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Reciprocity and the matrilineal advantage in European grand-parenting

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Abstract
This study proposes reciprocity between parents and children to explain the observed matrilineal advantage in grandparent—grandchildren relationships in Europe. On the one hand, maternal grandparents look after grandchildren more than paternal grandparents do. On the other hand, daughters help their parents with personal tasks more than sons do. This advantage is stronger in the countries of Europe with lower gender equality and lower trust in others, where the traditional view of the family is more likely to prevail.

Keywords Grandparents' childcare · Matrilineal advantage · Europe · Reciprocity

1 Introduction

Grandparents, and in particular grandmothers, are an important source of informal childcare for their grandchildren. In 2019, nearly half (47.1%) of all the children aged less than three years in the EU were cared for exclusively by their parents, while 35.3% were in formal care for at least one hour per week and 25% were cared for by their grandparents, other relatives, or professional childminders for at least one hour per week (Eurostat, 2021).

These informal transfers of care affect important individual decisions such as fertility (Garcia-Moran & Kuehn, 2017), labor force participation (Rupert & Zanella, 2018) and residence (Mendez, 2015). In a recent study, Zamarro (2020), finds evidence that, for some European countries, the childcare provided by working-age grandmothers has a positive effect on the labor force participation of their daughters.

The current paper is motivated by the observation that the quality and intensity of the relationship between grandparents and grandchildren may vary with the gender of

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the intermediate generation (grandparents' adult children). We define matrilineal advantage as the situation in which the ties involving maternal grandparents and their grandchildren are closer and more intense than those involving paternal grandparents.

Because of the high mortality rates prevailing in ancient times, family heads cared not only about their well-being but also about minimizing the probability of lineal (dynastic) extinction (Chu, 1991). This concern led to the development of a patrilineal advantage favoring the eldest son (and his children), not only in Europe (Bertocchi, 2006) but also in China and Japan (Nakane, 1967). In modern societies, the expected increased lifespan may have shifted the attention of grandparents from lineal succession to well-being in older age, and at least in part from sons to daughters.[1]

Recent evidence documents the presence of a matrilineal advantage in the US (Chan & Elder, 2000). Additional evidence in the same direction is provided by Zamarro (2020), who uses the first wave of the Survey on Health, Ageing and Retirement in Europe (SHARE) to show that grandmothers in ten European countries are more likely to provide childcare to the children of adult daughters than to children of adult sons.

In this paper, we contribute to this literature in several ways. First, using six waves of SHARE, that cover the 27 EU countries, Switzerland and Israel, we compare grandparents' childcare of grandchildren when the adult child is either female or male and show that the intensity of childcare – measured in days per month - is higher when the adult child is female. We show that the closer relationship between parents and daughters applies also to personal and household tasks other than childcare, as parents spend more days helping their daughters than their sons with these tasks. Daughters, on the other hand, are more likely than sons to spend time helping their parents with similar tasks.

Previous sociological research has explained matrilineal advantage with women's kin keeping, or the facilitation of contact among kin (see Hagestad, 1986). We interpret instead the combined evidence that grandparents favor daughters in their provision of childcare (and other personal and household tasks) and daughters provide parents with more intensive help than sons do as reciprocity.[2] Compared to alternative explanations such as cohabitation, kin keeping, and empathy/altruism/lack of antagonism, we argue that reciprocity better fits our empirical evidence.

[1] This shift may be less pronounced in Asian countries such as China, where sons are customarily responsible for providing old-age support to parents (see Murphy et al., 2011). However, Ho (2019), documents the increased attention to daughters as providers of support or comfort to parents in Asia as well. Pushkar et al. (2014) found that older parents of only daughters have more intimate family relations than parents of only sons. See also Kahana and Kahana (1970), Kivett (1991), Matthews and Sprey (1985), Somary and Stricker (1998).

[2] This reciprocity may have strategic motives (see for instance Konrad et al., 2002). Grandparents may invest more time and money in the care of their daughters' children in the reasonable expectation of receiving their daughters' help when in older age. Daughters, on the other hand, may provide care in the expectation of receiving bequests. Manacorda and Moretti (2006), and Horioka et al. (2018), discuss the strategic behavior of parents and adult children in the decision to cohabitate. The investigation of these motives is beyond the scope of the current paper. Reciprocity by adult children may also be a demonstration of affection for their own children.

Last but not least, we show that the intensity of matrilineal advantage in grandparents—grandchildren relations is higher in the countries of Europe where the traditional family and the traditional division of labor—with the husband working and the wife specializing in housework and care of children and parents – are more important.

The importance of matrilineal advantage and the strength of the mother-daughter relationship imply that maternal grandmothers have an important role in the development of their grandchildren's worldview and values. Family values are transmitted from grandmothers to grandchildren via the maternal line. Although there is a view that traditional society is characterized by male dominance, the presence of a matrilineal advantage in the countries of Europe suggests that females play an important role in the transmission of family values, consistent with findings for the U.S (Fernandez & Fogli, 2006) and Asia (Kawaguchi & Miyazaki, 2009).

Our paper is related to two strands of literature. The first strand investigates the relationship between grandparents' childcare of grandchildren and the labor supply of both grandparents (see for instance Rupert & Zanella, 2018; Zamarro, 2020; Mendez, 2015) and their adult daughters (see for instance Posadas & Vidal-Fernandez, 2013; Compton & Pollak, 2014 and Garcia-Moran & Kuehn, 2017). We confirm previous evidence indicating that retired grandparents invest more time in the childcare of their grandchildren.

The second strand includes the literature on reciprocity, which shows that females are more reciprocal than males (see for instance Croson & Gneezy, 2009),[3] and the literature on identity (Akerlof & Kranton, 2000), which points out that gender identity can determine economic behavior and the division of labor within a household.[4] We relate to these contributions by treating reciprocity as the key mechanism explaining our findings, and by showing that matrilineal advantage is more salient where the traditional division of labor prevails.

The remainder of the paper is organized as follows. Section 1 introduces the data; Section 2 discusses the empirical approach and Section 3 is dedicated to the results. Conclusions follow.

2 The data

We draw our data from the Survey on Health, Ageing and Retirement in Europe, a multi-disciplinary and cross-national representative European survey containing

[3] Corson and Gneezy define reciprocity, or conditional altruism, as a behavior in which one party's preferences over another party's consumption are conditional on the other party's actions.

[4] Working women can be role models that shape their children's identity and influence also mate selection (see Fernandez et al. 2004; Fernandez & Fogli, 2006; Kawaguchi & Miyazaki, 2009; Farre & Vella, 2013; Johnston et al., 2014). The sons of working mothers share more housework with their spouses after marriage (Yamamura & Tsutsui, 2021), and women who were exposed to a larger number of working mothers during adolescence are less likely to feel that work interferes with family responsibilities. This perception, in turn, is important for whether they work when they have children (Olivetti et al., 2020). For instance, Bredtmann et al. 2020, find that gender role preferences of foreign-born mothers-in-law can explain the labor supply of native US women, indicating that cultural values can be transmitted across cultural boundaries.

current and retrospective information on the labor market activity, retirement, health and socio-economic status of Europeans aged 50 or older. We use waves 1, 2, 4 to 6 and 8 of the survey, covering the period 2004 to 2020 and 27 European countries plus Israel and Switzerland.[5]

For convenience, we denote grandparents as G1, their adult children as G2 and their grandchildren as G3. For each interviewed G1 individual or couple, SHARE has information on G2 adult children and G3 grandchildren. In the first two waves, only the first four G2 children are considered. In the remaining waves, all G2 children are considered, but we only retain the first ten (households with at most ten children were at least 98.7% of the sample in each country in wave 8). Since the questions about children and grandchildren are answered by the family respondent on behalf of the couple, in the case of couples we retain only the family respondent.

Interviewed grandparents with grandchildren are asked whether, during the time since the last interview, they have regularly or occasionally looked after their grandchildren without the presence of parents. Those who answer positively are asked both about the frequency of care (less than monthly, almost every month, and almost every week, almost daily) and about the number of hours of care spent looking after grandchildren in a typical month during the past year.

Frequency and hours comprise the care provided to all the children of the same parent: if a couple G1 has two adult children G2, and each adult child has two G3 children, SHARE has information, for each G2, on G1's childcare of all G3. For each adult child, we also know the age of his/her youngest child. Since it is reasonable to assume that childcare matters for children aged 15 or younger, we retain in our working sample only adult children with the youngest child aged 15 or younger.

The information on hours of childcare is only available for the first two waves. Thus, we focus hereafter on the frequency of care and re-classify it as follows: thirty days per month for almost daily, four days per month for almost every week, one day per month for almost every month, and half a day per month for less than monthly.[6] Fig. 1 shows the average number of days spent by grandparents looking after their grandchildren in the 27 European countries, Israel and Switzerland. This frequency is higher than four days per month in Cyprus and Italy and lower than one day per month in Denmark, Finland, Slovakia and Sweden.

Respondents are asked whether, during the past year, they gave help to or received help from any family member from outside the household or within the household, including their own adult children. Help includes dressing, bathing or showering, eating, getting in or out of bed, or using the toilet; home repairs, gardening, transportation, shopping, household chores or help with paperwork, such as filling out forms, settling financial or legal matters. We define these activities as personal and household tasks, that exclude childcare.

[5] We exclude waves 3 and 7, which focus on retrospective life histories.

[6] Our empirical results are qualitatively unchanged if we treat frequency as an ordinal categorical variable.

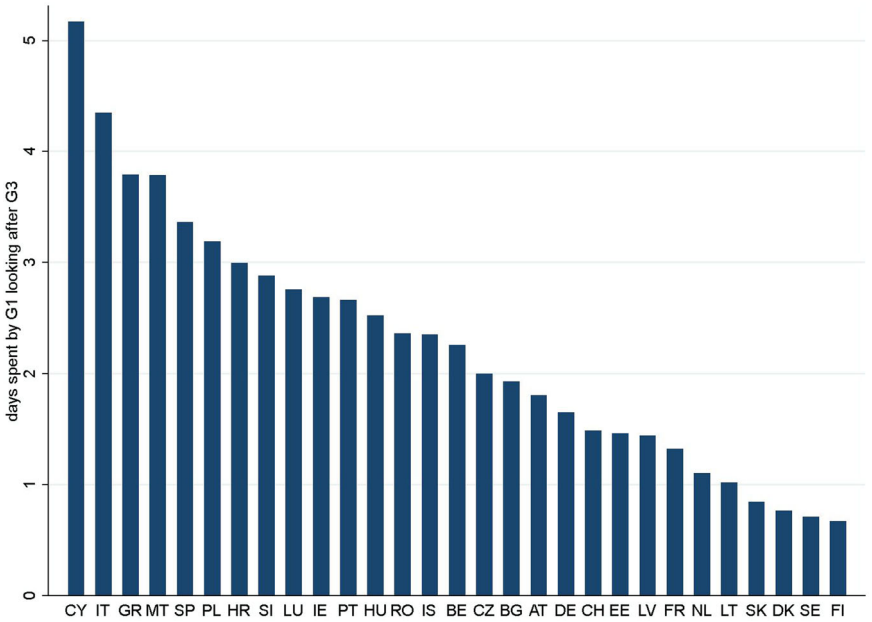

Fig. 1 Days per month spent by grandparents looking after grandchildren. Sample: adult children with the youngest child aged 15 or lower. By country. AT (Austria), BE (Belgium), BG (Bulgaria), CY (Cyprus), CH (Switzerland), CZ (Czechia), DE (Germany), DK (Denmark), EE (Estonia), FI (Finland), FR (France), GR (Greece), HR (Croatia), HU (Hungary), IE (Ireland), IS (Israel), IT (Italy), LU (Luxembourg), LT (Lithuania), LV (Latvia), MT (Malta), NL (Netherlands), PL (Poland), PT (Portugal), RO (Romania), SE (Sweden), SI (Slovenia), SK (Slovakia), SP (Spain). Source: our elaborations using the SHARE survey

They are also asked whether they gave financial or material gifts to or received these gifts from persons inside or outside the household, including own children G2. These financial transfers amount to at least 250 euro per year, exclude shared housing or shared food and include generic types of cost such as those for medical care or insurance, schooling and down payment for a home.[7]

In our working sample, respondents G1 are aged between 50 and 90. We consider adult children aged 55 or younger, who are at least 14 years younger than their parents,[8] and have a child aged 15 or younger.[9] As explained in the next section, since our identification strategy exploits gender variation of adult children G2 within each G1's household, we do not retain G1 respondents with a single child, ending up with 37,217 grandparents and 75,205 observations.

Table 1 shows the summary statistics for the frequency of childcare and G1 and G2 characteristics. The (weighted) average number of days spent per month in the

[7] Data on financial transfers and help with personal care are not available for Hungary. In addition, wave 4 of the survey does not allow for the identification of which child is giving or receiving financial transfers or care, and therefore is not used for these items. While information on the amount being gifted is available in waves 1 and 2, later waves only have information on whether this amount was equal to or larger than 5000 euro.

[8] We suspect that shorter gaps reflect measurement errors.

[9] This restriction eliminates about 35% of our observations.

Table 1 Summary statistics

	Mean	Standard deviation	Number of observations
Grandparent variables			
Looked after grandchildren during past year (days per month)	3.396 [0, 30]	8.407	75,205
Female	0.582 [0, 1]		75,205
Age	65.874 [50, 90]	8.315	75,205
Average years of education	8.953 [0, 25]	5.165	75,205
Average household income	28,548 [1, 1,129,127]	28,208	75,205
Retired (binary)	0.568 [0, 1]		75,205
Married (binary)	0.665 [0, 1]		75,205
Household size	2.113 [1, 12]	1.058	75,205
Self-reported health (1: excellent; 5: poor)	2.752 [1, 5]	1.036	75,205
Adult children variables			
Female (binary)	0.517 [0, 1]	–	75,205
Age	38.020 [17, 55]	6.375	75,205
Age missing (binary)	0.010 [0, 1]		75,205
Number of G3 children	1.897 [1, 23]	0.999	75,205
Employed full time (binary)	0.640 [0, 1]		75,205
Employed missing (binary)	0.002 [0, 1]		75,205
Median or above median school degree (binary)	0.602 [0, 1]	–	75,205
Median or above median school degree missing (binary)	0.032 [0, 1]		75,205
Further education or vocational training (binary)	0.570 [0, 1]		75,205
Further education or vocational training missing (binary)	0.129 [0, 1]		75,205
Firstborn (binary)	0.409 [0, 1]		75,205
Not living with partner (binary)	0.082 [0, 1]		75,205
10 years or more since moving out (binary)	0.677 [0, 1]		75,205
Distance from G1—same building or less than 1 km (binary)	0.220 [0, 1]		75,205
Distance from G1—from 1 to 25 kilometers (binary)	0.383 [0, 1]		75,205
Distance from G1—more than 25 kilometers (binary)	0.293 [0, 1]		75,205
Distance from G1—missing (binary)	0.104 [0, 1]		75,205

SHARE waves 1,2, 4 to 6 and 8

Means are computed using the individual weights provided by SHARE. G1: grandparents. Minimum and maximum values within brackets

Table 2 Grandparents' exclusive and not exclusive care of grandchildren

	All adult children	Male adult children	Female adult children
Percent of G1 providing no care	41.38	45.05	37.96
Percent of G1 providing exclusive care	28.61	27.80	29.36
Percent of G1 providing non-exclusive care	30.01	27.15	32.68
Average days of care—no care	0	0	0
Average days of care—exclusive	5.235	3.415	5.235
Average days of care—not exclusive	6.224	4.926	6.224

Based on the sample of grandparents with adult children whose youngest child is aged 15 or younger. Means are computed using the individual weights provided by SHARE. G1: grandparents

past year by grandparents looking after their grandchildren without the presence of parents is 3.396 (standard deviation: 8.407). While the share of G2 females is slightly over 50% (51.7%), the share of female grandparents (and female family respondents) is 58.2%, reflecting the fact that the survival probability is higher for females than for males. Average grandparents' age and years of education are 65.9 and 8.95 respectively. The share of retired and married grandparents is 56.8 and 66.5% respectively, and average real household income is about 28.5 thousand euro. Household size is 2.113 and average self-reported health is 2.752 (1 for excellent and 5 for poor).

Turning to adult children, their average age and number of children is 38.0 and 1.9 respectively. Close to 68% live more than 1 kilometer from their parents; 8.2% do not live with a partner, either because they are not married or because they are separated, divorced or widowed. We also find that 64% of adult children are employed (full time); 60% have attained a school degree below post-secondary education that is equal or higher than the country-specific median level[10] and 57 have completed some post-secondary education or vocational training; 40.9% are first-born, and 67.7% have moved out of their parent's household 10 or more years ago, which we interpret as an indicator of the intensity of ties between G2 and G1.

Our data also show that daughters are slightly less likely to live in the G1's household or building than sons: 7.7% versus 8.8%. The share of daughters who are not living with a partner and stay in G1's household or building is 19&, slightly less than the percentage of sons (23.3%). Finally, the percentage of three generations households (adult children with a partner living in the same household or building as parents) is 6.5 for daughters and 7.7 for sons.

As reported in Table 2, about 41% of grandparents provide no childcare (45% for male adult children and 38% for female adult children), 28.6% provide exclusive care of the children of a single adult child (27.8% for adult male children and 29.4% for female adult children), and 30% provide care to the children of more than one adult child (27.2% for adult male children and 32.7% for female adult children). The

[10] SHARE asks about the highest attained degree below post-secondary education. We compute for each country the median highest degree and define a dummy equal to 1 if G2's education is at or above the median and to 0 otherwise.

Table 3 Summary statistics on reciprocal financial help and help with tasks

	Mean	Standard deviation	Number of observations
Grandparent variables			
Gave financial gifts to G2 children (binary)	0.155		57,802
Gave help with tasks to G2 (days per month)	0.305	2.499	57,802
Gave financial gifts to G2 children worth more than 5000 euro (binary)	0.043		57,802
Gave help with tasks to G2 children (binary)	0.072		57,802
Adult children variables			
Gave help with tasks to G1 (binary)	0.066	–	57,865
Gave help with tasks to G1 (days per month)	0.369	2.832	57,865
Gave financial gifts to G1 parents (binary)	0.020		57,865
Gave financial gifts to G1 parents worth more than 5000 euro (binary)	0.001		57,865

SHARE waves 1,2, 4 to 6 and 8

Means are computed using the individual weights provided by SHARE. G1: grandparents; G2: adult children

frequency of childcare is higher for grandparents providing non-exclusive care (6.22 days per month) than for exclusive parents (5.24 days per month).

Turning to financial and other help from G1 to G2, 15.5% of grandparents gave financial gifts to adult children in the past year, 4.3% gifted 5000 euro or more, and 7.2% provided help with personal and household tasks, spending on average 0.305 days per month doing this (see Table 3). On the other hand, only 2% of adult children gave financial gifts to their parents (0.1% gifting 5000 euro or more), and 6.6% provided help with personal and household tasks (spending on average 0.369 days per month doing so).

3 The empirical approach

Figure 2 illustrates the web of interactions involving the three generations G1 to G3. The dotted box in the figure indicates the flow of services and resources taking place within a three-generation family. The solid arrows describe the flow of services (childcare, help with tasks) and the dashed arrows show the exchange of financial gifts.

These services are provided as alternatives or in addition to market provided services. Additional providers include the grandparents of G2's partners, friends and neighbors and other family members not included in Fig. 2. The choice between family provided and market provided care depends on availability as well as on relative costs and benefits.

We compare G1's childcare when G2 is female or male and establish that there is matrilineal advantage when the intensity of the former—measured in days per month—is higher than the intensity of the latter, conditional on G1 and G2 characteristics. Since stronger ties between parents and daughters do not show up only in grandchild caring but could also involve the exchange of financial transfers and other help, we also compare these services.

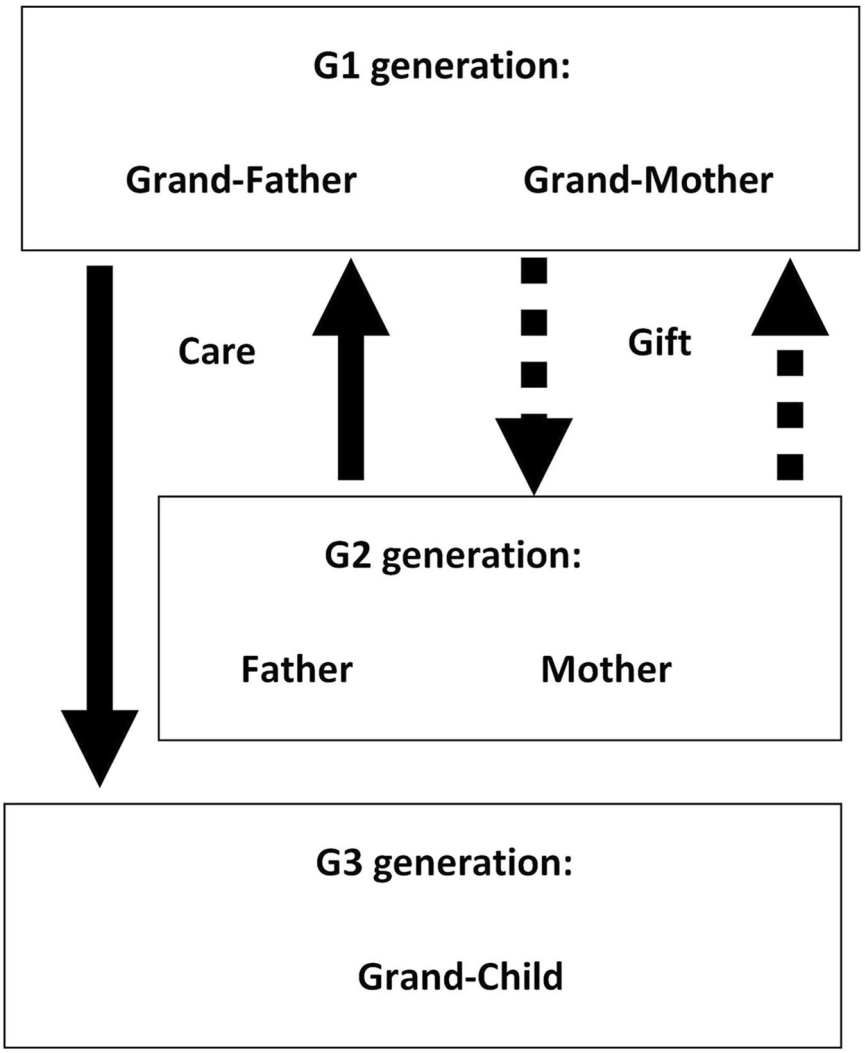

Fig. 2 Flows of family care and gift exchange. The solid arrows indicate flows of care and the dashed arrows show flows of financial or material gifts

Let Y be the intensity of grandparents' childcare of grandchildren, "Daughter" a binary variable equal to one when the adult child is a daughter and zero otherwise, and X a vector of covariates respectively. In the presence of matrilineal advantage, we expect to find that E [Y|Daughter = 1, X] > E [Y|Daughter = 0, X].

We estimate the following model

$$Y_{ijt} = \beta_0 + \beta_1 Daughter_{ij} + \beta_2 X_{it} + \gamma_j + \sigma_t + \varepsilon_{ijt} \quad (1)$$

where the subscripts i, j and t are for the child G2 (and her/his children G3), the grandparent G1 and time, X_{it} is a vector of G2's observable characteristics, both time varying and time invariant, γ_j is a time invariant household fixed effect and σ_t is an

Table 4 Share of firstborn females and number of adult children by gender of firstborn

	Sample of G2 with youngest child aged 15 or younger	Working sample used in estimates	*p*-value of difference
Share of firstborn females	0.511	0.506	0.066
Number of G2 children if female firstborn	2.972	3.088	0.000
Number of G2 children if male firstborn	2.932	3.032	0.000

Means are computed using the individual weights provided by SHARE. G2: adult children

aggregate time effect. A matrilineal advantage in the relationship between grandparents and grandchildren requires that parameter β_1 is positive.

It is important to notice that the gender of child G2 is not randomly allocated across G1 households, but depends on "endogenous stopping rules", according to which some parents may continue having children until they have one of the desired sex (Dahl & Moretti, 2008). Since these rules and the number of adult children are specific to the single G1 family, we control for them using G1's family fixed effects. Conditional on these effects, the dummy "Daughter" is as good as random. This strategy implies that the identification of β_1 is driven by "within-household" variations, and by the households with at least two children with a different gender, which comprise 56.2% of the observations in our working sample.

This identification strategy implies that we cannot use G1 households with a single adult child. However, we retain families in which all adult children have the same sex because, although they do not help identifying the parameter of interest β_1, they help in the estimation of the other parameters.

A potential concern with our empirical approach is that, since parents with a preference for sons are more likely to have a second child if the firstborn child is a girl (compared to a boy), the identification of β_1 is based on a selected sample that includes more firstborn G2 females and a larger number of siblings than the original sample. To investigate this, we consider a broader sample, which includes adult children with the youngest child aged 15 or younger, and our working sample, which excludes from the broader sample all G1 households with a single child.

We compare across these two samples the share of G1 families with a firstborn adult female child and the average number of adult children by sex of the firstborn (see Table 4). We find that the share of families with a firstborn adult female child is 0.511 in the broader sample and 0.506 in the working sample, a minor difference (and statistically not different from zero). Although the average number of children is higher in the working than in the broader sample (3.088 versus 2.972 when the firstborn is female and 3.032 versus 2.932 when the firstborn is male), as one would expect because of the exclusion of families with a single adult child in the working sample, the difference is small (but statistically significant). We conclude from this that it is unlikely that our estimates of parameter β_1 are driven by a sample which contains a larger share of firstborn adult females than the original sample.

The vector X_{it} includes G2's age, the number of G3 children, the distance from grandparents' home, a categorical variable taking 9 different values (including 0 for missing values), birth order and dummies for: employment (full time); education

(whether G2 has attained a degree below post-secondary at or above the country-specific median value and whether G2 has completed some post-secondary education or vocational training); not living with a partner; having moved out of G1's home at least 10 years ago.[11]

We recognize that some of these covariates are endogenous because of reverse causality or because they are decided jointly with grandparents' childcare. For instance, grandparents' childcare can affect G2's employment or higher education, and distance can be chosen to be near to grandparents and facilitate their childcare. We therefore estimate: (a) a baseline specification, that includes only the dummy D, time, family fixed effects, exogenous covariates such as G2's age and firstborn status (a binary variable); (b) an augmented specification that adds the other covariates in vector X_{it}. In all our regressions, we cluster standard errors at the household level.

Childcare of grandchildren G3 can also be provided by the partner's parents. Let the intensity of this childcare be OY, which we do not observe in the data. The omission of OY from (1) raises the question as to whether we may empirically detect matrilineal advantage when there is none. Reassuringly, this is not the case, because the omitted variable bias depends on the correlation between the dummy D and OY, which is zero when matrilineal advantage is absent.[12]

4 Results

4.1 Matrilineal advantage

Table 5 reports our main estimates, both for the baseline (columns (1)) and for the augmented specification (column (2)).[13] We find that the frequency of grandparents' childcare—measured in days per month—is 33.7 to 37% higher for the children of daughters than for the children of sons, consistent with the matrilineal advantage hypothesis.[14]

Adding potentially endogenous G2 controls to the baseline specification increases the estimated value of parameter β_1, from 1.147 to 1.259. We also find that grandparents' childcare is higher when G2 is younger, full time employed, not living with a partner, with a higher number of children and living in the same household or building as G1. To investigate which additional variable is responsible of the increase in β_1, we run the baseline specification by augmenting it with one variable omitted from column (1) but included in column (2) at the time and find that the largest increase in $\beta_1$is associated with the inclusion of the distance between G1 and G2 dummies (the estimated β_1 increases from 1.147 to 1.228). Higher distance from G1 reduces the frequency of childcare. Since daughters are more likely to live more than

[11] When a variable in vector X has missing values, we define a new variable equal to 1 if the value is missing and to 0 otherwise, replace the missing value with the mean value and add the new variable to the vector X.

[12] See the Appendix for further discussion.

[13] All specifications in the table include a constant, time and household fixed effects. The augmented specification includes also dummies for missing values.

[14] These percentages are computed with reference to mean childcare (3.40 days).

Table 5 Grandparents' frequency of care of grandchildren (days per month).

	Baseline Specification (1)	Augmented specification (2)
Adult children variables		
Daughter	1.147*** (0.112)	1.259*** (0.113)
Age	−0.175*** (0.019)	−0.140*** (0.018)
Firstborn	0.069 (0.106)	0.099 (0.113)
Number of children		0.238*** (0.056)
Not living with partner		0.613*** (0.200)
Median or above median school degree		0.194 (0.138)
Further education or vocational training		0.193 (0.169)
Employed full time		0.276** (0.118)
10 or more years since moving out		−0.241 (0.159)
Lives in same household as G1		6.201*** (0.487)
Lives in the same building as G1		1.458*** (0.283)
Lives less than 1 km away from G1		−0.100 (0.239)
Lives 1 to 5 km away from G1		−1.434*** (0.221)
Lives 5–25 km away from G1		−2.142*** (0.216)
Lives 25–100 km away from G1		−2.464*** (0.221)
Lives 100–500 km away from G1		−2.682*** (0.269)
Lives more than 500 km away from G1		−3.059*** (0.370)
Observations	75,205	75,205
R-squared	0.631	0.662

Sample: adult children with the youngest child aged 15 or lower. Household fixed effects estimates

Daughter: dummy equal to 1 if the adult child is a daughter, to 0 otherwise. G1: grandparents. Robust standard errors are clustered at the household level. Each regression includes wave and household dummies. The regression in column (2) includes dummies for missing values. Excluded category in the augmented specification: distance from grandparents is missing. Two and three stars for statistical significance at the 5 and 1% level of confidence

5 kilometers away from their parents than sons (57.7% versus 56.4%), the positive correlation between distance and being a daughter biases downwards the estimate of $\beta_1$in the baseline specification.[15]

Our identification strategy implies that, conditional on household fixed effects, the dummy "Daughter" is as good as random and therefore unrelated to un-observables such as kin keeping and altruism. For instance, when women become mothers, they may engage in more kin keeping and hence have a closer relationship to their own parents which also results in more grandparent-provided childcare. However, since we do not have a direct measure for any kin keeping activity, we would like to know whether selection on this type of un-observables is sufficient to explain away our results.

[15] Table 12 in the Appendix presents the results of an augmented regression which includes also time varying G1 controls such as age, retirement status and log household income. Although adequate care should be used when interpreting these results, there is evidence that retired grandparents invest more time in the childcare of their grandchildren.

One way to test whether our estimates are exposed to selection on un-observables is to use the Oster test (Oster, 2019). The test by Oster establishes bounds to the true value of the key parameter under two polar cases. In the first case, there are no un-observables, and our regression in column (2) of Table 5 is correctly specified. We denote as $\widehat{R}$ the estimated R squared in this case. In the second case, there are un-observables, but observables and un-observables are equally related to the variable D ($\delta = 1$ in Oster's notation). When un-observables are included, we assume, as suggested by Oster, that the R squared is equal to $Rmax = \min(1.3\widehat{R}; 1)$. If zero can be excluded from the bounding set, then accounting for un-observables would not change the direction of our estimates. This is our case, since the bounding set is [1.259, 1.571]. [16]

Our finding that maternal grandparents are more likely to engage in the childcare of grandchildren suggests that women, who play an important role in childcare decisions, rely more on their own parents than on their in-laws. It is consistent with previous sociological research, which shows that the relationship between mother and daughter is less antagonistic than the relationship between mother-in-law and daughter-in-law (Lee et al. 2003; Timmer & Veroff 2000; Willson et al., 2003). One reason for this is that biological bonds are stronger than affine bonds (Fischer, 1983). Another reason is that the lack of shared family history and background increases the distance between daughters-in-law and mothers-in-law (Merrill, 2007).

Our results also suggest that the labor force participation of adult daughters hinges much more on obtaining childcare than the participation of adult sons. Using the 2010 wave of the European Time Use Survey, we compute, for the subset of countries for which we have data, the average number of hours spent by males aged 25 to 44 on childcare. We also estimate the parameter β_1 in Eq. (1) by country, excluding the countries that are present only in wave 8 of the survey, because of the limited number of observations. Figure 3 shows that, except for Spain, where males spend relatively many hours of childcare per day despite the high degree of matrilineal advantage, the time spent by adult males on childcare activities is lower in countries with a high level of matrilineal advantage.

4.2 Heterogeneous effects

Since the importance of matrilineal advantage can vary with the marital status of the adult child, we interact the dummy "Daughter" with the dummy "adult child is not living with the partner", either because he/she is not married, or because he/she is separated, divorced or widowed. As shown in Table 6, Panel A, the advantage is present both for adult children living with a partner and for those living without, smaller in the former case (the estimated coefficient associated with the dummy "Daughter" ranges between 0.904 and 1.061) and larger in the latter (the estimated coefficient ranges between 3.296 and 3.417). The large difference in coefficients indicates that our results are not completely but in part driven by single adult mothers.

[16] We also estimate that selection on un-observables would need to be 2.36 times as large as selection on observables to explain away our results.

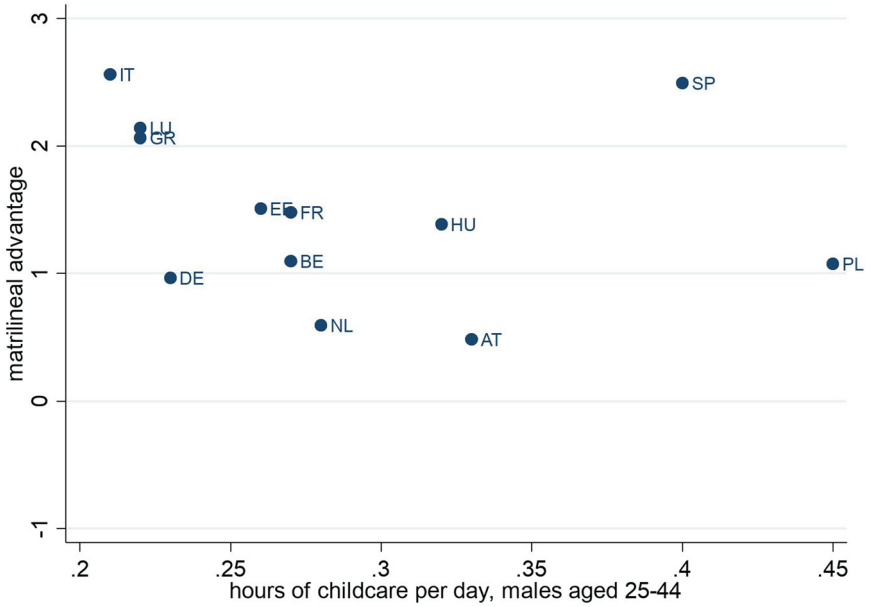

Fig. 3 Matrilineal advantage by country and the relative number of hours per day spent in childcare activities by males aged 25 to 44. AT (Austria), BE (Belgium), BG (Bulgaria), CY (Cyprus), CH (Switzerland), CZ (Czechia), DE (Germany), DK (Denmark), EE (Estonia), FI (Finland), FR (France), GR (Greece), HR (Croatia), HU (Hungary), IE (Ireland), IS (Israel), IT (Italy), LU (Luxembourg), LT (Lithuania), LV (Latvia), MT (Malta), NL (Netherlands), PL (Poland), PT (Portugal), RO (Romania), SE (Sweden), SI (Slovenia), SK (Slovakia), SP (Spain). Source: our elaborations using the SHARE survey and the European Use of Time Survey

We also consider the possibility that the matrilineal advantage varies with the education of the grandparent or the adult child but find little evidence that this is the case, as the interactions between the dummy "Daughter" and education are never statistically significant at the conventional 5% level of confidence see Table 6, Panel B.

The advantage could also vary with individual trust in others. In traditional and closed societies, people trust family and relatives but trust less others (Putnam et al., 1993; Snijders & Keren, 2001). In these societies, lack of trust is an obstacle to developing market transactions, including market or publicly provided childcare services, which are replaced by exchanges of services within the family (Zak & Knack, 2001; Algan & Cahuc 2010; Tabellini, 2010). As shown by Alesina and Giuliano (2010), low trust is positively correlated with strong family ties, which in turn are positively correlated with home production and a lower labor force participation of women.

We measure trust using the replies to the following question in SHARE: "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?". Answers range from zero (low trust) to ten (high trust). We define HT (high trust) as a binary variable equal to 1 if individual trust is between 1 and 5 and to 0 otherwise. As reported in Table 6, Panel C, we find that the interaction of the dummy "Daughter" with HT attracts a negative and statistically significant sign, as expected.

Table 6 Interaction of the dummy "Daughter" with G1 and G2 characteristics

	Baseline specification (1)	Augmented specification (2)
Panel A		
Daughter	0.904*** (0.113)	1.061*** (0.114)
Daughter x G2 not living with partner	2.513*** (0.301)	2.235*** (0.378)
Panel B		
Daughter	1.314*** (0.188)	1.512*** (0.197)
Daughter x G2 with further education or training	−0.273 (0.202)	−0.419* (0.218)
Daughter	1.099*** (0.178)	1.279*** (0.170)
Daughter x G1 with higher education	0.086 (0.220)	−0.037 (0.206)
Panel C		
Daughter	1.392*** (0.186)	1.493*** (0.181)
Daughter x G1' s individual high trust (HT=1)	−0.451** (0.218)	−0.379* (0.209)
Panel D		
Daughter	0.460*** (0.159)	0.813*** (0.152)
Daughter x G2 is firstborn	1.405*** (0.205)	0.885*** (0.194)
Daughter x G2 is second born	0.454** (0.186)	0.342** (0.174)
Basic controls	Y	Y
Additional controls	N	Y
Observations	75,205	75,205

Sample: adult children with the youngest child aged 15 or lower. Household fixed effects estimates. Dependent variable: G1's frequency of childcare (days per month)

Daughter: dummy equal to 1 if the adult child is a daughter, to 0 otherwise. Robust standard errors are clustered at the household level. G1: grandparents; G2: adult children. Basic controls: G2's age and whether firstborn. Additional controls: distance from G1 dummies, number or children, education, living with partner, employed, moved out of G1's household at least 10 years ago. Excluded category in the augmented specification: distance from grandparents is missing. Each regression includes wave and household dummies. Dummies for missing values in column (2). One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence

Finally, we investigate whether matrilineal advantage varies with birth order, by distinguishing between firstborn, second born and other adult children. We find that the advantage is strongest among firstborns and weakest among adult children who were born after the second child (see Table 6, Panel D).[17]

[17] Panel D also includes a dummy for second born children, which is estimated using families with more than two children.

4.3 Reciprocity versus alternative explanations

Grandparents help their adult children (with the youngest child aged 15 or younger) not only with the childcare of grandchildren but also with financial gifts and other personal and household tasks. As reported in Table 7, we find that they spend more time helping daughters than sons with personal and household tasks. The difference is sizeable: relative to the sample mean, the time spent by grandparents helping their daughters is 35 (0.107/0.305) to 43 (0.130/0.305)% higher than the time spent for their sons. On the other hand, there is little evidence that daughters and sons are treated differently when financial help is concerned.

At the same time, adult daughters (with the youngest child aged 15 or younger) spend between 36.5 (0.135/0.369) and 38.5 (0.142/0.369)% more days helping their parents with personal and household tasks than adult sons (Table 8). As in Table 7, there is instead no gender difference in the provision of financial gifts from adult children to their parents, as the coefficient associated to the dummy "Daughter" is very close to zero in both columns of the table.

We interpret these results as suggestive evidence of reciprocal behavior: parents help their daughters more than their sons with the care of grandchildren and other personal and household tasks, and daughters help their parents more than sons with personal and household tasks.

An alternative explanation of matrilineal advantage is that daughters are more likely to live in the same household or building as grandparents (they "cohabitate"). Yet we find that the probability of doing so is lower for daughters than for sons (the estimated difference is between 1.3 and 1.6 percentage points, as shown in columns (1) and (2) in Table 9).[18] In columns (3) and (4) of Table 9 we interact the dummy "Daughter" with the probability of cohabitating.[19] We find that grandparents provide substantially more childcare to cohabitating adult children (5.857 to 5.989 more days per month). There is also evidence that the children of both cohabitating and non-cohabitating adult daughters receive more care than the children of adult sons. Although matrilineal advantage is strongest among cohabitating adult daughters, the fact that this advantage exists also for non-cohabitating daughters speaks against this alternative explanation.

Another alternative to reciprocity as the explanation of matrilineal advantage is that daughters differ from sons because of un-observables such as empathy or altruism (see Falk et al., 2018). Grandparents are more likely to visit the grandchildren of altruistic daughters, and to receive from them more informal care, also because of lack of the antagonism that often characterize the relationship with in-laws.[20] Women are also more likely than men to act as kin keepers. Since kin keeping is the act of maintaining and enhancing family ties, it implies that women have more contact and learn more about the needs of their parents (and other family

[18] See Loken et al. (2013), for similar evidence for Norway.

[19] We prefer this specification to estimating separate regressions for cohabitating and other daughters because the sample of cohabitating females is small (5,196 observations). The results of separate regressions give qualitatively similar results and are available from the authors upon request.

[20] See Turner et al. (2006) on the complex relationship between mothers and daughters-in-law.

Table 7 Probability that grandparents help adult children with financial or material gifts valued at least 250 euro, and days per month spent by G1 helping G2 with personal tasks

	G1 gives financial help to G2—baseline (1)	G1 gives financial help to G2—augmented (2)	G1' days of help of G2 with personal tasks per month—baseline (3)	G1' days of help of G2 with personal tasks per month—augmented (4)
Adult children variables				
Daughter	0.008* (0.004)	0.004 (0.004)	0.130*** (0.004)	0.107*** (0.004)
Age	−0.002*** (0.001)	−0.002*** (0.001)	−0.017*** (0.006)	−0.015*** (0.006)
Firstborn	−0.001 (0.004)	−0.001 (0.004)	−0.009 (0.040)	−0.012 (0.040)
Number of children		0.002 (0.002)		0.048** (0.021)
Not living with partner		0.065*** (0.009)		0.140* (0.078)
Median or above median school degree		−0.017** (0.008)		−0.053 (0.064)
Further education or vocational training		−0.008 (0.006)		0.054 (0.064)
Employed full time		−0.011** (0.005)		−0.088* (0.048)
10 or more years since moving out		−0.011 (0.007)		−0.039 (0.065)
Observations	57,802	57,802	57,802	57,802
R-squared	0.721	0.723	0.584	0.587

Sample: adult children with the youngest child aged 15 or lower. Household fixed effects estimates

Daughter: dummy equal to 1 if the adult child is a daughter, to 0 otherwise. G1: grandparents; G2: adult children. Robust standard errors are clustered at the household level. Each regression includes wave and household dummies. The regressions in columns (2) and (4) include distance between G1 and G2 dummies and dummies for missing values. Excluded category in columns (2) and (4): distance from grandparents is missing. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence

Table 8 Probability that adult children help parents with financial or material gifts valued at least 250 euro, and days per month spent by G2 helping G1 with personal tasks

	Probability of G2's financial help of G1—baseline (1)	Probability of G2's financial help of G1—augmented (2)	G2's days of help of G1 with personal tasks per month—baseline (3)	G2's days of help of G1 with personal tasks per month—augmented (4)
Adult children variables				
Daughter	−0.002 (0.002)	−0.003 (0.002)	0.142*** (0.045)	0.135*** (0.047)
Age	0.000 (0.000)	0.000 (0.000)	−0.027*** (0.009)	−0.018** (0.009)
Firstborn	−0.000 (0.002)	−0.001 (0.002)	0.089* (0.049)	0.086* (0.049)
Number of children		−0.001 (0.001)		−0.005 (0.021)
Not living with partner		−0.006** (0.003)		−0.026 (0.079)
Median or above median school degree		0.000 (0.003)		0.045(0.059)
Further education or vocational training		0.006*(0.003)		−0.002 (0.066)
Employed full time		−0.002 (0.003)		−0.073 (0.047)
10 or more years since moving out		−0.001 (0.003)		−0.069 (0.060)
Observations	57,865	57,865	57,865	57,865
R-squared	0.654	0.654	0.589	0.594

Sample: adult children with the youngest child aged 15 or lower. Household fixed effects estimates

Daughter: dummy equal to 1 if the adult child is a daughter, to 0 otherwise. G1: grandparents; G2: adult children of respondents Robust standard errors are clustered at the household level. Data on financial transfers and help with personal care are not available for Hungary. In addition, wave 4 of the survey does not allow the identification of which child is giving or receiving financial transfers or care, and therefore is not used for these items. Each regression includes wave and household dummies. The regressions in columns (2) and (4) include distance between G1 and G2 dummies and dummies for missing values. Excluded category in columns (2) and (4): distance from grandparents is missing. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence

Table 9 Probability of cohabitation (G2 and G1 live in the same household or building) and G1's frequency of care of G3 (days per month), with interactions with cohabitation

	Probability of living in the same household or building—baseline (1)	Probability of living in the same household or building—augmented (2)	Grandparents' days of childcare—baseline (3)	Grandparents' days of childcare—augmented (4)
Adult children variables				
Daughter	−0.013*** (0.005)	−0.016*** (0.004)	1.014*** (0.136)	1.043*** (0.119)
Daughter x cohabitation			3.293*** (0.827)	3.229*** (0.682)
Cohabitation			5.989*** (0.479)	5.857*** (0.504)
Age	−0.006*** (0.001)	−0.005*** (0.001)	−0.108*** (0.018)	−0.110*** (0.019)
Firstborn	0.003 (0.004)	0.002 (0.004)	0.033 (0.122)	0.042 (0.122)
Number of children		−0.000 (0.002)		0.259*** (0.059)
Not living with partner		0.086*** (0.008)		0.559*** (0.217)
Median or above med. Degree		−0.007 (0.005)		0.109 (0.155)
Further education		−0.004 (0.006)		0.038 (0.186)
Employed full time		−0.010** (0.004)		0.242* (0.130)
0 or more years since out		0.007 (0.006)		−0.482*** (0.178)
Observations	67,382	67,382	67,382	67,382
R-squared	0.649	0.721	0.686	0.687

Sample: adult children with the youngest child aged 15 or lower. Household fixed effects estimates

Daughter: dummy equal to 1 if the adult child is a daughter, to 0 otherwise. G1: grandparents; G2: adult children; G3 grandchildren. Cohabitation: dummy equal to 1 if G1 and G2 live in the same household or building, to 0 otherwise. Robust standard errors are clustered at the household level. C: probability that G1 and G2 live in the same household or building. Each regression includes wave and household dummies. Regressions in columns (2) and (4) include also distance between G1 and G2 dummies and dummies for missing values. Excluded category in columns (2) and (4): distance from grandparents is missing. The number of observations is lower than in Table 3 because we omit observations for which distance is missing. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence

members) than men. Consequently, they may also provide more help to their parents, and their parents to them.

If either altruism, empathy, lack of antagonism or kin keeping are driving our results on matrilineal advantage, we would expect daughters to care for parents more than sons *independently* of whether they have children or not. If instead reciprocity is the relevant explanation, the gender gap in the provision of care/help by adult children should be stronger for those with children, because they can benefit or have benefitted in the past from grandparents' childcare. We try to discriminate between these two hypotheses by estimating both the baseline and the augmented specification separately for the sub-samples of adult children with children (columns (1) and (2) of Table 10)[21] and adult children without children (columns (3) and (4) of the table). Our estimates show that the dummy "Daughter" attracts a positive and statistically significant coefficient in columns (1) and (2), which ranges between 0.246 and 0.269, and a positive, significantly smaller (between 0.051 and 0.068) and in one case imprecisely estimated coefficient in columns (3) and (4). We test the hypothesis that the coefficients in columns (1) and (3) and in columns (2) and (4) are equal but reject the null with a *p*-value equal to 0.000.[22]

To make sure that childless adult children do not include individuals expecting to have children in the future, we consider in columns (5) and (6) only childless adult children aged 45 or more. Although the sample size is less than 5000 observations, we find that the value of the coefficient associated with the dummy "Daughter" is much smaller (between −0.004 and 0.041) than in the case of G2 with children, consistent with the reciprocity assumption.[23]

If altruism, empathy, lack of antagonism or kin keeping are the explanation of our findings, we would also expect parents to help their daughters with personal and household tasks (other than childcare) more than sons *independently* of the presence of grandchildren. Yet we find (see Table 13) that the frequency of help (in days) with these tasks is significantly higher for daughters with children than for sons with children (estimated coefficient of the dummy "Daughter" in column (1): 0.062, standard error: 0.025) but not statistically different for daughters and sons without children (estimated coefficient of the dummy "Daughter" in column (3): −0.021, standard error: 0.024).[24]

It could be argued that adult daughters are not more reciprocal but help their parents more because their labor force participation is not by default full time. To address this concern, we re-estimate the specifications in Table 10 by adding to the first four columns the interaction of the dummy "Daughter" with a dummy equal to 1 if the adult child is working full time and to 0 otherwise. As shown in Table 14 in the Appendix, the dummy "Daughter" always attracts a positive and statistically significant coefficient when we consider adult children with own children, and a smaller and imprecisely estimated coefficient in the case of adult children with no child,

[21] We include in this sub-sample adult children with the youngest child older than 15, because older grandchildren may have benefitted from grandparents' childcare in the past.

[22] Results are qualitatively similar if you use the less parsimonious specification that includes G2 controls.

[23] The *p*-value of the test indicates that the null cannot be rejected, most likely because of the small sample size in columns (5) and (6).

[24] The results in columns (2) and (4) are qualitatively similar.

Table 10 Days per month spent by adult children (with and without own children) helping parents with personal and household tasks

	G2 with children (1)	G2 with children (2)	G2 without children (3)	G2 without children (4)	G2 aged 45 plus without children (5)	G2 aged 45 plus without children(6)
Adult children variables						
Daughter	0.269*** (0.040)	0.246*** (0.041)	0.051 (0.032)	0.068** (0.033)	−0.004 (0.563)	0.041 (0.561)
Age	−0.017** (0.007)	−0.006 (0.007)	−0.002 (0.006)	0.005 (0.007)	0.077 (0.108)	0.081 (.115)
Firstborn	0.021 (0.044)	0.021 (0.044)	−0.012 (0.038)	−0.007 (0.038)	−0.798 (0.631)	−0.758 (0.613)
Number of children		−0.029* (0.018)				
Not living with partner		0.081 (0.069)		0.032 (0.038)		0.470 (0.481)
Median or above median school degree		0.024 (0.049)		−0.084 (0.053)		0.133 (0.953)
Further education		0.041 (0.060)		0.042 (0.045)		−0.271 (0.610)
Employed full time		−0.167*** (0.043)		−0.004 (0.039)		0.302 (0.573)
10 or more years since moving out		−0.107** (0.053)		−0.059 (0.057)		0.342 (1.141)
Test difference coefficients "daughter" (1)–(3) or (2)–(4): *p*-value	0.000	0.000				
Test difference coefficients "daughter" (1)-(5) or (2)–(6): *p*-value	0.331	0.573				
Observations	90,196	90,196	62,956	62,956	4,952	4,952
R-squared	0.499	0.573	0.656	0.658	0.663	0.877

Household fixed effects estimates. Baseline—columns (1), (3) and (5) - and augmented—columns (2), (4) and (6) - specifications

Daughter: dummy equal to 1 if the adult child is a daughter. Robust standard errors are clustered at the household level. Each regression includes wave and household dummies. Regressions in columns (2), (4) and (6) include also distance between G1 and G2 dummies and dummies for missing values. Excluded category in columns (2), (4) and (6): distance from grandparents is missing. The *p*-value refers to the test of the null hypothesis that the "daughter" coefficient does not differ across groups. G2: adult children. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence

independently of whether they work full time or not. These results indicate that adult daughters with children help their parents more than adult sons even when they work full time.

4.4 Sensitivities and extensions

A potential concern is that, when the grandfather is the family respondent and answers questions for the couple, including the grandmother, he might have a poor view of actual child-caring activities, which are often performed by his partner. We therefore estimate the specifications in Table 5 separately for female and male respondents. As shown in Table 15, the estimated value of β_1 is larger when the respondent is the grandmother (1.302/1.393) rather than the grandfather (0.943/1.035). Both values, however, are similar to the baseline estimates reported in Table 5 (1.147/1.259), suggesting that our findings are unlikely to be driven by a poor perception of child caring.

Is the matrilineal advantage that we observe in the data stronger for grandmothers than for grandfathers? To examine this question, we consider only single grandparents, exclude couples, because in the case of couples the question in SHARE about grandparents' childcare is answered by the family respondent for both members of the couple, and estimate separate regressions by the gender of the grandparent G1. The results in Table 16 show that – for the baseline (augmented) specification in columns (1)/(3) (columns (2)/(4))—the coefficient associated with the dummy "Daughter" is equal to 1.248 (1.343) for grandmothers and to 0.834 (0.906) for grandfathers. We conclude that the presence of a matrilineal advantage in our data is stronger for grandmothers but not exclusively driven by them.

So far, we have considered all adult children, without distinguishing between natural and other adult children. This distinction is not possible in waves 1 and 2 of the survey, which include information only on the total number of natural children. Retaining only natural adult children, who are 91% of the total, does not change our key results, as shown in Table 17 in the Appendix.

We have retained in our dataset families in which all adult children have the same sex because, although they do not help identifying the parameter of interest β_1, they help in the estimation of the other parameters. Table 18 in the Appendix confirm that removing these families reduces the sample drastically but does not alter our key results.

We have measured the frequency of childcare by assigning to "almost daily", "almost every week", "almost every month" and "less than monthly" the values of 30, 4, 2 and 0.5. We verify whether our results are sensitive to this classification by replacing it with a categorical variable ranging from 1 to 4 and by estimating both the baseline and the augmented specification of Eq. (1) using a fixed effect ordered logit. The estimates reported in Table 19 indicate that qualitative results are unchanged.

4.5 Differences within Europe

In this sub-section we focus on cross-country variations and ask whether the intensity of matrilineal advantage varies with the importance of the traditional family. We measure this importance in a country using two indicators: gender equality and the

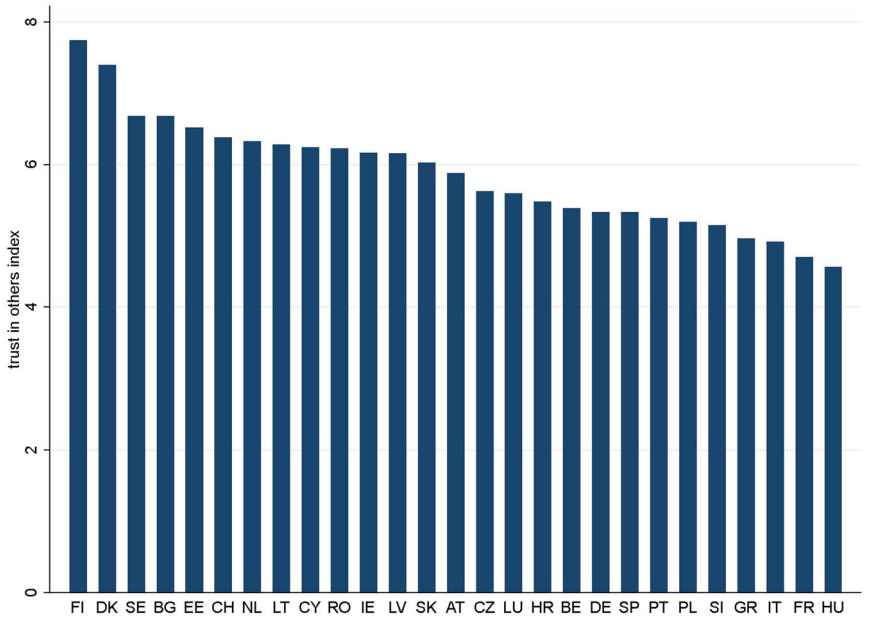

Fig. 4 Index of trust in others. By country. AT (Austria), BE (Belgium), BG (Bulgaria), CY (Cyprus), CH (Switzerland), CZ (Czechia), DE (Germany), DK (Denmark), EE (Estonia), FI (Finland), FR (France), GR (Greece), HR (Croatia), HU (Hungary), IE (Ireland), IS (Israel), IT (Italy), LU (Luxembourg), LT (Lithuania), LV (Latvia), MT (Malta), NL (Netherlands), PL (Poland), PT (Portugal), RO (Romania), SE (Sweden), SI (Slovenia), SK (Slovakia), SP (Spain). Source: our elaborations using the SHARE survey

degree of trust in others. In societies where a traditional view of the family prevails, gender equality is less developed and so is the provision of early public childcare.

In countries with lower gender equality, social values emphasizing the traditional role of women are stronger.[25] We capture these values with the percentage of individuals agreeing with the following statements included in the 2008 European Social Values Survey: (a) women need children to be fulfilled (F1); (b) preschool children suffer when the mother is working (F2); (c) women really want to stay home and have children (F3).[26]

We have argued that in traditional and closed societies, people trust family and relatives but trust less others. We take country averages of the measure of individual trust discussed and show in Fig. 4 that average trust is highest in Finland and Denmark and lowest in Hungary, Italy and France. We also compute the country specific percentage of individuals who respond positively to questions F1, F2 and F3.

[25] In the male breadwinner hypothesis, family solidarity is based on division of family work between male and female, in which family care for children and the elderly is delegated to the wife (Esping-Anderson, 1999). Algan & Cahuc, 2005, show that Catholics, Orthodox Christians and Muslims are more prone to embrace the traditional male breadwinner conception than Protestants and Atheists. According to Arrunada (2010), Catholicism places higher importance on the family and leads to lower trust of strangers, which hampers market exchanges in the provision of child and elderly care.

[26] These data do not include information for Israel and Malta.

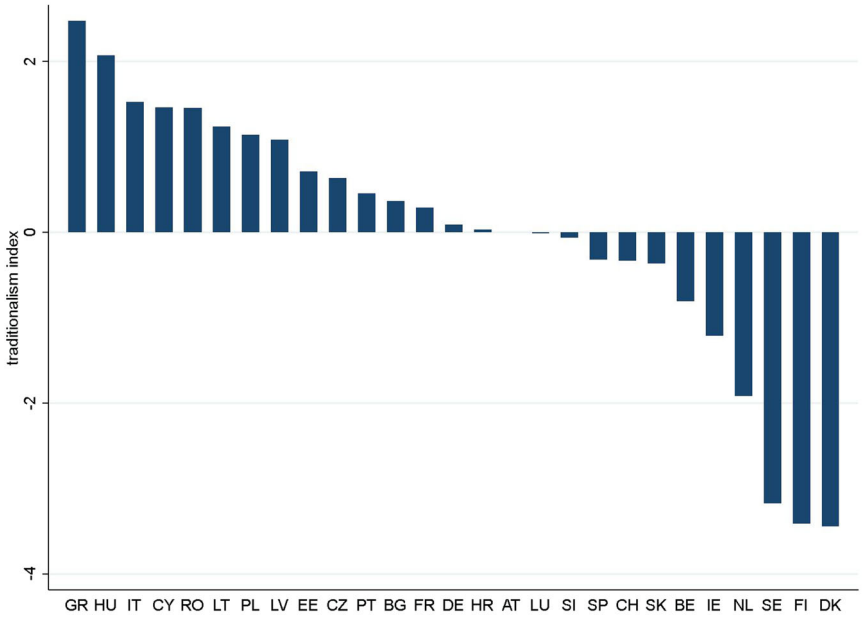

Fig. 5 Index of traditionalism. By country. AT (Austria), BE (Belgium), BG (Bulgaria), CY (Cyprus), CH (Switzerland), CZ (Czechia), DE (Germany), DK (Denmark), EE (Estonia), FI (Finland), FR (France), GR (Greece), HR (Croatia), HU (Hungary), IE (Ireland), IS (Israel), IT (Italy), LU (Luxembourg), LT (Lithuania), LV (Latvia), MT (Malta), NL (Netherlands), PL (Poland), PT (Portugal), RO (Romania), SE (Sweden), SI (Slovenia), SK (Slovakia), SP (Spain). Source: our elaborations using the SHARE survey and the European Social Values Survey

We then use principal component analysis to extract from the country-specific variables F1, F2, F3 and trust the index of traditionalism T.[27]

This index varies between −3.443 and 2.477 and is highest in Greece, Hungary and Italy and lowest in Sweden, Finland and Denmark (see Fig. 5). We estimate Eq. (1) separately for the sub-samples of countries with the index T above and at or below the median and report our results in Table 11, both for the baseline and the less parsimonious specification. We find that the estimates of β_1 range between 1.461 and 1.525 in the countries with a higher than median index T, and between 0.878 and 1.025 in the rest of the sample. The difference between these estimates is statistically significant at the 1% level of confidence for both specifications (p-values: 0.001 and 0.000, respectively), suggesting that the matrilineal advantage in the grandparents-grandchildren relationship is more relevant in countries where the traditional view of the family is stronger.[28]

[27] We use the eigenvector associated with the single eigenvalue higher than one, which explains 60% of total variance.

[28] The average number of days per month spent by grandparents looking after their grandchildren in 3.586 in the countries with a higher than median index T, and 2.930 in the rest of the sample.

Table 11 Grandparents' care of grandchildren (days per month)

	Higher than median T countries – baseline (1)	Higher than median T countries – augmented (2)	Lower than or at median T countries – baseline (3)	Lower than or at median T countries – augmented (4)
Adult children variables				
Daughter	1.461*** (0.199)	1.525*** (0.196)	0.878*** (0.135)	1.025*** (0.137)
Age	−0.194*** (0.028)	−0.148*** (0.029)	−0.158*** (0.020)	−0.152*** (0.021)
Firstborn	0.078 (0.196)	0.131 (0.183)	0.082 (0.139)	0.143 (0.132)
Number of children		0.283*** (0.096)		0.169** (0.073)
Not living with partner		0.787** (0.351)		0.521** (0.245)
Median or above median school degree		0.261 (0.243)		0.127 (0.174)
Further education or vocational training		0.223 (0.264)		0.140 (0.241)
Employed full time		0.372* (0.212)		0.177 (0.141)
10 or more years since moving out		−0.494** (0.252)		−0.002 (0.217)
Observations	32,914	32,914	38,949	38,949
Test difference coefficients daughter *p*-value	0.001	0.000		
R-squared	0.654	0.689	0.602	0.627

Sample: adult children with the youngest child aged 15 or less. By group of countries. Household fixed effects estimates

Daughter: dummy equal to 1 if the adult child is a daughter; T: index of traditionalism. Israel and Malta excluded. Robust standard errors are clustered at the household level. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence. Each regression includes wave and household dummies. The regressions in columns (2) and (4) include distance between G1 and G2 dummies and dummies for missing values. Excluded category in columns (2) and (4): distance from grandparents is missing. The *p*-value refers to the test of the null hypothesis that the "daughter" coefficient does not differ across groups

5 Conclusions

Using European data, we have documented the presence of a matrilineal advantage in the web of inter-personal relationships involving three generations: grandparents, parents and grandchildren. This advantage indicates that—ceteris paribus—maternal grandparents provide more childcare and more help with personal and household tasks to their grandchildren than paternal grandparents do.

We have interpreted matrilineal advantage as the outcome of the reciprocal exchange of services involving parents, who supply more help—in terms of care of grandchildren and informal care with personal and household tasks—to their daughters than to their sons, and daughters, who provide more help with personal and household tasks to their parents than sons do. In support of this view, we have shown that daughters without children—who cannot benefit from their parents' help with the care of grandchildren—are as likely as sons to provide informal help to their parents.

We have also shown that the matrilineal advantage in grandparents' care of grandchildren is stronger in the countries of Europe where the traditional family plays a bigger role and trust is lower. The moral-hazard problems involving principals (parents) and agents (childcare workers) is less likely to be serious in high trust societies, where market exchanges are enhanced (Zak & Knack, 2001). Where trust is relatively low, these market exchanges are replaced by help within the family and by closer ties between mothers and daughters. These ties are stronger when the traditional norm of intra-household division of labor – prescribing that women specialize in housework and care - prevails.

The different degrees of matrilineal advantage across the countries of Europe can be considered as social equilibria with path-dependence over generations (Aoki, 2001). The countries where the traditional family is more important can be characterized as being more traditional and conservative, also because of the relevant presence of Catholics and Orthodox Christians. In the countries where Protestants prevail, a stronger "social ethic" leads instead to higher reciprocal monitoring (Arruñada, 2010), which mitigates moral-hazard problems.

With matrilineal advantage, family values are transmitted from grandmothers to grandchildren via the maternal line. Although there is a view that traditional society is characterized by male dominance, the presence of a matrilineal advantage in the countries of Europe suggests that females play an important role in the transmission of family values, consistent with findings for the U.S (Fernandez et al., 2004; Fernandez & Fogli, 2006) and Asia (Kawaguchi & Miyazaki, 2009).

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Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

6 Appendix

In this appendix, we consider a simplified version of Eq. (1), which highlights the interaction between the childcare by own (Y) and the partner's grandfathers (OY). Assuming that Y and OY are substitutes, we specify the intensity of grandparents' care of grandchildren as

$$Y = \omega_0 + \omega_1 D + \omega_2 OY + \nu \tag{A1}$$

where ω_2 is negative, and

$$OY = \theta_0 + \theta_1 D + \theta_2 Y + \xi \tag{A2}$$

where θ_2 is also negative. Replacing (A2) into (A1) we obtain

$$Y = \pi_0 + \pi_1 D + \rho \tag{A3}$$

where

$$\pi_1 = \frac{\omega_1 + \theta_1 \omega_2}{1 - \theta_2 \omega_2} \tag{A4}$$

A stability argument can be used for the two reaction functions (A1) and (A2) to impose that $\theta_2 \omega_2 < 1$. In the presence of a matrilineal advantage, $\omega_1 > 0$ and $\theta_1 < 0$ and the overall effect of the female gender of the respondent's child G2 on the respondent's childcare is positive.[29] The effect is zero in the absence of matrilineal advantage, and negative with patrilineal advantage.

Tables 12–19

[29] When Y and OY are complements, a positive value of π_1 requires than we further assume that $\omega_1 + \theta_1 \omega_2 > 0$.

Table 12 Grandparents' care of grandchildren

Adult children variables	
Daughter	1.257*** (0.111)
Age	−0.138*** (0.018)
Firstborn	0.092 (0.113)
Number of children	0.236*** (0.056)
Not living with partner	0.613*** (0.199)
Median or above median school degree	0.192 (0.138)
Further education or training	0.195 (0.169)
Employed full time	0.275** (0.118)
10 or more years since moving out	−0.239 (0.159)
Grandparent variables	
Age	−0.132*** (0.045)
Log household income	−0.045 (0.096)
Retired	0.465*** (0.232)
Married	0.015 (0.441)
Household size	0.231 (0.195)
Self-reported poor health	0.075 (0.090)
Number of observations	75,205
R-squared	0.662

Sample of adult children with the youngest child aged 15 or lower. Household fixed effects estimates. Including G1 time varying controls Dependent variable: days of childcare per month

Daughter: dummy equal to 1 when the adult child is a daughter, to 0 otherwise. G1: grandparents; G2: adult children. Standard errors are clustered at the household level. Two and three stars for statistical significance at the 5 and 1% level of confidence. The regression includes wave, household, distance between G1 and G2 dummies and dummies for missing values. Excluded category: distance from grandparents is missing

Table 13 Days per month spent by parents helping adult children with and without children with personal and household tasks (other than childcare)

	G2 with children (1)	G2 with children (2)	G2 without children (3)	G2 without children (4)	G2 aged 45 plus without children (5)	G2 aged 45 plus without children (6)
Adult children variables						
Daughter	0.062*** (0.025)	0.043* (0.026)	−0.021 (0.032)	−0.014 (0.025)	−0.216 (0.369)	−0.207 (0.390)
Age	−0.017*** (0.004)	−0.016*** (0.004)	−0.002 (0.006)	0.004 (0.004)	0.011 (0.050)	0.014 (.047)
Firstborn	0.005 (0.024)	0.004 (0.023)	−0.012 (0.038)	0.040 (0.028)	−0.004 (0.399)	−0.024 (0.390)
Number of children		0.035*** (0.013)				
Not living with partner		0.137*** (0.046)		0.029 (0.033)		0.069 (0.186)
Median or above median school degree		0.012 (0.039)		−0.074* (0.039)		0.082 (0.191)
Further education		0.006 (0.041)		−0.043 (0.034)		−0.038 (0.087)
Employed full time		−0.073** (0.028)		−0.054* (0.029)		−0.174 (0.330)
10 or more years since moving out		−0.012 (0.050)		−0.116*** (0.040)		0.096 (0.185)
Test difference coefficients "daughter" (1)–(3) or (2)–(4): *p*-value	0.002	0.044				
Test difference coefficients "daughter" (1)–(5) or (2)–(6): *p*-value	0.147	0.226				
Observations	90,162	90,162	62,943	62,943	4,951	4,951
R-squared	0.521	0.524	0.548	0.550	0.851	0.852

Household fixed effects estimates. Baseline—columns (1), (3) and (5) - and augmented—columns (2), (4) and (6) - specifications

Daughter: dummy equal to 1 if the adult child is a daughter. Robust standard errors are clustered at the household level. Each regression includes wave and household dummies. Regressions in columns (2), (4) and (6) include also distance between G1 and G2 dummies and dummies for missing values. Excluded category in columns (2), (4) and (6): distance from grandparents is missing. The *p*-value refers to the test of the null hypothesis that the "daughter" coefficient does not differ across groups. G2: adult children. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence

Table 14 Days spent helping parents with personal tasks by adult children with and without children

	G2 with children—baseline (1)	G2 with children—augmented (2)	G2 without children (3)—baseline	G2 without children (4)—augmented
Adult children variables				
Daughter x G2 not employed full time	0.295*** (0.087)	0.359*** (0.086)	0.060 (0.045)	0.076* (0.046)
Daughter x G2 employed full time	0.192*** (0.042)	0.196*** (0.042)	0.040 (0.043)	0.058 (0.043)
Age	−0.016** (0.007)	−0.006 (0.007)	−0.001 (0.006)	0.005 (0.007)
Firstborn	0.016 (0.044)	0.022 (0.044)	−0.011 (0.037)	−0.007 0.038
Employed full time	−0.131* (0.072)	−0.067 (0.071)	−0.018 (0.044)	0.003 (0.004)
Number of children		−0.031* (0.018)		
Not living with partner		0.085 (0.069)		0.032 (0.038)
Median or above median school degree		0.026 (0.049)		−0.084 (0.053)
Further education or training		0.043 (0.060)		0.042 (0.045)
10 or more years since moving out		−0.106** (0.053)		−0.059 (0.057)
Test difference coefficients "daughter" (1)–(3): *p*-value	0.001			
Test difference coefficients "daughter" (1)-(3): *p*-value	0.002			
Test difference coefficients "daughter" (2)–(4): *p*-value		0.003		
Test difference coefficients "daughter" (2)-(4): *p*-value		0.000		
Observations	90,196	90,196	62,956	62,956
R-squared	0.500	0.510	0.656	0.657

With interactions of the dummy "daughter" with the probability of working full time. Household fixed effects estimates

Daughter: dummy equal to 1 when the adult child is a daughter, to 0 otherwise. Robust standard errors are clustered at the household level. Two and three stars for statistical significance at the 5 and 1% level of confidence. Regressions in columns (1) and (3) includes wave and household dummies and regressions in columns (2) and (4) include also distance between G1 and G2 dummies. Excluded category: distance from grandparents is missing. The *p*-value refers to the test of the null hypothesis that the "daughter" coefficient does not differ across groups

Table 15 Grandparents' care of grandchildren (days per month)

	Female respondent—baseline (1)	Female respondent—augmented (2)	Male respondent—baseline (3)	Male respondent—augmented (4)
Adult children variables				
Daughter	1.302*** (0.164)	1.393*** (0.162)	0.943*** (0.158)	1.035*** (0.160)
Age	−0.226*** (0.028)	−0.170*** (0.027)	−0.107*** (0.027)	−0.093*** (0.026)
Firstborn	0.368** (0.177)	0.288* (0.166)	−0.241 (0.171)	−0.163 (0.162)
Employed full time		0.316* (0.170)		0.147 (0.174)
Number of children		0.234** (0.089)		0.245*** (0.063)
Not living with partner		0.798** (0.289)		0.381 (0.296)
Median or above median school degree		0.262 (0.209)		0.298 (0.201)
Further education or training		0.208 (0.246)		0.278 (0.248)
10 or more years since moving out		−0.227 (0.237)		−0.281 (0.241)
Observations	43,298	43,298	31,907	31,907
R-squared	0.655	0.688	0.842	0.696

Sample of adult children with the youngest child aged 15 or lower. Household fixed effects estimates. By gender of respondent. Dependent variable: days of childcare per month

Daughter: dummy equal to 1 when the adult child is a daughter, to 0 otherwise. Standard errors are clustered at the household level. Two and three stars for statistical significance at the 5 and 1% level of confidence. Each regression includes wave and household dummies

Table 16 Single grandparents' care of grandchildren (days per month)

	Female grandparent (1)	Female grandparent (2)	Male grandparent (3)	Male grandparent (4)
Adult children variables				
Daughter	1.248*** (0.237)	1.343*** (0.239)	0.834*** (0.277)	0.906*** (0.277)
Age	−0.257*** (0.042)	−0.197*** (0.041)	−0.075 (0.047)	−0.053 (0.047)
Firstborn	0.357 (0.265)	0.366 (0.246)	−0.140 (0.297)	−0.065 (0.277)
Number of children		0.176 (0.141)		0.044 (0.099)
Not living with partner		0.637 (0.412)		0.456 (0.538)
Median or above median school degree		0.465 (0.322)		0.178 (0.392)
Higher education		0.472 (0.365)		0.043 (0.477)
Employed full time		0.377 (0.239)		0.057 (0.289)
10 or more years since moving out		−0.138 (0.361)		−0.352 (0.445)
Observations	21,575	21,575	10,272	10,272
R-squared	0.692	0.726	0.708	0.730

Sample of adult children with the youngest child aged 15 or lower. Household fixed effects estimates. Dependent variable: days of childcare per month

Daughter: dummy equal to 1 when the adult child is a daughter. Robust standard errors are clustered at the household level. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence. Each regression includes wave and household dummies. The regressions in columns (2) and (4) include also distance between G1 and G2 dummies and dummies for missing values. Excluded category: distance from grandparents is missing

Table 17 Grandparents' care of grandchildren

	Baseline specification (1)	Augmented specification (2)
Adult children variables		
Daughter	1.194*** (0.164)	1.329*** (0.164)
Age	−0.188*** (0.027)	−0.153*** (0.027)
Firstborn	0.111 (0.174)	0.141 (0.164)
Number of children		0.196** (0.080)
Not living with partner		0.764*** (0.296)
Median or above median school degree		0.236 (0.226)
Further education or vocational training		0.144 (0.260)
Employed full time		0.202 (0.181)
0 or more years since moving out		−0.327 (0.236)
Lives in same household as G1		5.582*** (0.624)
Lives in the same building as G1		1.292*** (0.383)
Lives less than 1 km away from G1		−0.256 (0.323)
Lives 1 to 5 km away from G1		−1.611*** (0.295)
Lives 5–25 km away from G1		−2.281*** (0.291)
Lives 25–100 km away from G1		−2.698*** (0.305)
Lives 100–500 km away from G1		−2.724*** (0.368)
Lives more than 500 km away from G1		−2.043*** (0.860)
Observations	45,097	45,097
R-squared	0.656	0.684

Household fixed effects estimates. Dependent variable: days of childcare per month. Only natural adult children

Daughter: dummy equal to 1 when the adult child is a daughter, to 0 otherwise. G1: grandparents. Standard errors are clustered at the household level. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence. Each regression includes wave and household dummies. Dummies for missing values in column (2). Excluded category in column (2): distance from grandparents is missing

Table 18 Grandparents' care of grandchildren

	Baseline specification (1)	Augmented specification (2)
Adult children variables		
Daughter	1.144*** (0.098)	1.260*** (0.101)
Age	−0.179*** (0.021)	−0.138*** (0.021)
Firstborn	0.066 (0.136)	0.044 (0.127)
Number of children		0.203 (0.062)
Not living with partner		0.579*** (0.227)
Median or above median school degree		0.329** (0.353)
Further education or vocational training		0.136 (0.192)
Employed		0.294** (0.130)
10 or more years since moving out		−0.335* (0.190)
Lives in same household as G1		5.972*** (0.577)
Lives in the same building as G1		1.399*** (0.333)
Lives less than 1 km away from G1		−0.354 (0.284)
Lives 1 to 5 km away from G1		−1.689*** (0.260)
Lives 5–25 km away from G1		−2.471*** (0.257)
Lives 25–100 km away from G1		−2.629*** (0.260)
Lives 100–500 km away from G1		−2.881*** (0.313)
Lives more than 500 km away from G1		−3.339*** (0.404)
Observations	32,963	32,963
R-squared	0.487	0.534

Household fixed effects estimates. Dependent variable: days of childcare per month. Excluding same sex adult children

Daughter: dummy equal to 1 when the adult child is a daughter, to 0 otherwise. G1: grandparents. Standard errors are clustered at the household level. One, two and three stars for statistical significance at the 10, 5 and 1% level of confidence. Each regression includes wave and household dummies. Dummies for missing values in column (2). Excluded category in column (2): distance from grandparents is missing

Table 19 Grandparents' care of grandchildren

	Baseline specification (1)	Augmented specification (2)
Adult children variables		
Daughter	0.289*** (0.027)	0.274*** (0.029)
Age	−0.055*** (0.005)	−0.062*** (0.005)
Firstborn	0.116*** (0.031)	0.116*** (0.037)
Number of children		0.136*** (0.023)
Not living with partner		−0.028 (0.056)
Median or above median school degree		0.013 (0.036)
Further education or vocational training		0.117** (0.040)
Employed full time		0.012 (0.038)
10 or more years since moving out		0.081** (0.037)
Lives in same household as G1		0.282*** (0.082)
Live in the same building as G1		0.131** (0.064)
Lives less than 1 km away from G1		0.083 (0.059)
Lives 1 to 5 km away from G1		−0.077 (0.057)
Lives 5–25 km away from G1		−0.349*** (0.063)
Lives 25–100 km away from G1		−0.684*** (0.091)
Lives 100–500 km away from G1		−1.111*** (0.087)
Lives more than 500 km away from G1		−1.498*** (0.200)
Observations	75,205	75,205
Pseudo R-squared	0.018	0.054

Household fixed effects estimates. Dependent variable: categorical variable (1 for less than monthly to 4 for almost daily). Fixed effects ordered logit

Daughter: dummy equal to 1 if the adult child is a daughter, to 0 otherwise. G1: grandparents. Robust standard errors are clustered at the household level. Each regression includes wave and household dummies. The regression in column (2) includes dummies for missing values. Excluded category in the augmented specification: distance from grandparents is missing. Two and three stars for statistical significance at the 5 and 1% level of confidence

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