Should I Care or Should I Work? The Impact of Work on Informal Care

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Abstract

This paper provides novel evidence on how a sharp increase in labor force participation among older women affects the provision of informal care to their older parents. Based on data from Understanding Society – The UK Household Longitudinal Study, we use an instrumental variable approach that exploits a unique reform that increased the female State Pension age by up to six years. Our results provide evidence of a trade-off between the intensive margin of work and informal care provided outside the household: an increase of 10 hours of work per week reduces the provision of informal care by 2.1 hours a week, which amounts to roughly £2,100 of yearly care-hours lost. This reduction in caregiving is largest among women working in physically or psychosocially demanding jobs, and "sandwich generation" women who have both a living grandchild and a parent alive. Using data from the English Longitudinal Study of Ageing, we show that older parents whose daughters became ineligible to claim their pensions experienced a significant reduction in the amount of care they receive from their daughters, which was not compensated by an increase in formal care or other sources of support. Our results suggest that policies that increase older workers' labor supply require changes in long-term care policy that compensate for the loss of informal care. © 2022 The Authors. Journal of Policy Analysis and Management *published by Wiley Periodicals LLC on behalf of Association for Public Policy and Management.*

INTRODUCTION

This paper provides novel evidence on how an increase in the labor supply of older women affects the provision of informal care and the care received by their older parents. Increased life expectancy often leads to two parallel challenges in ageing societies. First, it increases the demand for long-term care (LTC), i.e., support for people with functional limitations (Kingston et al., 2018), which is primarily covered through unpaid family help, both across generations (e.g., from children to older parents) and within generations (e.g., spousal care), and through public provision (Organisation for Economic Co-operation and Development [OECD], 2019). Second, in the absence of pension reform, population ageing leads to higher costs of pension systems. These two challenges are often met with countervailing policy responses. In response to increased demand for LTC, governments constrain access to publicly funded formal care services, thus increasing the care supply of informal

care providers (Brugiavini et al., 2017; Gori & Fernandez, 2015). Simultaneously, governments raise the statutory pension age (Börsch-Supan, 2014) to increase adult workers' employment rates (OECD, 2017b). Our paper aims to establish how these two policy domains are interdependent by examining how policies that increase the State Pension age (SPA) affect the supply of LTC by older workers (Burr & Colley, 2017). The population affected by increases in the SPA represent a large share of providers of intergenerational care: adults aged 55 to 65 represent about 30 percent of the total caregiving population, 60 percent of whom are women (OECD, 2017a; Rodrigues et al., 2012). In the context of reductions in the supply of formal care, an increase in the SPA may reduce the supply of overall care received by older people and increase their levels of unmet need.

The welfare implications of a potential decrease in the supply of informal care by older workers may be substantial given the large economic value of informal care (Colombo et al., 2011; Oliva-Moreno et al., 2017). In the UK, this has been estimated at £132 billion per year, slightly short of yearly public spending on health (Buckner & Yeandle, 2015). Moreover, while the need for LTC is increasing (Economic Policy Committee, 2015; Zigante et al., 2021),[1] the availability of informal care is expected to decline given changing family values and demographics (Pickard, 2015). Against this background, a reduction in the amount of care-time that adult workers provide to older generations may lead to reduced functioning and higher healthcare costs for older people, hence reducing societal welfare (Gori & Fernandez, 2015; Van Houtven et al., 2013). Implications may extend beyond adult children and older parents themselves: other informal caregivers, such as relatives and friends, may increase their care provision to compensate for a reduction in adult children's care involvement (Kalwij et al., 2014). A reduction in informal care supply may also be compensated by an increase in the demand for formal care, involving significant increases in public or private spending.

In this paper, we investigate how an increase in the labor supply of UK women in the years leading up to retirement affects the provision of care from adult female workers towards older parents or partners, and the impact of these changes on care coverage for older vulnerable people in the UK. We use data from two large longitudinal datasets: *The UK Household Longitudinal Study*, known as *Understanding Society* (years 2009 to 2017), and the *English Longitudinal Study of Aging* (*ELSA*; years 2006 to 2017), and exploit changes in eligibility to the State Pension in the UK as an instrumental variable for labor supply. Recent reforms in the UK gradually increased the SPA since 2010 by as much as six years beyond age 60 for women born after March 1950 (Cribb et al., 2016). As a result, women of the same age but slightly different birth year exhibit different Pension eligibility and exogenous incentive to work, which we exploit for identification.

Our paper makes three important contributions to the literature. First, we exploit a series of unique and contemporary reforms in the UK that led to a much more significant change in employment than those examined in prior studies (Bergeot & Fontaine, 2020; Fischer & Müller, 2020). Second, using *Understanding Society* data, we provide novel evidence on the impact of employment on both the incidence and intensity of care provision for women aged 55 to 65 using a two-part model (Carrino et al., 2018), differentiating between care-settings (in-household or extra-household care), the level of physical and psychosocial demand of the caregiver's employment, and the presence of pre-existing care commitments towards grandchildren (Grundy

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[1] In England, from 2015 to 2035, the number of highly vulnerable adults aged 85 and older is predicted to increase by 92 percent (Kingston et al., 2018).

& Henretta, 2006). Third, using data from *ELSA*, we provide novel evidence on the impact of Pension reform on the care received by older parents. By looking at the care utilisation arrangements of older people, we can evaluate whether the foregone support by daughters who extend their working life leads to a net loss of care support for the older parent in need of care. By adding exploring the intergenerational impact of working on the care received by older people, we extend the existing literature, which has mainly focused on the caregiver's perspective.

Our results demonstrate a trade-off between employment and informal care provided outside the household: relative to not being employed, working 10 hours per week reduces the provision of informal care by 2.1 hours a week (an elasticity of 0.37), which would amount to around £2,100 of yearly care-hours lost, using standard methods for informal care valuation. The negative effect of employment on intergenerational care is significantly stronger for women in physically and psychosocially demanding jobs, and for those with pre-existing multigenerational care responsibilities for parents and grandchildren. We then show that these changes are likely to affect societal welfare through lower care coverage to vulnerable older adults. In particular, parents with a daughter who is not eligible to the State Pension as a result of the reform receive less care overall, as the reduction in daughters' caregiving is not compensated by an increase in care from other unpaid or paid carers.

Our results have important policy implications. First, we provide novel evidence that policies to incentivise work in older age have unintended consequences for the supply of informal care and the care coverage for older vulnerable people. This suggests that the overall societal benefits of working longer could be smaller than anticipated, and that a comprehensive evaluation of Pension policy reform should incorporate the impact on intergenerational care. Second, we find that a reduction in informal caregiving from daughters is not compensated by an increase in the use of formal care, reinforcing the hypothesis that formal and informal care are not perfect substitutes. Our results suggest that policy reforms in response to population ageing should not be designed in institutional silos. In absence of new policy interventions supporting caregivers and care users, our findings imply that, combined with the tightened public spending on social care (Crawford et al., 2021; Zigante et al., 2021) and the predicted global increases in State Pension Age (OECD, 2017b), the reduction in the supply of informal care is likely to increase the unmet need for social care in older age in future decades (García-Gómez et al., 2015; Pickard, 2015).

The remainder of this paper is organised as follows: we first summarise our theoretical framework and empirical approach; we then present the empirical model and instrumental variable approach; we then discuss our main results and robustness checks; and finally we conclude and discuss policy implications.

Theoretical and Empirical Framework

Economic theory predicts that an increase in labor supply reduces caregiving supply: receiving a pension (non-labor income) reduces working hours and increases both care- and leisure-time (Johnson & Lo Sasso, 2000). The willingness to supply care decreases with the opportunity costs of caring, which are higher for working women and for workers with higher earnings who can purchase care on the market (Van Houtven et al., 2013). However, motivations to provide care, such as altruism and social norms (Klimaviciute et al., 2017), might moderate the impact of work on caregiving decisions (see also the framework by Laferrère & Wolff, 2006). An altruistic caregiver incorporates the health status of the care-recipient into the caregiver's own utility function (Stabile et al., 2006; Van Houtven & Norton, 2004).

A reduction in the supply of care reduces a caregiver's utility if the negative effect on the utility of the recipient is larger than the direct increase in utility caused by additional leisure or consumption. Similarly, the nature and strength of social norms imply that a significant reduction in care would reduce the utility of the caregiver (e.g., by triggering feelings of guilt), which might offset the benefits from work (Al-Janabi et al., 2018; Carmichael & Charles, 2003). The opportunity costs of caring depend on the type of care given—whether inside or outside the household—as well as the intensity of care provided and the kinship bond between caregiver and care recipient (Broese van Groenou & De Boer, 2016; Carmichael et al., 2010; Michaud et al., 2010; Van Houtven et al., 2013). The characteristics of the caregiver's employment also affect the opportunity cost of caring: women in physically and psychosocially demanding occupations face harder constrains to balance care duties while working (Broese van Groenou & De Boer, 2016; Burr & Colley, 2017). Moreover, adult workers "sandwiched" between two generations, with caring demands from both older parents and grandchildren, face higher incentives to reduce the intensity of care in response to an increase in the supply of labor (Grundy & Henretta, 2006; Vlachantoni et al., 2020). Finally, publicly funded formal long-term care can provide a substitute for lost informal care in an institutional context with higher provision of in-kind benefits (Geyer & Korfhage, 2015), while the literature on strategic interactions between siblings suggest expectations that a decrease in a daughter's care would be compensated by care from other informal carers to keep constant the level of support received by a vulnerable older person (Kalwij et al., 2014).

Establishing whether work has a causal effect on the incidence and intensity of informal care provision is challenging because employment is potentially endogenous: informal care decisions influence employment decisions, and both informal care and employment decisions are driven by individual and family circumstances that are not well measured. Several studies have investigated the impact of caregiving on labor market participation and wages (e.g., Crespo & Mira, 2014; Schmitz & Westphal, 2017, Van Houtven et al., 2013), but only a handful of studies have examined the impact of employment on the supply of informal care, and most of these have focused on younger adults. Both Michaud et al. (2010) and Carmichael et al. (2010) find that employment has a negative impact on willingness to supply informal care, but rely on the assumption that employment prior to caring is exogenous. He and McHenry (2016) overcome this assumption by using state-level unemployment rates as instrumental variable for employment status and find that an increase in working hours reduces informal care provision. Their identification strategy, however, relies on the strong assumption that local unemployment rates are exogenous and do not have a direct effect on the supply of informal care. Two recent papers have focused on older workers. Exploiting differences in official early statutory retirement age in 17 European countries to instrument retirement status, Bergeot and Fontaine (2020) find that retirement has no impact on the decision to provide care, but among those who already provide care, it increases the probability of providing intensive—i.e., daily or weekly—care. Their design, however, relies on the assumption of homogeneity in the impact of retirement age across countries with diverse incentive systems, and does not explicitly examine the impact of a change in the retirement age. Using the German Socio-Economic Panel (SOEP) data, Fischer and Müller (2020) exploit changes in women's early retirement age thresholds through a German pension reform in 1999, which increased the age of retirement from age 60 to age 63. They show that retirement increases the provision of informal non-intensive care by women approaching retirement age, while it has no impact on high-intensity care.

Our paper expands on the existing literature in three important ways. First, we focus on a reform that increased the State Pension age for up to six years, a considerably larger increase relative to earlier studies. Second, we assess the

intergenerational impact of working longer on the care coverage for older vulnerable parents.[2] Third, we provide novel evidence that the impact of work on care depends on the type of care (within or outside the household), employment characteristics (high vs. low physical and psychosocial job-demands), and the presence of multigenerational care roles (i.e., towards parents and grandchildren).

DATA AND DESCRIPTIVE EVIDENCE

We use data from *Understanding Society – The UK Household Longitudinal Study* (hereafter *Understanding Society*) to identify the effect of females' working decision on care provision, and data from *ELSA* to study the consequences of females' working decision on the care coverage of older individuals.

Understanding Society – The UK Household Longitudinal Study

Understanding Society is an annual survey of household members aged 16+ in the UK comprising detailed information on health, work, education, income, family, and social life. See Lynn (2009) and Knies (2016) for more details on the survey. We use panel data from wave 1 to 8 (2009 to 2017) and focus on women aged between 55 and 65, as women of these ages provide the larges share of all informal care and they are the target of the State Pension age eligibility reform. We exclude women who never worked, as their working hours throughout the life course have been, by definition, zero, and therefore they would not face a trade-off between working longer and caregiving (1,174 women); women who were interviewed via a proxy (391); and women with missing values for our variables of interest (304). Our final sample consists of 7,102 women and 27,044 observations. Our results are based on pooled data analysis, where we do not make restrictions on the number of times respondents are interviewed during the study period (however, restricting the sample to individuals who are observed multiple times does not affect our results).

Informal caregivers are defined as those reporting to "look-after or give special help" to someone who is "sick, disabled or elderly" (Carmichael & Ercolani, 2016, p. 2). Informal carers may co-reside with the recipient (in-household) or they may reside elsewhere (extra-household care setting). Participants report the weekly number of care-hours provided (Appendix Figure A1).[3,4] We follow Michaud et al. (2010) and Carmichael et al. (2010) and define two dichotomous indicators for the provision of, respectively, meaningful care (at least five hours per week) and intensive care (at least 20 hours per week).

The survey includes information on hours usually worked per week, for the main and secondary occupations. As the working hours sometimes exceed plausible values, we trim this variable at the 99th percentile. We also employ a binary indicator for working one or more hours per week. Moreover, we transform both working

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[2] Fischer and Müller (2020) study how the reduction in female caregiving is linked to changes in the care received by households where a dependent person lives. However, their data does not enable them to distinguish between informal and formal providers, and their analysis focuses exclusively on households where both a dependent person and a woman affected by the pension reform cohabit.

[3] Care hours are reported in brackets. Two brackets— "care under 20 hours" and "care 20 hours or more" (6 percent of caregivers)—are less precise than other categories. When dropping these respondents, results do not change (results available upon request). We are not able to disaggregate care-hours for the 1 percent of the respondents who provide both in- and extra-household care. Since care intensity is significantly higher for in-household settings compared to extra-household care, we classify such respondents as in-household caregivers (as suggested by Michaud et al., 2010).

[4] All appendices are available at the end of this article as it appears in JPAM online. Go to the publisher's website and use the search engine to locate the article at http://onlinelibrary.wiley.com.

and care hours using an inverse hyperbolic sine function, which is equivalent to the logarithmic transformation, while being able to deal with zero values (Burbidge et al., 1988).

We exploit information on respondents' socioeconomic status, derived from the hierarchical National Statistics Socio-economic Classification (NS-SEC), which distinguishes between managerial/professional, intermediate (including small employers and own-account workers), and routine/manual-workers.[5] We include as control variables several additional respondents' characteristics including living arrangements ("single/never married," "living in couple," and "widowed/divorced/separated"), the year at which respondents left their last job, number of children, educational attainment (categorised as A-level or higher, GCSE level, no education), and a binary indicator on whether the respondent owns her home. We exploit information on respondents' year-and-month of birth, as well as interview date, to build a binary indicator for whether a respondent is above or below her State Pension age at the time of interview.[6]

Descriptive Evidence

Table 1 provides descriptive statistics for the total sample. The average age is 60, and the majority of respondents is working, living in couple, below the SPA, and owning their house.[7]

Nearly half of the women has one child, about half has an A-level education certificate, and around one-third is in the lowest socio-economic status (SES). Compared to women who report that they do not work, those in paid work are younger, have a higher SES, have higher education, and are more likely to report having no children (columns b, c).

Descriptive statistics confirm several known stylised facts (Carmichael & Ercolani, 2016; Michaud et al., 2010). First, around 28 percent of respondents provide informal care. Second, extra-household caregiving is more common but less intensive than in-household care (see Table 1 and Appendix Figure A1). Third, the probability of providing care is similar for women in paid work and women not in paid work, but women in paid work are more likely to provide extra-household care and less likely to provide in-household care than women who are not in paid work. Fourth, women in paid work are less likely to provide intensive care than women who are not in paid work. Fifth, care outside the household comprises intergenerational support to parents (68.8 percent), friends/neighbours (17.3 percent), and other relatives (16.5 percent). By contrast, care inside the household is primarily provided to a spouse (65.4 percent), followed by parents (17.1 percent), and children (13.5 percent).

Figure 1 shows that there is a negative and graded relationship between the intensity of work (as measured by weekly working hours) and the intensity of informal care provided (as measured by hours of care per week). For example, women who report zero working hours provide on average 6.4 hours of care per week; women who work 10–19 hours provide an average of 4.3 hours of care per week; while women who work for 40 hours or more provide only three hours of care per week. This association is likely to reflect both the impact of informal care on work, as well as the impact of work on care. Therefore, in the next section, we discuss our econometric

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[5] The NS-SEC coding is based on a cross-reference between individuals' current or last occupational category (based on the Standard Occupational Classification, SOC2000), firm size, and employment status (employer, self-employed or employee).
[6] Information on respondents' living parents and/or grandchildren is available only in selected waves.
[7] Respondents who report that they are not working report that they are either retired (71.2 percent), unemployed (5.2 percent), sick/homecarer (23 percent), or other (0.6 percent).

Table 1. Descriptive statistics for the total sample and by employment status.

	(a) Whole population		(b) Not in paid work		(c) In paid work	
	Mean	SD	Mean	SD	Mean	SD
Age	59.84	3.164	61.15	3.004	58.77	2.873
Working	0.547	0.498	0	0	1	0
Hours worked per week	15.63	16.74	0	0	28.05	12.59
Retired	0.322	0.467	0.712	0.453	0	0
Below State Pension Age	0.614	0.487	0.422	0.494	0.772	0.420
Living with a partner	0.703	0.457	0.688	0.463	0.716	0.451
Widowed	0.240	0.427	0.253	0.435	0.229	0.420
Single	0.057	0.232	0.059	0.237	0.054	0.228
No children	0.256	0.437	0.210	0.408	0.294	0.456
One child	0.475	0.499	0.495	0.500	0.459	0.498
Two children or more	0.268	0.443	0.294	0.456	0.247	0.431
No education	0.168	0.374	0.248	0.432	0.102	0.303
Education at GCSE level	0.339	0.473	0.343	0.475	0.335	0.472
Education at A-level or higher	0.493	0.500	0.409	0.492	0.563	0.496
SES routine	0.379	0.485	0.425	0.494	0.342	0.474
SES intermediate	0.269	0.444	0.253	0.435	0.282	0.450
SES managerial	0.351	0.477	0.322	0.467	0.376	0.484
House owned	0.808	0.394	0.763	0.425	0.845	0.362
Provides informal care	0.286	0.452	0.288	0.453	0.284	0.451
- inside household	0.080	0.272	0.103	0.304	0.061	0.241
- outside household	0.206	0.404	0.185	0.389	0.223	0.416
Provides 5+ hours informal care	0.186	0.389	0.204	0.403	0.172	0.377
- in household	0.068	0.252	0.0908	0.287	0.049	0.217
- outside household	0.118	0.323	0.114	0.317	0.122	0.327
Provides 20+ hours informal care	0.068	0.251	0.092	0.289	0.047	0.212
- in household	0.044	0.204	0.064	0.245	0.026	0.161
- outside household	0.024	0.152	0.028	0.164	0.020	0.142
N	27045		12238		14807	

Notes: The sample (Understanding Society waves 1–8) includes women aged 55 to 65, who have been engaged in paid work. It excludes women who never worked and those whose interview was carried out via a proxy interview. The SES classification follows the National Statistics SEC-3 taxonomy.
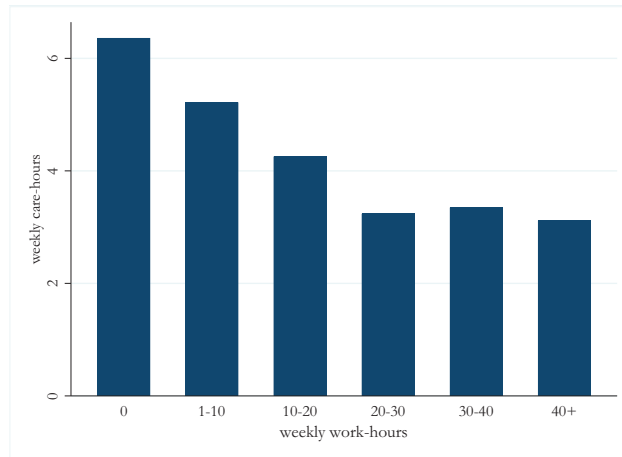
Notes: The sample (Understanding Society waves 1–8) includes women aged 55 to 65 who have ever been engaged in paid work and currently provide informal care

Figure 1. Working-Hours and Care-Hours.
[Color figure can be viewed at wileyonlinelibrary.com]

specification approach to estimate the causal impact of work on informal caregiving exploiting the UK Pension reform.

English Longitudinal Study of Ageing

As *Understanding Society* does not provide information on the care recipients if they do not reside in the same household as the caregiver, we use data from the *English Longitudinal Study of Ageing* (*ELSA*) to obtain information on older people who receive informal home-care from outside the household. For the purpose of this analysis, we will exploit data from Wave 3 (2006) to Wave 8 (2017). *ELSA* collects detailed information on health, care use, socio-demographic characteristics, and children's demographics for representative cohorts of individuals aged 50 and older residing in England (Marmot et al., 2016).

ELSA respondents provide information on whether they received any domiciliary help for substantial limitations with basic daily activities (such as moving across a room, using the toilet, dressing, bathing, shopping for groceries, housework), and whether the caregiver is an informal (e.g., partner, son, daughter, other relatives, friend) or a formal helper (e.g., home care worker, voluntary helper). The survey also includes information on the number of daily activities (tasks) for which the respondent receives help from each provider, while the number of hours of care received is only available from wave 6 onwards. Therefore, as primary measure of care intensity, we compute the number of tasks the respondents received help with, separately for each care-provider, and then across all the providers. If a respondent receives help for the same activity from two providers, we record it as two help-tasks received. Measuring the number of help-tasks received has an important limitation, as it does not convey information on the time (and effort) spent by the caregiver in the specific task. As a result, it would be possible for a caregiver to reduce the number of help-tasks provided, yet increasing the total amount of time spent caring in other tasks. However, we argue that the number of help-tasks is a good proxy for intensity of caregiving, as help-tasks and hours of care in waves 6 to 8 are

strongly and positively correlated (rho = 0.64 using absolute care-hours, 0.78 using log-hours).

As discussed above, over two third (68.8 percent) of the extra-household care provided by women is provided to parents. In *ELSA*, we restrict the sample to respondents aged 65 or older who have any daughters aged 55 to 65 between 2006 and 2017. This allows us to focus on the older population that potentially receives care from women aged 55 to 65, i.e., the group of caregivers we focus on in our analysis of the *Understanding Society* data. Our sample comprises 3,911 observations from 1,617 individuals.[8]

We derive the State Pension eligibility status for each daughter of each respondent. We recover information on daughters' year of birth from *ELSA* life-histories (wave 3), as well as the regular waves 1 to 8. Using the relevant Pension legislation, we compute each daughter's State Pension age (Cridland, 2017).[9] We then derive a binary variable, respondent- and wave-specific, equal to one if all of the respondent's daughters are under the SPA, and 0 otherwise.

Over two-thirds (66.9 percent) of respondents in our analytical sample are women. The average age of *ELSA* respondents is 84 years. The average number of daughters is 1.9, and the average age of the eldest daughter is 60. During the course of the study, 1,031 respondents (63.7 percent) always have all of their daughters below SPA, 444 respondents (27.5 percent) always have at least one daughter over SPA, while 138 respondents (8.8 percent) see at least one of their daughters cross their SPA.

A large proportion of respondents (44.9 percent) receives help with daily tasks from informal or paid carers. Over a fifth (22.2 percent) receives intergenerational help from their daughters and just under a fifth (18.3 percent) receives care from a paid provider. On average, respondents receive help with 1.35 tasks (across all the caregivers and all respondents). Conditional on receiving informal or formal care, the average number of help-tasks is 3.

EMPIRICAL APPROACH

Effect of Work on Caregiving Supply

We investigate the causal effect of work on the supply of informal care in older age. We adopt a two-part model (2PM), a standard model in the health economics literature, which is particularly useful as it allows to separately model informal care provision at the extensive and the intensive margin. First, the individual decides whether to provide care; second, conditional upon caregiving, she determines the amount of care provided. We refer to zero caregiving hours as corner solutions, which indicates that no care was provided, as individuals cannot provide a negative amount of hours of care (see, e.g., Carrino et al., 2018; Duan et al., 1983; Van Houtven & Norton, 2004).

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[8] The *ELSA* sample from waves 3 to 8 has 9,447 respondents aged 65 or older (31,734 observations). We drop 30 respondents with no information on children, and 3,014 respondents who do not have daughters, which leaves us with 6,403 respondents (21,848 observations). From these, we select those with daughters aged 55 to 65 (1,622 respondents, 3,910 observations).
[9] In *ELSA*, we only know the year of birth of respondents' daughters. However, the exact SPA depends on months of birth for cohorts born after March 1950. Therefore, to compute the SPA, we randomly assign daughters' month of birth using a uniform distribution. This imputation process introduces some small measurement error in the daughter SPA, which could bias towards zero the estimated coefficient of the impact of having all daughters under the SPA on care received.

The first part of the model is estimated through a probit regression for individual i at time t:

$$Pr(ICH_{it} > 0) = \Phi \left(\gamma_0 + \gamma_1 WH_{it} + \sum_a \delta_a 1\,(A_i = a) + \sum_y \vartheta_y 1\,(Y_t = y) + X_{it}\beta + \varepsilon_{it} \right). (1)$$

The dependent variable *ICH* represents the number of informal care hours provided per week and $\Phi()$ is the cumulative distribution function of the standard normal distribution. The type of care provided, its intensity, and the identity of the care-recipient are likely to differ depending on care-setting—i.e., extra- vs. in-household—and this may affect the relationship between care and employment—e.g., in-household caregiving has been shown to have a stronger negative effect on employment than extra-household care (Carmichael et al., 2010; Heitmueller, 2007; Mentzakis et al., 2009; Michaud et al., 2010). Thus, we implement separate models by care-setting.

The main independent variable *WH* (working hours) is a continuous variable for working hours, transformed using the inverse hyperbolic sine. This transformation provides a coefficient interpretation equivalent to the logarithmic transformation, while being able to deal with zero values (Bellemare & Wichman, 2020). In an alternative specification, we employ a binary variable for being in paid work.

We flexibly control for age, a likely determinant of both employment and caregiving supply, by adding fixed effects for each year of age (*A*). We also control for common trend shocks in caregiving outcomes as well as in employment, with a set of dummies for interview year (*Y*).[10]

Whilst we control flexibly for age and interview year, the treatment and control groups may still differ on several sociodemographic characteristics because of cohort effects. To address this, we follow Carrino et al. (2020) and include in the vector *X* a range of socio-demographic characteristics that are likely to have changed across cohorts. We include categorical variables for having zero, one/two, or at least three children; highest educational attainment (A-level or higher, GCSE level, or less than GCSE/no education); current (or former) routine, intermediate, or managerial level job (NS-SEC classification); and marital status (single, widowed/separated, living with someone). Furthermore, we control for country dummies (England, Wales, Scotland, and Northern Ireland) to account for geographical factors that might have a direct effect on health; and for homeownership, i.e., measure of financial resources that is unlikely to be affected by our instrument (eligibility to the State Pension, see the next section). Although such controls should enhance the precision of our estimates, and improve the credibility of our identification strategy, our results are robust to excluding these controls from the model.

We do not control for health measures in our main specification, as health may be endogenous to informal care: first, unobservable variables like personality may affect both respondents' health and informal care decisions; second, caregiving may affect the provider's physical and mental health (Bom et al., 2019; Brenna & Di Novi, 2016; Zwart et al., 2017). However, in the robustness checks section, we show that our results are robust to extensive controls for the health of the caregiver.

In the second part of the model, estimated on the conditional sample of caregivers, the dependent variable is interval informal care transformed using the inverse

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[10] We test for alternative specifications as robustness checks.

hyperbolic sine, with same regressors as in (1), estimated through an interval regression model (Bettin & Lucchetti, 2012; Stewart, 1983).

$$\log(ICH_{it}^*) = \gamma_0 + \gamma_1 WH_{it} + \sum_a \delta_a 1\,(A_i = a) + \sum_y \vartheta_y 1\,(Y_t = y) + X_{it}\beta + \upsilon_{it} \qquad (2)$$

with $ICH_{it} = j$ if $\xi_{j-1} < ICH_{it}^* \le \xi_j$, $j=1,\ldots,m$ where we account for m cut-off points.

Monetary Evaluation

Moreover, we provide a monetary evaluation of the observed changes in informal care provision due to working longer. To do so, we apply to each hour of informal care the shadow price of a market substitute. As shadow price, we use the hourly cost of homecare Personal Social Services (NHS Digital, 2016), which is the official estimate of the actual cost per hour of providing homecare to an adult in England (Buckner & Yeandle, 2015; Dzingina et al., 2017). In 2015, such value was £17,20 per hour (£19,1 in 2019 prices). Although widely used, this method makes two implicit assumptions. First, it assumes that formal and informal carers are perfect substitutes. Second, it assumes that formal carers can replace informal caregivers' tasks without efficiency/quality losses or gains (Hoefman et al., 2013).

Finally, while our identification strategy does not require us to include individual fixed effects, results are robust to their inclusion.

UK Pension Eligibility Rules as Instrumental Variable: Identification Strategy

The causal effect of work on caregiving can be consistently identified at both margins only if the error terms ε_{it} and υ_{it} are uncorrelated with employment status. This assumption is unlikely to hold for several reasons (Carmichael et al., 2010; Crespo & Mira, 2014; He & McHenry, 2016). First, individuals make caregiving and employment decisions jointly. Second, observable and unobservable individual and family characteristics influence both decisions, e.g., the degree of dependency of the care recipient, and the caregiver's preferences between caregiving and leisure. Thus, to identify the causal effect, we use eligibility to the State Pension to instrument employment status. In the UK, the SPA is the minimum age at which people can claim the Basic State Pension, which provides an almost-flat minimum level of retirement income (the specific amount depends on National Insurance contribution-years; for further details see OECD, 2013; Pension Policy Institute, 2015). Since 2010, the female SPA has been raised gradually, based on birthdate, for women born after March 1950, with the aim to bring the SPA from the baseline age of 60 to the age of 66 in 2020. The impact of the reform on Pension eligibility is substantial (see Thurley & Keen, 2017 and Appendix Figure B1): being born one year after March 1950 implies a one-year delay in SPA. The SPA postponement exceeds three (six) years for cohorts born after March 1953 (November 2014). Thus, women born just a few years apart face different eligibility status (above- vs. below-SPA) at any given age (right panel): e.g., a woman aged 60 in 2009 is above her SPA, while a woman aged 60 in 2012 is two years below her SPA. To determine Pension eligibility, we combine information on year-and-month of birth with date-of-interview (which are also included as separate controls as explained above).

The Pension reform constitutes the ground for our identification strategy, as it allows us to compare the employment outcomes and caregiving choices of women of the same age, but subject to different Pension eligibility status. Figure 2 plots the employment rates, average weekly working hours, and average weekly care hours (among carers) for women of the same age, but different Pension eligibility due
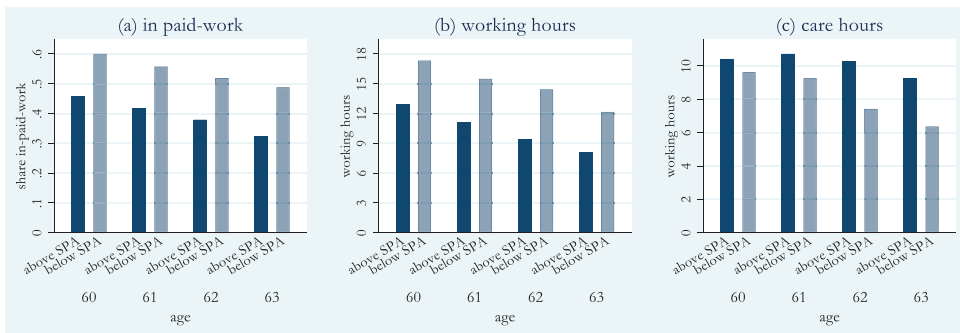
Notes: Panel (a) shows the percentage of women reporting to be working for pay; panel (b) shows the average weekly hours worked (non-working women are assigned zero hours).

Figure 2(a)–(c). Employment Participation and Caregiving by Pension Eligibility Status for Women of Same Age, Years 2009–2017.
[Color figure can be viewed at wileyonlinelibrary.com]

to the policy change, interviewed between 2009 and 2017. Women who are not eligible to the State Pension exhibit a higher employment rate than women eligible for the State Pension. As the reform was implemented gradually, Figure 2 might also capture a general positive trend in employment for any age group. In Appendix A we provide further visual support to our identification, showing that this is not the case: age groups whose Pension eligibility does not change over time do not exhibit changes in employment outcomes over time. Figure 2 also suggests that, among women of same age, the intensity of care provision (among carers) is lower for the subgroup who is unable to collect the State Pension at the time of the interview (below SPA) than for those who are able to do so (above SPA).

To be valid, our instrumental variable should satisfy four conditions. First, it must be have a strong and causal effect on the endogenous variable (employment). Recent estimates show that eligibility to the State Pension, in the UK and elsewhere, provide a strong retirement incentive (Belloni et al., 2016; Bonsang et al., 2012; Cribb et al., 2016; Staubli & Zweimüller, 2013). Second, whilst the instrument may have no effect on some individuals, it must affect everybody who is affected in the same way (monotonicity). The eligibility to the State Pension may not affect the employment decision of some groups—e.g., those who would have continued working past their SPA—but it is unlikely that people would decide to start working as a result of becoming eligible to the State Pension. Third, the instrument must be uncorrelated with error terms ε_{it} and υ_{it}, that is, as-good-as randomly assigned (Angrist & Pischke, 2009). Our instrument satisfies this requirement, as the State Pension age is regulated by law based on birthdate, a variable over which respondents have no control. Fourth, the instrument must satisfy the exclusion restriction, which, in our context, implies that being above/below the SPA affects caregiving only through an effect on employment. Individuals who are above the SPA are older than those below SPA, which could influence the propensity to provide care directly. Therefore, we flexibly control for age and time effects by adding fixed effects (dummies) for each year of age and year of interview. Notice that fixed effects for age and interview year are not colinear with our instrument, which depends on the combination of year of age with year of interview.

More formally, we model working hours (our *first-stage*) as follows:

$$WH_{it} = \alpha_0 + \alpha_1 underSPA_{it} + \sum_a \delta_a 1\,(Age_i = a) + \sum_y \vartheta_y 1\,(Year_t = y) + X_{it}\beta + \varepsilon_{it} \quad (3)$$

where *underSPA*$_{it}$ is a binary variable indicating whether the individual i observed at time t is below her State Pension age. The coefficients δ_a and ϑ_y capture the age and time trend on employment by flexibly allowing for age- and interview-year-specific effects.[11] The vector X includes the same covariates as in equations (1) and (2). The coefficient a_1 captures the causal impact on working hours of changes in Pension eligibility due to the reform, above and beyond the effect of age and year. Conditioning on age and year, being above the SPA is unlikely to directly affect caregiving through other channels than employment and retirement. While the impact of working longer on caregiving could be mediated through effects on health or income, we will show that these mechanisms are unlikely to drive our results. Our findings are robust to alternative parametric and non-parametric specifications for age and time trends, as well as to controlling for distance in years between current age and the SPA.

We consider that reaching the SPA may not affect the working hours of women who have long been disengaged from the labor market, but it would increase their income as they would be able to claim a State Pension, hence potentially violating the exclusion restriction.[12] A higher income without a reduction in working hours may reduce the amount of informal care if it increases the purchase of formal care to substitute for informal care (Bonsang, 2009; Carmichael et al., 2010; Carrino et al., 2018; He & McHenry, 2016; Stabile et al., 2006). For long-term inactive women, reaching the SPA may thus result in higher income and lower caregiving provision. By contrast, for working women, we expect that reaching the SPA would reduce working hours and increase caregiving. Thus, including long-term inactive women may bias the estimate of the (instrumented) γ_1 coefficient in (1) and (2), i.e., understate the effect of working on caregiving, which we would expect to be negative. As a robustness check, we estimate models that exclude women who permanently left the labor force one and five years before their SPA. Finally, we estimate falsification tests on women who were not affected by the reform due to age or employment history.

We follow the recent literature (e.g., Carrino et al., 2018) and estimate model (1) as an IV-probit, through a 2 stage residual inclusion (2SRI), where the instrumented variable is the continuous amount of log working hours (Deb et al., 2017; Terza et al., 2008). We estimate model (2) as an instrumented interval regression (the eintreg command in Stata15). Standard errors are always clustered at the month-year-of-birth level (224 clusters), as the treatment assignment varies by month of birth, but findings are robust to individual level clustering. Our estimates should be interpreted as a Local Average Treatment Effect (LATE), that is, the effect on caregiving of being in paid employment as a result of being below the SPA.

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[11] As noted by, e.g., Cribb et al. (2016), such a model assumes that age-effects are cohort- and time-constant; cohort effects are time- and age-constant; and time-effects are age- and cohort-constant.
[12] For women born after (before) April 1950, the full pension amount (£126/week) requires 30 (39) years of National Insurance contribution. It is reduced pro rata based on contribution years. No pension is earned below 1 (10) years of contribution.

The Effect of Work on Intergenerational Care Use

We aim to estimate the effect of women's increase in work supply (induced by the changes in Pension rules) on the total amount of care that their older parents receive. We use data from *ELSA*, where we identify respondents with daughters aged over 50, who become eligible to the State Pension over the course of the study. As we do not have information on the labor market status of daughters, we estimate a reduced-form model to analyse the impact of having the respondent's eldest daughter reaching her SPA on the respondent's use of care. We estimate the following model, with individual Fixed Effects:

$$care_{i,t}^{j} = \beta D\_belowSPA_{i,t} + x_{i,t}\gamma + c_i + \varepsilon_{i,t} \qquad (4)$$

where $care_{i,t}^{j}$ is a measure of care received by individual i in year t from provider j. The variable $D\_belowSPA_{i,t}$ is a binary variable indicating whether the respondent's eldest daughter is below the SPA. The vector $x_{i,t}$ is a vector of time varying characteristics, which include the age of the respondents (as a third-order polynomial), and the age of the eldest daughter and interview year, included as a set of binary variables for each year of age. As explained in the section "UK Pension Eligibility Rules as Instrumental Variable," because of the Pension reform, the daughter's age is not collinear with Pension eligibility: Pension eligibility status is an interaction between daughter's age and interview year.

We use several different measures of care received, including binary variables indicating whether the respondent received any help-task from any provider (any care), any help-task from any daughter, or any help-task from paid providers. We then employ continuous outcomes for the number of help-tasks the individual receives from daughters, other informal carers, or paid carers, separately and jointly considered.[13]

RESULTS

The Caregiver's Perspective and her Spouse

Before discussing the main findings from the instrumental variable model, we provide evidence of the link between State Pension eligibility and caregiving hours. We estimate a reduced form model, which explains how respondents' provision of care varies depending on the relative time to/from State Pension age that a respondent faces at the time of the interview. The dependent variable is care-hours per week, measured in log or raw. The main independent variable is distance to/from State Pension age, measured as a difference between respondents' actual age and their State Pension age (hence, relative age). As in the main analysis, for the identification of the effect of SPA status, we include fixed effects for age (years) and interview year. Results are shown in Figure 3, where a vertical dashed line separates respondents above and below the SPA at the time of interview. Results show that care provision intensity is significantly higher for respondents who are above their State Pension age with respect to those who are below their SPA. We now more carefully study this effect with an Instrumental Variable approach.

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[13] As a sensitivity test, we also use information on (log) care-hours received, on a subsample from waves 6 to 8.

Table 2. Summary Statistics, *ELSA*.

	Mean	SD	Min	Max
Female	0.669	0.471	0.000	1
Age	84.112	6.964	65.000	99
Number of daughters	1.90	0.988	1	7
Age eldest daughter	59.908	4.194	55.001	85
All daughters under the SPA	0.619	0.486	0.000	1
Received any help	0.449	0.497	0.000	1
Number of help-tasks for which received help	1.354	2.263	0.000	27
Received any help from daughter	0.222	0.415	0.000	1
Number of help-tasks for which received care from daughter	0.428	1.003	0.000	6
Received any help from other informal carer	0.257	0.437	0.000	1
Number of help-tasks for which received care from others	0.534	1.190	0.000	13
Received any help from paid carers	0.183	0.386	0.000	1
Number of help-tasks for which received care from paid carers	0.393	1.107	0.000	18
N	3,911			

Notes: The sample includes respondents with daughters aged over 55 interviewed between 2006 and 2017.

Table 3(a)–(b). Effect of working hours on informal care provision.

	Any care (1+ hours)		Log weekly hours among carers	
	(1) Probit	(2) Probit IV	(3) Interval reg.	(4) Interval reg. IV
(a) – extra-household caregiving				
Log working-hours	0.002	-0.029	-0.059***	-0.367**
	(0.002)	(0.033)	(0.010)	(0.145)
N	27,044	27,044	5,566	5,566
F-test excl. instr.		47.070		20.485
Average working hours		15.6		16.6
Fraction of caregivers		0.206		-
Average caregiving hours		-		9.05
(b) – in-household caregiving				
Log working-hours	-0.009***	-0.019	-0.128***	-0.336
	(0.001)	(0.021)	(0.019)	(0.390)
N	27,039	27,039	2,173	2,173
F-test excl. instr.		47.070		2.923
Average working hours		15.6		12
Fraction of caregivers		0.08		-
Average caregiving hours		-		31.3

Notes: In columns 1 and 2 the dependent variable is a binary indicator for any care provided outside (Panel A) or inside the household (Panel B). In columns 3 and 4 the dependent variable is the log of weekly hours spent providing care coded as intervals. In columns 2 and 4, log of working hours is instrumented by the status of being above/below State Pension age (SPA). All models control for fixed effects for age (in years), interview year, Socio-economic Status (NS-SEC), home-ownership, marital status (dummies for being single or widowed), number of children (dummies for one child, two or more), highest educational attainment and country dummies. We report marginal effects computed at means for a probit (column 1), iv-probit 2SRI (column 2), interval regression (3), and instrumented interval regression (4) models. Standard errors are clustered at the month-year of birth level. The sample (Understanding Society waves 1-8) includes women aged 55-65, having been engaged in paid work in their life. Statistical significance: *** p-value < 0.01; ** $p < 0.05$; * $p < 0.1$.
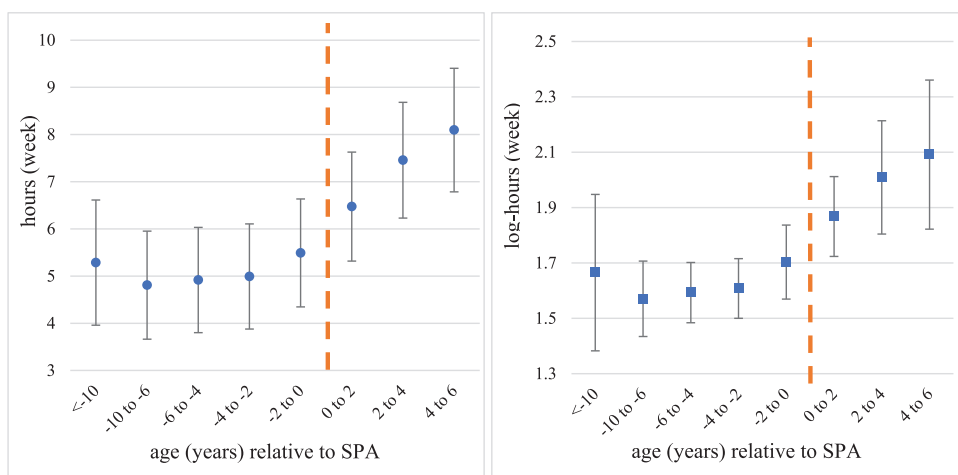
Notes: Event study for the provision of long-term care outside the household relative to individual's age relative to her State Pension age. For the identification of the effect of SPA status, we conrol for fixed effects for age (years) and interview year.

Figure 3. Reduced-Form Results: How Do Respondents Adjust Caregiving After Crossing the State Pension Age.
[Color figure can be viewed at wileyonlinelibrary.com]

Effect of Employment on Female Care-Provision

Appendix Table J1 reports the first-stage regression estimates of the Pension eligibility status on women's employment status. We find that women who are below the State Pension age as a result of the reform increase their working hours by around 50 percent, and are more likely to be in paid employment by nine percentage points, in line with the established evidence (see, e.g., Cribb et al., 2016).

Table 3 reports the results of equation (1). Columns 1 and 2 summarise estimates of the impact of employment on the probability of providing one or more weekly hour of care (the extensive margin), separately for care inside (Table 3a) and outside the household (Table 3b). In a regular probit model (column 1), longer working hours is associated with lower probability of in-household care, but not with the probability of extra-household care. The IV model (Column 2) suggests a negative relationship between work hours and the probability of care provision, but the effect is not statistically significant. The *F*-test of the excluded instrument (State Pension eligibility) is large and highly significant (see Appendix I).

Columns 3 and 4 summarise results for the intensive margin based on model (2). The reported coefficient is an elasticity, i.e. the percentage change in caregiving hours resulting from a 1 percent change in working hours, computed at averages. A negative and relatively small statistical association is found in the interval regression model, for both care settings. IV estimates, by contrast, suggest a significant impact of working on the intensity of non-residential care: a 10 percent increase in working hours (approximately 100 minutes per week, computed at the average) reduces care-hours by 3.7 percent (21 minutes per week). Alternatively stated, increasing working time by 10 hours per week (the average working hours per week among workers is 30) would decrease extra-household caregiving by 2.1 hours. This is a substantial effect, given that roughly half of the caregivers provide less than five hours of

extra-household care. In a year, this would amount to just over 110 foregone care-hours, valued around £2100 in 2019 prices (£19.1/hour).

The instrument is highly informative (see Appendix I). The IV estimate of the effect is substantially more negative than the un-instrumented interval regression model. This is not surprising as unobserved factors (e.g., poor health) associated with low working hours are also likely to be associated with reduced working hours, thus generating a positive correlation between caregiving and working time. In addition, the IV model identifies the Local Average Treatment Effect, the effect on care provision of an increase in working hours as a result of not being eligible to receive the State Pension.

We find no statistically significant effect for in-household care. However, because of the small number of observations, our instrument becomes weak at the intensive margin and we lack power to detect the causal effect of working hours on in-household care intensity (Appendix I).[14] The difference between the effect of working hours on care provided extra-household and care provided in-household may be driven by the fact that care outside the household was primarily care for an older parent (69 percent), while care inside the household was primarily care provided to a spouse (65.4 percent). A possible explanation is that care for older parents is a function of the number of adult children and their availability to provide care in a family setting. Adult children who are employed may be less likely to be considered primary caregivers for their older parents than adult children who are not working or who work part-time, explaining the strong association between work intensity and caring hours outside the household. By contrast, as explained in the section "Theoretical and Empirical Framework," the decision to provide care for a spouse is likely to fall primarily under the responsibility of the partner, regardless of their work status, due to a stronger normative connotation, as well as the emotional and physical proximity between spouses (Broese van Groenou & De Boer, 2016; Burr & Colley, 2017; Klimaviciute et al., 2017; Van Houtven et al., 2013). This might explain the reduced elasticity of in-household caregiving to employment decisions.

Effect on Specific Help: ADL and iADL

We then estimate the effect of working hours on the probability of providing help with specific tasks to parents who report functional limitations. This comes from a set of questions available in selected waves of *Understanding Society*, covering specific instrumental activities of daily living (iADL; such as shopping for groceries, doing housework, managing finances), and a general question on help for any difficulty in activities of daily living (ADL; e.g., bathing, dressing, eating). We find that an increase in working hours reduces the probability of providing help with ADL and iADL tasks. For example, Figure 4 shows that a 10 percent increase in working hours leads to a reduction in the probability of providing help with any ADL by 0.87 percentage points, which amounts to a 9.1 percent reduction computed at the relevant mean (9.5 percent). Full results are shown in Appendix D. As illustrated by the large confidence intervals in the figure, we may be underpowered to compare the strenght of the impact on ADL and iADL. Taken at face value, these findings support previous knowledge on the nature of long-term care support. First, the impact of working hours on in caregiving for iADL limitations can be explained by the fact that these limitations are largely covered by informal carers (Van Houtven et al., 2013), and also because iADL deficits are less likely to be covered by formal public programmes of care (Brugiavini et al., 2017). Second, while the limitations with ADL

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14 Using a binary dependent indicator for being in paid work leads to similar results (Appendix C).
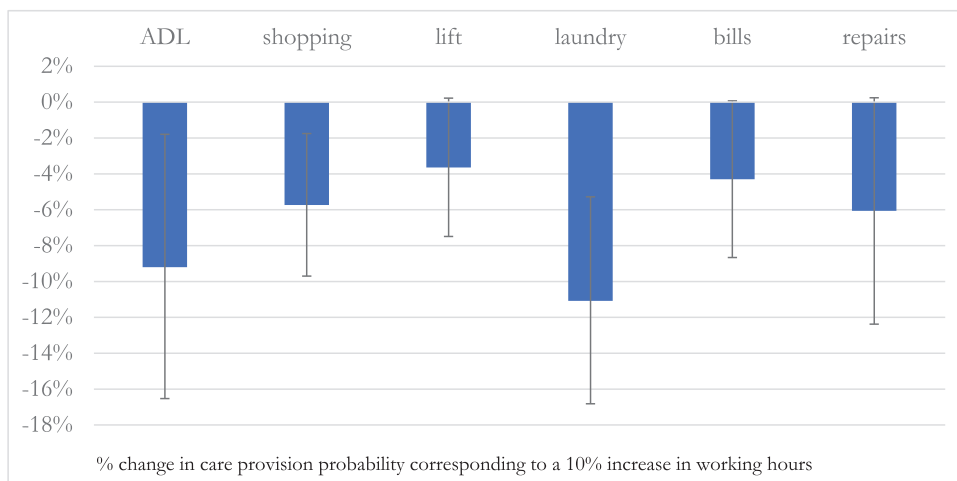
Notes: Full results are available in Appendix D.

Figure 4. Percentage Change in Probability of Providing Specific Help to Parents, for a 10 Percent Increase in Working Hours.
[Color figure can be viewed at wileyonlinelibrary.com]

are more likely to qualify for formal support from the social care system than those with iADL, they are still burdensome for informal caregivers as they typically require a higher average amount of care-time than iADL tasks (Brugiavini et al., 2017).

Effect on Partner's Care-Provision

We also investigate whether a woman's working hours affects their partner's labor and care supply. To do so, we employ information on the spouse's employment, care provision, and demographic characteristics, and estimate the same models in (1) and (2) using the partner's outcomes as dependent variables, and controlling for the partner's age. We find that a change in women's working hours has no effect on their partners' employment choices, nor on the partners' provision of care (Appendix Table F1).[15] These findings suggest that the reduction in female caregiving as a result of increased labor force participation is not compensated by an increase in the care provided by their spouse. We interpret this finding in terms of gender norms around caregiving and employment. First, evidence suggests that social norms play an important role in both the decision to supply care and the amount of care supplied (Della Giusta & Jewell, 2014). Gender norms also translate into differences in expectations of who should be responsible for care (mostly women), and the life satisfaction of caregivers (Della Giusta & Jewell, 2014). Second, the lack of a link between changes in women's caring hours and their male partners' caring

[15] However, the spillover effect between one partner's retirement and the spouse's employment decisions has been shown to be asymmetrical across sex. While retirement (and pension eligibility) of the male partners is typically found to affect female employment decisions, female retirement (and female pension eligibility) has been shown to have almost no effect on male employment (Lalive & Parrotta, 2017). This can be explained by the fact that men's labor supply is more fixed, as their choice of working hours is effectively discrete (for example, most men in the UK or in France work full-time, or do not work), while women's labor supply is more flexible (Blundell et al., 2007; Donni & Moreau, 2007).

behaviour decisions may also be explained by the higher propensity of men to work full-time than women (Blundell et al., 2007; Donni & Moreau, 2007; Office for National Statistics, 2022). Higher levels of part-time work may thus enable women to share caring and work responsibilities, while the caring behaviour of male partners may be insensitive to their partners' caring decisions given their tendency to work full-time.

Effect of Employment on Meaningful Care and Intensive Care Provision

Results above are based on the entire distribution of self-reported care hours. We now turn to assess how working hours affect different levels of care intensity. High intensity care may reflect higher commitment/responsibility, potentially implying lower substitutability between care and work than for low intensity care; however, intensive care responsibilities may be harder to combine with work than low intensive care (He & McHenry, 2016). Based on prior literature (see Carmichael et al., 2010), we define high intensity caregiving with a threshold of 20+ hours a week, and meaningful caregiving with a threshold of 5+ hours per week (Michaud et al., 2010). We run a series of IV-probit models as in (1), for the aforementioned dichotomous dependent variables.

Focusing on non-residential care, results in Table 4 highlight that working hours lead to a substantial decrease in both meaningful (above five hours) and intensive (above 20 hours) extra-household caregiving.[16] The coefficients indicate that, for a 10 percent increase in working hours (equal to 1.5 hours per week, computed at the average of 15 hours), the probability of 5+ hours caregiving drops by 0.63 percentage points (average prevalence 11.6 percent) while that of intensive care drops by 0.2 percentage points (average prevalence 2.5 percent). Alternatively stated, increasing working time by 10 hours per week (the average working hours among workers is 30) would decrease the probability of providing extra-household care (5+ hours) by 4.2 percentage points, and intensive care by 1.3 percentage points. We find no evidence of an impact on intensive in-household care.

Heterogeneity by Job-Demand

We now investigate whether the previous findings are heterogeneous across job types. We link to *Understanding Society* and two indices built by Kroll and Lampert (2011) on physical and psychosocial burden (further details in the Appendix K). These indices have been externally validated (Santi et al., 2013) and are more informative on job-demand than the coarse distinctions (e.g., white vs. blue collar) based on the first digit of the ISCO-code (Mazzonna & Peracchi, 2017). The index captures the level of physical demands (based on assessments of ergonomic stress and environmental pollution) and psychosocial demands (based on assessments of mental stress, social stress, and temporal loads). We retrieve the indices for 99 percent of our sample using the 4-digit International Classification of Occupation (ISCO-88) for linkage. Following Santi et al. (2013) and Mazzonna and Peracchi (2017), we split the sample between those working in high- and low-demand occupations for each index, using a cutoff score of six (out of 10), and estimate our models for

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[16] When focusing on the 5+ hours cutoff, we drop respondents who reported care hours as "20 hours or less" instead of using more detailed bands, because we cannot disentangle whether this specific group provided more or less than five hours of care.

Table 4. Heterogeneous effects of working hours by level of caregiving intensity.

	In household intensive care (20+ hrs week)		Extra-household intensive care (20+ hrs week)		Extra-household care (5+ hrs week)	
	(1) Probit	(2) iv-probit	(3) Probit	(4) iv-probit	(5) Probit	(6) iv-probit
Log working hrs	-0.009***	-0.010	-0.003***	-0.020**	-0.003	-0.063***
	(0.001)	(0.015)	(0.001)	(0.009)	(0.002)	(0.021)
N	26,812	26,812	26,812	26,812	26,812	26,812
F-test excl. instr:		46.41		46.41		46.41
Mean outcome		0.044		0.024		0.114

Notes: In columns 1 to 4 the dependent variable is a binary indicator for providing 20+ weekly hours of care inside/outside the household. In columns 5 and 6 the dependent variable is a binary for 5+ hours care provision outside the household. In columns 2, 4 and 6, log-working hours are instrumented by the status of being above/below State Pension age (SPA). All models control for fixed effects for age (in years), interview year, Socio-economic Status (NS-SEC), home-ownership, marital status (dummies for being single or widowed), number of children (dummies for one child, two or more), highest educational attainment and country dummies. We report marginal effects for IV-probit 2SRI models, computed at means. Standard errors are clustered at the month-year of birth level. The sample (Understanding Society waves 1–8) includes women aged 55–65 who were engaged in paid work at some point in their life. Statistical significance: *** p-value < 0.01; ** $p < 0.05$; * $p < 0.1$.

each sub-group.[17,18] Examples of high physically or psychosocially demanding jobs include workers in crafting, agriculture, transport/travel and sales occupations, plant operators, social workers, and health professionals; while examples of low-demand jobs include workers in government, legal sector, engineering professionals, secretaries, and office clerks.

At the intensive margin for extra-household care, Table 5 highlights that the trade-off between working hours and care-intensity is large and significant for caregivers in demanding jobs (elasticity coefficient around 0.6). For women with a psychosocially or physically strenuous job, an increase of 10 working hours reduces caregiving by 3.6 hours. By contrast, we found no effect of working hours on caregiving intensity for women in occupations classified as low demand. Similar findings emerge when looking at the probability to provide 5+ or 20+ hours of care (Appendix E). We find no statistically significant effect at the extensive margin, and no effect for in-household care overall.

Care Impacts on the Club Sandwich Generation

In the UK as in the U.S., around a third of middle-aged adults have ageing parents, children, and grandchildren alive (colloquially referred to as the "club sandwich generation"). Among this group, half provide care to both their ageing parents but also support their grandchildren (Vlachantoni et al., 2020). We expect that the impact of work on caregiving to older parents may be more salient for club sandwich generation women, as these women face more severe work-family demands than women who provide care to only one generation (Grundy & Henretta, 2006; Vlachantoni et al., 2020).

In our sample, 15 percent of respondents are in a club sandwich generation at the time of the interview.[19] While this information is not tantamount to multigenerational care-provision (which we cannot measure as information on grandchild care is not in the database), it has the benefit of being exogenous to our instrumental variable (eligibility to State Pension). Still, we note that we cannot estimate a causal effect of being in a club-sandwich status on care provision, as the decision to provide care might be determined by unobserved characteristics (e.g. parental education, social norms) which also determine family composition. Hence, we study how family composition characteristics moderate the effect of working hours on care.

We estimate the heterogeneous effect of working hours on care outcomes by family composition, through an instrumental variable with interaction terms based on (1), as detailed in Appendix G. Our findings show that increase in working hours leads to a significantly stronger reduction in the probability of providing long-term care outside the household for club sandwich generation women than for women in other settings, incuding those with living parents and no grandchildren. No statistically significant result is found for in-household care outcomes.

Sensitivity Analysis: The Role of Health and Income

We performed a large number of sensitivity checks and robustness tests, which range from adding new control variables to our model to alternative sample selections and

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[17] One concern is that women may self-select themselves into less straining jobs as a result of being below the SPA. We find no evidence that being below the SPA is associated with job demand (Appendix I).
[18] As common factors could affect both the job-type and the care decision (e.g. education, family composition), the purpose of this analysis is not to estimate the causal effect of job-type, but to test whether the effect of working hours on care is heterogeneous across job types with different levels of job demand.
[19] Among our sample, 16 percent have living parents without grandchildren, 40 percent have living grandchildren but no grandparents, and 29 percent have neither parents nor grandchildren alive. See Appendix G for details on sample and methods.

Table 5. Effect of working hours on extra-household care hours, by job exposure (physical or psychosocial).

Exposure	log weekly hours among extra-hh carers (Instrumented interval-regression) net effects for sub-groups			
	Psychosocial strenuous job		Physical strenuous job	
	No	Yes	No	Yes
Log working hours	-0.129	-0.639***	-0.253	-0.602**
	(0.142)	(0.236)	(0.137)	(0.267)
N	2,497	3,012	3,103	2,406
F-test excl. instr.	15.548	11.560	18.851	8.463
Average work hours	16.9	16.3	17.6	15.4

Notes: the dependent variable is the log of weekly hours spent providing care outside the household among caregivers, coded as intervals. Log-working hours are instrumented by the status of being above/below State Pension age (SPA). All models control for fixed effects for age (in years), interview year, socio-economic status (NS-SEC), home-ownership, marital status (dummies for being single or widowed), number of children (dummies for one child, two or more), highest educational attainment and country dummies. We report coefficients from an instrumented interval regression, with standard errors clustered at the month-year of birth level. The sample (Understanding Society waves 1-8) includes women aged 55 to 65 who were engaged in paid work at some point in their life. See Appendix K for details on the job-demand indices. Statistical significance: *** p-value < 0.01; ** $p < 0.05$; * $p < 0.1$.

placebo tests. We hereby report only a brief summary of such tests, which are fully described in the Appendix H.

As the relationship between working hours and caregiving may be explained by a change in the respondent's health status triggred by retirement (Bertoni et al., 2018; Carrino et al., 2020), in Appendix H we show that our findings are robust to including caregiver's (and her partner's) health as regressor (Appendix Table H1).

A change in caring hours may also arise as a result of changes in earnings after retirement (Banks et al. 1998). We test that our results are stable to controlling for household and individual income (Appendix Table H1).

Sensitivity Checks: Alternative Specifications and Placebo Tests

Results are robust to excluding secondary covariates; alternative specifications for age and time trend; alternative clustering of standard errors; dichotmous defintion of employment status (Appendix Table H2).

Our instrument is less likely to affect working hours for women who have already stopped working, while it could affect their Pension income and, through income, their care decisions. We test that our findings are confirmed after excluding women who permanently left the labor force before their SPA (Appendix Table H2).

As a falsification/placebo test, we focused on an age-group of 45 to 55 years old women (altering their birthdate as if they were 55 to 65 years old), and on women who never worked. Both groups should exhibit no relationship between Pension eligibility, working hours, and care. Our test shows indeed no effect of working hours (nor of Pension eligibility) on care (Appendix Table H3).

Finally, our results are robust to the inclusion of individual fixed effects, as discussed in Appendix Table H4. However, a fixed effect specification captures the impact on one's own provision of care of a reduction in working hours due to reaching one's own State Pension Age. We feel that a fixed effect specification therefore fails to exploit the full variation in the State Pension age, which is presumably exogenous as it arises as a result of a Pension reform.

The Care-User Perspective: ELSA Results

Our results suggest that increasing work participation of older women reduces the amount of care they provide outside of the household. This is expected to increase unmet needs and potentially affect the health and well-being of older adults in need of care, unless a reduction in a daughter's informal caregiving is compensated by an increase in the use of formal care or by higher care provision by other informal carers, such as relatives or friends (Kalwij et al., 2014). Using data from *ELSA*, we have estimated whether having the eldest daughter (hence, all daughters if more than one) ineligible to State Pension (i.e., under the SPA) reduces the amount of care received from daughters, whether other providers compensate for the reduction, and how the overall amount of care received changes.

Table 6 presents estimates of the effect of having all daughters under the SPA on care received from any carer, their daughters, other informal helpers, and from paid carers. Results in Table 6(a) indicate that, while having the eldest (hence, every) daughter under the SPA has no effect on the overall probability of receiving care (column 1), it significantly reduces the probability of receiving care from a daughter (by nine percentage points), and it significantly reduce the average number of tasks they get help with overall (a measure of care intensity) (column 2). The number of help-tasks that respondents receive from their daughters reduces by 0.2 as a result of the eldest daughter working longer. The baseline number of help-tasks that respondents receive from their daughters is 0.428 (Table 2). Compared to the

Table 6. Effect of daughters' pension eligibility on overall care receipt.

	(1) Any help	(2) Number of tasks
	A- help by anyone	
All daughters under the SPA	-0.0274	-0.452**
	(0.0425)	(0.218)
	B- help by daughters	
All daughters under the SPA	-0.0898**	-0.204**
	(0.0372)	(0.0950)
	C- help by other informal carer	
All daughters under the SPA	-0.00818	-0.0365
	(0.0404)	(0.0981)
	D- help by a paid carer	
All daughters under the SPA	0.0112	-0.150
	(0.0364)	(0.107)
Observations	3,911	3,911
Number of Individuals	1,617	1,617

Notes: The variable of interest indicates whether the respondents in a given wave has all daughters under the SPA. All models control for age of respondent (third-order polynomial), age of daughters and interview year as dummies and individual Fixed Effects. Data from ELSA. The sample includes respondents aged 65 or over and who have at least one daughter aged between 50 and 65, between 2006 and 2017. Statistical significance: *** p-value < 0.01; ** $p < 0.05$; * $p < 0.1$.

average, the result suggests a drop by 50 percent, which is consistent with the results obtained from *Understanding Society*: the results in Table 4 suggest that women who are induced to fully continuing working (100 percent hours, full-time work) instead of retiring, exhibit a drop in the probability of caregiving (5+ hours) by 54 percent. However, we prefer not to place too large of an emphasis on the magnitude of the effect estimated in the *ELSA* data, given the rather large confidence interval of the coefficient.

This analysis crucially shows that there is no evidence that care provided by other informal helpers or paid carers serves as substitute for the reduction in caregiving by daughters; having all daughters under the SPA has no effect on the informal care provided by other relatives and friends nor on formal care. Analysing data from waves 6 to 8 (Appendix I), we also find that having all daughters under the SPA reduces the total care hours received by about 40 percent, although the coefficient is imprecisely estimated due to the limited sample of individuals for which this information is available.

CONCLUSION

In this paper, we estimate the effect of increasing labor supply in older age on the provision and receipt of informal care within and between generations in the UK, using Pension eligibility to account for the endogeneity of labor supply. Our results show that working longer hours as a result of an increase in women's State Pension age reduces the intensity of informal care provided outside the household (mostly to older parents). This effect is substantial: we estimate that an increase of 10 hours of work per week reduces extra-household caregiving by 2.1 hours per week, which would amount to 110 less hours of caregiving per year (per caregiver), valued around £2,100 using shadow prices of a market substitute. Similarly, an increase in working hours reduces the probability of providing both meaningful (5+ hours per week) and intensive care (20+ hours per week). The observed effects are stronger among women in physically and psychosocially demanding jobs, and for club sandwich generation

women with multigenerational care responsibilities. Furthermore, we show that the reduction in informal caregiving caused by longer working hours is not replaced by an increase in the demand for formal care, resulting in reduced demand for care overall for older vulnerable adults.

Our findings are consistent with the hypothesis that the marginal utility of caregiving is positive because of altruistic preferences (Stabile et al., 2006; Van Houtven & Norton, 2004). On average, we find that an increase in working hours reduces care intensity but not the probability of caregiving. This suggests that, while individuals choose the optimal hours of caregiving to equate the marginal utility of caregiving to the marginal utility of working and leisure (Johnson & Sasso, 2000), their marginal utility of caregiving for a few hours is larger than the marginal utility of leisure and work. This might be explained by the moral obligation attached to caring for close kinship, so that failing to fulfil the moral obligation to provide care leads to a significant utility loss (Al-Janabi et al., 2018; Burr & Colley, 2017).

Among club sandwich generation women facing multigenerational care responsibilities, we find that an increase in employment reduces the probability of providing any long-term care. This reinforces the hypothesis that these women face stricter work-family conflicts and might more often give up care to remain in paid work (Vlachantoni et al., 2020). Moreover, the observed reduction in caregiving is concentrated among workers in occupations characterised by higher physical or psychosocial demands. This might reflect larger trade-offs in combining work and caring responsibilities due to demanding jobs being on average less flexible and more taxing on health than less demanding jobs (Belloni et al., 2022; Broese van Groenou & De Boer, 2016; Burr & Colley, 2017).

Our results reject the hypothesis that the reduction in informal care is compensated by purchasing formal care on the market. While prior evidence has suggested that formal and informal care provision are not perfect substitutes but complements (Bonsang, 2009; Carrino et al., 2018), our work suggest that, in the context of a policy-driven change in the care supply of adult women, formal and informal care are weakly correlated. In particular, the lack of a substitution effect between informal care with formal care provision may be due to the higher relative price of the latter (if privately purchased) and the limited availability of public services (AgeUK, 2017; Iparraguirre, 2017). Finally, although it is too early yet to test for effects on the welfare of older parents given that only a short period has elapsed after the Pension reform was introduced, these findings suggest that increasing the labor supply of older women could have unintended long-term consequences on the health and well-being of older adults in need of care.

This study contributes to the academic and policy debate by showing that ageing policies should not be designed and evaluated in institutional silos. Policies that increase retirement age may have unintended consequences for intergenerational support within families, by affecting the provision and receipt of informal care, especially for club sandwich generation women and women in physically or psychosocially demanding jobs. These effects can reduce the welfare gains arising from raising the labor supply of adult women, given that a reduction in the care received by older parents is not compensated by an increase in the demand for other forms of formal or informal care.[20] This further suggests that there is currently little room for substitutes (either informal or formal) to female provided informal care. As a

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[20] It is worth noting that the welfare effect for the caregiver of a reduction in care-supply is ambiguous, although not the focus of this research. On the one hand, the caregiver might suffer from the impossibility of helping their loved ones, and possibly need to purchase formal care for them; on the other hand, the caregiver would be less subject to the negative health effects of caregiving (Bom et al., 2018).

consequnc, lower care provision risks to increase unmet needs and worsen the well-being of vulnerable older adults, which could increase future health and social care costs (AgeUK, 2017; Iparraguirre, 2017; Pickard, 2015).

Our findings suggest that social care policies aiming at increasing the supply of informal care need to consider the impact of work incentives as a result of recent Pension reforms, particularly for women in psychosocially and physically demanding jobs. For example, eligibility rules to receive formal care for older people with functional limitations may need to be revised to consider changes in the Pension reform affecting the labor supply of their children as potential criteria for formal care service eligibility. Likewise, expanding caregivers' allowances coverage to women who face an increasing State Pension age might increase their ability to care for older relatives and improve long-term care outcomes. The eligibility to the UK's Carer's Allowance includes providing at least 35 hours of care per week, and having a net weekly income below £123. This may be suboptimal for women who wish to provide some hours of informal care while at the same time continuing to work, suggesting that more flexible eligibility criteria might improve the take up and efficiency of the Carer's Allowance. Finally, optimal welfare may also include workplace interventions that incentivise employers to offer higher flexibility for women in high-demand jobs who have caring responsibilities and are ineligible to claim their Pension. Such interventions could include options for part-time work, flexible hours, home working, improvement in the quality of employment (e.g., higher job-control), and support to a smoother reemployment of older workers who choose to switch to a more flexible job. Such policies might help workers and families to balance the demands from work and caring responsibilities, thus reducing the impact of work on the provision of care (OECD, 2017c).

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