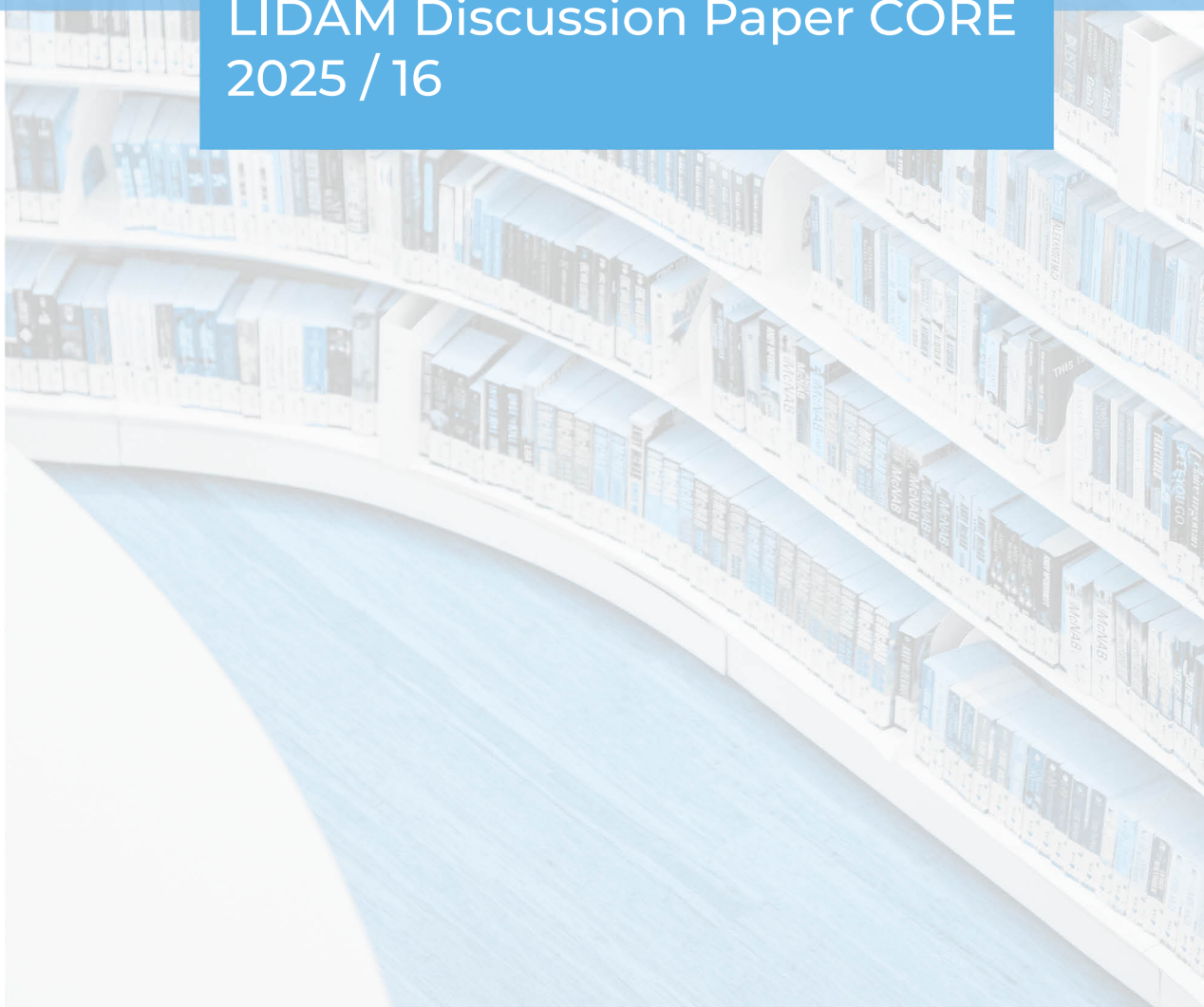
INFORMAL AND FORMAL CARE FOR DISABLED ELDERLY INDIVIDUALS. SUBSTITUTES OR COMPLEMENTS?

Sergio Perelman, Pierre Pestieau

LIDAM Discussion Paper CORE
2025 / 16



UCLouvain

CORE | LIDAM
Louvain Institute of Data Analysis and Modeling in economics and statistics

CORE

Voie du Roman Pays 34, L1.03.01

B-1348 Louvain-la-Neuve

Tel (32 10) 47 43 04

Email: immaq-library@uclouvain.be

https://uclouvain.be/en/research-institutes/lidam/core/core-discussion-papers

Informal and formal care for disabled elderly individuals. Substitutes or complements?

Sergio Perelman*and Pierre Pestieau†

06/14/25

Abstract

The relationship between informal and formal care for disabled elderly individuals—whether they function as substitutes or complements—represents a fundamental question for optimizing public resource allocation in aging societies. We develop a theoretical framework demonstrating that long-term care (LTC) policy design hinges critically on this relationship. Using data from the Survey of Health, Ageing and Retirement in Europe (SHARE), we provide empirical evidence to address this pivotal question.

JEL Classification: H, I.

Keywords: long term care, informal versus formal care, social insurance.

1 Introduction

The relationship between informal and formal care for disabled elderly individuals lies at the heart of aging and social care policy. These two types of care—informal care typically provided by family members, and formal care delivered by professional services and mainly financed by own saving and government — can function either as substitutes or as complements, and understanding this dynamic is crucial for effective public policy design. If informal and formal care are substitutes, then expanding public access to formal care services would reduce the burden on families, allowing them to step back from caregiving responsibilities. In such a scenario, formal services could relieve stress on informal caregivers, particularly women, who often reduce their labor market participation to care for aging relatives. This substitution effect implies that well-targeted public investment in formal care could not only improve the well-being of the elderly but also enhance economic productivity and gender equality.

On the other hand, if informal and formal care are complements, increasing one calls for an increase in the other. In this case, public support for formal care

*HEC, University of Liege

†HEC, University of Liege; CORE, University of Louvain

could actually encourage families to provide more care themselves, by making it more feasible or effective Rather than replacing family care, formal services in this context empower and sustain it. This view acknowledges that even when professional help is available, the emotional and social support provided by family remains indispensable. Understanding whether these forms of care act as substitutes or complements has direct implications for the allocation of public resources. If policymakers wrongly assume substitution when the relationship is complementary, they risk underfunding formal services and overburdening families. Conversely, assuming complementarity when substitution prevails could lead to inefficient overlap and waste.

Furthermore, this question intersects with issues of equity. In low-income households, formal care may be unaffordable or unavailable, leaving families with little choice but to provide care themselves—often at great personal and financial cost. If formal care effectively substitutes for informal care, publicly funded access becomes a powerful tool for reducing inequality and ensuring that care responsibilities are not inequitably distributed across social classes. At the same time, in case of complementarity, the pressure on low-income families can be unbearable and it can induce the government to subsidize informal care.

The remainder of the paper is structured as follows. Section 2 presents a theoretical model illustrating how the optimal design of public long-term care (LTC) policy hinges on whether formal and informal care are substitutes or complements. It also highlights the importance of considering how families factor in the impact of caregiving on their employment and personal health when making care decisions. Section 3 provides a new empirical analysis of the relationship between formal and informal care, drawing on data from the SHARE survey. The final section concludes.

2 Theoretical model.

The basic model used is a two period one that involves parent-child families, where children's contributions to their elderly parents' care depend on their individual market productivity and their degree of altruism.[1] Families differ in the levels of wages w_i and ω_i of the parent and the child and the disability risk π_i. The parent lives two periods, working during the first period and earning $w_i l_i$,. The labor supply l_i brings a monetary disutility $v(l_i)$. In the second period, the parent consumes his/her saving s_i, if healthy. In case of disability, his/her LTC utility is $H(a, m)$, which depends on informal care provided by children, a_i, and formal cares m_i, financed by saving s_i and public LTC benefit, g. LTC public benefits are financed by a payroll tax τ paid by the parent when young. Parent's lifetime utility can be written as:

$$U_i^p = u(w_i(1-\tau)l_i - s_i - v(l_i)) + (1-\pi_i)\,u(s_i) + \pi_i H\left(a_i, s_i + g\right)$$

[1] We here only consider the case of families consisting of just one parent and one child. In case there are several siblings, the problem would be different as shown by Stern(2023) for example.

where $u(.)$ and $H(.,.)$ are respectively concave and strictly concave whereas $v(.)$ is strictly convex. We assume zero interest rate and no time preference.

The timing of the game is the following:

1. The government chooses the tax rate and the benefit level that maximize the parents' welfare.
2. Parents choose their labor supply, their saving and the LTC insurance premium, if any .
3. Children help their parents in case of disability.

2.1 Child's problem

As standard, we proceed backward and thus look first at the child problem. The child's utility depends on whether the parent is dependent or not. It can be written as:

- in case of healthy parent: $U_i^c = u(d_i) = u(\omega_i)$
- in case of disabled parent: $U_i^c = u(d_i) + \beta H(a_i, m_i) - \sigma\kappa(a_i) = u(\omega_i(1-a_i)) + \beta H(a_i, m_i) - \sigma\kappa(a_i)$,

where β denotes the degree of altruism, d_i the child's consumption, $m_i = s_i + g$ formal care, $\kappa(a_i)$ the various (psychological and physical) costs of providing care and σ the degree to which children take into account those costs. In other words $1-\sigma$ measures the degree of myopia that is assumed constant.

When the parent is healthy, the child consumes his/her earning ω_i. In case of loss of autonomy, he/she devotes a fraction of time a_i to caring. The FOC that defines the optimal a_i is simply

$$\Delta = -u'(d_i)\omega_i + \beta H_1(a_i, m_i) - \sigma\kappa'(a_i) = 0.$$

From this interior condition, we obtain a supply function for caring time: $a_i = a(m_i; \beta, \omega_i, \sigma)$. Differentiating the above FOC, we get:

$$\frac{\partial a_i}{\partial m_i} = \frac{\beta H_{12}}{-\Delta_{a_i}} \lesseqgtr 0 \Leftrightarrow H_{12} \lesseqgtr 0.$$

Note that in the separable case where $H_{12} = 0$, elder care would only depend on ω_i, σ and β. In case of complementarity, elder care increases with m_i and in case of substitutability, we have some crowding-out. We might be interested by the effect of ω_i on a_i. This can be obtained by differentiating the above FOC:

$$\frac{da_i}{d\omega_i} = \frac{u'(d_i)[R_R(d_i) - 1]}{-\Delta_{a_i}}$$

In other words, the effect of ω_i on a_i is positive or negative depending on whether the coefficient of relative risk aversion is higher or lower than 1. In this

paper, we posit that the relative risk aversion coefficient as well as the distribution of children's wages are such that they have a small impact on informal care. Using the same approach we have that: $\frac{da_i}{d\beta} > 0$ and $\frac{da_i}{d\sigma} < 0$.

Throughout this paper, we assume that children care only for their disabled parents out of altruism, meaning they do not provide assistance when their parents are healthy. Additionally, we intentionally selected altruism as the primary motive for caregiving. An alternative explanation could be the influence of social norms, in which case informal care would remain independent of the variable m_i.[2]

2.2 Parent's problem

Before knowing his/her health status, the parent chooses l_i and s_i so as to maximize lifetime expected utility U_i^p subject to the caring function $a\left(m_i; \beta, \omega_i.\sigma\right)$.

The FOCs with respect to l_i and s_i are:

$$w_i(1-\tau) - v'(l_i) = 0$$

$$-u'(c_i) + (1-\pi_i)\, u'(s_i) + \pi_i H_2\left(a_i, m_i\right) + \pi_i H_1\left(a_i, m_i\right) \frac{\partial a_i}{\partial s_i} = 0$$

where $\frac{\partial a_i}{\partial s_i} = \frac{\partial a_i}{\partial g} = \frac{\partial a_i}{\partial m_i}$.

2.3 Government's problem

The problem of the government is expressed by the following Lagrangian to be maximized:

$$\mathcal{L} = E\{u(w(1-\tau)l - s - v(l)) + (1-\pi)\, u(s) +$$

$$\pi\left[H\left(a\left(.\right), s+g\right) + u\left(\omega\left(1-a\right)\right) + \beta H\left(a, m\right) - \kappa(a)\right] + \mu\left[\tau w l - \pi g\right]\}$$

where $Ez = \sum n_i z_i$ and μ is the multiplier associated with the revenue constraint.

Note that the government takes into account the cost of care-giving regardless of the degree of myopia of children.

Interior solutions are obvious here and thus, using the envelope theorem, we obtain the FOCs:

$$\frac{\partial \mathcal{L}}{\partial g} = E\pi\left[\left(H_1 - (1-\sigma)\,\kappa'(a)\right)\frac{\partial a}{\partial m} + H_2 - \mu\right] = 0$$

$$\frac{\partial \mathcal{L}}{\partial \tau} = -E\left[u'(c) w l - \mu\left(wl + \tau w \frac{\partial l}{\partial \tau}\right)\right] = 0.$$

[2] Klimaviciute et al. (2017)

Combining those two FOCs, we derive the compensated effect of the tax, that is $\frac{\partial \mathcal{L}^{\mathcal{C}}}{\partial \tau} = \frac{\partial \mathcal{L}}{\partial \tau} + \frac{dg}{d\tau}\frac{\partial \mathcal{L}}{\partial g}$. We thus obtain:

$$\frac{\partial \mathcal{L}^{\mathcal{C}}}{\partial \tau} = -E\left[u'(c)wl - \pi H_2 \frac{Ewl}{E\pi} - \pi\left(H_1 - (1-\sigma)\kappa'(a)\right)\frac{\partial a}{\partial m}\frac{Ewl}{E\pi} - \mu\tau w\frac{\partial l}{\partial \tau}\right] =$$

$$-cov\left(u'(c), wl\right) + cov\left(\pi, H_2\right)\frac{Ewl}{E\pi} + EwlE\left[H_2 - u'(c)\right] + E\pi\left(H_1 - (1-\sigma)\kappa'(a)\right)\frac{\partial a}{\partial m}\frac{Ewl}{E\pi} - \mu\tau Ew\frac{\partial l}{\partial \tau} = 0.$$

And thus :

$$\tau = \frac{-cov\left(u'(c), wl\right) + cov\left(\pi, H_2\right)\frac{Ewl}{E\pi} + EwlE\left[H_2 - u'(c)\right] + E\pi\left(H_1 - (1-\sigma)\kappa'(a)\right)\frac{\partial a}{\partial m}\frac{Ewl}{E\pi}}{-\mu Ew\frac{\partial l}{\partial \tau}}$$

The first covariance is clearly negative and the second is positive. The third term is expected to be positive. Indeed in the First Best, we have that $H_2 - u'(c) = 0$, which can be implemented with an actuarial fair private insurance. In the absence of such insurance, the level of m is suboptimal. As to the last term of the denominator, it is positive as long as $H_{12} > 0$ and $\sigma = 1$. We thus have that family solidarity fosters public spending in case of complementarity between a and m. This effect can be offset by the myopia factor that has a negative effect on social LTC in case of complementarity. In case of substitutability, it has a positive effect. As mentioned in the introduction, a strong complementarity puts pressure on households to provide the informal care that matches formal care.

3 Empirical study.

Existing scanty literature suggests that the relationship depends on needs and intensity (higher dependency often requires both types) and on type of services (personal care vs. household help). Most evidence points to a mixed relationship where they can be both substitutes and complements depending on the specific circumstances and needs of the care recipient. Among early studies, we can mention Pezzin et al. (1996) who found evidence of substitution between informal and formal care in the U.S., suggesting that formal care may crowd out family-provided care as well as Van Houtven and Norton (2004) who also concluded that formal and informal care are largely substitutes, using data from the U.S. Health and Retirement Survey (HRS).

In the European Context, we have the widely cited paper by Bonsang (2009) who examines the relationship between informal and formal care using data from SHARE. It shows that informal care can substitute for formal care but primarily for low-skilled care needs. The substitution relationship depends significantly on the type of care and level of disability of the care recipient. Informal care tends to substitute for formal care when addressing low-skilled care needs (like household help or basic assistance with daily activities). As care needs become

more complex and involve higher-skilled care (such as nursing or medical care), the relationship shifts toward complementarity rather than substitution. There is also the paper of Bolin et al. (2008) that examines substitution effects across European countries.

In short, the existing literature provides mixed evidence, with context-specific and policy-contingent outcomes. While formal and informal care are often substitutes in terms of time and tasks, they may be complements in broader caregiving strategies, especially when informal caregivers provide emotional support and coordinate professional services. We now turn to our own assessment of the relation between formal and informal care using the most recent SHARE data. Formal-informal care substitution in European countries

In our attempt to evaluate the degree of substitution between formal and informal care, we depart from the conventional approach that assumes a causal relationship between the two. Instead, we adopt an agnostic framework inspired by the literature on production efficiency. For each level of disability, we construct a best-practice frontier under the assumption that care providers seek to deliver optimal outcomes. This efficiency frontier serves as an isoquant, illustrating how formal and informal care substitute for one another at varying levels of dependence. Using the terminology of production theory, this method allows us to estimate the elasticity of substitution, assess the relative contributions of each type of care, and examine the presence of scale economies—specifically, how much additional care is required as disability severity increases. We acknowledge, however, that this approach implicitly involves a cardinalization of our indicators of dependence.[3]

3.1 Input distance function

We postulate that the provision of care to disabled elderly individuals can be assumed as a production process and represented by an input distance function of the form:

$$D(y,x) = max\rho : x/\rho \in L(y), \tag{1}$$

where y corresponds to a given degree of dependency (denoted by β_i in the above model), x to a vector of inputs, the hours of informal and formal care received (a_i and m_i), and ρ the distance to the minimum set $L(y)$ which, in our case, represents the set of all combinations of informal and formal care for a given level of disability among the targeted population. $D(y,x)$ is assumed non-decreasing, positively linearly homogeneous and concave in x, and increasing in y.

We adopt a translog representation of this distance function:

$$D_i = \alpha_0 + \alpha_1 \ln(y_i) + \alpha_{11} \ln(y_i)^2 + \beta_1 \ln(x_{1i}) + \beta_2 \ln(x_{2i}) + 1/2\beta_{11} \ln(x_{1i})^2$$

[3]For an application of a parametric distance function approach in the healthcare sector, see Grosskopf et al. (1995). In this paper, the authors estimate an output distance function to measure the substitutability between different hospital services.

$$+1/2\beta_{22}\ln(x_{2i})^2 + \delta_1\ln(y_i)\ln(x_{1i}) + \delta_2\ln(y_i)\ln(x_{2i}) \geq 1, \quad (2)$$

where y_i, x_{1i} and x_{2i} indicate, for individual i, the degree of dependency and the hours of informal and formal care received, respectively. Homogeneity of degree 1 on inputs implies the following restrictions on equation (2):

$$\beta_1 + \beta_2 = 1, \beta_{11} + \beta_{12} = 0, \beta_{22} + \beta_{12} = 0, \quad (3)$$

and, by symmetry, $\beta_{21} = \beta_{12}$.

Applying these restrictions to equation (1) and rearranging terms, the functional form becomes:

$$\ln(1/(x_{2i}) = \alpha_0 + \alpha_1\ln(y_i) + 1/2\alpha_{11}\ln(y_i)^2 + \beta_1\ln(x_{1i}^*) +$$

$$1/2\beta_{11}(\ln(x_{1i}^*)^2 + \delta_1\ln(y_i)\ln(x_{1i}^*) - \ln(D_i), \quad (4)$$

where $x_{1i}^* = x_{1i}/x_{2i}$ indicates that input x_{2i}, in this case formal care, is chosen as the numeraire and $\alpha_0, \alpha_1, \alpha_{11}, \beta_1, \beta_{11}$ and δ_1 parameters to be estimated.[4]

Given the non-linear nature of this function we cannot impose the other announced proprieties, that is, non-decreasing and concave on x and increasing on y. Nevertheless we can test in each case if the estimated function fulfilled them, either for all observations, either for a proportion of them.

Hicks elasticity of substitution between informal and formal care can then be computed from the estimation of input distance function (4) after imposing $D_i = 1$ (Stern, 2010):

$$\sigma_{12,i} = \partial\ln(s_{1i}/s_{2i})/\partial\ln(x_{2i}/x_{1i}), \quad (5)$$

where s_{1i} and s_{2i} are distance function elasticities with respect to the inputs, the hours of informal and formal care, respectively. These indicators have a direct interpretation as input shadow shares, and are computed as follows:

$$s_{1i} = (\partial\ln(D_i))/(\partial\ln(x_{1i})) = \beta_1 + \beta_{11}\ln(x_{1i}) + \beta_{12}\ln(x_{2i}) + \delta_1\ln(y_i) \quad (6)$$

and

$$s_{2i} = (\partial\ln(D_i)/(\partial\ln(x_{2i})) = \beta_2 + \beta_{22}\ln(x_{2i}) + \beta_{21}\ln(x_{1i}) + \delta_1\ln(y_i). \quad (7)$$

Elasticity of substitution may vary from perfect complementarity ($\sigma_{12,i} = 0$) to perfect substitutability ($\sigma_{12,i} = \infty$). Very often values are close to $\sigma_{12,i} = 1$, which corresponds to proportional changes in (shadow) prices and in quantities. From this point of view, the advantage offered by the translog function is that it allows for variable (non-constant) elasticity of substitution, contrary to the

[4]Note that the results are invariable to the input variable selected as the numeraire (Coelli and Perelman, 1999).

Cobb-Douglass and the CES function. And, as mentioned before, our aim here is to estimate the elasticity of substitution between formal and informal care at different disability levels which requires a flexible technology.

Moreover, scale elasticities can also be derived from equation (4) estimates. In the case of one single output it corresponds to the partial derivative of the input distance function with respect to $\ln(y_i)$:

$$sc_i = (\partial \ln(D_i))/(\partial \ln(y_i)) = \alpha_1 + \alpha_{11} \ln(y_i) + \delta_1 \ln(x_{1i}) + \delta_2 \ln(x_{2i}) \qquad (8)$$

with $sc_i = -1$, $sc_i > -1$ and $sc_i < -1$ for constant, decreasing and increasing returns to scale, respectively. Given that the output variable in our model, y_i, corresponds to the number of limitations, decreasing (increasing) returns to scale elasticity means that resources, informal and formal care intensity, increase (decrease) more than proportionally the increase in disability.

Finally, another important caveat is that in the frontier efficiency literature, as mentioned before, inputs' minimisation is the main hypothesis underlying the estimation of an input distance function (4). In the particular case under studied here, we assume that $\ln(D_i) = \varepsilon_i$, which corresponds to an error term normally distributed, $\varepsilon_i \simeq N(0, \sigma^2)$ and an OLS specification.

Proceeding in this way, we move away from the traditional stochastic frontier analysis approach, which assumes a composed error term. In our view, this is justified by the high proportion of dependent people for which the hours of care received, informal or formal or both, are very low or null. In practice, the access and the intensity of care will depend, other than individuals' degree of dependency, multi-dimensional by definition, on their own idiosyncrasy and on a combination of multiple factors. We think, on the one hand, to those determining the provision of informal care, e.g. the presence and the availability of children or other closer people and, on the other hand, to those driving the access to formal care, e.g. long-term care provided by public and by private institutions for free, or the possibilities offered by the market, when it is possible, for the dependent person and her family, to afford for them.

3.2 Data

As in Bolin et al. (2008) and Bonsang in (2009), our analysis relies on SHARE data, but on more recent waves, 8th and 9th ran in 2020 and 2023, respectively (SHARE-ERIC, 2024). We are particularly interested in two batteries of questions asked in SHARE. Questions on potential limitations aged people may experience to perform activities of daily living and, when it is the case, questions on care received at home. On the one hand formal care provided by professionals and, on the other hand care provided informally by persons not living in the same household (children, siblings or other relatives, including friends or neighbours).

We retain for our analysis dependent respondents aged 60+ years old not

living in institutions.[5] To this aim, we consider a person dependent if she reported suffering of at least one limitation of daily living. Given that the hours of care provided by the partner or, eventually, by other household members is not available in SHARE, our study relies on a sample composed exclusively of respondents without partner in the same household. Table 1 reports summary statistics for this sub-sample, making the distinction between European regions -Central-Western, Eastern, Northern and Southern- and also as a function of the number of limitations of daily living.[6]

On Table 1 we observe that, as expected, the percentage of respondents receiving care increases nearly systematically with disability (the number of limitations). However, clear differences appear across regions. For instance, in Central-Western and Northern countries formal care dominates informal care, while in Eastern countries the reverse is observed. In Southern countries both types of care are present in close proportions, 32.4% and 36.8%, respectively.

When we turn to the number of hours of care received within a week, the intensive margin, differences are less marked. On the one hand, it is among Southern countries that both the hours of formal and informal care are the highest (15.8 and 11.5 hours/week, respectively). On the other hand, lower intensity of formal care is observed in Central-Western countries (6.5 hours/week) and for informal care in Northern European countries (7.4 hours/week).

At the end of the day, not clear evidence can be drawn from these aggregated statistics concerning the formal vs. informal care substitutability/complementary question. Then, we turn to the results obtained using individual data and applying the parametric approach presented in subsection 3.1.

3.3 Distance function estimation and results

Table 2 reports the results of OLS estimations for the four European regions. In all cases parameters are highly statistically significant, which is confirmed by high R^2 statistics. Given that for estimation purposes $\ln(y_i)$, $\ln(x_{1i})$ and $\ln(x_{2i})$ are expressed in deviations to the mean, the coefficients β_1, $\beta_2\,(=1-\beta_1)$ and α_1 correspond to elasticities at mean values (m), as described by equations (6) to (8). Therefore, we see that, for mean values, in all the regions the sign of partial elasticities are those expected: $s_{1m}=\beta_1>0$, $s_{2m}=\beta_2>0$ and $sc_m=\alpha_1<0$. More detailed results are presented in Table 3.

In Table 3, besides the estimations corresponding to average values for each region, we report the detailed results by levels of dependency (number of limitations), also at mean values. First of all, in most cases a gradient is observed in input distance elasticities with respect to informal and formal care as a function of disability. For instance, a decrease of formal care in Northern and Southern countries while an increase in Western-Central countries. Given that these elasticities have a direct interpretation as shadow input shares, they indicate

[5] SHARE conducts interviews in nursing homes, but we decided to not consider them in the analysis. Other the issue of potential sample bias, in such cases information concerning formal and informal care intensity is also subject to important measurement bias.

[6] For details on SHARE selected questions and on data treatments, see Appendix A.

Table 1: Formal and informal care among 60+ disabled.

European Region	Limitations	Obs.	Age	Receive care (%)		Hours/week	
				Informal	Formal	Informal	Formal
Central Western	1	636	79.0	8.3	10.4	4.1	3.2
	2	387	80.3	5.6	9.9	5.5	3.1
	3-5	607	81.2	18.5	31.1	9.8	5.2
	6+	533	83.6	35.9	61.8	12.4	8.1
	All	2163	81.1	18.3	30.3	10.3	6.5
Eastern	1	592	74.9	10.5	2.9	7.8	5.2
	2	404	79.4	8.4	5.9	6.3	7.4
	3-5	826	79.7	23.9	6.1	6.9	8.2
	6+	923	82.3	60.4	22.4	11.3	13.5
	All	2745	79.7	32.6	11.4	9.9	11.9
Northern	1	210	78.5	7.1	7.1	4.2	4.3
	2	144	80.5	5.3	10.1	5.3	2.8
	3-5	158	82.4	12.1	25.7	9.3	6.1
	6+	96	82.3	18.4	62.2	8.9	11.2
	All	608	80.6	9.9	21.8	7.4	8.0
Southern	1	170	79.8	9.6	5.3	10.7	10.1
	2	149	81.3	18.2	13.5	7.7	7.8
	3-5	328	83.9	25.5	19.0	8.8	15.1
	6+	464	86.0	59.8	56.7	12.5	16.7
	All	1111	83.8	36.8	32.4	11.5	15.8
All	1	1608	78.4	8.9	7.8	6.3	4.4
	2	1084	80.3	8.5	9.8	6.5	4.7
	3-5	1919	81.6	21.3	21.7	8.7	7.6
	6+	2016	84.1	49.6	50.6	12.1	11.9
	All	6627	81.5	25.9	26.3	10.6	9.9

Notes: SHARE waves 8 and 9, respondents without partner in household.

Table 2: Input distance function estimations by European region.

Explanatory variables	Parameters	European Regions			
		Central Western	Eastern	Northern	Southern
Constant	α_0	0.735***	0.616***	0.631***	0.753***
		(0.091)	(0.123)	(0.073)	(0.204)
$\ln(y_i)$	α_1	-0.865***	-0.615***	-0.278***	-1.358***
		(0.046)	(0.031)	(0.060)	(0.074)
$\ln(y_i)^2$	α_{11}	-1.117***	-1.031***	-0.829***	-1.233***
		(0.114)	(0.073)	(0.152)	(0.151)
$\ln(x^*_{1i})$	β_1	0.581***	0.308***	0.652***	0.425***
		(0.014)	(0.010)	(0.021)	(0.017)
$\ln(x^*_{1i})^2$	β_{11}	-0.085***	-0.095***	-0.120***	-0.042***
		(0.004)	(0.003)	(0.007)	(0.005)
$\ln(y_i)\ln(x^*_{1i})$	δ_1	-0.097***	0.104***	-0.080***	0.055***
		(0.015)	(0.010)	(0.021)	(0.019)
	N	2139	2713	592	1065
	R^2	0.683	0.584	0.848	0.706

Notes: Country dummies are included as controls and continuous variables, $\ln(y_i)$, $\ln(x_{1i})$ and $\ln(x_{2i})$, were expressed in deviations to mean values. Missing parameters, β_2, β_{22}, β_{12}, β_{21} and δ_1, are computed applying homogeneity and symmetry conditions (3). Standard errors in parentheses, $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

that in Northern and Southern countries formal care is easily accessible, with respect to informal care, when disability increases, while the contrary occurs for European Western and Central countries. In Eastern countries, no clear path is observed but, as we can see, in average informal and formal care shadow shares are by far the lowest and the highest, respectively, compared to other regions. However, for elasticity of substitution and scale elasticity the results go in the same direction in all regions, as we can see in last columns of Table 3.[7]

On the one hand, we observe a rather clear substitutability ($\sigma_{12} > 1$) between informal and formal care for low levels of disability. The elasticity of substitution decreases quickly as the level of dependence increases, particularly in Northern countries, to become complementary ($\sigma_{12} < 1$) when the number of limitations reaches its maximum (6 or more). It should be noted that the elderly who end up in a nursing home and are generally severally disabled are not part of our sample. Clearly for those dependent, formal care is predominant.

On the other hand, as we can see in last column of Table 3, for mean values elasticities of scale correspond to decreasing returns ($sc > -1$), except in the case of Southern countries for which mean estimations correspond to increasing returns ($sc < -1$). Anyway, in all cases we observe a gradient, from decreasing to increasing returns of scale, as the number of limitations increases. In other words, even if the degree of dependency is measured here cardinally, this result indicates, that limitations tend to increase faster than hours of care received. A direct consequence is that for higher levels of dependence, care at home become unaffordable, both in terms of informal and formal care, and nursery homes appear, in most cases, as the only option.

4 Conclusion

Research on the relationship between informal and formal care for disabled elderly individuals has significant implications for long-term care policy. Informal caregiving can help reduce public health expenditures by lowering the demand for formal care services. However, the literature shows that the interaction between informal and formal care is not uniform; whether they function as substitutes or complements depends on a range of factors, including the severity of the care recipient's needs, the availability of informal caregivers, cultural context, and the nature of the formal services provided.

In this paper, we begin by illustrating how the complementarity or substitutability between the two forms of care affects the design of public policy. We then present new empirical findings based on SHARE data that shed further light on this complex relationship. Using a production theory framework, we find that the elasticity of substitution declines as disability severity increases.

[7] At mean values, elasticities reported in Table 3 fulfill the regularity conditions (concave in x, and increasing in y), the only exception is for scale elasticities in the case of individuals with only one limitation. With this same exception, and conditionally to receive both types of care, the regularity conditions are also verified at individual level in a high number of cases ($> 80\%$).

Table 3: Formal and informal care. Cost shares, elasticity of substitution and scale elasticity.

European Region	Limitations	Partial elasticities		Elasticity of substitution	Scale elasticity
		Informal	Formal	Informal	Formal
Central Western	1	0.637	0.363	12.25	0.21
	2	0.582	0.418	5.67	-0.55
	3-5	0.551	0.449	2.02	-1.22
	6+	0.548	0.452	0.65	-2.00
	Mean	0.581	0.419	1.72	-0.86
Eastern	1	0.265	0.735	7.59	0.56
	2	0.331	0.669	9.59	-0.15
	3-5	0.349	0.651	3.60	-0.75
	6+	0.290	0.710	0.54	-1.47
	Mean	0.308	0.692	1.39	-0.62
Northern	1	0.655	0.345	30.23	0.35
	2	0.595	0.405	7.86	-0.22
	3-5	0.623	0.377	3.97	-0.68
	6+	0.791	0.209	0.35	-1.17
	Mean	0.652	0.348	2.64	-0.28
Southern	1	0.341	0.659	6.74	0.39
	2	0.388	0.612	8.79	-0.48
	3-5	0.398	0.602	3.01	-1.23
	6+	0.492	0.508	0.81	-2.46
	Mean	0.425	0.575	1.56	-1.36

Notes: In each case, estimations correspond to average $\ln(y_i)$, $\ln(x_{1i})$ and $\ln(x_{2i})$ values.

This result suggests that long-term care policy should be differentiated based on the degree of dependency—distinguishing between mild and severe cases.

References

[1] Bolin, K., B. Lindgren, P. Lundborg (2008), Informal and formal care among single-living elderly in Europe. Health Economics, 17(3), 393-409.

[2] Bonsang, E. (2009), Does informal care from children to their elderly parents substitute for formal care in Europe?, Journal of Health Economics, 28, 143-154.

[3] Coelli, T. and S. Perelman (1999), A comparison of parametric and non-parametric distance functions: With application to European railways, European Journal of Operational Research, 117,326--339.

[4] Grosskopf, S., Margaritis, D. and V. Valdmanis (1995), Estimating output substitutability of hospital services: A distance function approach, European Journal of Operation Research, 80, 575-587.

[5] Klimaviciute, J., S. Perelman, P. Pestieau and J. Schoenmakers (2017), Caring for dependent parents: altruism, exchange or family norm?, Journal of Population Economics 30: 835-873.

[6] Nishimura and Pestieau (2025), Public pensions and LTC insurance with family solidarity, unpublished

[7] Pezzin, L., P. Kemper, and J. Reschovsky, (1996), Does Publicly Provided Home Care Substitute for Family Care?: Experimental Evidence with Endogenous Living Arrangements. Journal of Human Resources, Vol. 31, No. 3

[8] SHARE-ERIC (2024), Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 1, Release version: 9.0.0. SHARE-ERIC. Data set. DOI: 10.6103/SHARE.w1.900.

[9] Stern, D. I. (2010), Derivation of the Hicks, or direct, elasticity of substitution using the input distance function, Economic Letters, 108, 349-351.

[10] Stern, S. (2023), Where Have All My Siblings Gone? Journal of Human Resources, 53, 852-892.

[11] Van Houtven, C. and E. Norton (2004), Informal Care and Health Care Use of Older Adults, Journal of Health Economics, 23(6):1159-80.

Appendix A. SHARE Data

Individual data collected by the Survey of Health, Ageing and Retirement in Europe (SHARE-ERIC, 2024), Waves 8 (2020) & 9 (2023).

Selection rule

Respondents aged 60+ living without a partner in the household and who reported at least one limitation in activities of daily leaving and any kind of care or help received (see hereafter).

European regions

Center-Western: Austria, Belgium, France, Germany, Luxembourg, The Netherlands and Switzerland)

Eastern: Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia

Northern: Denmark, Finland and Sweden

Southern: Cyprus, Greece, Italy, Malta, Portugal and Spain.

Variables definitions and questions

Limitations in activities of daily living

PH049_HeADLb: *Please tell me if you have any difficulty with these activities because of a physical, mental, emotional or memory problem. Exclude any difficulties you expect to last less than three months*:

1. *Dressing, including putting on shoes and socks*
2. *Walking across a room*
3. *Bathing or showering*
4. *Eating, such as cutting up your food*
5. *Getting in or out of bed*
6. *Using the toilet, including getting up or down*
7. *Using a map to figure out how to get around in a strange place*
8. *Preparing a hot meal*
9. *Shopping for groceries*
10. *Making telephone calls*
11. *Taking medications*
12. *Doing work around the house or garden*
13. *Managing money, such as paying bills and keeping track of expenses*
14. *Leaving the house independently and accessing transportation services*
15. *Doing personal laundry*

Formal care

HC127AtHomeCare: *We already talked about the difficulties you may have with various activities because of a health problem. During the last twelve months, did you receive in your own home any professional or paid services listed on this card due to a physical, mental, emotional or memory problem?*

- Help with personal care (e.g. getting in and out of bed, dressing, bathing and showering).

HC034HrsNursCare: *On average, how many hours per week did you receive professional or paid help with personal care at home?*

Informal care

SP002_HelpFrom: *Thinking about the last twelve months, has any family member from outside the household, any friend or neighbour given you any kind of help?*

SP004_TypesOfHelp: *Which types of help has this person provided in the last twelve months?*

- *Personal care, e.g. dressing, bathing or showering, eating, getting in or out of bed, using the toilet.*

SP005_HowOftenHelpRec: *In the last twelve months how often altogether have you received such help from this person?*

1. *About daily* (12 hours/week)
2. *About every week* (2 hours/week)
3. *About every month* (0.45 hours/week)
4. *Less often* (0.15 hours/week)

Into brackets the number of hours/week imputed in each case based in average hours/week reported by respondents to SHARE Wave 1. Respondents can report informal care received from up to three persons. For estimation purposes, the total number of hours/weeks of care corresponds to the sum of them.