Economic Analysis of the Intangible Impacts of Informal Care for People with Alzheimer's Disease and Other Mental Disorders

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A B S T R A C T

Objectives: Valuation of the intangible impacts of informal care remains a great challenge for economic evaluation, especially in the framework of care recipients with cognitive impairment. Our main objective was to explore the influence of intangible impacts of caring on both informal caregivers' ability to estimate their willingness to pay (WTP) to be replaced and their WTP value. **Methods:** We mapped characteristics that influence ability or inability to estimate WTP by using a multiple correspondence analysis. We ran a bivariate probit model with sample selection to further analyze the caregivers' WTP value conditional on their ability to estimate their WTP. **Results:** A distinction exists between the opportunity costs of the caring dimension and those of the intangible costs and benefits of caring. Informal caregivers' ability to estimate WTP is negatively influenced by both intangible benefits from caring ($P < 0.001$) and negative intangible impacts of caring ($P < 0.05$). Caregivers' WTP value is negatively associated with positive intangible impacts of informal care ($P < 0.01$). **Conclusions:** Informal caregivers' WTP and their ability to estimate WTP are both influenced by intangible burden and benefit of caring. These results call into question the relevance of a hypothetical generalized financial compensation system as the optimal way to motivate caregivers to continue providing care.

Keywords: Alzheimer, cognitive impairment, contingent valuation, informal care, intangible impact of caring.

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Introduction

It has been argued that Alzheimer's disease and other mental disorders can generate direct, indirect, and intangible costs [1–4]. Informal care, as part of the indirect and intangible impacts of caring, has been a subject of interest for both research and social policies. In the case of long-term care in particular, "family care management" is considered a substantial part of the total cost of care [5]. Analyzing the socioeconomic impacts of Alzheimer's-type disease in Europe (EU27), Kenisgsberg et al. [1] estimated that in 2008, on average 55% of the total cost of care was attributable to informal care.

Informal care was described by Van den Berg et al. [6] as a "quasi-market composite commodity [provided] by one or more members of the social environment of the care recipient, [and resulting] of the care demand of the care recipient." Because ageism, combined with lack of public funding, could lead to informal care becoming the cornerstone of elderly care, a value must be placed upon it. The unpaid aspects of informal care have been the main focus of economic evaluation, and informal caregivers' time trade-off has been the subject of an abundant literature [7–11]. In addition, most economic studies to date have focused on the negative impacts of caregiving [12]; however, informal caregivers may also derive benefits from caring [13]. If research in psychology was a forerunner of the concept of the intangible impacts of caring [14], a growing economics literature

has also deemed these impacts to be worthy of inclusion in cost-benefit or cost-utility analysis [13,15–17].

Intangible impacts of caring are another facet of externalities. Applied to mental health care by Mulvaney-Day [18], intangible costs encompassed the "pain and the suffering associated with the illness" and related to the disease's subjective burden and lost quality of life. Such impacts have been progressively extended to informal care and the subjective burden of caring defined as the informal caregiver's perception of "the impact of the objective burden related to caregiving" [19–21]. Therefore, the subjective burden is influenced by the amount of time spent on caregiving, as well as by the social relations between the informal caregiver and his or her care recipient and the psychological and emotional consequences of caring [16,22]. Additional intangible effects may also be considered, such as grief, anxiety and social handicap, fatigue, giving up leisure activities, and fewer social contacts, ultimately [23,24].

There has been less literature about the intangible benefits of informal care. The latter, such as strengthened family ties, feeling of accomplishment, and alleviation of guilt or empathy, have to be part of the informal caregiver's utility function [25]. Caregiving satisfaction is inversely influenced by the same factors as burden of caring because it represents "the perceived subjective gains and rewards, and the experience of personal growth that occurs as a result of providing care [26].

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The main objective of our article was to examine the relationship between the positive and negative intangible impacts of caring and the monetary value informal caregivers are willing to pay to be replaced. By focusing on how intangible impacts of informal care may influence the willingness to pay (WTP), within the framework of the contingent valuation (CV) method, we developed an original approach. In our study, intangible impacts encompass both the intangible costs (i.e., lack of social relationships or negative effect on caregiver's morale) and benefits such as the change in caregiver-care recipient relationships or fulfilled motivations to provide care. In contrast to many studies' recommendations, we could not supervise the whole questionnaire drafting process. Because WTP does not increase at fixed intervals, the WTP question format was not standard. Furthermore, intangible impacts of caring were not approximated by any validated scale such as Caregiver Reaction Assessment or by any common measure such as quality-adjusted life-year (QALY). These impacts were therefore more broadly analyzed in a broader scope than is usual in research on informal care because we focused on more facets of intangible impacts of caring than do validated scales [27,28].

WTP and Intangible Impacts of Caring

Informal care is part of health function production. Thus, informal caregiving time is not a free input [29]. Informal caregivers derive both direct and indirect (dis)utility from time spent on caregiving activities [13,30] and, according to the Hicksian theory, this affects their willingness to provide informal care [2,6]. What we call the intangible impacts of caring will be approximated by informal caregivers' WTP to be replaced for 1 hour of care, as WTP is supposed to be related to the caregivers' disutility (utility) associated with this intangible negative (positive) impact of caring. Although WTP has been used in many studies valuing informal care [6,13,15,28,31], few have explored how the intangible impacts of caring may affect the informal caregivers' ability to estimate their own WTP [13,32] and how these impacts are more likely to influence the value of their WTP.

To elicit an informal caregiver's WTP, we used the CV method, which has been proved to be relevant in the frame of nonmarket commodity. As stated by Glendinning et al. [33], this method is "capable of capturing all relevant aspects of informal care due to its sensitivity to the different circumstances informal caregivers are faced with, and it reflects their true preferences." In the literature about stated preference methods, several techniques are developed and allow informal caregivers to be asked for their WTP. The bidding game, the dichotomous choice, and the payment card can be considered benchmarks [34–36]. In addition, some validated scales are used to quantify the burden of caring when the intangible effects of informal care are valued [37–39].

As the "citizen worker" model has progressively replaced the traditional "male breadwinner" model in Western countries [40], informal care has tended to become more and more "commodified." Some authors, however, considered total "commodification" of care as being impossible because care also reflects emotional needs and remains socially embedded [41]. Lewis and Giullari , in line with Sen and Nussbaum's capability's approach [42–45], showed that valuing care was the only way to render "choice to care" equal to "choice to not care" among caregivers. These findings raise two fundamental questions for the present study: To what extent do the intangible impacts of caring limit caregivers' ability (capability) to estimate a price for their caregiving activities? What would this price be, given that limitation? Integrating the emotional and relational impacts of caring into the value of care could improve caregivers' capabilities in terms of making a decision to care and then improve their freedom to achieve care. From a societal perspective, giving monetary value to these intangible impacts, given caregivers' potential inability to value WTP, should make the caring-noncaring trade-off fairer and might involve either a more efficient financial compensation policy or the development of more efficient alternative policies.

Our analysis was thereby developed on the basis of two main hypotheses related to the possible associations between the intangible impacts of caring and the caregivers' WTP. The first assumed that these impacts affect informal caregivers' ability to estimate their WTP to be replaced for 1 hour. Under the second hypothesis, the WTP value was assumed to be affected by the intangible impacts of caring. To our knowledge, such an analysis has not been carried out so far in economic evaluation.

The outline of this article is as follows. The main characteristics of our sample will be presented. Then, the empirical methods and model specifications used will be described. Results are presented and then discussed along with policy implications.

Data Collection and Study Sample

Data collection was set by a French polling institute named BVA, associated with the Novartis Foundation, which is dedicated to informal caregivers in France. The data used stemmed from the fourth wave of the informal caregivers' panel data, collected in 2010, and comprises 533 nondependent caregivers, older than 15 years, and representative of French population. A close-ended questionnaire, specific to the French context, was used for the phone interviews and included 112 questions about the informal caregivers' feelings concerning both the objective and subjective impacts of informal caregiving. Representativeness of the sample was ensured by using the quota sampling method, based on sex, age, and occupation, after regional stratification.

We focused on informal caregivers providing care to elderly care recipients with cognitive impairments because the latter are known to mobilize more burdensome care than do elderly people without such impairment [46,47]. The inclusion criteria for our selected population of care recipients aged 65 years and older were suffering from Alzheimer's disease, "suffering from old age," and suffering from depression. There were two motivations behind this clustering of care recipients. First, we supposed that being considered a care recipient because of "old age" could hide dementia-stigmatization. Indeed, research in sociogerontology has already demonstrated that a loss of cognitive skills can be misinterpreted as a normal "old age" factor [48–50]. Second, depression is a mental disorder that can be hard to distinguish from dementia symptoms in the case of elderly patients [51]. Furthermore, preliminary chi-square tests were performed on informal assistance for activities of daily living activities (ADL) and instrumental ADL (IADL), which have been shown to be associated with patients' cognitive impairment [52–54], and on the negative impact of caring on caregivers' moral and social relationships (burden of caring proxies). Because the latter, as well as informal ADL and IADL assistance, were found to be significantly independent of the care recipients' disease at the 0.05 level, analyzing the intangible impacts of informal care of one cluster of care recipients with cognitive impairments was therefore possible. Consequently, 201 informal caregivers who met the care recipients' inclusion criteria were selected and represented our target population. Caregiver distribution among the main facets of the intangible impacts of caring studied is reported in Table 1.

In this article, the WTP question is designed as a derived payment card framework, although the latter used ranges of WTP that did not increase at fixed intervals. Basically, five answers to the WTP question were proposed and then converted into three categories for analysis, as presented in Table 2. "I don't know"

Table 1 – Caregivers' distribution per main facets of intangible impacts of caring.

Variables	Caregivers (%)
Dummy impact on social relationships (negative = 1)	27
Dummy ICr doesn't cope with his caregiver's role (yes = 1)	11
Dummy impact of caring on ICr moral (negative = 1)	45
Dummy delegating care generates a sense of failure (yes = 1)	7
Dummy motivation to care: Sense of duty (yes = 1)	46
Dummy motivation to care: Personal values (yes = 1)	55
Dummy motivation to care: I do it well (yes = 1)	9
Dummy providing care makes CR more responsible (yes = 1)	10
Dummy caregiving effect: Feel valued (yes =1)	19

Note. Data were obtained from the sample of 201 informal caregivers from the "Panel des Aidants Familiaux 2008, France." CR, care recipient; ICr, informal caregiver.

answers (1%) were merged with inability to estimate WTP, and we also put in one category all caregivers who estimated an "over €13 WTP" to have a binary WTP variable (€13 and less vs. more than €13). In taking €13 as our WTP reference, we had a value close to market prices or health sector tariffs for housework and to some values found in previous studies [6,55]. Only 55% of the sample estimated their WTP, which may lead to selection bias if focusing on this subsample to analyze the intangible impacts of caring on caregivers' WTP value.

Statistical Analysis

Data analysis was carried out including the two following steps. To identify characteristics in the informal caregivers that might imply their ability or inability to estimate their WTP to be replaced, we began by performing a multiple correspondence analysis. Then, because we were particularly interested in testing the two hypotheses relating to the association between the

Table 2 – Willingness-to-pay (WTP) answers and percentage of respondents. *Imagine you could be replaced for 1 hour of care to your care recipient. What would be your willingness to pay for this forgone hour of informal care?*

Original version of WTP answers	%
≤€13	19
>€13 and ≤€18	23
>€18	13
I can't estimate it	44
I don't know	1
Constructed version of WTP answers	**%**
I can't estimate it	45
≤€13	19
>€13	26

Note. Data were obtained from the sample of 201 informal caregivers from the "Panel des Aidants Familiaux 2008, France."

intangible impacts of caring and the above-mentioned caregivers' WTP, we ran a bivariate probit model with sample selection [56]. Because the payment scale was not detailed enough to evaluate incremental variation [57–59], it was not possible to estimate a Heckman two-step model, with continuous dependent outcome variable. In using sample selection model, we were able to analyze caregivers' WTP conditional on their ability to estimate their WTP. In addition, marginal effects were computed to better emphasize the economic significance of our results. All statistical analyses were performed by using STATA SE-64 statistical software 12.0 (StataCorp. LP, College Station, TX).

Both the ability to estimate WTP (AEWTP) and the value of the WTP (VWTP) to be replaced variables are interrelated caregiver decisions. We supposed these two probit models to have correlated errors that could hide unobservable factors related to caregivers' perceptions of the WTP question.

The first equation (1) selected the whole sample—the caregivers who were asked for the WTP question (n = 201)—and focused on caregivers' AEWTP, while the second equation (2) focused on the VWTP among the caregivers who placed monetary value on their potential replacement (n = 114).

In both equations, certain explanatory variables were used as proxies for the intangible benefits/costs of informal caregiving, such as "coping with the caregiving role," "suffering from negative impacts of caring on family life," and "feeling valued with caring." In addition, explanatory socioeconomic variables (e.g., income, education, and working status) were included along with caregiving task variables (e.g., ADL and supervision) to check whether our model would confirm the robust results the literature has shown [6,12,60]. Collinearity was also checked while running the procedure, as done in several studies about informal caregivers' burden [61]. No multicollinearity was observed because variance inflation factors were found below 2, except for IADL assistance.

Explanatory variables are represented by x_i in the selection equation (1) and by z_i in the outcome equation (2).

The model has the following form:

$$AEWTP_i^* = x_i\beta + \varepsilon_i \tag{1}$$

$$VWTP_i^* = z_i\alpha + u_i \tag{2}$$

where for each individual i, both $AEWTP_i^*$ and WTP_i^* are unobservable and, respectively, related to the reported binary dependent variables $AEWTP_i$ and $VWTP_i$ by the following rule:

$$AEWTP_i = \begin{cases} 1 & if \ AEWTP_i^* > 0 \\ 0 & if \ AEWTP_i^* \leq 0 \end{cases} \tag{3}$$

and

$$VWTP_i = \begin{cases} 1 & if \ VWTP_i^* > 0 \\ 0 & if \ VWTP_i^* \leq 0 \end{cases} \tag{4}$$

Use of the sample selection model is justified if the error terms of these two above equations are dependent; that is, $COV[\varepsilon, u] \neq 0 = \rho$, with

$$\varepsilon_i = v_i + \gamma_i$$

and

$$u_i = s_i + \gamma_i$$

where v_i, s_i, γ_i are normally distributed, ε_i and u_i are normal too, and the two dependent variables $AEWTP_i$ and $VWTP_i$ are also related to each other. Therefore,

$$VWTP_i = \begin{cases} 1 & only \ if \ AEWTP_i = 1 \\ 0 & only \ if \ AEWTP_i = 1 \end{cases} \tag{5}$$

To strengthen identification, we introduced an "exclusion restriction," that is, a variable featuring in the selection equation (1) but not in the outcome equation (2) [62,63]. This is the case for the will of being replaced (or not), which is an appropriate variable to capture the individual's decision in estimating his or her WTP to be replaced. The former was considered a "signal" for the latter. Because the null hypothesis was rejected while performing the likelihood ratio test, the "exclusion restriction" introduced in our model was relevant.

In addition, marginal effects were computed in line with Davin et al.'s [64] findings in the frame of behavioral models. It was thus more convenient and accurate to interpret the influence of intangible impacts of caring on the VWTP conditionally on caregivers' ability to estimate WTP (AEWTP).

Results

Table 3 reports the main descriptive statistics of caregivers and their care recipients from the sample studied. The latter was fairly equally shared between male and female caregivers, and most of them were care recipients' children but do not share the home jointly with them. Half of the caregivers have provided care for 5 years and more to care recipients, whose median age was 87 years, and 89% of them benefit from a caregiver network, either professional or informal.

As shown in Figure 1, the plane identified by the first two factorial axes was found to explain 32% of the total inertia in the data, a level close to that observed in other studies about caregiver quality of life [65]. Only 15 variables that obtained both the quality of representation of the axes higher than 25% and the highest contribution to the axes formation have been kept in Figure 1. The horizontal axis was mainly determined by the "impacts" of informal care, while the vertical axis was mainly determined by the opposition between informal caregivers who faced the potentially high opportunity cost of caring and those with the relatively low opportunity cost of caring. Thanks to this mapping, possible relations between these impacts and caregiver socioeconomic attributes were anticipated and were then confirmed by the findings of the bivariate probit models (Table 4) as explained below.

In the bivariate probit estimations, the null hypothesis of the likelihood ratio test (no correlation between equation residuals) was rejected (Table 4). This confirms that using the sample selection model in our study was relevant because we obtained both the marginal effects for the probability of a WTP higher than €13 given the dependent variable being observed and the marginal effects for the probability of being able to estimate the WTP being observed.

Unsurprisingly, the negative intangible impact of caring such as negative influence on caregivers' morale was associated with ability to estimate WTP (by accepting to putting a price on their potential replacement, caregivers accept the idea of a cost of caring—monetary compensation) ($P < 0.01$). Inversely, positive intangible impacts of caring such as feeling valued through caring activity multiply by -0.3 the probability of estimating WTP ($P < 0.001$). In the same way, experiencing positive behavioral evolution of the care recipient decreased the value of WTP (conditional on ability to estimate WTP) ($P < 0.01$). We found, however, unexpected positive associations between caregivers' ability to estimate WTP and the fact that caring fulfilled their sense of duty and their values and led to their inability to cope with their own role as caregiver ($P < 0.01$, $P < 0.05$, $P < 0.05$). Furthermore, negative impacts of caring on caregiver social relationships decreased the value of WTP (conditional on caregiver ability to estimate WTP) ($P < 0.01$) while feeling valued through caring multiplies this value by 1.3 ($P < 0.05$). Table 5

summarizes our results regarding the nine subhypotheses about the influence of different facets of intangible impacts on both the ability to estimate WTP and the value of WTP.

Table 3 – Characteristics of informal caregivers and of care recipients.

Characteristics	Value
Informal caregivers' characteristics	
Age (%)	
More than 50 y old	69
Female (%)	55
Mean net household income (%)	
< €1500	22
Between €1500 and €2499	36
≥€2500	42
Relation to care recipient (%)	
Partner	6
Child	67
Other	27
Live together with care recipient (%)	27
Education level (%)	
Low	40
High	60
Occupation (%)	
Retired (%)	50
Has at least one child younger than 15 y (%)	14
Provides assistance to the care recipient with… : yes (%)	
ADL	32
IADL	60
Supervision tasks	70
Other caregiver helps: yes (%)	89
Median amount of years dedicated to caregiving	5
Frequency of request for informal care (%)	
Often	26
Sometimes	74
Care recipients' characteristics	
Female (%)	80
Age (y) (median)	87
Care recipient lives in institution (%)	33.3
Alzheimer (%)	90
Old (older than 70 y) and depressive (%)	45
Oldness—dementia stigma (older than 70 y) (%)	69

Note. Low education level means neither diploma nor primary school certificate and high means secondary school diploma (baccalaureate) and/or university degree.ADL, activities of daily living; IADL, instrumental activities of daily living.

Discussion

This article proposed an original study on the intangible impacts of caring and their associations with both the caregiver's ability to estimate his or her WTP and the caregiver's WTP value conditional on his or her ability to estimate it. These were the initial assumptions of the study. Significant association was found between feeling valued through caring and decreased probability of ability to estimate WTP, confirming results from recent research related to informal care [11,13,15] in which intangible impacts of caring were found to influence informal caregivers' process utility. In the same way, the significant association between the positive behavioral evolution of the care recipient and the decreased value of WTP (conditional on ability to estimate WTP) corroborates some results of Al-Janabi et al. [66]
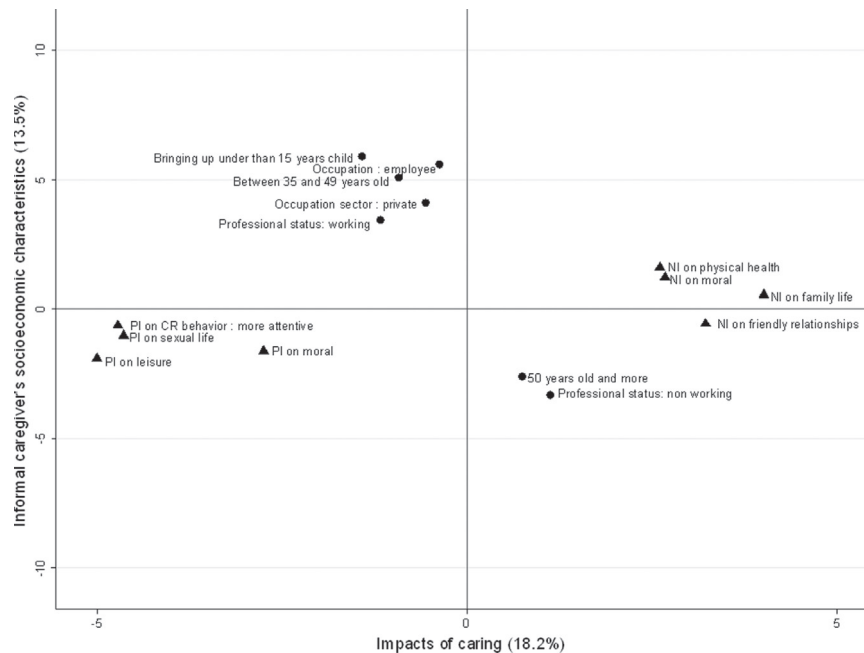
Legend: PI : Positive Impact   NI : Negative Impact   CR : Care Recipient

Fig. 1 – Results from multiple correspondence analysis—201 informal caregivers. CR, care recipient; NI, negative impact; PI, positive impact.

when presenting the "relationship attributes" (caregiver-care recipient relationships) as a possible reward where this relationship improves as a result of care. Furthermore, this variable can be considered an "altruistic component" because it deals with both care recipient and caregiver utility. The latter is derived from care recipient utility as described in van den Berg et al. [28] when studying the caregiver utility function as a joint function with that of the care recipient.

The association between the negative impact of caring on caregivers' morale and increased ability to estimate their WTP also comes within the scope of utility theory, implying that the higher an individual disutility, the higher will be the WTP to be free of it. Intangible impacts of caring influence caregivers' attitude toward hypothetical replacement situation and underline the influence of positive and negative intangible facets of caring.

The present study, like similar ones focusing on caregiver socioeconomic and caregiving task attributes, provides evidence that informal caregivers having the highest income level and deriving opportunity cost of caring (e.g., due to ADL and supervision tasks provision and because of the impossibility of care delegation) have either higher probability of estimating their WTP or have higher WTP value (conditional on the probability of being able to estimate WTP) [11,12,22,67,68]. Sharing care responsibilities with professional caregivers was found to increase both the probability to be able to estimate WTP and the probability of having a WTP of over €13, corroborating the results of other studies [6,66]. In line with the results of Fontaine et al. [69] , we observed that sharing care with another informal caregiver increases the probability of being able to estimate WTP. On the contrary, caring for a partner was associated with a lower probability of being able to estimate WTP [6,12].

Some missing, yet significant associations must be acknowledged. Neither the probability of being male nor that of caring for a male influenced caregiver ability to estimate his WTP and the monetary value of his WTP. Similar findings were observed for caregiver age or working status and were also unexpected because all these variables are usually associated with caregiver WTP or with their "willingness to accept" as shown by van den Berg et al. [6]. The lack of heterogeneity of the sample in terms of age and sample size could have influenced working and gender effects as they did for Van den Berg and Ferrer-i-Carbonell [32] when valuing informal care through the well-being valuation method and then comparing their results with those of van Praag and Ferrer-i-Carbonell [70].

Some of our subhypotheses about the different facets of intangible impacts on WTP and WTP value were rejected (Table 5). We found an unexpected association between the "feel valued through caring" variable and a probability of having a WTP of over €13 (conditional on caregiver's ability to estimate WTP). This is comparable to the "self-esteem item" from the Caregiver Reaction Assessment scale used by van den Berg et al. [6] and its impact on informal caregivers' WTA. Furthermore, variables "satisfying sense of duty" and "satisfying his/her values" by caring were in relation to the probability of being able to estimate WTP. This might be explained if the sense of duty and value motives for caring were to be considered as a societal strain on informal caregivers, rather than personal fulfillment [66,71]. Last, negative caring impacts on caregivers' social relationships and WTP of under €13 were associated as well as not "coping with caregiver's role" was with the probability of being unable to estimate WTP. According to Anderson et al. [68], an "overprotection" phenomenon in reaction to a caregiver sense of guilt might explain the inverse relationships between disruption of caregiver social life or emotional difficulties due to care and the inability to forgo part of their caring activity. These results are important in terms of preferences and economic choices even though they do not fit utility theory. The latter would have implied that all other things being equal, caregivers deriving disutility (utility) from caring could (could not) estimate their WTP and would have a relatively higher (lower) WTP value (proxy price of their utility loss) [72,73].

Table 4 – Variables associated with ability to estimate willingness to pay to be replaced (AEWTP) and willingness to pay value (VWTP)—results of bivariate probit model with sample selection.

Variables	Accept to estimate WTP (AEWTP)			Give a monetary value to WTP (VWTP)		
	Coefficient	SE	Marginal effect	Coefficient	SE	Marginal effect
Gender and socioeconomic variables						
Dummy ICr sex (male = 1)	−.3171936	.2490526		−.1324195	.4018392	
Dummy CR sex (male = 1)	.0937666	.2872946		−.5245244	.5627634	
Dummy ICr education level (high = 1)	−.0784713	.2552768		.2077389	.3932908	
Dummy ICr working status (working = 1)	.2994051	.3089752		.0246762	.4912303	
Dummy ICr has at least one child younger than 15 y (yes = 1)	−1.468698*	.423281	−.5214868	−.4975678	.5993452	
ICr age less than 50 y (yes = 1)	1.298428†	.5836519	.4163023	1.198845	1.017645	
ICr income						
< €1500	−1.137896‡	.4210128	−.4299683	1.601231‡	.5768272	.1380402
Between €1500 and €2499	−1.212056*	.3497151	−.4538627	.4399006	.4167203	
≥€2500	−1.515037	.4268853	−.5457618	2.107417‡	.7497503	.1682944
Dummy CR live in elderly home (yes = 1)	−.2753648	.299056		−.7925669	.4640589	
Dummy ICr and CR live together (yes = 1)	.3202531	.4281669		.1301049	.5781014	
Dummy ICr relation to the care recipient (partner = 1)	−1.475771*	.447833	−.5079468	−.1390087	.6786333	
Caregiving						
Dummy ADL (yes = 1)	.4939322†	.2399552	.1837356	−.1697306	.3596566	
Supervision tasks (yes = 1)	.8250024‡	.2873524	.0826758	.280433	.3923174	
Dummy frequency of request for informal care (often = 1)	.5940811	.3508562		1.212534	.6700122	
CR is also cared for by						
Professional caregiver	.7111881*	.2695369	.2715971	.8941024†	.4443685	.2634388
Another informal caregiver	.6410281†	.2649112	.2456527	−.9415214	.493972	
Dummy possibility to delegate (no = 1)	.7423894†	.3074571	.2604184	−.3805978	.4885843	
Dummy ICr wants to be replaced (no = 1)	−.9271642*	.2554374	−.336519			
Intangible aspects of caring						
Dummy impact on social relationships (negative = 1)	.0219633	.306103		−1.342374‡	.5052711	−.3874812
Dummy ICr copes with his caregiver's role (no = 1)	−.7587077†	.3428917	−.2954115	.5768676	.5313032	
Dummy impact of caring on ICr moral (negative = 1)	.9330028‡	.3008681	.3442659	.0141335	.4050497	
Dummy delegating care generates a sense of failure (yes = 1)	1.124757	.7793585		.4858445	.8380227	
Dummy motivation to care: Sense of duty (yes = 1)	.6748329‡	.2288178	.2538977	.2149749	.3738982	
Dummy motivation to care: Personal values (yes = 1)	.5591925†	.2377752	.2144639	−.1510026	.3827706	
Dummy motivation to care: I do it well (yes = 1)	.9561099†	.4608202	.2959565	−.8959437	.5510855	
Dummy providing care makes CR more responsible (yes =1)	.4459242	.4735184		−1.974619‡	.6415344	−.7238866
Dummy caregiving effect: Feel valued (yes =1)	−.9950355*	.3121625	−.3807862	1.264588†	.5427116	.1093384
LR test (ρ = 0): $\chi^2(1)$ = 6.80 Prob > χ^2 = 0.0091.						

Note. Marginal effects represents the marginal effects for the probability of a positive outcome (WTP) given the dependent variable (AEWTP) being observed.

ADL, activity of daily living; CR, care recipient; ICr, informal caregiver; LR, likelihood ratio; SE, standard error.

* $P < 0.001$.

† $P < 0.05$.

‡ $P < 0.01$.

We advise caution in interpreting the results in this article, because our study has some limitations. The first of these arises out of our sample, which presents specific characteristics. The latter was fairly equally shared between male and female caregivers, which is fairly unusual when caring for persons with cognitive impairments [37,73–75], and most of the caregivers were care recipients' children, which could be understood as a lower burden of caring [76,77]. Indeed, in their meta-analysis of the costs and rewards of caregiving, Raschick and Ingersoll-Dayton [77] showed how adult child caregivers were more likely

Table 5 – Validation of hypotheses about intangible impacts of caring on WTP and on WTP value.

Hypothesis	Independent variable	Hypothesis 1— Probability to estimate WTP		Hypothesis 2—WTP value	
		Expecting effect dependent variable (AEWTP)	Result	Expecting effect dependent variable (VWTP)	Result
1	Negative impact on caregiver's social relationships			Higher value	Rejected
2	Caregiver doesn't cope with his caregiver's role	Increased probability	Rejected		
3	Negative impact on caregiver's morale	Increased probability	Accepted		
4	Delegating care generates a sense of failure				
5	Motivation to care: Sense of duty	Increased probability	Rejected		
6	Motivation to care: Personal values	Decreased probability	Rejected		
7	Motivation to care: I do it well	Decreased probability	Rejected		
8	Providing care makes care recipient more responsible			Lower value	Accepted
9	Caregiving effect: Feel valued	Decreased probability	Accepted	Lower value	Rejected

Note. Empty cells represent the nonsignificant explanatory variables. AEWTP, ability to estimate WTP; VWTP, value of WTP; WTP, willingness to pay.

to experience reward from caring than a spousal caregiver. Furthermore, van den Berg et al. [78] considered that providing care for a long time and living with the care recipient involved difficulties in measuring the amount of time forgone in order to provide care. Because half of the caregivers had been providing care for 5 years or more and because most of them were not sharing a home jointly with care recipients, we assume that they were likely be able to estimate what they were missing out on in terms of leisure, work, and social life while providing care. Last, we considered care recipients suffering from "Alzheimer's disease," "old age," and "depression" as a single group of care recipients with cognitive impairments. Such an inclusion criteria might first appear inaccurate because of indisputable differences in clinical characteristics of these three types of recipients [79,80]. Thus, our sample might not be fully homogenous and mask differences in patterns of caregiving [46,81]. Nevertheless, our choice was motivated by three main raisons. First, the types of care recipients' disease were based on declaration of informal caregivers, which might not capture exact disease nosology and which allowed our study design to be focused on illness consequences in line with Wood's international classification of impairments [82]. Second, the chi-square tests confirmed no significant difference in care recipients' cognitive impairments, approximated by their needs for informal ADL and IADL assistance. Third, to our knowledge, no economic analysis of informal care has yet been done with such a care recipient sampling, which was challenging but could limit the scope of our findings somewhat.

The difficult comparison with similar studies might be a second limitation of this work. As already stated in the Introduction, we did not use any validated scale to measure the intangible impacts of caring. Furthermore, we did not use QALY, a common measure for assessment of caring impacts [71]. However, it has been criticized as being a restricted measure of intangibles once the sole utility associated with quality and quantity of one's life is considered and it may also lack sensitivity to the psychological impacts of caring [27,66,83,84]. Van den Berg

et al. showed that cost-utility analysis does not require "to use QALYs by definition" and the monetary value of informal care as derived by the CV method could be included on the cost side of any economic evaluation, which is also true for benefits [6,12]. Valuing intangible impacts of caring with using the CV method instead of using QALY allows avoiding the QALY compensation between caregivers and their care recipients [28]. The WTP question was designed as a "derived" payment card that did not increase at fixed intervals and that avoided starting point bias [85,86]. Nonetheless, we were not able to estimate any cumulative function of caregiver WTP—contrary to traditional payment card format. In addition, because the question was not concrete enough (i.e., the situation remained extremely "hypothetical about who will replace the caregivers"), a risk of hypothetical bias arises in caregiver responses [87,88], while strategic bias was excluded because the WTP question did not include potential reimbursement or provision of replacement caregiver [89].

We are aware that some concerns with potential endogeneity in our model may arise [90]. A well-known solution to endogeneity problems is the instrumental variable. But in practice, finding the perfect instrument is not straightforward— especially if its inclusion in the model was not anticipated [91]. Endogeneity issues have been found within the framework of substitution between formal and informal care [92–94] but to our knowledge, endogenous intangible impacts of caring have never been studied. As explained in the "Statistical Analysis" section, we checked for endogeneity due to omitted variables with an exclusion restriction variable. Hartmann et al. [95] considered that "exclusion restrictions are the most accessible identification approach to solving the simultaneity problem." Because modeling the probability of having high WTP conditional on reported ability to estimate WTP within sample selection model helped to prevent heterogeneity bias and because quiet a high number of explanatory variables were included in our model, the probability for the latter to suffer from endogeneity because of both unobserved and observed omitted variables was assumed to be low [51,64]. Endogeneity probability due to simultaneity was also

assumed to be very low—because having reverse causality between caregivers' WTP and the intangible impacts of the caring they experienced was scarcely probable. Eventually, sensitivity analysis showed that running a model without suspicious endogenous variables (e.g., income and education) did not change the significance of the main results of the study. Our model, however, still faced low-magnitude endogeneity bias because some variable coefficients changed slightly.

Finally, generalization of results could be regarded as a common limitation to all CV studies. One could wonder if use of the CV method in economic evaluation might lead to difficulties in results' generalization. This preference elicitation technique is known to be justified by consumer theory as respondents are supposed to maximize their utility when they estimate their WTP. Ciriacy-Wantrup [96], who first proposed CV surveys, explained that if individuals' WTP values are aggregated, "the result corresponds to a market demand schedule." This method, already widely used in the field of environmental economics, tends to be used increasingly in health economics, even where it involves important constraints such as opportunistic behavior due to a hypothetical scenario. This method, however, is most concerned with caregiver heterogeneity and preferences compared with benchmark methods in this field, such as opportunity cost and proxy good methods [6]. Given our subject of interest, the intangible impacts of caring, using a method that is more accommodating of caregiver subjectivity (preferences) seemed relevant.

Conclusions

Our results enhanced social policy–targeting incentives to care for informal caregivers dedicated to care recipients having cognitive impairments, which should pay attention to the intangible impacts of caring when valuing informal care. Taking the latter into account would permit determination of an optimal financial compensation system, for two reasons. First, for informal caregivers who are able to estimate their WTP, taking intangible impacts of caring into account might decrease the price of this potential financial compensation. Indeed, our findings suggest that benefits from caring might increase the probability of having a less than €13 WTP value. In this case, "cash for care" policies would be more socially efficient than a public investment focusing on private home working development [6,55]. Second, for informal caregivers who are not able to estimate their WTP, taking intangible impacts into account might support the need for alternative policies in order to motivate informal caregivers to continue providing care, without replacing them. Because we showed that being unable to estimate WTP does not mean not experiencing the burden of caring, alternatives, such as respite care or work arrangements [97,98], might be more efficient than direct financial compensation from a societal perspective.

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