Do Informal Carers support Labour, Leisure and Health Costs? The Effects of Care Arrengements on Informal Carers' Lives.*

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Abstract

In this work, we study why individuals engage in care giving and how care arrangements affect informal caring-time and labour and leisure costs. First, we develop a theoretical model in which we explain how the care decision process has taken place. We study empirically the factors that determine informal caregivers' caring-time. Then, we study whether labour and leisure costs supported by informal carers must be analysed separately, using two comparable Spanish samples, for the years 1994 and 2004. We find that, in 1994, both labour and leisure costs can be identified separately. However, in 2004, the leisure cost must be treated as endogenous in the labour cost estimation. We also find that the impact of care activities on labour cost is greater after controlling for the care decision process. This results in inefficient outcomes in 1994, but not in 2004.

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1 Introduction

It is well-documented in the economic literature that even in the short term, informal carers are potentially more exposed to labour market disadvantage, and to the apparent adverse effects that the informal care activities produce in the form of forgone earnings. Existing studies of the supply of informal care mainly analyse the influence of informal care responsibilities on the labour supply of the caregivers, relative to non-caregivers (Carmichael and Charles, 1998, 2003, Heitmueller, 2007). However, they do not consider the importance of analysing labour and leisure costs jointly, since informal care introduces an additional time constraint on the individual, which complicates the usual trade-off between leisure and work, or leisure and consumption.

Recently, as Spillman and Pezzin (2000) explain, full-time workers have maintained or even increased their efforts as primary caregivers. Therefore, many informal carers combine both work and caring responsibilities. Why do they make these efforts? Is there a minimum level of informal care below which no costs are supported? For a government concerned with bringing people back into the labour market, it is necessary to identify the factors which determine the existence of labour cost for the caregivers, rather than studying the differences between caregivers and non-caregivers. If the caregiver does not consider that she supports labour cost as a consequence of devoting time to care activities, she is unlikely to return to the labour market or to increase the time she devotes to labour activities.

One aspect which the literature has not devoted particular interest to, to date, for lack of data on the care decision process, is the effects that care arrangements have on labour and leisure costs in empirical analysis. The provision of care is often the product of numerous individual and joint decisions by family members (Heitmueller, 2007). Does the care decision process increase labour and leisure costs? The preferences of the care recipient may differ from those of the other members of the family. For example, parents may prefer receiving care from their daughter as primary caregiver, which can result in the daughter spending less time than she would like on leisure or labour activities.

In this paper, we try to understand better why individuals engage in care giving and how care arrangements affect informal caring-time and labour and leisure costs. First, we develop a theoretical model in which we explain how the care decision process has taken place. Ignoring the care decision process may lead to inefficient informal care provision. Then, we study empirically the factors that determine informal caregivers' caring-time. We extend previous studies by distinguishing between labour and leisure costs, and also by considering how the care decision process takes place, and the extent to which carers consider they are bearing more labour and leisure costs.

This paper proceeds as follows: Section 2 briefly reviews the literature regarding household decision-making. Section 3 develops the theoretical model.. Section 4 outlines the data used in the analysis. Section 5 outlines our empirical specification and main results. Section 6 shows our main conclusions.

2 Theoretical Background

Those papers that focus on analyzing ways of modeling the care decision-making process vary along several dimensions analysing which family members participate in the decision-making process and which types of care and/or living arrangements are considered. Most of the existing theoretical models involve parent-child relationship in which only one child is considered in the decision-making process. For example, 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) and Pezzin et al. (2007).

More recent works have 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 a game theoretic model of family bargaining to analyse long-term care, the former by way of a non-cooperative game in two stages. In this sense, Pezzin and Schone (1997) and Pezzin, et al. (2007) find that exist incentives for family members to behave in a manner strategically. Therefore, care decisions are often the results of numerous individual and joint decisions by family members.(Heitmueller, 2007) which make important to study family decision-making process taking into account that "one model cannot capture all possible aspects of a family's long-term care and living arrangements", Stern (1999).

Game theoretic models are especially suitable for analyzing care decision-making process. A priori, it is unclear whether care arrangements should be modeled as a cooperative or a noncooperative game. Modeling interactions as a cooperative game forced not to pay attention on strategic factors, cooperative games allow us to obtain Pareto efficient outcomes without specifying the rules of the game. On the other hand, noncooperative game theory shows that the rules of the game are often crucial determinants of the outcome, in extensive form, the sequence of moves and the information available to each player at each move affect the equilibrium of the game. As Pezzin et al. (2007) highlight, this kind of social interactions are difficult to model since are "complex, loosely structured", but the modeling family interactons as a noncooperative or a cooperative is a "research strategy".

In what follows, we extend the theoretical approach comparing how care decision processes affect caring-time. Then, we study empirically the effects of those care decision processes on the choice of hours devoted to care activities. [1]

3 The Framework

Our purpose is to capture different interactions between care recipients and the informal caregivers considering three care decision processes. We analyze three separate games with three players: a disabled person and two family members. We develop three models in each one we model family interactions as a two-stage game.[2] The strategy goes as follows: in the first stage of the game we determine optimum hours to spend caring for disabling people, in the first model, the care recipient decides the hours that the caregiver has to devote to care activities which is called *Care Recipient decision*. In the second model, the caregiver takes the decision on her own which is called *Informal Carer Decision*. Finally, in the third model, the care arrangement is obtained by way of a family decision which is called *Family Decision*. In the second stage of each game, we determine the optimum behaviour of the other agents obtaining resource allocation under each arrangement. These two-stage sequential games are solved by backward induction.[3]

[1] In previous research, there are limitations in the data, as the data used do not account for how the decision processes have taking place, which can have an effect on the caring-time since those carers who does not decide by themselves the hours devoted to care activities can be forced to spend more hours than those who decide by themselves.

[2] Both stages may contain substages, for instance, living arrangements. However, we do not analyse these substages.

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

We use the subscripts $\{1,2,3\}$ to indicate the decision process and the subscripts $\{r, m1, m2\}$ to indicate the care recipient, and the family members, respectively. For the sake of simplicity, we assume that care giver is going to be $m1$. Thus, $C_{r,1}$ denotes private consumption by the recipient when the recipient is who decides the hours that the carer spends caring for her.

To construct the decision processes, we begin by specifying the preferences of each of the agents. Let $U_{r,j}(u_{r,j}(\mathbf{C_r}_{,j}), A_j)$ be the utility functions of the grandparent where $u_r^j : \Re_+^n \to \Re$ is the grandparent's sub-utility function, and where $\Re$ is the set of real numbers. The argument $\mathbf{C_r}_{,j} \in \Re_+^n$ 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). $U_{r,j}$ 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 carer spends caring for, and $t_{0,j}$ indicates the hours of formal care. For the sake of simplicity, we make the assumption that care recipient's health status is separable from the care-giving time performed by others.[4]

We suppose that both family members get utility from the private consumption, the leisure time and the ability of 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 each member of the family and $l_{mi,j}$ indicates the hours devoted to leisure activities. We assume that $U_{mi,j}$ is twice continuously differentiable, strictly increasing, and strongly concave. We suppose that each family member cares about the care recipient's health status by way of the effect of H_j in A_j, which also affects the care recipient's well-being also.

3.1 The Second Stage Game

As we have explained above each game is solved by backward induction. We begin analysing the second stage of each game. We can model this stage as a bargaining solution or non-bargaining solution.[5] For each of the decision making process, we consider several formulations of the second stage game which determines, depending on who decides in this stage, private consumption and the leisure time. In the case of the care recipient we do not have introduced leisure time in her utility function, we have introduced the level of formal care. We assume that the informal carer accepts whatever caring-time is decided by the care recipient, in the first model, and that the care recipient accept whatever the informal carer or both family members have decided in the first stage of the game, in the second and the third model.

3.1.1 Care Recipient Decision

We begin considering that the informal carer accepts the decision taken by the care recipient in the first stage of the game. In this case, $t_{1,1}$ is fixed given that it is determined in the first stage of the game, so A_1 is also fixed.

A Non-Bargaining Solution First, we suppose that the members of the family decide separately the private consumption of each agent, the labour supply and the

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

[5] When the recipient lives independently, the game between family's members can take many possible forms. For example, the family's members may play a one-shot noncooperative game, a repeated game, or a cooperative game.

leisure time.[6]

Formally:

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

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 i can devote to these activities. We assume that there is only one caregiver, the agent $m1$, therefore $t_{2,j}$ is equal to zero.

The associated first-order conditions implies that at the equilibrium point, the individual's MRS between individual i's leisure and private consumption is equal to the wage rate, formally:

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

Let $\tilde{l}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$, $\tilde{h}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$ and $\tilde{C}_{mi,1}(w_{mi}, Y_{mi}, A_1, T_{mi,1})$ $i = 1, 2$, 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 (1), in equilibrium. We may obtain that $\frac{\partial \tilde{h}_{m1,1}}{\partial t_{1,1}} < 0$. In words, 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 that we suppose that $T_{m1,1}$ is fixed. if $\frac{\partial \tilde{h}_{m1,1}}{\partial t_{1,1}} = -1$, the leisure time does not change. However, when $\frac{\partial \tilde{h}_{m1,1}}{\partial t_{1,1}} < -1$, that is, we can observe that $\frac{\partial \tilde{l}_{m1,1}}{\partial t_{1,1}} \lesseqgtr 0$. That is, an increase in the time devoted to care activities can increase the time devoted to leisure time.[7]

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

A Collective Approach We can suppose that the members of the family are the daughter, of the disabled person, the caregiver, and her husband. Considering the usual strategy of collective models (Chiappori 1988, 1992) the decisions made by the household are Pareto-efficient. We introduce in the utility functions the ability to perform daily living activities of the care recipient. This is equivalent to assuming that household allocations are determined as solutions to the problem:

[6] For instance, a mother and her daughter, who lives independently. Pezzin and Schone (1999, 2002) assumed that when the recipient and the family members coreside their interactions are cooperative, however, when they lives independently there is not a bargaining solution for the game.

[7] For the non-caregiver, $t_{1,1}$ does not affect her time constraint. However, her utility functions depends positively on that argument. Therefore, we can observe that an increase in the time devoted to care activities, $t_{1,1}$, can generates an increase on the time devoted to labour market. That is, if her mother cares for her disabled parent, and given that the changes in her marginal utility of consumption when the ability to perform activies of her parent weighted for her wage rate is greater than the changes in her marginal utility of leisure when the ability to perform activies of her parent changes. It produces an increase in the time devoted to market activities, what diminishes the time devoted to leisure time.

$$\max_{C_{m1,1},l_{m1,1},C_{m2,1},l_{m2,1}} \Psi(C_{m1,1}, l_{m1,1}, C_{m2,1}, l_{m2,1}, A_1; \lambda) = \lambda U_{m1,1}(C_{m1,1}, l_{m1,1}, A_1) +$$

$$+(1-\lambda)U_{m2,1}(C_{m2,1}, l_{m2,1}, A_1) \tag{2}$$

subject to the household budget constraint, time constraints and the ability of care recipients to perform daily living activities:

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

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

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

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

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

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

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

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

$\rho_{mi}\left(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}\right) = w_{mi}\hat{l}_{mi,1}\left(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}\right) +$

$+\hat{C}_{mi,1}\left(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}\right) + w_{mi}(t_{i,1} - T_{mi,1}),\ i = 1, 2.$

where $t_{2,1} = 0$, we suppose that there is only one caregiver, the agent $m1$, ρ_{m1} and ρ_{m2} represents 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} :

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

The functions $\hat{l}_{mi,1}\left(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}\right)$, $\hat{C}_{mi,1}\left(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}\right)$ and $\hat{h}_{mi,1}\left(w_{m1}, w_{m2}, Y_m, A_1, T_{m1,1}, T_{m2,1}\right)$ 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 the budget constraint, the time constraint and the ability of perform daily living activities of the care recipient:

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

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

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

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

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

The first-order conditions implies that the individual's MRS between individual i's leisure and private consumption is equal to the wage rate in equilibrium. We are interested in study the effects that an increase in $t_{1,1}$ have on both the hours spent in market work and the leisure time for both members of the family. The result that we have obtained is similar to what we have found in the non-bargaining solution. In this case, the changes on the labour supply when caring-time change also depends on the changes produce in the sharing rule when the time devoted to care activities changes. Being $\frac{\partial \rho_{m1}}{\partial t_{1,1}} > 0$, an increase in the time devoted to informal care can generates labour cost, $\frac{\partial \hat{h}_{m1,1}}{\partial t_{1,1}} < 0$, under the same conditions than in the non-bargaining solution. In

the case of the leisure time, and given that $T_{mi,1} = l_{mi,1} + h_{mi,1} + t_{i,1}$, we also observe similar results than the non-bargaining solution. We have to remark that the impact of $t_{1,1}$ on $\hat{h}_{mi,1}$ is more likely to be greater, that is, the changes in the labour supply are more likely to be greater than in the non-bargaining solution, which is not conditioned to the changes in the sharing rule. When the fraction of residual non-labour income allocated to the spouse $m1$, ρ_{m1}, considerably increases when the time devoted to caring-time increases, that is, agent $m2$ compensate $m1$ for devoting time to care activities, we find that the hours devoted to labour market decrease more than in the non-bargaining approach.[8]

We have also omitted corner solution in this approach. However, we can conclude the same than in the non-bargaining solution.

3.1.2 Informal Carer Decision and Family Decision

In this case, we consider that the care recipient accepts the decision taken by the informal carer in the first stage of the game or the family decision. In this case, $t_{1,2}$ is also fixed, which is determined in the first stage of the game, however, 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. The care recipient optimization problem is[9]

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

with $T_{r,2}$ being the total time needed to perform the daily living activities, and P the price of the formal care, which we assume that is 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, which does not depend on the non-labour income of the care recipient, $Y_{r,2}$. It is straightforward to obtain the level of private consumption in equilibrium, from the budget constraint, $\bar{C}_{r,2}$. Therefore, there is not a maximization process, this is 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. In this situation, the equilibrium of our two-stage game can be Pareto inefficient ex ante even when the first stage game is Pareto efficient.

3.2 The First Stage Game

In the remainder, we analyze the first stage game. We suppose three possible first stage of the game, first, the care recipient decides the hours of informal caring-time, second the caregiver decides the hours to devote to caring for the disabling person by herself. Finally, we study the family care arrengement.

[8] For the non-caregiver, and given that $t_{1,1}$ does not affect his time constraint. However, his utility functions depends positively on that argument. Therefore, we can observe that an increase in the time devoted to care activities $t_{1,1}$ can generates an increase on the time devoted to 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 her marginal utility of consumption when the ability to perform activies of the disabled person weighted for his wage rate is greater than the changes in his marginal utility of leisure when A_1 changes. It produces an increase in the time devoted to market activities, what diminishes the time devoted to leisure time.

[9] We assume that n=1.

3.2.1 Care Recipient Decision

The care recipient is the agent who decides the hours of informal and formal caring-time in the first stage of the game. This choice is based on the following recipient's maximization, formally

$\max_{C_{r,1},t_{0,1},t_{1,1}} U_{r,1}(C_{r,1}, A_1)$
subject to
$A_1 = A_1(A_{1,1}(H_1), A_{2,1}(t_{1,1}, t_{0,1}))$
$C_{r,1} + t_{0,1} \leq Y_{r,1}$
$t_{1,1} + t_{0,1} = T_{r,1}$
From the associated first order condition we obtain that:

$$\frac{\partial U_{r,1}}{\partial C_{r,1}} = \frac{\partial U_{r,1}}{\partial A_1}\left[\frac{\partial A_1}{\partial t_{1,1}} - \frac{\partial A_1}{\partial t_{0,1}}\right] \tag{3}$$

In words, at the equilibrium point, the individual's MRS between consumption and the ability of performance daily living activities is equal to the difference between the changes produced in the ability of perform activities of daily living of the care recipient when the informal caring-time changes and the changes produce 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 $\tilde{t}_{1,1}\left(T_{r,1}, Y_{r,1}, H_1\right)$, $\tilde{C}_{r,1}\left(T_{r,1}, Y_{r,1}, H_1\right)$, and $\tilde{t}_{0,1}\left(T_{r,1}, Y_{r,1}, H_1\right)$.

$\tilde{C}_{r,1}$ and $\tilde{t}_{0,1}$, that is, the optimum value of private consumption of the care recipient and the formal caring-time in the situation 1, respectively, can be equal to thus obtained in the second stage of the game in the situation 2, $\bar{C}_{r,2}$ and $\bar{t}_{0,2}$, when $\bar{t}_{1,2}$ satisfied (3), we analyse the condition which make that $t_{1,2}$ satisfied (3) below. If the informal caring-time, $\bar{t}_{1,2} < \tilde{t}_{1,1}$ from the informal carer perspective in the situation 1 she has to devote more time to care activities than she prefers. From the care recipient perspective in the situation 2, she receives less informal care than she prefers.

3.2.2 Informal Carer Decision

A Non-Bargaining Solution In the second model, the caregiver decides the hours to devote to care activities by herself in the first stage of the game. The maximization problem for the family members are represented by:

$\underset{C_{mi,2}l_{mi,2},h_{mi,2},t_{i,2}}{Max} U_{mi,2}(C_{mi,2}, l_{mi,2}, A_2)$
subject to
$C_{mi,2} \leq Y_{mi} + w_{mi}h_{mi,2}$
$A_2 = A_2(A_{1,2}(H_1), A_{2,2}(t_{1,2}, t_{0,2}))$
$T_{mi,2} = l_{mi,2} + h_{mi,2} + t_{i,2}$
with $i = 1, 2$, we assume that there is only one caregiver, the agent $m1$, therefore $t_{2,j}$ is equal to zero.[10]

For the non-caregiver we obtain similar behaviour than in the situation 1, in the non-bargaining situation. Therefore, the behaviour of the non-caregiver is not conditioned for the stage in which participates.

When the informal care giver decides individually the private consumption of each agent and the labour supply, the leisure time and the informal caring-time, from the first order condition and using the envelope theorem, we observe,

[10] Imagine a mother, agent $m1$, who decides to care for her disabled husband, and the other member of the family is represented by her daughter.

$$\frac{\partial U_{mi,2}/\partial l_{mi,2}}{\partial U_{mi,2}/\partial C_{mi,2}} = w_{mi}, i = 1, 2. \tag{4}$$

and that

$$\frac{\partial U_{m1,2}}{\partial C_{m1,2}} w_{m1} = \frac{\partial U_{m1,2}}{\partial A_2} \frac{\partial A_2}{\partial t_{1,2}} \tag{5}$$

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

We can compare the time assigned to informal care activities in both situations, when the care recipient decides first, the situation 1, with the informal caring-time determined by the informal carer, in the situation 2. From (3), (4) and (5) we obtain a condition necessary to observe a similar informal caring-time in both situation,[11]

$$\frac{\partial U_{r,j}/\partial C_{r,j}}{\partial U_{r,j}/\partial A_j} = \frac{\partial U_{m1,j}/\partial l_{m1,j}}{\partial U_{m1,j}/\partial A_j} \gamma \tag{6}$$

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 $j = 1, 2$. Therefore, when the care recipient's MRS between consumption and the ability of performance activities of daily living is equal to MRS between leisure and the ability of performance activities of daily living weighted by γ, $\bar{t}_{1,2}$ is equal to $\tilde{t}_{1,1}$. Therefore, in this situation, there is not any difference between the decision taken by the care recipient and the informal carer.

3.2.3 Family Decision

We model the *family decision* as an intra-family bargaining model, following the particular case of the collective approach (Chiappori, 1988, 1992) since this approach takes into account the intra-family allocation of resources.

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

$$\max_{C_{m1,3}, l_{m1,3}, C_{m2,3}, l_{m2,3}, t_{1,3}} \Psi(C_{m1,3}, l_{m1,3}, C_{m2,3}, l_{m2,3}, t_{1,3}; \lambda) = \lambda U_{m1,3}(C_{m1,3}, l_{m1,3}, A_3) +$$

$$+ (1-\lambda) U_{m2,3}(C_{m2,3}, l_{m2,3}, A_3) \tag{7}$$

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

$C_{m1,3} + C_{m2,3} \leq Y_m + w_{m1}\left(T_{m1,3} - l_{m1,3} - t_{1,3}\right) + w_{m2}\left(T_{m2,3} - l_{m2,3}\right)$

$A_3 = A_3(A_{1,3}(H_3), A_{2,3}(t_{1,3}, t_{0,3}))$

The solution of the household problem can be obtained using a two-stage process. First of all, we determine the distribution of the residual nonlabour income between them, ρ_{mi}. Formally,

$$\rho_{mi}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right) = w_{mi} l^*_{mi,1}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right) +$$

[11] Under the assumption that $\frac{\partial A_1}{\partial A_{2,1}} = \frac{\partial A_2}{\partial A_{2,2}}$ and that $\frac{\partial A_{2,1}}{\partial t_{1,1}} = \frac{\partial A_{2,2}}{\partial t_{1,2}}$ in the non-bargaining solution.

$$+C^*_{mi,3}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right) + w_{mi}(-T_{mi,3}), i = 1, 2.$$

with $l^*_{mi,3}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right), h^*_{mi,3}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right)$ and $C^*_{mi,3}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right), i = 1, 2$ indicated the solution of the household problem.

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

$$\rho = \rho_{m1}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right) + \rho_{m2}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right) =$$

$$= Y_m - w_{m3} t^*_{1,3}\left(w_{m1}, w_{m2}, Y_m, t_{0,3}, H_3, T_{m1,3}, T_{m2,3}\right)$$

At stage 2, both spouses choose their level of consumption, leisure time, and labour supply. As Blundell et al. (2005) remark, we can obtain the optimum values of ρ_{m1}, ρ_{m2} and $t_{1,3}$. Solving,

$\max_{\rho_{m1}, \rho_{m2}, t_{1,3}} \lambda V_{m1}\left(w_{m1}, \rho_{m1}, t_{1,3}\right) + (1-\lambda) V_{m2}\left(w_{m2}, \rho_{m2}, t_{1,3}\right)$

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

with $V_{mi}\left(w_{mi}, \rho_{mi}, t_{1,3}\right)$ being the individual indirect utilities, from this we obtain:

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

In words, the aggregate individual´s marginal willingness to that agent $m1$ devotes time caring for is equal to the marginal willingness to increases the distribution of the residual nonlabour income of agent $m1$ weighted by the wage rate of the agent $m1$.

If the level of informal caring-time determined by the care recipient in the first stage of the game, $\tilde{t}_{1,1}$, satisfied (8) family member will be indifferent between decide first or after the care recipient, if not, we can find cases of underprovision or overprovision of informal caring-time from care recipient perspective.

We can also analyse the differences between, $\bar{t}_{1,2}$ and $t^*_{1,3}$. We find that $t^*_{1,3}$, that is, the optimum hours devoted to care activities in the *family decision,* is likely to be greater than $\bar{t}_{1,2}$, the optimum hours devoted to care activities in the *informal carer decision* when agent $m2$ considerably compensate $m1$ by way of increasing the ρ_{m1}, the fraction of residual non-labour income allocated to the spouse $m1$ for spending more time caring for. Therefore, we may observe greater labour and leisure costs.

The remainder of the paper turns to studying the effects of these care decision process have on the time spending in care activities, and on the labour and leisure costs using Spanish data. As we have explained above we study whether depending on the care decision process the informal caregivers have to devote more time to care activities than they prefers. Under the *family decision* is more likely to observe that the informal carer tend to devote more time to informal care activities. Under the *care recipient decision* if the care recipient consider the informal caring-time as free, they tend to considerably increase this caring-time, which can produce that the informal caregivers have also to devote more time to informal care activities than they prefer.

4 Data

We use two comparable Spanish samples, *Encuesta de Apoyo Informal a los Mayores* 1994 and 2004. The two surveys were developed by the IMSERSO (*Instituto de Mayores y Servicios Sociales)* of the Spanish Ministry of Employment and Social Services. The surveys contain information on individuals 18 years and older, residing in Spain, and devoting time to informal care activities. These surveys exclude the formal caregivers who receive the equivalent of a salary, but leave open the possibility of informal carers receiving money compensation. They include any kind of assistance with activities that the care recipient can no longer do for himself, excluding those tasks that were done for the care recipient by others, prior to his current need for care. Informal care is measured at three levels, less than 2 hours, from 3 to 5 and more than 5 hours, that the careprovider devotes, on average, per day.

A typical care recipient is an 80 year old woman, with a low level of education, receiving a pension and not married in both periods. In 2004, she has more health problems than in 1994. We observe that a typical carer is a middle-aged woman, married, with a lower educational level in both periods. In 2004 she lives in a city of 10,000 to 100,000 inhabitants, works more than in 1994 and has fewer children. She is the primary caregiver and does these tasks each day. We have also observed that workers have increased their efforts as caregivers between those dates.

We consider three care decision processes. First, the care recipient decides who will be the caregiver. Second, the caregiver takes the decision on her own. Finally, the care arrangement is obtained by way of a family decision. We observe that in 1994 the care decision is taken by the caregiver in about 64% of the time, and by the family 33% of the time. In 2004 these figures were 62,2% and 33.5%, respectively.

5 Empirical Models and Results

5.1 Informal Caring Time

Given the objective of the study, that is, to investigate the extent to which carers wish to spend more or less time on providing informal care we have to define the variable used to measure the individuals' caring time. Respondents are asked about how many hours devote to informal care activities on average the days in which they devote time to these activities, less than two hours, from three to five hours or more than five hours.[12] We first considers what motives individuals to choose between different informal caring-time using a multinomial logit model (MNLM). This allow us to analyse how the informal caring-time vary depending on informal care's demographics characteristics, recipient's demographic characteristics and by the way that the informal care decision has taken place.[13]

[12] The 1994 *Informe de Apoyo Informal a Mayores* and the 2004 *Informe de Apoyo Informal a Mayores* asked informal caregivers the hours they spend caring for the dependent person. In these surveys, answers are classified into four categories: less than 1 hour, from one to 2 hours, from 3 to 5 hours and more than five hours. We computed a test for combining alternatives, that is, if none of the independent variables significantly affect the odds of alternative m versus alternative n, (Anderson, 1984). In our case, we compute Wald tests and LR tests for combining alternatives. We cannot reject the hypothesis that categories "less than 1 hour" and "less than 2 hours" are indistinguishable. Therefore, we combine these two categories in our estimations.

[13] How reasonable is this specification? we treat this outcome as nominal, even though it can be considered as partially ordered, and in this case, we should have used an Ordinal Model. We test the parallel regression assumption which is implicit in the Ordinal Models. It can be tested by comparing the estimate from the $J-1$ binary regressions,

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

where the βs are allowed to differ across the equations. The parallel regression assumption implies that $\beta_1 = \beta_2 = ... = \beta_{J-1}$. In this case, $J = 3$. We compute the approximate likelihood-

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

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

where b is the base category and $J = 3$ and $\mathbf{x}$ is a vector of demographic characteristics of the informal caregiver, of the recipient, and help and decision process variables.[14]

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 income (considered at the household level), her work status, the size of her city of residence and whether she receives money compensation for care activities. With respect to the information of care recipients' characteristics, we observe her age, her gender, her income, her educational level, and her health status. In the help variables, we control for the kind of task developed that is IADLs and ADLs activities, and the geographical distance between the carer and the recipient. Moreover, sharing the same household may make family members more obliged to care, hence, we include a variable to control if care recipient lives with a relative. We also include variables to control for the frequency and the permanency of the help, and if the care recipient receive a formal help or another family member help. We control for the care decision process by using the carer decision as the variable of reference.

The estimated equations provide a set of probabilities for the J choices for a decision maker with characteristics $\mathbf{x}_i$ of the form:

$$\Pr(K_i = j\,|\mathbf{x}) = \frac{e^{\beta'_{m|b}\,\mathbf{x}_i}}{\sum_{k=1}^{3} e^{\beta'_{m|b}\,\mathbf{x}_i}}, \quad j = 1, 2, 3. \tag{9}$$

We study how all variables affect the odds of a person choosing one caring-time to other. Holding other variables constant, the factor change in the odds of outcome m versus outcome n as x_i increases by δ equals

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

ratio test of proportionality of odds across response categories (chi-squared(38)=56.74(0.026) in 1994, chi-squared(38)=81.82(0.000) in 2004), and we conclude that this test provides evidence that the parallel regression assumption has been violated at 5% level of significance. We have also plotted predictions to compare predictions from ordered logit and multinomial logit. We obtain 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 orderd logit model is substantively unrealistic. See Long and Freese (2006). Moreover, these surveys include the category "don't know", which problaby does not correspont to the middle category in a scale. Therefore, when the proper ordering is ambiguous, the models for nominal outcomes can be considered. In this case, we consider the Multinomial Logit Model (MNLM).

[14] The MNLM make the assumption known as the independence of irrelevant alternatives (IIA). In this model,

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

where the odds do not depend on other alternatives that are available. What this means is that adding or deleting alternatives does not affect the odds among the remaining alternatives. From the point of view of estimation, it is useful that the odds ratio, does not depend on the other choices, which follows from the independence of disturbances in the original model. This property is called the independence from irrelevant alternatives (IIA). The independence assumption follows from the initial assumption that the disturbances are independent and homoscedastic. We consider two of the most common tests that have been developed for testing the validity of the assumption, the Hausman's specification test (Hausman and McFadden (1998)) and the Small-Hsiao test (1985). In this work, we cannot reject the null hypothesis, that is, odds are independent of other alternatives in both periods 1994 and 2004. We find similar results even with a different base category.

In what follows, we explain our findings in the choice of devoting different number of hours to care activities.

5.1.1 Results

This model includes many coefficients, being difficult to interpret the effects on all pairs of outcome categories. We have developed odds-ratio plots to analyse both periods, Figure 1 and Figure 2, see Long and Freese (2006).[15]

Comparing the *Recipient's Demographic Characteristics* between 1994 and 2004, we observe in Figure 1.1 and 2.1 that an increase in one year in the Age of the recipient in the three intervals considered produce that the odds of choosing more than five hours of caring-time versus less than two hours or from three to five hours were about 0.55 times smaller for both periods. However, those effects are not permanent, since the coefficients of Age Squared are opposite to the coefficients of Age. We can remark that the average absolute change in the probability of choosing different caring-time for increasing in one year the age of the recipient has decreases being around 0.09 in 1994 to 0.07 in 2004. Therefore, an increase in the Age of the recipient has lost weight in the decision of different caring-time.[16]

The gender and income of the recipient is only significant in 2004, the odds of choosing more than five hours of caring-time versus from three to five hours are 1.66 times greater for women care recipient than for men care recipient. However, the average absolute change in the probability of choosing different caring-time for being female is only 0.06. For those who are poor, increasing the odds of devote more than five hours and from three to five hours of caring-time versus less than two hours.

The level of education of the care recipient is not significant in both periods considered. The marital status of the care recipient is only significant in 1994, for those who are married/cohabiting the odds of choosing more than five hours of caring-time versus less than two hours are 70.2% greater. For those who receive a pension we observe that only in 1994 the odds of choosing more than five hours versus from two to five are greater and significant.

As we have outlined in the descriptive analysis informal assistance in 2004 to the elderly is considerably more focused than ten years ago in people who suffer from health problems. That variable is only significant in 2004, in which the odds of choosing devoting time from three to five hours versus more than five hours are greater, but the odds of choosing devoting from three to five hours versus less than two hours in caring-time is 0.22 times smaller, being the average absolute change in the probability of choosing different caring-time for a poorer health status of the recipient greater than the average change generated by other variables analysed, in that case is about 0.11 in 2004.

Considering the *Informal Carer's Demographic Characteristics*, see Figures 1.2 and 2.2, we observe that the age of the carer is not significant in 2004. However, in 1994 the odds of choosing devoting more than five hours versus less than two

[15] In the odds-ratio plot, the independent variables are each represented on a separate row, and the horizontal axis indicates the relative magnitude of the β coefficients associated with each outcome. The numbers correspond to the outcome categories, that is, "1" denotes less than to hours of caring-time, which corresponds with the base category, "2" indicates from three to five hours of caring-time, and "3" corresponds with more than five hours of caring time. The additive scale on the bottom axis measures the value of the $\beta_{k,m|n}s$. The multiplicative scale on the top axis measures the $\exp(\beta_{k,m|n})s$. The distance between a pair of outcomes indicates the magnitude of the effect. Statistical significance is added by drawing a line between categories for which there is not a significant coefficient.

[16] We have considered three intervals of the Age of the Recipient since we try to control for the those who are more dependent. We have also evaluated these effects without considering different intervals of the Age of the Recipient obtaining similar results. Results are available upon request.

hours are 0.92 times smaller. However, those effects are not permanent, since the coefficients of Age Squared are opposite to the coefficients of Age. The gender of the carer is only significant in 2004 where the odds of choosing from three to five hours increasing versus choosing less than two hours or more than five hours being women. The average absolute change in the probability of choosing different caring-time for being women is about 0.06 in 2004. Studying the income of the carer we see that the odds of choosing from three to five hours are greater and significant in both periods versus the other alternative, holding the rest of the variables constant. The level of education is not significant in the choice of different caring-time in 1994. However in 2004, for the carers who report having a degree, the odds of choosing devoting from three to five hours to caring time versus less than two are 0.47 times smaller, holding all other variables constant. The marital status is not significant in determining the hours of caring-time in both periods. The number of children of the carer are significant in 1994, the odds of choosing more than five hours versus from three to five hours are smaller in 0.88 times, in 2004, are significant in that the odds of choosing devoting more than five hours versus less than two hours were 0.79 times smaller. The city of residence of the informal caregiver is significant in determining the hours of caring time only in 1994, for those who live in a cities from 10,000 to 100,000 inhabitants the odds of choosing more than five hours versus from three to five hours are 98% greater. However, the odds of choosing from three to five hours versus less than two hours in caring-time are 0.61 times smaller, being the cities with more than 100,000 the reference level.

When we analyse the work status of the caregivers we observe that the odds of choosing less than two hours versus from three to five and more than five are significant and greater for those who report spend time in the labour market in 1994. However, in 2004 the odds of choosing from three to five hours versus less than two hours and more than five hours are significantly higher. Studying the average absolute change in the probability of choosing different caring-time in both periods for those who report being involved in the labour market we observe that is higher in 1994 than in 2004 (10% vs. 8.5%). Considering the carers who report that they are houseworkers, in 2004, the odds of choosing more than five hours or from three to five hours are significant and higher, but this variable is not significant in 1994.

Finally, we compare both periods for the *help and decision variables*, observing that for those who reports engaging in IADLs, the odds of choosing more than five hours versus the other alternatives are higher and significant in 1994. However, in 2004, the odds of choosing from three to five hours in caring-time versus the other alternatives are higher. Analysing the ADLs, we observe similar results, the odds of choosing more than five hours versus the other alternatives are higher and significant in both periods considered. Comparing the average absolute change in the probability of choosing different caring-time in both periods for those who reports engaged in IADLs we observe that this variable has won weight in deciding caring-time (0.08 vs. 0.14), but for those who reports engaged in ADLs we observe that this variable lost weight (0.19 vs. 0.10) in 2004. If the carer is the primary caregiver the odds of spending from three to five or more than five in caring activities versus less than two hours is higher in both periods considered. Being the average absolute change in the probability of choosing different caring-time for those who are primary caregivers greater in 2004 than in 1994 (0.10 vs. 0.08). The frequency of the help is not significant in both periods. If the help is permanent is only significant in 2004, the odds of choosing less than two hours versus the others alternatives are higher.

The place of residence if the care recipient cohabits with a relative or not is clearly significant in both periods, with the odds of choosing more hours versus the other

alternatives greater in 2004 than in 1994. Being the average absolute change in the probability of choosing different caring-time for those who are primary caregivers greater in 1994 than in 2004 (0.23 vs. 0.19). For the care recipient who does not cohabite with the caregiver we have analysed the distance (in minutes) between their homes. However, this variable is only significant in 1994.

For the carers who are the spouse of the care recipient we observe similar results in both periods being the odds of choosing more than five hours versus from three to five hours higher and significant. In the case of the son/daughter of the care recipient we observe significant results in 2004 where the odds of choosing more than five hours versus less than two hours are 64% higher.

The money compensation received by the carers and the formal help that the care recipients receive are not significant in both periods considered. However, the help received by other family members is significant in the odds of choosing more hours versus less than two hours which are higher. This indicates that family members help and the informal care that we are analysing are complementary.

Our key variables are the decision process variables. We observe that the odds of choosing more than five hours versus less than two and from three to five hours are 63% and 73% higher, respectively in 2004 and the odds of choosing more than five hours versus from three to five are 50% higher in 1994. In the case of the care recipient's decision we observe that this variable is only significant in 2004 where the odds of choosing more than five hours versus from three to five hours are considerably greater than those analyse before.

5.2 Labour and Leisure Costs

We estimate a two-equation probit model using the maximum likelihood estimation,

$$c_i^* = \mathbf{x}_{i1}^{'}\beta_{i1} + \mathbf{x}_{i2}^{'}\beta_{i2} + \varepsilon_i, c_i = 1 \; if \; c_i^* > 0, \; 0 \; otherwise, \tag{10}$$

$$E\left[\varepsilon_i \left| \mathbf{x}_{i1}^{'}, \mathbf{x}_{i2}^{'} \right.\right] = 0,$$

$$Var\left[\varepsilon_i \left| \mathbf{x}_{i1}^{'}, \mathbf{x}_{i2}^{'} \right.\right] = 1 \quad (i = h, l)$$

$$Cov\left[\varepsilon_h, \varepsilon_l \left| \mathbf{x}_{h1}^{'}, \mathbf{x}_{h2}^{'}, \mathbf{x}_{l1}^{'}, \mathbf{x}_{l2}^{'} \right.\right] = \rho$$

where c_h^* and c_l^* represent the labour and leisure costs for the informal caregiver, respectively, $\mathbf{x}_{i1}^{'}$ is a vector of demographic characteristics of both the caregiver and the recipient and $\mathbf{x}_{i2}^{'}$ is a vector which includes the variables to control for the decision process.

The variables which indicate the demographic characteristics of the informal caregiver include her age, her gender, her educational level, her marital status, her number of children, her income (considered at the household level), and the size of her city of residence, and whether she receives money compensation for care activities. With respect to the recipient's characteristics, we observe her income and whether she receives a pension. We control for the caring-time, considering as reference the variable that indicates less than two hours spent on caring-time.[17] We include a variable to control if the care recipient lives with her carer. We also include variables to control for the frequency of care activities, and whether the care recipient receives family

[17] Respondents are asked whether they have supported labour or leisure costs since they participate in informal care activities. They are only asked one of the two questions proposed by Heitmueller and Inglis (2007) "do carers choose to work fewer hours?" but not "do part time workers choose to provide informal care?". Therefore, we consider the provision of informal care as an exogenous factor in the labour and leisure cost equations.

member help or formal help, and if this formal help is received from a domestic employee. We control for the care decision process by using the carer decision as the variable of reference.

We are interested in studying the endogenous nature of the leisure cost in the equation of labour cost. For the year 1994, we observe that ρ equals zero, so the model consists of independent probit equations, in which labour and leisure costs are identified separately (Greene, 2003). However, in 2004, we cannot reject the hypothesis that ρ equals zero. Therefore, we estimate a recursive simultaneous-equations model in which

$$\Pr ob\left[c_h = 1, c_l = 1 \left| \mathbf{x}_{h1}^{'}, \mathbf{x}_{h2}^{'}, \mathbf{x}_{l1}^{'}, \mathbf{x}_{l2}^{'} \right.\right] = \Phi\left(\mathbf{x}_{h1}^{'}\beta_{h1} + \mathbf{x}_{h2}^{'}\beta_{h2} + \gamma c_l, \mathbf{x}_{l1}^{'}\beta_{l1} + \mathbf{x}_{l2}^{'}\beta_{l2}, \rho\right)$$

where $\Phi(.)$ is the cdf.

The marginal effects are given in table 1, for 1994 and 2004.[18] Considering one variable which is included in $\mathbf{x}_{h1}^{'}$ and $\mathbf{x}_{l1}^{'}$, we observe a direct effect produced by its presence in the first equation, but there is also an indirect effect. The total effect are determined by way of:

$$\begin{aligned}
&E\left[c_h \left| \mathbf{x}_{h1}^{'}, \mathbf{x}_{h2}^{'}, \mathbf{x}_{l1}^{'}, \mathbf{x}_{l2}^{'} \right.\right] = \Pr\left[c_l = 1\right] E\left[c_h \left| c_l = 1, \mathbf{x}_{h1}^{'}, \mathbf{x}_{h2}^{'}, \mathbf{x}_{l1}^{'}, \mathbf{x}_{l2}^{'} \right.\right] + \\
&+ \Pr\left[c_l = 0\right] E\left[c_h \left| c_l = 0, \mathbf{x}_{h1}^{'}, \mathbf{x}_{h2}^{'}, \mathbf{x}_{l1}^{'}, \mathbf{x}_{l2}^{'} \right.\right] = \\
&= \Phi\left(\mathbf{x}_{h1}^{'}\beta_{h1} + \mathbf{x}_{h2}^{'}\beta_{h2} + \gamma c_l, \mathbf{x}_{l1}^{'}\beta_{l1} + \mathbf{x}_{l2}^{'}\beta_{l2}, \rho\right) + \\
&+ \Phi\left(\mathbf{x}_{h1}^{'}\beta_{h1} + \mathbf{x}_{h2}^{'}\beta_{h2}, -\mathbf{x}_{l1}^{'}\beta_{l1} - \mathbf{x}_{l2}^{'}\beta_{l2}, -\rho\right)
\end{aligned}$$

5.2.1 Results

Columns (1) and (2) in Table 1 show the marginal effects of the Probit estimation of labour and leisure costs in 1994. Columns (3) and (4) show the total marginal effects of the recursive simultaneous-equations model in 2004.[19]

As expected, the female supports more labour cost (increasing the probability of supporting labour cost by 25.9%, in 1994 and 23.3%, in 2004). Being married or cohabiting significantly decreases the probability of supporting leisure cost by 9% in 1994, but this variable is not significant in 2004. For those carers with a high level of income decrease the probability of suporting labour cost by 14.2%. The size of the city of residence is clearly significant for those carers who lives in cities with less than 10,000 inhabitants, living in these cities significantly increase the probability of bearing labour cost by 21.3 % in 2004. However, the probability of supporting leisure cost decreases significantly by 9 % in 1994. Co-residence has a consistent effect on the probability of borne labour cost (increasing by 8.2 % in 1994 and by 11.5 % in 2004) but not on leisure cost, which is not significant, in both periods.

The probability of supporting labour cost decreases more for carers with a higher level of education, contrary to what is expected. We could expect that, for more highly educated carers, caregiving activities represent a higher level of forgone earnings. However, in both periods, we observe that carers who report having a University degree perceive less labour cost, but support more leisure cost. It is possible that highly-educated carers are more likely to be married to a highly-educated person with a high salary. As a result, they do not face a costly trade-off between labour market participation and caregiving responsibilities.

[18] These results correspond to the individuals of working age. Respondents who were not of working age were excluded, since their labour supply behaviour may not be comaparable to individuals of working age. We have also repeated the analysis with the whole sample. Additionally, to control for cohort differences by education level, we have interacted the carer age with the education levels. Results obtained are quite similar and are available upon request.

[19] We compute the total effects in the same way as Rhine et al. (2006).

There is growing evidence that providing informal care may lead to health problems for the caregiver. The probability of supporting labour and leisure costs increases, in both periods, for those carers, making the probability of supporting leisure cost more likely.

Analysing other kinds of care that the care recipient receives, we find that when a family member helps, the probability of supported leisure cost increases by 20 % in 2004, but this variable is not significant in 1994. This kind of care may be complementary to the caring-time offered by the respondent.

For the year 1994, we find that informal caring-time significantly increases the probability of borne labour cost, but is not significant in the case of leisure cost. This effect is maintained in 2004, but we observe that there is a level of informal care below which no significant effect is observed on the probability of supporting leisure cost. The probability of supporting leisure cost increases by about 15% when the informal carers devote more than five hours to care activities.

The impact of care activities on labour cost is greater after controlling for the decision process, resulting in inefficient outcomes in 1994. In 2004 these inefficient outcomes have disappeared. In 1994, the family decision is positive and significant correlated with the labour cost, increasing the probability of supported labour cost by 10.2 % for those who are of working age. We find that these variables are not significant in 2004, which indicates no difference in the impact of care arrangements: the informal carer decision, the care recipient decision and the family decision on labour and leisure costs.

In 1994, labour and leisure costs were analysed separately. However, we must point out that the strongest effect appears to be exerted by the effect that the leisure cost has on the labour cost, when the former is treated as endogenous in 2004, since the probability of supported labour cost increases by 46.2 % when the informal carers report that they support leisure cost. This finding contains an important message, in 2004, labour and leisure costs cannot be analysed separately.

6 Conclusions

In this study, we try to understand better why individuals engage in care giving and how care arrangement affect informal caring-time and labour and leisure costs. To do that, we develop a theoretical model in which we explain how the care decision process has taken place. We show that ignoring the care decision process may lead to inefficient informal care provision in the form of underprovision or overprovision of informal caring-time.

Then, we study empirically the factors that determine informal caregivers' caring-time. Considering only our key varialbes, we observe that informal caregivers tend to spend more hours in caring time activities if the care arrangements has taken place by way of a family care decision process. The odds of choosing more than five hours versus less than two and from three to five hours are 63% and 73% higher, respectively in 2004 and the odds of choosing more than five hours versus from three to five are 50% higher in 1994. In the case of the care recipient's decision we observe that this variable is only significant in 2004 where the odds of choosing more than five hours versus from three to five hours are considerably greater than those analyse before.

Finally, we extend previous studies by distinguishing between labour and leisure costs, and also by considering how the care decision process takes place, and the extent to which carers consider they are bearing more labour and leisure costs. The impact of care activities on labour cost is greater after controlling for the decision process, resulting in inefficient outcomes in 1994. In 2004 these inefficient outcomes

have disappeared. In 1994, the family decision is positive and significant correlated with the labour cost, increasing the probability of supported labour cost by 10.2 % for those who are of working age. We find that these variables are not significant in 2004, which indicates no difference in the impact of care arrangements: the informal carer decision, the care recipient decision and the family decision on labour and leisure costs.

In 1994, labour and leisure costs were analysed separately since the model consists of independent probit equations. However, we must point out that the strongest effect appears to be exerted by the effect that the leisure cost has on the labour cost, when the former is treated as endogenous in 2004 where the model does not consists of independent probit equations, since the probability of supported labour cost increases by 46.2 % when the informal carers report that they support leisure cost.

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Figure 1.

Figure 1.1 Recipient's Demographic Characteristics 1994

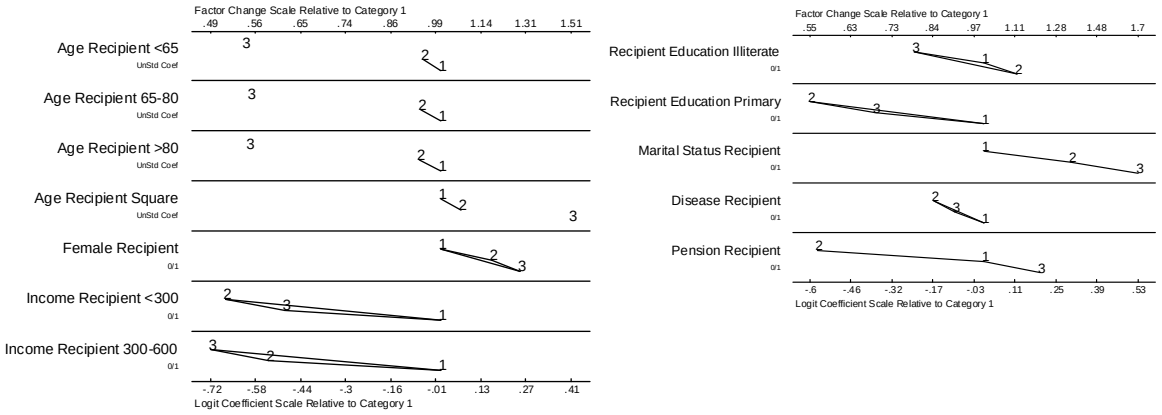

Figure 1.2 Carer's Demographic Characteristics 1994

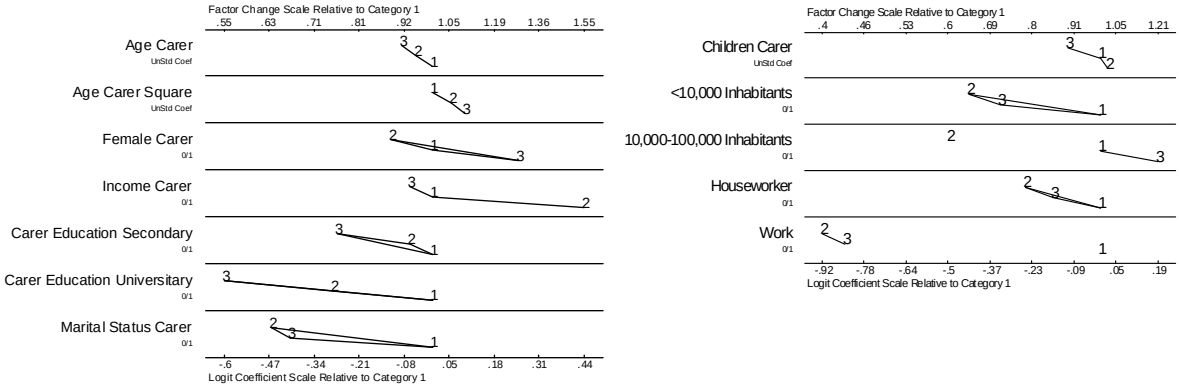

Figure 1.3 Help and Decision Variables 1994

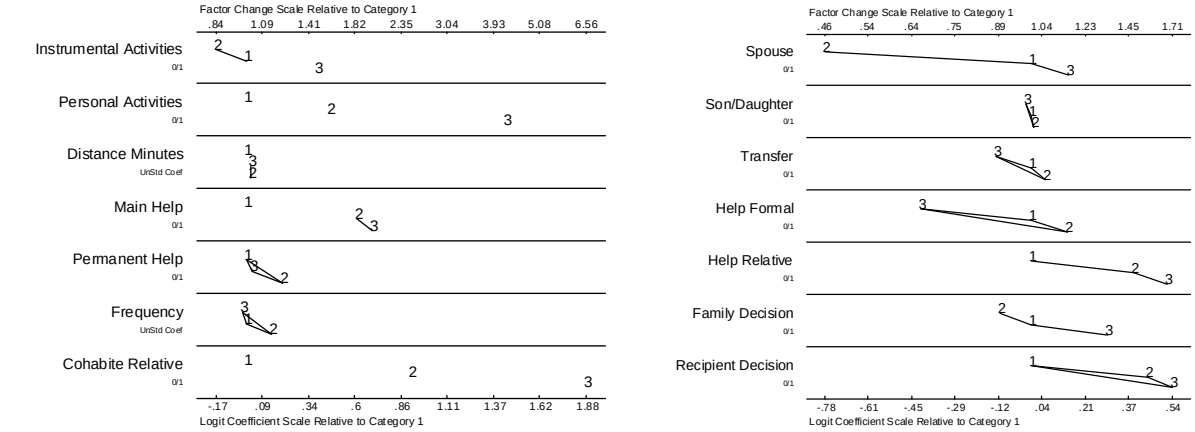

Figure 2.

Figure 2.1 Recipient's Demographic Characteristics 2004

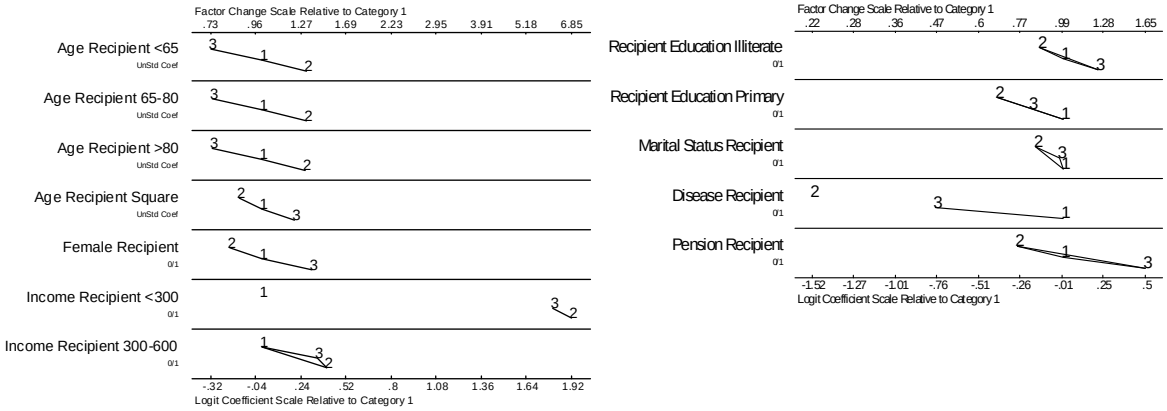

Figure 2.2 Carer's Demographic Characteristics 2004

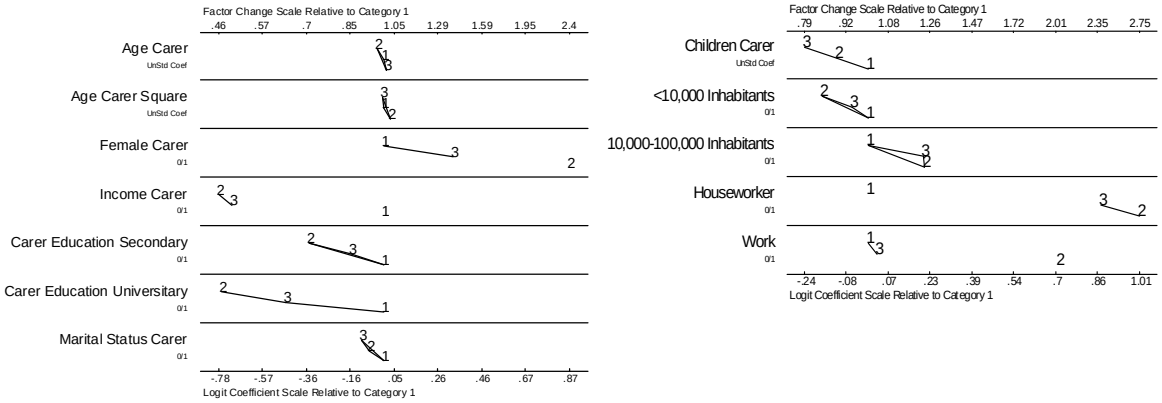

Figure 2.3 Help and Decision Variables 2004

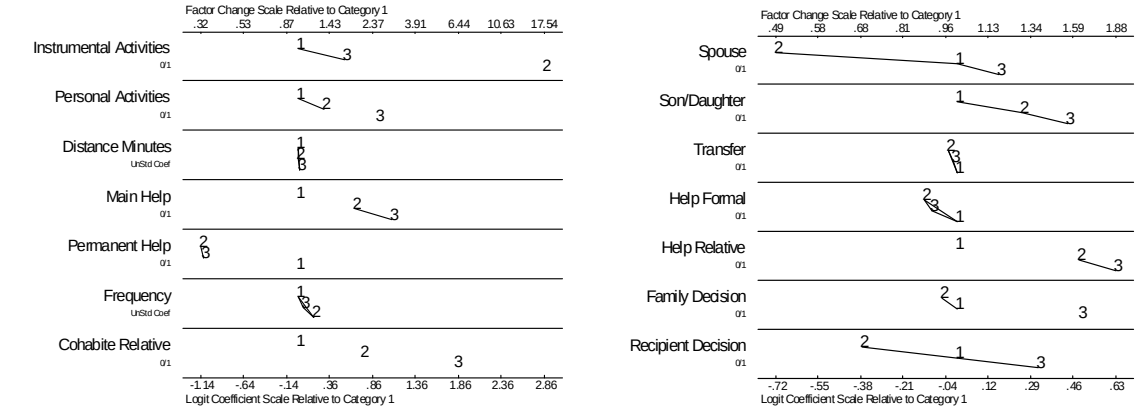

Table 1: Marginal Effects of the estimation of Labour and Leisure Costs 1994 and 2004

	1994		2004	
	Labour Cost	Leisure Cost	Labour Cost	Leisure Cost
Age	0.031*	0.018	0.027	0.001
	(0.016)	(0.014)	(0.019)	(0.017)
Age Square	-0.043**	-0.023	-0.032	0.000
	(0.018)	(0.015)	(0.021)	(0.018)
Low Education	-0.096*	0.048	-0.170**	0.112*
	(0.058)	(0.052)	(0.076)	(0.061)
Medium Education	-0.141	-0.005	-0.152*	0.065
	(0.088)	(0.082)	(0.079)	(0.065)
High Education	-0.178*	0.131	-0.328***	0.126*
	(0.108)	(0.084)	(0.088)	(0.073)
Gender	0.258***	-0.019	0.233***	-0.060
	(0.061)	(0.060)	(0.063)	(0.055)
Marital Status	-0.003	-0.086*	-0.021	0.014
	(0.057)	(0.047)	(0.052)	(0.048)
Income Carer	-0.142***	0.034	-0.043	-0.041
	(0.054)	(0.049)	(0.053)	(0.046)
N Children	-0.001	0.012	0.023	-0.004
	(0.015)	(0.013)	(0.021)	(0.019)
<10,000 Inhabitants	-0.002	-0.099**	0.213***	-0.062
	(0.051)	(0.047)	(0.053)	(0.052)
10,000-100,000 Inhabitants	-0.023	-0.044	0.059	-0.057
	(0.052)	(0.048)	(0.044)	(0.042)
Health Status	0.094**	0.125***	0.135***	0.249***
	(0.044)	(0.040)	(0.042)	(0.037)
Transfer	-0.052	0.086**	0.022	0.038
	(0.044)	(0.039)	(0.043)	(0.039)
Pension	-0.052	0.011	0.158	0.037
	(0.095)	(0.084)	(0.127)	(0.113)
Income Recipient <300	0.121	0.051	0.140	0.075
	(0.088)	(0.078)	(0.123)	(0.105)
Income Recipient 300-600	0.026	0.052	-0.020	0.074*
	(0.095)	(0.077)	(0.053)	(0.043)
Caring-Time3-5	0.135**	-0.025	0.150**	0.066
	(0.063)	(0.057)	(0.062)	(0.055)
Caring-Time >5	0.276***	0.038	0.169***	0.142**
	(0.052)	(0.049)	(0.064)	(0.059)
Frequency	0.015	0.003	0.043	0.030
	(0.038)	(0.033)	(0.028)	(0.025)
Cohabite	0.082*	-0.024	0.115**	-0.024
	(0.049)	(0.044)	(0.049)	(0.044)
Spouse	-0.004	-0.081	-0.083	-0.047
	(0.114)	(0.105)	(0.122)	(0.112)
Son/Daughter	0.068	0.036	0.057	0.012
	(0.047)	(0.042)	(0.048)	(0.044)
Relative Help	-0.064	0.024	0.049	0.200***
	(0.044)	(0.040)	(0.042)	(0.036)
Formal Help	0.140	-0.095	0.089	0.021
	(0.123)	(0.120)	(0.075)	(0.069)
Domestic Employee	-0.026	-0.162	-0.185	0.117
	(0.167)	(0.162)	(0.218)	(0.176)
Family Decision	0.102**	-0.037	0.048	0.052
	(0.046)	(0.041)	(0.044)	(0.039)
Recipient Decision	-0.044	0.122	0.078	-0.086
	(0.103)	(0.076)	(0.082)	(0.079)
Leisure Cost	-	-	0.462*	-
	-	-	(0.273)	-
Observations	667		783	

Notes: [1] Standard errors in parenthesis [2] ***Significant at the 1% level **Significant at the 5% level *Significant at the 10 % level