time needed by the care recipient and the lower the level of private consumption of the care recipient.

Nevertheless, the care recipient must accept whatever decision is taken by the caregiver or the family decision, even when the level of utility of this individual is considerably lower than that obtained when the decision was his own, thus $U_{r,2} \leq U_{r,1}$ and $U_{r,3} \leq U_{r,1}$. The care recipient could be worse off if he does not accept the informal caring-time decided in the first stage, since if he does not accept it, the total

time needed to perform daily living activities would have to be covered by formal help, $T_{r,2} = t_{0,2}$, which decreases the private consumption of the care recipient.

The potential caregivers would tend to determine lower levels of caring-time, since they do not derive utility from that obtained by the care recipient, they only derive utility from his ability to perform activities of daily living, A_j , and do not take into account the losses of well-being that the care recipient incurs from the increase in formal caring-time. We expect that the care recipient will be worse off when the informal caregiver decides on her own, since she will spend fewer hours of caring-time, not being compensated by the other potential caregivers, as we observe in the first stage of the game.

3.2 The First Stage Game

We analyze here the first stage of each game for each of the three models (see Table 1). In the first model, the care recipient decides the hours of informal care; in the second, the caregiver decides by herself; and in the third the hours spent on care are the result of a family decision (see Table 3).

Table 3: FIRST STAGE

	Non-Bartaining Solution	A Collective Approach
Process 1. <i>Care Recipient Decision</i>	$t_{1,1}, t_{0,1}, C_{r,1}$	
Process 2. <i>Informal Caregiver Decision</i>	$C_{mi,2}, l_{mi,2}, h_{mi,2}, t_{1,2}$	
Process 3. <i>Family Decision</i>		$C_{mi,3}, l_{mi,3}, h_{mi,3}, t_{1,3}$

Note: $t_{1,j}$: Informal Caring Time and $t_{0,1}$: Formal Caring Time.

$C_{mi,j}$: Consumption; $l_{mi,j}$: Leisure Time and $h_{mi,j}$: Time spent in labour market

Care Recipient Decision In this game, it is the care recipient who decides the hours of informal care, $t_{1,1}$. In this stage, we also determine the optimum value of private consumption of the care recipient, $C_{r,1}$, and the formal caring-time, $t_{0,1}$. From the first order condition, and taking into account the budget and time constraint, we obtain the optimum level of the private consumption, the formal and informal caring time as functions of the total time needed to perform daily living activities, $T_{r,1}$, the non-labour income of the care recipient, $Y_{r,1}$, and his health status, H_1 (see Appendix B).

We examine the optimum informal caring time fixed by the care recipient to be able to compare this caring-time with the caring time determined in the rest of the care decision processes. The informal caring-time is determined to be about the total time needed to perform daily living activities, $t_{1,1} \approx T_{r,1}$, when we assume that the informal caring-time is considered to be unpaid by the care recipient. Thus, the optimum level of formal care determined in this stage may be close to zero (see Figure 1), and the time fixed by the care recipient may be considerably greater than the time that the informal caregiver would prefer. In Figure 1, the time fixed by the care recipient is $t_{1,1}^{NA}$. In this case, the utility level of the informal caregiver would be considerably lower than that obtained when she decides by herself, $U_{m1,1} \ll U_{m1,2}$, so this is not a Pareto superior solution. The level of utility achieved by the informal caregiver in this game, if she accepts $t_{1,1}^{NA}$, is represented by $U_{m1,1}^{NA}$ in Figure 2. We have assumed that the informal caregiver accepts the decision taken by others when the utility obtained for her is at least equal to the utility that she obtains when she decides on her own, $U_{m1,2} \leq U_{m1,1}$, but in this case $U_{m1,1} \ll U_{m1,2}$, that is, the utility that she achieves, if she accepts, is considerably lower. Therefore, the informal caregiver would reject the care recipient's request, that is, she would not spend time in informal care, $t_{1,1}^{NA}$ in Figure 1.

The informal caregiver would only accept the care recipient's request if $t_{1,1} \approx t_{1,2}$ when the potential caregivers decide separately in the second stage of the game, or $t_{1,1} > t_{1,2}$ when the interactions between the potential caregivers in the second stage are cooperative, since the potential final caregiver may be compensated in such a way that the level of informal caring time accepted will be $t_{1,1}$ in this state (see Figure 1), which corresponds to a level of utility of the informal caregiver derived from the caring activity $U_{m1,1}^C$ (see Figure 2). Therefore, we would not expect significant differences between the informal caring-time decided by the informal caregiver, and the informal caring-time decided by the care recipient, and we would not expect significant differences between the level of utility derived from the informal caring-time in both situations.

(Figure 1 goes here)

Informal caregiver Decision - A Non-Bargaining Solution In the second process, Informal caregiver Decision, the caregiver decides by herself the hours to devote to care activities. We maintain the assumption that, even though both agents are potential caregivers, only one is going to be caregiver, in our case agent $m1$, in such a way that the informal caregiver decides individually her optimum level of private consumption, labour supply, leisure time and informal caring-time (see Appendix B).

As in the second stage, the levels of these variables individually decided by the informal caregiver are functions of the wage rate, w_{mi} , the non-labour income, Y_{mi} , the formal caring-time needed by the care recipient, $t_{0,2}$, the health status of the care recipient, H_2 and the total time the agent mi can devote to care and non-care activities, $T_{mi,2}$.

Focusing on the amount of informal caring time, we can compare the time given to informal care activities in both situations, when the care recipient decides first, process 1, and when the informal caring-time is determined by the informal caregiver in process 2, that is to say, the informal caring-time that the informal caregiver would prefer to spend, $t_{1,2}$ in Figure 1. From the first order conditions of both maximization problems, we obtain a necessary condition to observe a similar informal caring-time in both situations:

$$\frac{\partial U_{r,j}/\partial C_{r,j}}{\partial U_{r,j}/\partial A_j} = \frac{\partial U_{m1,j}/\partial t_{m1,j}}{\partial U_{m1,j}/\partial A_j} \gamma \quad (1)$$

where $\gamma = \frac{\frac{\partial A_{2,j}}{\partial t_{1,j}} - \frac{\partial A_{2,j}}{\partial t_{0,j}}}{\frac{\partial A_{2,j}}{\partial t_{1,j}}}$ and $j = 1, 2$, with $\gamma > 0$ to satisfy the first order conditions

of the care recipient maximization problem, and with $\frac{\partial A_1}{\partial A_{2,1}} = \frac{\partial A_2}{\partial A_{2,2}}$ and $\frac{\partial A_{2,1}}{\partial t_{1,1}} = \frac{\partial A_{2,2}}{\partial t_{1,2}}$ in the non-bargaining solution, that is, the same ability requirements in both situations, and with the same effect of the informal caring-time on the ability to perform activities of daily living, in both situations.

When the care recipient's marginal rate of substitution between consumption, and the ability to perform activities of daily living, is equal to the marginal rate of substitution between leisure and the ability to perform activities of daily living, weighted by γ , $\bar{t}_{1,2}$ is equal to $\hat{t}_{1,1}$. Thus, there is no difference between the decision taken by the care recipient and that taken by the informal caregiver. However, in the case that the care recipient's ability to perform activities of daily living increases much more when the care recipient receives informal caring-time, than when he/she receives formal caring-time, this equality is less sustainable, since the demand for

informal caring-time by the care recipient would considerably increase, creating an unacceptable situation for the informal caregiver, given the resulting losses of utility.

The utility that the informal caregiver derives from the informal caring activity is represented by $U_{m1,2}^C$, with $U_{m1,j}$ being the overall level of utility reached by the informal caregiver in Figure 2.

(Figure 2 goes here)

Family Decision - Collective Approach In the third game, we model the family decision as an intra-family bargaining model, following the collective approach (Chiappori, 1988, 1992), since this takes into account the intra-family allocation of resources, in our particular case, the allocation of resources between both potential caregivers (see Appendix B).

Using this collective approach, we may determine the optimum level of informal caring-time in a bargaining approach, $t_{1,3}$. We find that $t_{1,3}$, that is to say, the optimum hours devoted to care activities in the family decision, is likely to be greater than $t_{1,2}$, the optimum hours devoted to care activities in the informal caregiver decision, when agent $m2$ considerably compensates $m1$ by way of increasing ρ_{m1} , the fraction of residual non-labour income allocated to the spouse $m1$ for spending more time on care.

Thus, we find cases of over-provision of informal care in the family decision model, since the informal caregiver can receive compensation by way of an increase in ρ_{m1} , which produces an increase in the time spent on care, which can be even greater than the informal caring-time demanded by the care recipient, $t_{1,1}$.

This affects the level of utility that the informal caregiver derives from the time that she devotes to care, $U_{m1,3}^C$, since it is considerably lower than that obtained when she decides on her own the level of informal caring-time, $U_{m1,2}^C$, holding all other variables constant, and even lower when the care recipient decides his informal caring-time requirements, $U_{m1,1}^C$ under the assumption that in the three cases the level of utility achieved by the informal caregiver is the same, $U_{m1,1} = U_{m1,2} = U_{m1,3}$, corresponding to $U_{m1,j}$ in Figure 2.

The remainder of the paper empirically studies the effects that these care decision processes have on the time spent on care activities, and on the level of satisfaction of the informal caregiver. As explained, we determine whether, depending on the care decision process, informal caregivers must devote more time to care activities than they would prefer. With the family decision, we are more likely to observe that the informal caregiver tends to devote more time to informal care activities, which also produces a considerable decrease in the level of utility reached by the informal caregiver. With the care recipient decision, since the care recipient considers informal caring-time to be unpaid, time spent on care is considerably increased, which can result in the informal caregiver devoting more time to informal care activities than he/she would prefer. However, when the informal caregiver does not receive compensation, and given that she must accept the informal caring-time demanded by the care recipient, we would expect that those Pareto inferior solutions, that is, those situations in which the overall utility reached by the informal caregiver is lower than that obtained when she takes the decisions, will be rejected by the informal caregiver. Thus, we would expect no differences between the informal caring-time decided by the informal caregiver, and that determined by the care recipient, and thus we would not expect significant differences in the utility derived from the informal caring-time in either situation.

4 Data

We use data from the Spanish Survey of Informal Assistance for the Elderly (*Encuesta de Apoyo Informal a los Mayores*) conducted in 2004. This survey was developed by the Institute for the Elderly and Social Services (*Instituto de Mayores y Servicios Sociales*) of the Spanish Ministry of Employment and Social Services. It contains information on individuals 18 years and older, residing in Spain, and devoting time to informal care activities. This survey excludes formal caregivers who receive the equivalent of a salary, but leaves open the possibility of informal caregivers receiving monetary compensation. It includes any kind of assistance with activities that the care recipient can no longer do alone, excluding those tasks that were done by others, prior to the current need for care.⁵ In consequence, we have a sample of 1,219 informal caregivers.

Mean and standard deviations for the main variables used are presented in Table 1. Column (1) reports values for the whole sample, and columns (3), (5), and (7) include values for the samples of informal caregivers who report devoting time to informal care activities for less than two hours, from three to five hours, and more than five hours, per day, respectively. We observe that the mean of the informal caregivers is 52.6 years of age. Those who report spending time on care for less than two hours are the youngest, 47, and the oldest are those who report time spent on care for more than five hours, about 55. The number of women engaged in caring activities is high, about 85.2% in 2004, even as women have become more involved in the labour market. The greatest number of informal caregivers, 40.3%, have a low level of education, but those who report spending time in informal care for less than two hours per day, 48.9%, have a medium level of education. About 74% of caregivers in 2004 are the spouse or the son/daughter of the care recipient. Hence, care for disabled people continues largely to be provided by family members, with the son/daughter of the care recipient primarily providing this caring-time, about 59.4%. About 77% of these care providers are married/cohabiting. The number of children of the care provider is significantly low, 0.98.

With regard to the population of the city of residence among informal caregivers, the percentage of care providers is greater, 47.9%, in cities with more than 100 000 inhabitants in the whole sample, and in all three caring-time intervals, reaching 57.4% among those who report devoting time for less than two hours per day. In the case of cities with less than 10 000 inhabitants, the percentage of caregivers is greater when they report devoting more than five hours per day to informal care.

About 28 % of informal caregivers spend time in work activities. 45.3% devote less than two hours per day to informal care, whereas 36.3% devote from 3 to 5 hours per day. The percentage of homemakers devoting time to care activities is considerably higher, 45.7%, with 50% devoting more than five hours per day.

Analyzing the different kinds of care, and the decision process variables, we find that the number of those who report spending time on care of less than two hours per day is 15.6%. The number of informal caregivers who report spending time more intensively, more than five hours, is dramatically greater, 60.5%. Such care is usually classified into two groups, depending on the needs of the care recipient. The informal caregiver can be engaged in Instrumental Activities of Daily Living (IADL), such as cleaning, ironing, making lunch, and administrative tasks such as shopping, visits to the doctor, to the bank; or in Personal Activities of Daily Living (ADL), such as bathing or showering, grooming, dressing, eating, etc, which are more time-

⁵For instance, in the case of housework, only the additional part of housework due to the illness or disability of the care recipient should be seen as informal care.

consuming. As we can observe in Table 1, informal caregivers are intensive caregivers, since the number of those who report time spent in ADL is 74.2%, and those who spend more than 5 hours per day on care are engaged in more ADL, 82.5% in 2004.

The number of primary caregivers is high in the whole sample, 82.5%, due to the high number of those who spend more hours in care activities and are primary caregivers, 90.6%. The number of primary caregivers who spend fewer hours is considerably lower, 62.1%. 75.2% of caregivers are engaged in permanent care for the disabled person, with this being greater for those who report devoting more than five hours per day to informal care, 79.9%.

Given that different living arrangements are likely to affect the amount of care, we include in this analysis the travel time between the informal caregiver and the care recipient, the mean being 9.4 minutes, with this time being less, 6.97 minutes, for those who report spending more than five hours of caring time. In the same way, the existence of care recipients who cohabit with a relative may affect the hours devoted to care. About 56.3% of care recipients cohabit with a relative, with extra-residential care being greater for those less intensive caregivers. 32.2% of caregivers in 2004, received monetary compensation from the care recipient.⁶ We also include other variables to control for whether other people are looking after a particular care recipient, that is, whether informal and/or formal care is supplied by people other than the respondent. Overall, 16.3% of informal caregivers report that the care recipients receive formal help. Those who spend less than 2 hours per day, 23.7%, on care report receiving greater formal help. However, care supplied by family members is lower for those who report spending less than 2 hours per day.

With respect to the care decision processes, we observe that the decision to engage in care is taken by the caregivers in 61.9% of the sample in 2004, by the family in 32.5%, and by the care recipient in 5.6%. Caregivers decide for themselves in a greater percentage in all the intervals, but the informal caregiver decisions decrease with the intensity of the caring-time. However, the family decision increases with the intensity of the caring-time. The percentage of care recipients who decide for themselves is considerably lower in all the intervals, but the relationship between intensive caring-time and the care recipient decision is negative.

Finally, a typical care recipient is an 80 year old woman with health problems, with a low level of education, receiving a pension and with no spouse

In sum, we observe that a typical caregiver is a middle-aged woman, married, with a lower educational level. She lives in a city of more than 100 000 inhabitants, is probably a homemaker and has a small number of children. She is the primary caregiver, does these tasks every day and decides on her own whether to engage in care. However, differences exist among those who devote different daily amounts of caring-time.

5 Informal Caring-Time: Empirical Model And Results

5.1 Empirical Model

We are here interested in empirically analysing whether, depending on the care decision process, informal caregivers devote different amounts of time to care activities. We expect that, under the family decision situation, the informal caregiver tends to be a more intensive caregiver, and that the informal caring-time decided by the care recipient would be no different from that decided by the informal caregiver (see Figure 1). We use data from the Spanish Survey of Informal Assistance for the Elderly

⁶There is no available information about the compensation that informal caregivers might receive from other potential caregivers.

in which respondents are asked about the reasons, if any, why informal caregivers engage in informal care, differentiating between the caregiver's own decision, a family decision, and a recipient decision. In previous research, the data used do not account for the decision processes, which can have an effect on the caring-time, since those caregivers who do not decide for themselves the hours devoted to care activities can be required to spend more hours than those who do decide for themselves, as we have seen in the theoretical approach.⁷

With respect to the informal caring-time, informal caregivers are asked how many hours they devote, on an average day, to informal care activities, classifying them as: less than two hours, from three to five hours, or more than five hours.⁸ To analyse how informal caring time varies from one category to another, depending on the informal care decision process, we use a multinomial logit model (MNL), and we control by the demographic characteristics of both the informal caregiver and the recipient.

Even though our outcome, informal caring-time, can be considered as partially ordered, in which case, we should have used an Ordinal Model, we have tested the parallel regression assumption, implicit in the Ordinal Model, by comparing the estimate from the $J - 1$ binary regressions,

$$\Pr(y \leq m | \mathbf{x}) = \Phi\left(\mu_m - \mathbf{x}'\beta\right) \quad \text{for } m = 1, 2, \dots, J - 1$$

where the β s are allowed to differ across the equations. This parallel regression assumption implies that $\beta_1 = \beta_2 = \dots = \beta_{J-1}$. We compute the approximate likelihood-ratio test of proportionality of odds across response categories (chi-squared(35)=80.47(0.000) including all controls), and we conclude that we have evidence that the parallel regression assumption has been violated at the 1% level of significance. We have also compared the predictions from ordered logit and multinomial logit, obtaining that probabilities predicted for one of the categories ended abruptly in the case of ordered logit predictions. This abrupt truncation of the distribution for the ordered logit model is substantively unrealistic (see Long and Freese, 2006). Therefore, when the proper ordering is ambiguous, the models for nominal outcomes can be considered and, in these circumstances, we use the Multinomial Logit Model (MNL).

In the MNL, we estimate a separate binary logit for each pair of outcome categories. Formally, the MNL can be written as:

$$\ln \phi_{m|b} = \ln \frac{\Pr(y=m|\mathbf{x})}{\Pr(y=b|\mathbf{x})} = \mathbf{x}'\beta_{m|b} \quad \text{for } m = 1 \text{ to } J$$

where b is the base category, $J = 3$ and \mathbf{x} is a vector of the demographic char-

⁷We cannot observe the reasons why the decision of care is taken by way of a family decision, by way of the care recipient decision or by way of the caregiver decision, and so we cannot test why informal caregivers accept a family decision or a recipient decision, since we have no available information, for instance, about the potential caregivers. Therefore, we cannot estimate a structural model of caregiver behaviour, see Hiedemann and Stern (1999) for an example.

⁸Specifically, the Spanish Survey of Infomal Assistance asked informal caregivers the hours they spent caring for the dependent person, in four categories: less than 1 hour, from 1 to 2 hours, from 3 to 5 hours and more than 5 hours. In our work, we combine categories "less than 1 hour" and "from 1 to 2 hours" in a new category "less than two hours" since we have observed that those categories are indistinguishable. We have computed a test for combining alternatives to test whether the categories are indistinguishable, with respect to the variables in the model, that is to say, if none of the independent variables significantly affect the odds of alternative m versus alternative n (Anderson, 1984). Alternatives m versus n being indistinguishable corresponds to the hypothesis that

$$H_0 : \beta_{1,m|n} = \dots = \beta_{i,m|n} = \dots = \beta_{I,m|n} = 0$$

with β_i being the coefficient associated with the explanatory variable x_i . We have tested this using both Wald tests and LR tests, and we cannot reject the hypothesis that categories "less than 1 hour" and "less than 2 hours" are indistinguishable.

acteristics of the informal caregiver, and of the recipient, and of the decision process variables.⁹

The variables capturing the demographic characteristics of the informal caregiver include her age, her gender, her educational level, her marital status, her number of children, her work status, the population of her city of residence, and whether she receives monetary compensation for care activities.¹⁰ With respect to the care recipients' characteristics, we observe her age, her gender, her educational level, and her health status. In the help variables, we control for the kind of task developed, that is IADL and ADL activities, and the travel time between the caregiver and the recipient. Moreover, sharing the same household may lead to a greater obligation of family members to engage in care, and so we include a variable to control whether the care recipient lives with a relative. We also include variables to control for the frequency and permanency of the care, and if the care recipient receives formal help or help from another family member. We control for the care decision processes by using the caregiver decision as the variable of reference.

We have computed marginal changes and discrete changes for each explanatory variable. The J discrete-change coefficients for a variable, one for each outcome category, can be summarized by computing the average of the absolute values of the changes across all outcome categories,

$$\bar{\Delta} = \frac{1}{J} \sum_{j=1}^J \left| \frac{\Delta \Pr(y=j|\bar{\mathbf{x}})}{\Delta x_i} \right|$$

where the absolute value is taken because the sum of the changes, without taking the absolute value, is necessarily zero. However, discrete change does little to illuminate the dynamics among the outcomes. To account for that, we also study how the variables affect the odds of a person devoting one amount of caring-time over another. Holding other variables constant, the changed factor in the odds of outcome m versus outcome n , as x_i increase by δ , equals:

$$\frac{\phi_{m|n}(\mathbf{x}, x_i + \delta)}{\phi_{m|n}(\mathbf{x}, x_i)} = e^{\beta_{i,m|n} \delta}$$

5.2 Results

To analyse the effect of each variable on the change in the probability of devoting caring-time, we present Table 5, which shows the average absolute change of this probability by informal caregivers, controlling by the caregiver Demographic Characteristics, the Recipient Demographic Characteristics and the Help and Decision Variables. In this way, we analyse the impact of these variables on changing the decision of devoting time to informal care activities.¹¹

⁹The MNLM makes the assumption known as the independence of irrelevant alternatives (IIA). In this model:

$$\frac{\Pr(y=m|\mathbf{x})}{\Pr(y=n|\mathbf{x})} = e^{\mathbf{x}'(\beta_{m|\mathbf{b}} - \beta_{n|\mathbf{b}})}$$

where the odds do not depend on other available alternatives. Thus, adding or deleting alternatives does not affect the odds among the remaining alternatives. The independence assumption follows from the initial assumption that the disturbances are independent and homoscedastic. We consider two of the most common tests developed for testing the validity of the assumption, the Hausman's specification test (Hausman and McFadden, 1998), and Small-Hsiao test (Small and Hsiao, 1985). We cannot reject the null hypothesis, that is to say, odds are independent of other alternatives. We find similar results even with a different base category.

¹⁰We do not include the income of the caregiver, since respondents are not asked in the survey.

¹¹Results are presented for the joint sample of men and women. Tests reject separate specifications by gender. For consistency, we have also estimated with different sub-samples to correct for other selection biases. We consider that the selection bias may be generated by either age or frequency of the help. To that end, we change the age range and we estimate only using those caregivers

The variables of interest are the family decision and the recipient decision. In Column (1), we capture the relationship between the care decision processes and the change in the probability of devoting different amounts of caring-time, without controlling for care recipient characteristics. This approach yields an upward bias in the estimation of the effect of the care decision processes, as shown in Column (2). As we have specified in our theoretical analysis, the utility function of the caregiver depends on the ability of the recipient to perform activities of daily living, with this being controlled by the recipient’s characteristics in our empirical analysis. The variations in the average change in the probability of devoting different amounts of caring-time decreases from 8.21 to 7.6 percentage points, when the Care Recipient Characteristics are included, which suggests that omitting care recipient characteristics results in an overestimation of the effect of the family decision on the probability of devoting different amounts of caring-time, even though the poor health status of the care recipient is the only significant characteristic.¹² In the case of the recipient decision, this variable is not significant in any estimation.

(Table 5 about here)

The specification in Column (3) controls for care decision processes when the informal caregiver reports being employed in the labour market. We observe that the average change in the probability of devoting different amounts of caring-time is greater for those who engage in care as a result of a family decision, and are not employed. It is more likely that these individuals will spend more hours on care. The recipient decision variable affects the probability of devoting different amounts of caring-time in a different way, since the average change in the probability is greater for those who report being employed, and since they engage in care as a result of a care recipient decision, but this variable continues to be not significant.

Column (4) in Table 5 includes recipient age dummies to account for the differences in care recipient needs at different periods of their lives, showing that the effect of the age variable is greater for those who are more than 80 years old, but are not significant for the three intervals considered (under 65 years, between 65 and 80, and over 80 years). The average changes of the probability of devoting different amounts of caring-time produced by the care decision process, have not appreciably varied with respect to the estimation in Column (2).

To study the dynamics among the informal caring-time intervals, the MNLM includes a number of coefficients, which present difficulties of interpretation of the effects on all pairs of outcome categories. We have developed odds-ratio plots, Figure 3 (Long and Freese, 2006), from a model that includes the Recipient Demographic Characteristics, the caregiver Demographic Characteristics and the Help and Decision Variables, using the same model as in Column (2) of Table (5), corresponding with the better-fitting model. In the odds-ratio plot, the independent variables are represented in a separate row. The horizontal axis indicates the relative magnitude of the β coefficients associated with each outcome. The numbers correspond to the outcome

who devote time to care activities every day. Results are consistent with those previously obtained and are available upon request. We have also analysed changes in the informal caring time, using the Spanish Survey of Informal Assistance for the Elderly 1994 (*Encuesta de Apoyo Informal a los Mayores*), obtaining similar results to those obtained using the Spanish Survey of Informal Assistance for the Elderly for the year 2004.

¹²We have also computed some measures of fit, the Pseudo- R^2 , with this being greater in the estimation including the care recipient demographic characteristics, thus showing evidence in favor of the model in Column (2). However this measures of fit always increases as new variables are added, so an adjusted version is also computed, McFadden’s Adj R^2 . As in the previous case, this value is greater for the estimation in Column (2). We have also computed an information measure to compare the estimated models, the Bayesian information criterion, with the more negative value, the better-fitting model. In our case, this corresponds with the Column (2) estimated model.

categories, that is to say, "1" denotes less than two hours of caring-time, which corresponds to the base category, "2" indicates from three to five hours of caring-time, and "3" corresponds to more than five hours of caring time. The additive scale on the bottom axis measures the value of $\beta_{i,m|n}\delta$. The multiplicative scale on the top axis measures $\exp(\beta_{i,m|n})\delta$, which are the odds of a person to devote one amount of caring-time over another with $\delta = 1$. The distance between a pair of outcomes indicates the magnitude of the effect, and the statistical significance is added by drawing a line between categories for which there is no significant coefficient.

As expected, under both the family decision and the care recipient decision variables, it is more likely that the informal caregiver will tend to devote more time to informal care activities, but the care recipient decision is not significant. There are no differences between the informal caring-time decided by the informal caregiver and that determined by the care recipient, as we have hypothesized in our theoretical framework. In Figure 3.3, Help and Decision variables, we observe that the odds of choosing more than five hours, versus less than two, and versus from three to five hours, are 53.5% and 74.9% greater, respectively. In the case of the care recipient decision, we observe that the odds of choosing more than five hours, versus less than two hours, and versus from three to five hours, are greater, with this being not significant.

(Figure 3 about here)

As we have outlined in the descriptive analysis, informal assistance to the care recipient, is considerably focused on people of poorer health status. That variable is the only significant recipient demographic characteristic (see Table 5). The average absolute change in the probability of choosing different amounts of caring-time for a recipient with poorer health status is 0.07. With respect to the other recipient demographic characteristics, we observe in Figure 3.1 that only the age, the level of education and receiving a pension, have a significant impact on the dynamics among the informal caring-time, affecting only the odds of devoting more than five hours versus from three to five hours, and increasing the odds of devoting more hours to informal care activities (see Figure 3.1). An increase of one year in the age of the recipient only significantly decreases by 0.75 times the odds of choosing more than five hours of caring-time, versus from three to five hours. However, this effect is not permanent, since the coefficients of age squared are opposite to the coefficients of age. The odds of choosing from three to five hours, versus more than five hours of caring-time are 0.52 times smaller for illiterate care recipients. For those who receive a pension, we observe the odds of choosing more than five hours, versus from three to five hours, are greater and significant.

As expected, when we consider the informal caregiver's demographic characteristics, being female and a homemaker has larger effects on choosing different amounts of caring-time, making it more likely that the informal caregiver will spend more hours in caring-time (see Figure 3.2). When the caregiver has a degree and is employed, it is more likely that he/she will spend fewer hours on care, with this also occurring when we consider the number of children of the caregiver. The other caregiver demographic characteristics have no impact on the dynamics of informal caring-time.

The gender of the caregiver is only significant in the odds of choosing from three to five hours, versus choosing less than two hours, or versus more than five hours. For caregivers who report having a degree or a medium level of education, the odds of choosing to devote from three to five hours to caring time, versus less than two, are 0.61 and 0.45 times smaller, respectively. When we analyse the work status of the caregivers, we observe that the odds of choosing the two more intensive categories, from three to five hours versus more than five hours, are significant and greater for

those who report spending time in the labour market. The number of children of the caregiver affects the odds of choosing more than five hours, versus less than two hours, with this being 0.84 times smaller and significant.

Finally, for the help and decision variables, as expected, cohabitation with a relative produces the largest effect, cohabitation increases the likelihood that the caregiver will spend more time on caring. This result is maintained if the caregiver is the primary caregiver, making it more likely that the informal caregiver will spend more time on caring. The same occurs if the caregiver is engaged in ADL, that is, more time-consuming activities. Considering the relative of the care recipient, we have found that it is more likely that the spouse of the care recipient will spend more than five hours, versus from three to five hours. The same occurs in the case of the son/daughter, increasing the probability of devoting more than five hours to care. We have also found that other family members' assistance, and informal care, may be complementary, since this assistance is more likely when the informal caregiver spends more than five hours on care. Receiving a monetary compensation is not significant in our estimations.¹³

We have considered necessary to control for the cohabitation status, to avoid overestimating the effect of the care decision process, since those who cohabit tend to spend more time in caring than those who do not cohabit. However, it should be noted that this variable could affect the care decision process. For instance, it could be that the family decision follows from the fact that the recipient is a cohabitant, and thus the family decision follows from the fact that it is more convenient to arrange the care in this way. We are not able to control for that since we have no information about the living arrangements of the potential caregiver, and of the care recipient, when the care decision process took place. The same occurs when we consider other variables, such as the work status of the potential caregivers.

In addition, we have some endogeneity concerns about certain variables included in the analysis such as the decision to cohabit or the work status of the caregiver. Both the decision to cohabit and the work status of the caregiver might be endogenous since the care recipient could cohabit with a relative or the informal caregiver could be employed, depending on the amount of informal caring time required by the care recipient. That could affect our estimates

To tackle these problems, we have considered several sub-samples. First, we have analysed separately those who cohabit with a relative and those who do not. Second, we have studied the informal caregiver subsample of those who devote time to work activities, and the subsample of those who are not employed independently. These do not change our results. Third, we have carried out our estimates without those variables that can generate endogeneity problems, and our results are maintained. However, as stated above, if we exclude those variables that can produce endogeneity problems, we overestimate the effects of the care decision processes.¹⁴

As we have explained above, depending on the care decision process, informal caregivers devote more time to care activities when they do not decide for themselves. As expected, under both the family decision and the care recipient decision variables, it is more likely that the informal caregiver will tend to devote more time to informal care activities, but the care recipient decision is not significant. The family decision variable has the largest effect on the choice of different amounts of caring-time, increasing the odds of devoting more hours to informal care activities, which can

¹³This variable does not include the fraction of residual non-labour income allocated among potential caregivers in a cooperative situation, since the caregiver reports that this is a monetary compensation received from the care recipient.

¹⁴All these results are available upon request.

affect the level of satisfaction derived from the caregiver activity, as we show in the next section.

6 Informal caregiver’s Satisfaction: Empirical Model and Results

6.1 Empirical Model

The care satisfaction information may help to explain informal caregivers’ behaviour, in the same way that job satisfaction information is used to measure the worker’s well-being, that is to say, this may help policy makers to design strategies to increase the satisfaction of informal caregivers.

In the Spanish Survey of Informal Assistance for the Elderly 2004, respondents are asked whether engaging in care provides them with great satisfaction. The question provides the response categories of strongly disagree (SD), disagree (D), neither disagree nor agree (ND), agree (A), and strongly agree (SA). We consider this variable to be representative of the level of satisfaction that the informal caregiver derives from devoting time to care activities, in such a way that we are able to study whether the level of utility that the informal caregiver derives from the time that she devotes to care, $U_{m1,k}^C$, ($k = 1, 3$), is considerably lower than that obtained when she decides on her own the level of informal caring-time, $U_{m1,2}^C$, (see Figure 2).

In order to analyze such responses, ordinal regression models have become common. We compute an ordered logit model (OLM) to analyse the effects that care decision processes have on the level of satisfaction of the informal caregiver, controlling for informal caregiver characteristics, informal caring-time, labour, leisure and health costs.¹⁵ The models for ordinal outcomes account for the different distance between two responses. For example, the distance between strongly agreeing and agreeing might not be the same as the distance between agree and disagree. In this case, although the outcome is discrete, the multinomial logit model would fail to account for the ordinal nature of the dependent variable. The responses are coded 1,2,...,5.¹⁶

The model is built around a latent regression:

$$u_i^* = \mathbf{x}_i' \beta + \varepsilon_i$$

with u^* being the latent variable, ε is an unobserved disturbance term which is assumed to be logistically distributed, and \mathbf{x} is a vector which includes variables to control for the caring-time, the care decision process, the labour, leisure and health costs. We also include as control the demographic characteristics of both the caregiver and the care recipient.

As usual, u^* is unobserved. The relation between the unobserved u_i^* and the observed outcome for i , $u_i = 1, 2, \dots, 5$ can be summarized as follows:

$$\begin{aligned} u_i &= 1 \text{ if } u_i^* \leq \mu_1, \\ &= 2 \text{ if } \mu_1 < u_i^* \leq \mu_2, \\ &\dots \\ &= 5 \text{ if } \mu_4 \leq u_i^* \end{aligned}$$

Thus, when the latent u^* crosses a cutpoint μ , the observed category changes. The μ s are unknown parameters to be estimated with β . We define the ordered logit

¹⁵We do not include these variables in the previous analysis, since they are not exogenous factors in the estimation of the time devoted to care activities. Respondents are asked whether they have incurred labour, leisure and health costs through their participation in informal care activities.

¹⁶We compute the approximate likelihood-ratio test of proportionality of odds across response categories, concluding that this test provides evidence that the parallel regression assumption cannot be rejected at the 5% level.

model as:

$$\ln \phi_{\leq m | > m}(\mathbf{x}) = \ln \frac{\Pr(u \leq m | \mathbf{x})}{\Pr(u > m | \mathbf{x})} \quad \text{for } m = 1, \dots, J - 1$$

For a unit increase in x_i , the odds of an outcome being less than or equal to m is changed by the factor $e^{-\beta_i}$, holding all other variables constant, are computed as:

$$\frac{\phi_{\leq m | > m}(\mathbf{x}, x_i + 1)}{\phi_{\leq m | > m}(\mathbf{x}, x_i)} = e^{-\beta_i}$$

The value of the odds ratio does not depend on the value of m , which is why the parallel regression assumption is also known as the proportional odds assumption. Therefore, we could interpret the odds ratios as follows, for a unit increase in x_i , the odds of a lower outcome compared with a higher outcome are changed by the factor $e^{-\beta_i}$, holding all other variables constant.

6.2 Results

Since the objective of this analysis is to study the effects of care decision processes on the caregiver's satisfaction derived from caregiver activities, Column (1) only includes the caring-time variables, by using the caring-time for less than two hours as the variable of reference. We introduce a dummy variable which takes the value one if the informal caregiver reports devoting time from three to five hours, and another dummy variable which takes the value one if the informal caregiver devote more than five hours. Neither of these variables are significant, even when we introduce as controls the caregiver and the recipient demographic characteristics, Column (4).¹⁷

In Column (2), we not only control for the caring-time, but also introduce the care decision processes, family decision and recipient decision, with the caregiver decision being the variable of reference, to study whether the level of utility that the informal caregiver derives from the time that she devotes to care is considerably lower than that obtained when she decides on her own the level of informal caring-time. We observe that the family decision affects the odds of having more care satisfaction, with this, compared to lower satisfaction, being 0.61 times smaller and significant. Recipient decision increases the odds of having greater care satisfaction, when we consider the whole sample, but this effect is not significant, even after introducing the caregiver and recipient characteristics as controls in Column(5). The variables capturing the caring-time continues to be not significant. We also interact the care decision process variables with the informal caring-time, in such a way that we capture the impact of the caring-time on the informal caregiver's satisfaction, when informal caregivers are obliged, by the family or by the care recipient, to devote time to informal care activities (Column (3) and Column (6) with controls). For those intensive caregivers, that is to say, those who engage in care for more than 5 hours per day, greater satisfaction is less likely than for those non-intensive caregivers, when the informal caregiver devotes time to caregiver activities as a consequence of a family decision, which confirms our theoretical hypothesis, (Figure 2). We show that the odds of having greater care satisfaction compared to lower satisfaction are 0.55 times smaller, or 0.59 times smaller when we introduce the controls.¹⁸

¹⁷For consistency, we have also estimated with different sub-samples to correct for selection biases. We consider that the selection bias may be generated by either age or frequency of the help. To that end, we change the age range and we estimate only with those caregivers who devote time to care activities every day. Results are consistent with those previously obtained and are available upon request. We have not been able to use the Spanish Survey of Informal Assistance for the Elderly (*Encuesta de Apoyo Informal a los Mayores*) 1994, since the informal caregiver satisfaction question is not available.

¹⁸We have also repeated the analysis with different sub-samples, as in the previous section, and we obtain similar results.

However, in previous analyses we have ignored one important aspect which can reduce the level of utility derived from care activities, that is to say, the trade-off among labour, leisure and care activities. As we have explained in our theoretical approach, the time devoted to informal care activities affects positively the utility derived from care activities by way of its impact on the care recipient's ability to perform activities of daily living. However, informal caregivers are time and budget constrained, in such a way that an increase in the time devoted to informal care may produce a decrease in both leisure time and in the time devoted to labour activities. Thus, an increase in the time devoted to caring-time produces labour and leisure costs. We have included these in our caregiver satisfaction estimation, and introduced the possibility that the informal caregiver supports health costs which have not previously been considered in the theoretical framework, but which can affect the utility derived from care activities (Columns from (7) to (12)). Surprisingly, labour cost does not significantly affect the level of care satisfaction.¹⁹ However, for those caregivers who incur leisure and health costs, the odds of having greater satisfaction are about 0.78 and 0.62 times smaller, respectively, and significant. The results suggest that, if informal caregivers feel themselves to be less healthy, the level of caregiver's satisfaction decreases even more than the decrease in the level of satisfaction produced by the leisure costs. These results are maintained for the other variables. For those who report being engaged in care activities by way of a family decision, the odds of having greater satisfaction are smaller, and are even lower for those intensive caregivers who spend more than five hours engaged in care and are obliged by a family decision (Columns (9) and (12)).²⁰

7 Conclusions

This work first studies the time caregivers spend on informal care, controlling for how the care decision process takes place and, second, analyses how that affects the informal caregiver's level of satisfaction. We develop a theoretical framework in which we compare different care decision processes, since we hypothesize that they can generate different caring-time solutions. We show that it is more likely that informal caregivers must devote more time to care activities, when the obligation is a result of the family or the recipient decision, than the caregiver would prefer. The family decision significantly increases the time spent on care by informal caregivers, due to a possible monetary compensation, arising from changes in the fraction of residual non-labour income allocated to the informal caregiver. The impact of the care recipient decision may change, since if we only assume Pareto superior solutions, no differences appear between the caring-time determined by the care recipient, and that determined by the informal caregiver. However, if informal caregivers accept Pareto inferior solutions, the time that they must spend is considerably higher than the time they spend when they decide on their own, or under a family decision.

We use Spanish data to estimate a multinomial logit model which allows us to analyse the effect that care decision processes have on the amount of caring-time. As expected, under the family decision, it is more likely that the informal caregiver will devote more time to informal care activities, which confirms our theoretical hypotheses. The family decision has the greatest effect on the choice of different

¹⁹The effect of this variable changes when we restrict the sample to those informal caregivers of working age, when the odds of having greater care satisfaction are smaller, but not significant.

²⁰The better-fitting model is the one estimated in Column (11), since it is the model with the smaller AIC and Akaike's information criterion, and the greater Pseudo-R² and McFadden's Adj R². If we only compare the Bayesian information criterion (BIC), we conclude that the better-fitting model is that shown in Column (8), which includes the same variables as in Column (11), but does not include the controls.

amounts of caring-time, increasing the odds of devoting more hours to informal care activities. The impact of the care recipient is not significant in the dynamics of informal caring-time.

Why do informal caregivers make these efforts? To design and evaluate formal care policies, a greater understanding of the process by which family members come to assume caring responsibilities is necessary, but the study of informal caregivers' satisfaction can also be a useful tool in designing policies, given that this analysis can be a predictor of informal caregivers behaviour. Results show that, being obligated to spend time on caring activities, by way of the family decision, decreases the probability of greater satisfaction, since, in most cases, informal caregivers must spend more time than they would prefer. The probability of greater satisfaction decreases more for intensive caregivers. The same occurs if they report incurring leisure and health costs. Therefore, one way to increase the satisfaction of informal caregivers who incur health costs, which considerably decrease their level of satisfaction, consists of a greater concern for these caregivers among policy makers.

The care decision process which decreases the probability of greater satisfaction may not be Pareto inferior, since a decrease in the caregivers' satisfaction derived from care activities can be compensated by an increase in the utility that the caregiver obtains from, for example, leisure time or their own private consumption. Policies which attempt to increase the well-being of the informal caregiver may focus not only on the utility derived from care activities, but also on the overall level of utility achieved by the informal caregiver. The satisfaction measure used here only captures the caregivers' satisfaction derived from care activities, which is the only information available, and thus further research should be carry out on the level of utility achieved by the informal caregiver.

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Appendix A. Second Stage Game

Care Recipient Decision

Non-Bargaining Solution

In the first approach, we suppose that the potential caregivers decide separately the private consumption, the labour supply and leisure time.²¹ Formally:

$$\underset{C_{mi,1}, l_{mi,1}, h_{mi,1}}{\text{Max}} \quad U_{mi,1}(C_{mi,1}, l_{mi,1}, A_1)$$

subject to

$$C_{mi,1} \leq Y_{mi} + w_{mi}h_{mi,1}$$

$$A_1 = A_1(A_{1,1}(H_1), A_{2,1}(t_{1,1}, t_{0,1}))$$

$$T_{mi,1} = l_{mi,1} + h_{mi,1} + t_{i,1}$$

with $i = 1, 2$, where Y_{mi} represents non-labour income, w_{mi} is the wage rate, $h_{mi,1}$ indicates the hours spent in paid work, and $T_{mi,1}$ represents the total time the agent mi can devote to care and non-care activities. We assume that the caregiver is the agent $m1$, therefore $t_{2,j}$ is equal to zero.

The associated first-order conditions imply that, at the equilibrium point, the individual's marginal rate of substitution (MRS) between individual i 's leisure and private consumption is equal to the wage rate:

$$\frac{\partial U_{mi,1} / \partial l_{mi,1}}{\partial U_{mi,1} / \partial C_{mi,1}} = w_{mi}, i = 1, 2. \quad (2)$$

Let $\hat{l}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$, $\hat{h}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$ and $\hat{C}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$, $i = 1, 2$, be the solution of this stage.

From the envelope theorem, and given that $T_{mi,1} = l_{mi,1} + h_{mi,1} + t_{i,1}$ and (2), we may obtain in equilibrium that $\frac{\partial \hat{h}_{m1,1}}{\partial t_{1,1}} < 0$, that is to say, an increase in the time devoted to care activities generates a decrease in the time devoted to labour activities. Given that $T_{mi,1} = l_{mi,1} + h_{mi,1} + t_{i,1}$, and supposing that $T_{m1,1}$ is fixed, if $\frac{\partial \hat{h}_{m1,1}}{\partial t_{1,1}} = -1$, the leisure time does not change. However, when $\frac{\partial \hat{h}_{m1,1}}{\partial t_{1,1}} < -1$, we can observe that $\frac{\partial \hat{l}_{m1,1}}{\partial t_{1,1}} \leq 0$, that is to say, an increase in the time devoted to care activities can, or not, increase the time devoted to leisure.²²

In this case, we have not considered a corner solution, that is to say, we do not consider that the agent i does not devote time to the labour market, and thus it is possible that this agent does not perceive the labour cost that the time devoted to care activities can produce.

A Collective Approach

In the second approach, the caregiver can be the daughter of the disabled person, and the other potential caregiver can be her husband. Considering the usual strategy of collective models (Chiappori 1988, 1992), the decisions made by the household are Pareto-efficient. This is equivalent to assuming that household allocations are determined as solutions to the problem:

²¹For instance, a mother and her daughter, who lives independently. Pezzin and Schone (1999, 2002) explain that when the recipient and the family members co-reside, their interactions are cooperative, but when they live independently there is no bargaining solution for the game.

²²For the non-caregiver, $t_{1,1}$ does not affect her time constraint. However, her utility functions depend positively on that argument. Therefore, we can observe that an increase in the time devoted to care activities, $t_{1,1}$, can generate an increase in the time devoted to the labour market. That is to say, given that the changes in her marginal utility of consumption, when the ability to perform activities of her parent, weighted for her wage rate, is greater than the changes in her marginal utility of leisure when the ability to perform activities of her parent changes, the time devoted to market activities increases, which diminishes the time devoted to leisure.

$$\begin{aligned} \max_{C_{m1,1}, l_{m1,1}, C_{m2,1}, l_{m2,1}} \Psi(C_{m1,1}, l_{m1,1}, C_{m2,1}, l_{m2,1}, A_1; \lambda) &= \lambda U_{m1,1}(C_{m1,1}, l_{m1,1}, A_1) + \\ &+ (1 - \lambda) U_{m2,1}(C_{m2,1}, l_{m2,1}, A_1) \end{aligned} \quad (3)$$

subject to

$$C_{m1,1} + C_{m2,1} \leq Y_m + w_{m2} h_{m2,1} + w_{m1} h_{m1,1}$$

$$A_1 = A_1(A_{1,1}(H_1), A_{2,1}(t_{1,1}, t_{0,1}))$$

$$T_{m1,1} = l_{m1,1} + h_{m1,1} + t_{1,1}$$

$$T_{m2,1} = l_{m2,1} + h_{m2,1}$$

where $Y_{m1} + Y_{m2} = Y_m$, the overall budget constraint is represented by

$$C_{m1,1} + C_{m2,1} \leq Y_m + w_{m1} (T_{m1,1} - l_{m1,1} - t_{1,1}) + w_{m2} (T_{m2,1} - l_{m2,1})$$

We assume that Ψ is a strictly concave function of $(C_{m1,1}, l_{m1,1}, C_{m2,1}, l_{m2,1})$ and has separability properties. It is possible to obtain some marginal rates of substitution which do not depend on λ , that is, the Pareto weight (see Blundell et al., 2005).

It is possible to solve the household problem (3) as a two-stage process. At stage 1, both spouses agree in determining the distribution of the residual non-labour income between them. At stage 2, both spouses choose their level of consumption, leisure time, and labour supply. Given that $\hat{l}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1})$, $\hat{h}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1})$ and $\hat{C}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1})$ $i = 1, 2$ represent the solution of the household problem, we can define ρ_{mi} as:

$$\begin{aligned} \rho_{mi}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}) &= w_{mi} \hat{l}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}) + \\ &+ \hat{C}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}) + w_{mi}(t_{i,1} - T_{mi,1}), \quad i = 1, 2. \end{aligned}$$

where $t_{2,1} = 0$. We suppose that both agents are potential caregivers, but finally there is only one caregiver, the agent $m1$, with ρ_{m1} and ρ_{m2} representing the sharing rule, which is the fraction of residual non-labour income allocated to the spouse mi . Both spouses share what is left after private consumption. Hence ρ_{mi} can be positive or negative. If we aggregate ρ_{m1} and ρ_{m2} :

$$\rho_{m1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}) + \rho_{m2}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}) = Y_m$$

The functions $\hat{l}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1})$, $\hat{C}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1})$ and $\hat{h}_{mi,1}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1})$ can be obtained from the following maximization problem:

$$\max_{C_{mi,1}, l_{mi,1}, h_{mi,1}} U_{mi,1}(C_{mi,1}, l_{mi,1}, A_1)$$

subject to

$$C_{mi,1} \leq \rho_{mi}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}) + w_{mi} h_{mi,1}$$

$$A_1 = A_1(A_{1,1}(H_1), A_{2,1}(t_{1,1}, t_{0,1}))$$

$$T_{mi,1} = l_{mi,1} + h_{mi,1} + t_{i,1}$$

with $i = 1, 2$. Therefore, the overall budget constraint is

$$C_{mi,1} \leq \rho_{mi}(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}) + w_{mi}(T_{mi,1} - l_{mi,1} - t_{i,1})$$

The first-order conditions imply that the individual's marginal rate of substitution between individual i 's leisure and private consumption is equal to the wage rate in equilibrium. We study the effects that an increase in $t_{1,1}$ has on both the hours spent in market work and the leisure time for both members of the family, obtaining results similar to those found in the non-bargaining solution. However, the changes in the labour supply when caring-time changes also depend on the changes produced in the sharing rule. Given $\frac{\partial \rho_{m1}}{\partial t_{1,1}} > 0$, an increase in the time devoted to informal care can generate labour cost, $\frac{\partial \hat{h}_{m1,1}}{\partial t_{1,1}} < 0$, under the same conditions as in the non-bargaining solution. For leisure time, and given that $T_{mi,1} = l_{mi,1} + h_{mi,1} + t_{i,1}$, we observe

similar results as in the non-bargaining solution. We also see that the impact of $t_{1,1}$ on $\hat{h}_{mi,1}$ is more likely to be greater, that is to say, the changes in the labour supply are more likely to be greater than in the non-bargaining solution, which is not conditioned on the changes in the sharing rule. When the fraction of residual non-labour income allocated to the informal caregiver $m1$, ρ_{m1} , considerably increases when the time devoted to caring-time increases, that is, agent $m2$ compensates $m1$ for devoting time to care activities, we find that the hours devoted to the labour market decrease more than in the non-bargaining approach.²³

Informal caregiver Decision and Family Decision

We now consider that the care recipient accepts the decision taken by the informal caregiver, or the family decision, in the first stage of the game. Therefore, $t_{1,2}$ is fixed, which is determined in the first stage of the game, although A_2 is not fixed.

Therefore, the care recipient decides the optimum amount of hours of formal care and the level of her own private consumption. Assuming that $n = 1$, the care recipient optimization problem is:

$$\begin{aligned} & \max_{C_{r,2}, t_{0,2}} U_{r,2}(C_{r,2}, A_2) \\ & \text{subject to} \\ & A_2 = A_2(A_{1,2}(H_2), A_{2,2}(t_{1,2}, t_{0,2})) \\ & C_{r,2} + Pt_{0,2} \leq Y_{r,2} \\ & t_{1,2} + t_{0,2} = T_{r,2} \end{aligned}$$

with $T_{r,2}$ being the total time needed to perform daily living activities, and P the price of the formal care, which we assume equal to one. Given that $t_{1,2}$ is fixed, and that $T_{r,2}$ is also fixed, from $t_{1,2} + t_{0,2} = T_{r,2}$, we can easily obtain $\bar{t}_{0,2}$, that is, the formal caring-time in equilibrium. It is straightforward to obtain the level of private consumption in equilibrium, from the budget constraint, $\bar{C}_{r,2}$. Therefore, there is no maximization process due to the constraint exhibited by $t_{1,2}$. It is more likely that the levels of $\bar{C}_{r,2}$ and $\bar{t}_{0,2}$ are not the optimum solution for the maximization problem of the disabled person.

Appendix B. First Stage Game

Care Recipient Decision

In this game, it is the care recipient who decides the hours of informal and formal care, with this choice being based on the recipient's maximization problem:

$$\begin{aligned} & \max_{C_{r,1}, t_{0,1}, t_{1,1}} U_{r,1}(C_{r,1}, A_1) \\ & \text{subject to} \\ & A_1 = A_1(A_{1,1}(H_1), A_{2,1}(t_{1,1}, t_{0,1})) \\ & C_{r,1} + t_{0,1} \leq Y_{r,1} \\ & t_{1,1} + t_{0,1} = T_{r,1} \end{aligned}$$

From the first order condition, we obtain:

$$\frac{\partial U_{r,1}}{\partial C_{r,1}} = \frac{\partial U_{r,1}}{\partial A_1} \left[\frac{\partial A_1}{\partial t_{1,1}} - \frac{\partial A_1}{\partial t_{0,1}} \right] \quad (4)$$

²³For the non-caregiver, and given that $t_{1,1}$ does not affect his time constraint. However, his utility function depends positively on this argument. Therefore, we can observe that an increase in the time devoted to care activities $t_{1,1}$ can generate an increase in the time devoted to the labour market, depending on the sign of the relationship between the sharing rule and the caring-time. If this relationship is positive, and given that the changes in his marginal utility of consumption when the ability to perform activities of the disabled person, weighted for his wage rate, is greater than the changes in his marginal utility of leisure when A_1 changes. This produces an increase in the time devoted to market activities, which diminishes the time devoted to leisure.

At the equilibrium point, the individual's marginal rate of substitution between consumption and the care recipient's ability to perform activities of daily living is equal to the difference between the changes produced in the ability to perform activities of daily living of the care recipient, when the informal caring-time changes and the changes produced in the same ability when the formal caring-time changes.

From here, and given the time and budget constraints, we can determine the functions of $\hat{t}_{1,1}(T_{r,1}, Y_{r,1}, H_1)$, $\hat{C}_{r,1}(T_{r,1}, Y_{r,1}, H_1)$, and $\hat{t}_{0,1}(T_{r,1}, Y_{r,1}, H_1)$.

Informal caregiver Decision - A Non-Bargaining Solution

In the second game, the caregiver decides the hours to devote to care activities by herself. We maintain the assumption that even though both agents are potential caregivers, only one is going to be the caregiver, in our case agent $m1$. The maximization problem for each agent mi is represented by:

$$\begin{aligned} & \underset{C_{mi,2}, l_{mi,2}, h_{mi,2}, t_{i,2}}{\text{Max}} && U_{mi,2}(C_{mi,2}, l_{mi,2}, A_2) \\ & \text{subject to} && \\ & C_{mi,2} &\leq & Y_{mi} + w_{mi}h_{mi,2} \\ & A_2 &= & A_2(A_{1,2}(H_1), A_{2,2}(t_{1,2}, t_{0,2})) \\ & T_{mi,2} &= & l_{mi,2} + h_{mi,2} + t_{i,2} \\ & && \text{with } i = 1, 2, t_{2,j} \text{ is equal to zero.}^{24} \end{aligned}$$

For the non-caregiver, we obtain similar behaviour to process 1, in the non-bargaining approach. Therefore, the behaviour of the non-caregiver is not conditioned by the stage of participation.

The informal caregiver decides individually the private consumption, the labour supply, the leisure time and the informal caring-time. From the first order condition, and using the envelope theorem, we observe:

$$\frac{\partial U_{mi,2}/\partial l_{mi,2}}{\partial U_{mi,2}/\partial C_{mi,2}} = w_{mi}, i = 1, 2. \quad (5)$$

and:

$$\frac{\partial U_{m1,2}}{\partial C_{m1,2}} w_{m1} = \frac{\partial U_{m1,2}}{\partial A_2} \frac{\partial A_2}{\partial t_{1,2}} \quad (6)$$

Let $\bar{C}_{mi,2}(w_{mi}, Y_{mi}, t_{0,2}, H_2, T_{mi,2})$, $\bar{l}_{mi,2}(w_{mi}, Y_{mi}, t_{0,2}, H_2, T_{mi,2})$, $\bar{h}_{mi,2}(w_{mi}, Y_{mi}, t_{0,2}, H_2, T_{mi,2})$ and $\bar{t}_{1,2}(w_{mi}, Y_{mi}, t_{0,2}, H_2, T_{mi,2})$ be the solutions of the above maximization problem.

Family Decision - Collective Approach

In the third game, we model the family decision as an intra-family bargaining model, following the collective approach (Chiappori, 1988, 1992), since this takes into account the intra-family allocation of resources.

As we have explained above, in the collective approach, allocations are determined by solving the following maximization problem:

$$\begin{aligned} & \max_{C_{m1,3}, l_{m1,3}, C_{m2,3}, l_{m2,3}, t_{1,3}} \Psi(C_{m1,3}, l_{m1,3}, C_{m2,3}, l_{m2,3}, t_{1,3}; \lambda) = \lambda U_{m1,3}(C_{m1,3}, l_{m1,3}, A_3) + \\ & \quad + (1 - \lambda) U_{m2,3}(C_{m2,3}, l_{m2,3}, A_3) \end{aligned} \quad (7)$$

²⁴For example, a mother, agent $m1$, who decides for herself to care for her disabled husband, and the other member of the family is represented by her daughter.

where $Y_{m1} + Y_{m2} = Y_m$, subject to the overall budget constraint and the ability of the care recipient to perform daily living activities:

$$\begin{aligned} C_{m1,3} + C_{m2,3} &\leq Y_m + w_{m1}(T_{m1,3} - l_{m1,3} - t_{1,3}) + w_{m2}(T_{m2,3} - l_{m2,3}) \\ A_3 &= A_3(A_{1,3}(H_3), A_{2,3}(t_{1,3}, t_{0,3})) \end{aligned}$$

The solution of the household problem can be obtained using a two-stage process. First, we determine the distribution of the residual non-labour income, ρ_{mi} :

$$\begin{aligned} \rho_{mi}(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}) &= w_{mi} l_{mi,1}^*(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}) + \\ &+ C_{mi,3}^*(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}) + w_{mi}(-T_{mi,3}), i = 1, 2. \\ &\text{with } l_{mi,3}^*(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}), l_{mi,3}^*(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}) \\ &\text{and } C_{mi,3}^*(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}), i = 1, 2 \text{ indicating the solution of the} \\ &\text{household problem.} \end{aligned}$$

Aggregating ρ_{m1} and ρ_{m2} , we obtain:

$$\begin{aligned} \rho &= \rho_{m1}(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}) + \rho_{m2}(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}) = \\ &= Y_m - w_{m3} t_{1,3}^*(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}) \end{aligned}$$

Second, both spouses choose their level of consumption, leisure time, and labour supply. As Blundell et al. (2005) show, we can obtain the optimum values of ρ_{m1} , ρ_{m2} and $t_{1,3}$ solving:

$$\begin{aligned} \max_{\rho_{m1}, \rho_{m2}, t_{1,3}} \quad &\lambda V_{m1}(w_{m1}, \rho_{m1}, t_{1,3}) + (1 - \lambda) V_{m2}(w_{m2}, \rho_{m2}, t_{1,3}) \\ \text{subject to} \quad & \end{aligned}$$

$$\rho_{m1} + \rho_{m2} = Y_m - w_{m1} t_{1,3}$$

with $V_{mi}(w_{mi}, \rho_{mi}, t_{1,3})$ being the individual indirect utilities.

The solution gives:

$$\frac{\frac{\partial V_{m1}}{\partial t_{1,3}}}{\frac{\partial V_{m1}}{\partial \rho}} + \frac{\frac{\partial V_{m2}}{\partial t_{1,3}}}{\frac{\partial V_{m2}}{\partial \rho}} = \frac{w_{m1} \frac{\partial V_{m1}}{\partial \rho_{m1}}}{\frac{\partial V_{m1}}{\partial \rho}} \quad (8)$$

The aggregate individual marginal willingness of agent $m1$ to devote time to care is equal to the marginal willingness to increase the distribution of the residual non-labour income of agent $m1$, weighted by the wage rate of agent $m1$. ■

Table 4: SUMMARY STATISTICS

	All		Caring-Time < 2		Caring-Time 3 – 5		Caring-Time > 5	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Caregiver Demographic Characteristics								
Age	52.604	(13.723)	46.958	(12.931)	49.411	(12.997)	55.324	(13.500)
Female	0.852	(0.356)	0.816	(0.389)	0.914	(0.280)	0.836	(0.371)
Illiterate	0.140	(0.347)	0.026	(0.160)	0.079	(0.270)	0.194	(0.396)
Low Education	0.403	(0.491)	0.326	(0.470)	0.435	(0.497)	0.410	(0.492)
Medium Education	0.373	(0.484)	0.489	(0.501)	0.394	(0.489)	0.335	(0.472)
High Education	0.084	(0.277)	0.158	(0.366)	0.092	(0.290)	0.061	(0.240)
Homemaker	0.457	(0.498)	0.284	(0.452)	0.462	(0.499)	0.499	(0.500)
Employed	0.282	(0.450)	0.453	(0.499)	0.363	(0.482)	0.206	(0.405)
Spouse	0.147	(0.354)	0.058	(0.234)	0.072	(0.259)	0.199	(0.400)
Son/Daughter	0.594	(0.491)	0.568	(0.497)	0.582	(0.494)	0.605	(0.489)
Married	0.774	(0.419)	0.742	(0.439)	0.788	(0.410)	0.776	(0.417)
< 10000 Inhabitants	0.180	(0.385)	0.153	(0.361)	0.154	(0.362)	0.198	(0.399)
10000 – 100000 Inhabitants	0.340	(0.474)	0.274	(0.447)	0.353	(0.479)	0.353	(0.478)
> 100,000 Inhabitants	0.479	(0.500)	0.574	(0.452)	0.493	(0.501)	0.449	(0.498)
N Children	0.981	(1.023)	1.337	(1.142)	1.154	(1.036)	0.821	(0.950)
Recipient Demographic Characteristics								
Age	80.493	(8.235)	79.037	(7.884)	80.596	(7.631)	80.828	(8.519)
Female	0.701	(0.458)	0.737	(0.442)	0.688	(0.464)	0.696	(0.460)
Illiterate	0.579	(0.494)	0.442	(0.498)	0.534	(0.500)	0.632	(0.483)
Low Education	0.363	(0.481)	0.463	(0.500)	0.394	(0.489)	0.326	(0.469)
Medium Education	0.037	(0.189)	0.047	(0.213)	0.041	(0.199)	0.033	(0.178)
High Education	0.021	(0.142)	0.047	(0.213)	0.031	(0.173)	0.009	(0.097)
Poor Health Status	0.954	(0.209)	0.953	(0.213)	0.925	(0.264)	0.966	(0.181)
Pension	0.926	(0.262)	0.911	(0.286)	0.911	(0.285)	0.936	(0.245)
Married	0.331	(0.471)	0.326	(0.470)	0.305	(0.461)	0.343	(0.475)
Help and Decision Variables								
Caring-time < 2 hours	0.156	(0.363)						
Caring-time 3 – 5 hours	0.240	(0.427)						
Caring-time > 5 hours	0.605	(0.489)						
IADL	0.966	(0.182)	0.932	(0.253)	0.993	(0.083)	0.963	(0.188)
ADL	0.742	(0.437)	0.516	(0.501)	0.682	(0.467)	0.825	(0.380)
Primary Caregiver	0.825	(0.380)	0.621	(0.486)	0.753	(0.432)	0.906	(0.292)
Permanent Help	0.752	(0.432)	0.716	(0.452)	0.658	(0.475)	0.799	(0.401)
Frequency	0.035	(0.185)	0.063	(0.244)	0.024	(0.153)	0.033	(0.178)
Relative Cohabitation	0.561	(0.496)	0.253	(0.436)	0.387	(0.488)	0.710	(0.454)
Travel Time	9.441	(31.345)	13.426	(20.704)	13.079	(27.975)	6.973	(34.511)
Monetary Compensation	0.322	(0.468)	0.268	(0.444)	0.298	(0.458)	0.346	(0.476)
Formal Help	0.163	(0.370)	0.237	(0.426)	0.158	(0.365)	0.147	(0.354)
Family Member Help	0.512	(0.500)	0.416	(0.494)	0.510	(0.501)	0.537	(0.499)
Caregiver Decision	0.619	(0.486)	0.663	(0.474)	0.654	(0.476)	0.594	(0.491)
Family Decision	0.325	(0.469)	0.253	(0.436)	0.291	(0.455)	0.357	(0.479)
Recipient Decision	0.056	(0.230)	0.084	(0.278)	0.055	(0.228)	0.049	(0.216)
Observations	1219		190		292		737	

Source: Spanish Survey of Informal Assistance for the Elderly (IMSERSO).

Table 5: AVERAGE ABSOLUTE CHANGE IN THE PROBABILITY OF CHOOSING DIFFERENT AMOUNTS OF CARING-TIME^{1,2,3}

	(1)	(2)	(3)	(4)
Recipient Demographic Characteristics				
Age		0.2886	0.2906	
Age Recipient < 65				0.4480
Age Recipient 65 – 80				0.6593
Age Recipient > 80				0.6639
Age Recipient Square		0.2823	0.2844	0.3265
Female		0.0358	0.0351	0.0363
Illiterate		0.0911	0.0924	0.0899
Low Education		0.0411	0.0414	0.0402
Married		0.0076	0.0076	0.0088
Poor Health Status		0.0739*	0.0731*	0.0704*
Pension		0.0750	0.0751	0.0771
Caregiver Demographic Characteristics				
Age	0.0290	0.0299	0.0316	0.0290
Age Square	0.0313	0.0330	0.0356	0.0303
Female	0.0655**	0.0624**	0.0625**	0.0614**
Medium Education	0.0309*	0.0299	0.0299	0.0299
High Education	0.0585*	0.0446*	0.0455*	0.0468*
Married	0.0244	0.0195	0.0178	0.0179
N Children	0.0180	0.0183	0.0182	0.0186
< 10000 Inhabitants	0.0288	0.0177	0.0176	0.0180
10000 – 100000 Inhabitants	0.0194	0.0139	0.0155	0.0149
Homemaker	0.0475**	0.0482**	0.0493**	0.0490**
Employed	0.0984***	0.0852**	0.0920**	0.0853**
Help and Decision Variables				
Instrumental Activities (IADL)	0.1476***	0.1475***	0.1478***	0.1473***
Personal Activities (ADL)	0.1328***	0.1280***	0.1288***	0.1280***
Primary Caregiver	0.1439***	0.1408***	0.1413***	0.1407***
Permanent Help	0.0520***	0.0508***	0.0508***	0.0499***
Frequency	0.1253**	0.1210**	0.1250**	0.1209**
Relative Cohabitation	0.2083***	0.2026***	0.2044***	0.2030***
Travel Time	0.0113	0.0119	0.0122	0.0114
Spouse	0.0660	0.0831	0.0826	0.0852
Son/Daughter	0.0549*	0.0596*	0.0608*	0.0601*
Monetary Compensation	0.0142	0.0162	0.0158	0.0162
Formal Help	0.0087	0.0070	0.0067	0.0053
Family Member Help	0.0392*	0.0385*	0.0372*	0.0388*
Family Decision	0.0821***	0.0758***	0.0652**	0.0759***
Recipient Decision	0.0445	0.0450	0.0637	0.0433
Work x Family Decision			0.0307	
Work x Recipient Decision			0.0709	
Observations	1219	1219	1219	1219
Pseudo- R^2	0.1771	0.1870	0.1883	0.1882
McFadden's Adj R^2	0.127	0.132	0.125	0.125
BIC	-6323	-6414	-6297	-6297

Notes: ¹ Source: Spanish Survey of Informal Assistance for the Elderly (IMSERSO). ² For binary variables, it is computed the average of the absolute values of the discrete changes across all the outcome categories. For the rest of the variables, we have computed the average absolute change of one standard deviation centered on the base values. ³ The hypothesis that x_i does not affect the dependent variable is tested here, $H_0 : \beta_{i,1|b} = \dots = \beta_{i,J|b}$ where b is the base category. Because $\beta_{i,b|b}$ is necessarily 0, the hypothesis imposes constraints on $J - 1$ parameters. This hypothesis is tested with LR test. ***Significant at the 1% level **Significant at the 5% level *Significant at the 10 % level

Table 6: ESTIMATION OF INFORMAL CAREGIVER'S SATISFACTION^{1,2,3}

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Caring Time 3 – 5	0.834 (0.148)	0.837 (0.149)	1.005 (0.224)	0.872 (0.160)	0.869 (0.160)	1.090 (0.251)	0.921 (0.166)	0.912 (0.165)	1.127 (0.255)	0.942 (0.175)	0.932 (0.173)	1.173 (0.273)
Caring Time > 5	1.062 (0.166)	1.102 (0.173)	1.056 (0.209)	1.007 (0.175)	1.050 (0.183)	1.067 (0.231)	1.344* (0.222)	1.362* (0.226)	1.316 (0.270)	1.232 (0.222)	1.266 (0.229)	1.274 (0.282)
Family Decision		0.606*** (0.071)	0.697** (0.103)		0.670*** (0.082)	0.741** (0.113)		0.627*** (0.074)	0.734** (0.109)		0.690*** (0.085)	0.776* (0.119)
Recipient Decision		0.974 (0.239)	1.359 (0.473)		1.139 (0.292)	1.683 (0.608)		0.942 (0.233)	1.301 (0.456)		1.125 (0.291)	1.631 (0.599)
Caring time 3 – 5 x Family Decision			0.994 (0.348)			1.212 (0.434)		0.980 (0.343)				1.138 (0.408)
Caring time 3 – 5 x Recipient Decision			0.576 (0.366)			0.524 (0.344)		0.628 (0.403)				0.584 (0.388)
Caring time > 5 x Family Decision			0.552** (0.157)			0.590* (0.169)		0.518** (0.147)				0.569** (0.164)
Caring time > 5 x Recipient Decision			0.451 (0.262)			0.390 (0.232)		0.441 (0.257)				0.388 (0.232)
Labour Cost							1.090 (0.127)	1.113 (0.130)	1.103 (0.129)	1.020 (0.128)	1.033 (0.130)	1.024 (0.129)
Leisure Cost							0.738** (0.090)	0.760** (0.093)	0.755** (0.093)	0.762** (0.097)	0.777** (0.100)	0.776** (0.100)
Health Cost							0.632*** (0.075)	0.638*** (0.076)	0.633*** (0.076)	0.611*** (0.076)	0.616*** (0.077)	0.617*** (0.077)
Caregiver Demographic Characteristics	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Recipient Demographic Characteristics	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
μ_1	-4.183*** (0.271)	-4.356*** (0.275)	-4.344*** (0.292)	-4.522*** (0.798)	-4.603*** (0.800)	-4.680*** (0.811)	-4.451*** (0.278)	-4.592*** (0.282)	-4.583*** (0.298)	-4.346*** (0.805)	-4.425*** (0.807)	-4.497*** (0.818)
μ_2	-2.665*** (0.174)	-2.833*** (0.181)	-2.819*** (0.206)	-2.988*** (0.771)	-3.066*** (0.773)	-3.139*** (0.785)	-2.927*** (0.186)	-3.065*** (0.192)	-3.052*** (0.215)	-2.807*** (0.779)	-2.883*** (0.780)	-2.949*** (0.792)
μ_3	-1.371*** (0.148)	-1.528*** (0.155)	-1.51*** (0.183)	-1.659** (0.764)	-1.728** (0.766)	-1.795** (0.779)	-1.622*** (0.160)	-1.748*** (0.166)	-1.731*** (0.192)	-1.466* (0.772)	-1.533** (0.773)	-1.595** (0.785)
μ_4	0.283** (0.142)	0.148 (0.148)	0.172 (0.177)	0.058 (0.762)	0.004 (0.764)	-0.056 (0.776)	0.061 (0.153)	-0.048 (0.158)	-0.023 (0.185)	0.277 (0.771)	0.223 (0.772)	0.168 (0.783)
Observations	1186	1186	1186	1186	1186	1186	1186	1186	1186	1186	1186	1186
Pseudo-R ²	0.001	0.008	0.01	0.021	0.026	0.028	0.01	0.016	0.018	0.03	0.034	0.036
McFadden's Adj R ²	-0.003	0.002	0.001	0.006	0.008	0.008	0.004	0.008	0.008	0.012	0.014	0.014
AIC	2.445	2.433	2.435	2.425	2.418	2.419	2.428	2.418	2.419	2.409	2.404	2.405
BIC	-5464	-5469	-5446	-5402	-5400	-5378	-5469	-5471	-5449	-5406	-5402	-5380

Notes: ¹ Odds ratio and Standard errors in parenthesis ² μ_i , $i = 1, \dots, 4$ are the cutpoints. ³ ***Significant at the 1% level **Significant at the 5% level *Significant at the 10 % level

Figure 1.

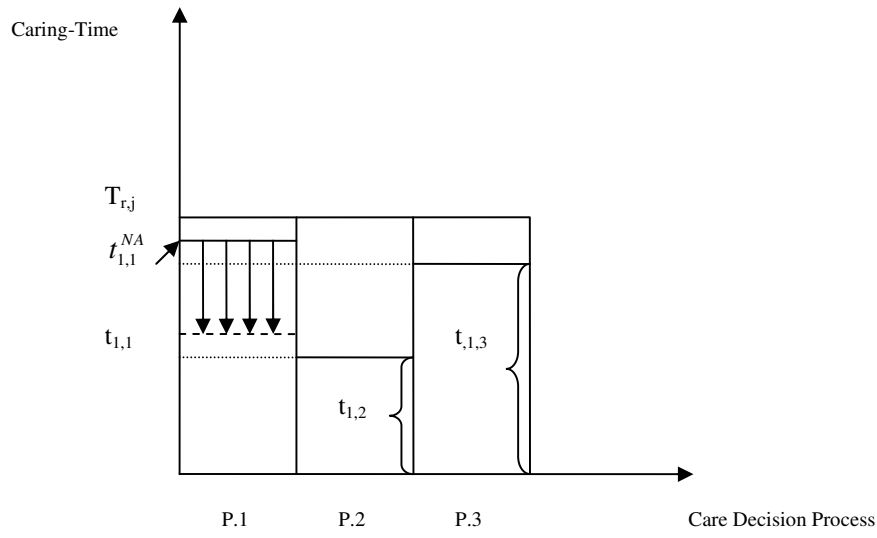


Figure 2.

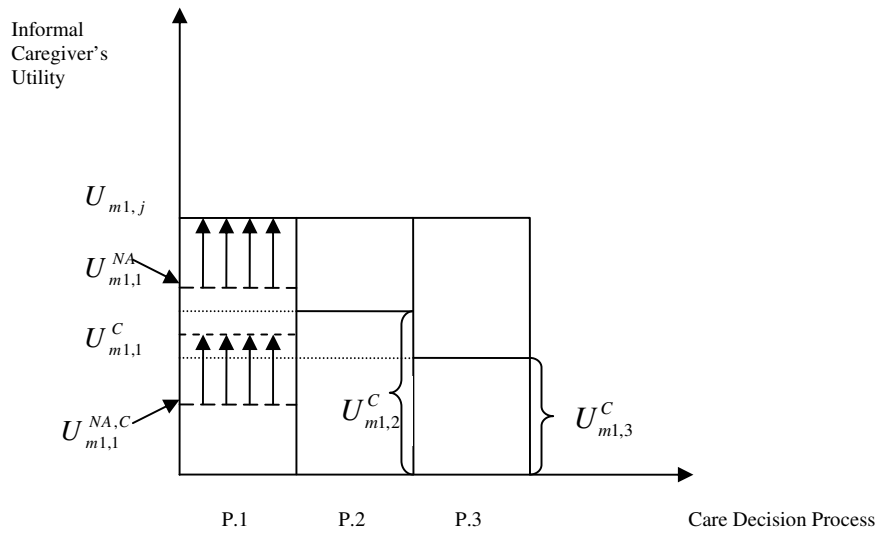


Figure 3

Figure 3.1 Recipient Demographic Characteristics

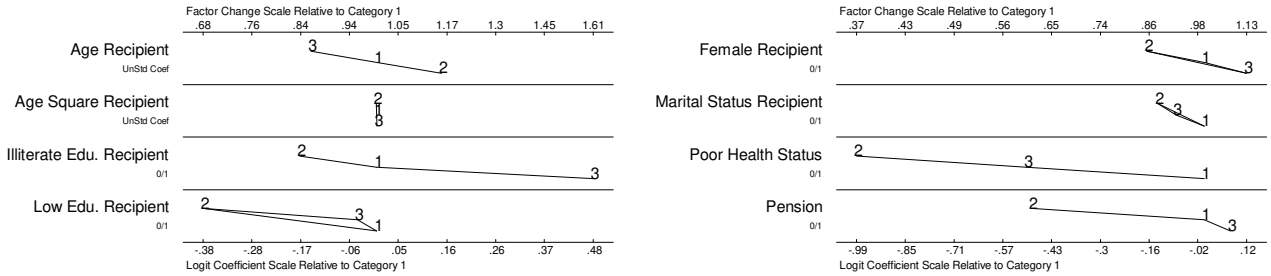


Figure 3.2 Caregiver Demographic Characteristics

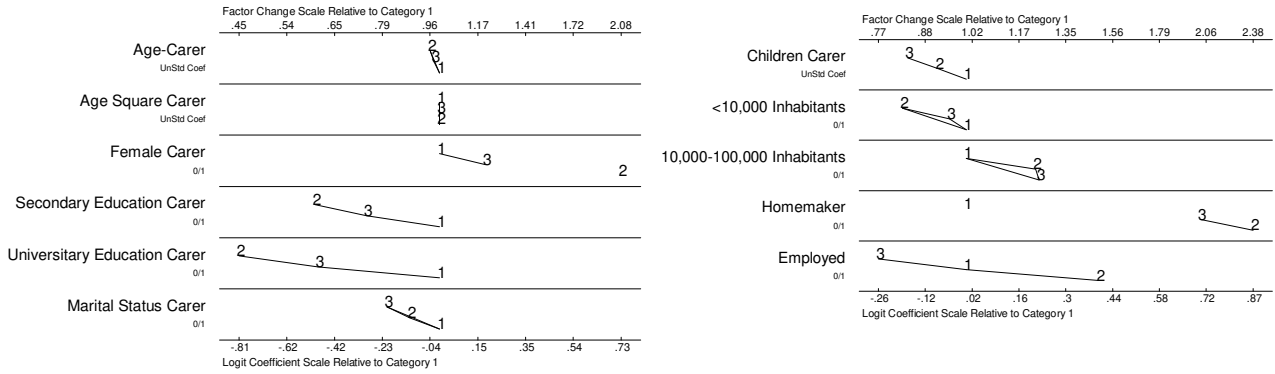


Figure 3.3 Help and Decision Variables

