The mental health consequences of spousal bereavement

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Abstract

We examine the dynamic effects of the loss of a spouse on mental health. We use data from the SHARE study for 28 European countries over the period 2004-2022 and estimate event study regressions to examine how individuals' mental health changes over the transition into widowhood. We find no evidence of changes in mental health before the death of a spouse due to anticipation or caregiving effects. Bereaved individuals experience up to 1.5 additional depressive symptoms and their risk of depression increases by around 20 percentage points, with similar effects for men and women. Individuals adapt relatively quickly and their risk of depression reverts to baseline levels within 3 years of the death. We provide suggestive evidence that this adaptation is in part due to increased rates of social participation.

JEL codes: I14, J12, J14

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1 Motivation

The loss of loved ones is a tragic yet inescapable aspect of the human condition. Older adults frequently experience bereavement as they outlive their parents, friends, and spouses. The loss of a spouse, in particular, can be a disruptive event with potentially long-lasting consequences for the surviving partner. Beyond grief, widows and widowers may also experience reduced financial resources and smaller social networks. It is therefore crucial to understand how the transition into widowhood affects older adults' lives and whether and how they adapt to the loss to ensure that the surviving partners receives the required support to cope with this major life event.

This paper studies the impact of the loss of a spouse on mental health among older Europeans. Previous research shows that spousal bereavement can have severe consequences for mental health (e.g., Lee et al., 2001; Peña-Longobardo et al., 2021; Schaan, 2013; Siflinger, 2017; Streeter, 2020; Tseng et al., 2017). Yet, it is not well understood how this effect unfolds dynamically across the transition to widowhood. For example, some individuals might experience a deterioration of mental health already before the death of their spouse. Such anticipation effects could occur, e.g., because individuals expect that their spouse may not survive, or because the death is preceded by a care spell, which can negatively affect mental health (Schmitz and Westphal, 2015). Siflinger (2017) provides evidence for such anticipation effects in the US, which can bias estimates of the impact of widowhood on mental health towards zero. There is also substantial disagreement on whether and how quickly individuals adapt to the loss of their spouse. Tseng et al. (2017) report that older adults in Taiwan adapt within 4 years of bereavement. In contrast, Streeter (2020) finds that in the US symptoms can persist up to 8 years after the death of a spouse. The mechanisms behind this adaptation (or lack thereof) are not well understood.

In this study, we use data from the Survey of Health, Ageing and Retirement in Europe (SHARE), covering 28 European countries during the period 2004 to 2022. We focus on 6,739 individuals who are initially observed as married and later experience the death of their spouse during the study period. We estimate event study regressions that allow us to trace out the dynamic effects of the impact of spousal loss on mental health. We find no significant anticipation effects. In contrast to Siflinger (2017), we directly observe caregiving, which allows us to rule it out as a potential source for anticipation effects. We find that spousal loss leads to an increase in depressive symptoms by up to 1.5 symptoms, and it increases the risk of depression by around 20 percentage points. Reassuringly, mental health appears to return to baseline levels within 3 years of the death

of the spouse. We also provide suggestive evidence that this adaptation might in part stem from increased levels of engagement in social activities.

We further consider differences in the impact of bereavement and the adaptation process between men and women. The empirical evidence on such gender differences is mixed. Schaan (2013) finds similar patterns for men and women. Peña-Longobardo et al. (2021) report stronger effects on women, whereas most other studies find stronger effects on men (Espinosa and Evans, 2008; Lee et al., 2001; Siflinger, 2017; Streeter, 2020). Beyond the initial impact, there may also be gender differences in the adaptation process. Lee et al. (2001) and Siflinger (2017) suggest that men adapt faster than women, in part because women face more severe financial consequences in the long-term (Bíró, 2013; Streeter, 2020). Our study finds no evidence of gender differences, neither in the initial impact of widowhood nor in the adaptation process. However, our analysis of heterogeneity across age groups shows some differences between men and women – while the impact is strongest for men aged 50 to 59 and decreases with age, the negative impact for women only emerges among women aged 60 and above and appears to increase in intensity with age.

Our study addresses several important gaps in the literature on the mental health effects of widowhood. First, our paper estimates a credibly identified causal effect of spousal loss on mental health. Our event study regressions based on recently developed estimators (Callaway and Sant'Anna, 2021) allow us to examine the dynamics of mental health across the transition to widowhood, including anticipation and adaptation effects. In contrast to Siflinger (2017), our event study approach does not rely on differences between (self-reported) expected and unexpected deaths to address potential anticipation effects. Instead, we assume that any anticipation effects are limited to the 24 months preceding the death of the spouse and that there are no systematic changes in mental health 3-5 years before the event. Our event study graphs provide suggestive evidence for this assumption. Second, we are the first study to provide evidence on potential mechanisms for adaptation effects. Our analysis allows us to rule out caregiving as a potential source of bias. Instead, we show that higher levels of social participation might partly explain why the risk of depression returns back to baseline levels within 3 years of the death of the spouse. Third, we provide additional evidence regarding gender differences in both the initial impact of widowhood and the adaptation process. We find no evidence of gender differences, however, there appear to be relevant differences by gender across age groups.

The remainder of the paper is structured as follows: Section 2 describes the data used in our analysis. In section 3, we describe our event study approach. Section 4 discusses the results, and section 5 concludes.

2 Data

2.1 Working sample

We use data from the Survey of Health, Ageing and Retirement in Europe (SHARE), which focuses on individuals aged 50 and above from 28 European countries (including Israel) (Börsch-Supan et al., 2013). The survey started in 2004, and collects data biannually. SHARE conducts interviews with all household members in eligible households, including, e.g., spouses below age 50. The survey collects information about the respondent's household characteristics, individual attitudes, and socioeconomic and health conditions. One of the advantages of SHARE is that it provides information on individuals living under different welfare and policy regimes, which will allow us to study the potential moderating role of institutions and policies in future analyses (e.g., survivorship pensions).

For our analysis, we pool data across all countries for the time period 2004-2022. We then select all individuals aged between 50 and 90[4] who are initially married and for whom we observe the subsequent death of their spouse. This means that all individuals in our sample are observed for at least two waves of the survey. All individuals who either remain married, separate or divorce are excluded from the analysis. In total, our sample includes 27,180 observations from 6,739 individuals, who are observed for (on average) 3 waves (i.e., 6 years) before the transition to widowhood and 2.70 waves after the event.

2.2 Primary outcome: Depression

Our main outcome of interest is respondent's mental health as measured by the EURO-D score. The EURO-D score was developed as a common instrument to measure depressive symptoms across different countries in Europe (Prince et al., 1999). SHARE respondents are asked 16 questions, e.g., whether they felt sad or depressed in the last month, whether they had any hopes for the future, whether they had trouble sleeping, or what their appetite has been like. These 16

[4] We restrict our sample to individuals under age 90, because the subsample of individuals above 90 is too small to be included in our analysis of effect heterogeneity between age groups.

questions are then combined into 12 items. Each item is scored with a value of 1 if the respondent displays symptoms of depression, and 0 otherwise. Thus, the total EURO-D score can vary between 0 ("not depressed") and 12 ("very depressed") (Mehrbrodt et al., 2019). We consider two outcomes based on the EURO-D scale – *(i)* the total score of depressive symptoms, and *(ii)* a binary indicator for individuals with four or more depressive symptoms, who are considered to suffer from depression (Prince et al., 1999).

2.3 Additional variables

Our main specification controls for age as well as individual and year fixed effects. We also consider several secondary outcomes that might explain possible anticipation or adaptation effects. These include informal caregiving, volunteering, participation in clubs, and recreational activities. Informal caregiving is measured using a question whether respondents provided help to anyone in the last year. Our measure of volunteering considers whether respondents provided voluntary or charity work. Participation in clubs considers whether individuals participated in sports clubs, social clubs or any other club activities in the last year. We create a measure of recreational activities, which includes (i) participation in education or training courses, (ii) playing cards or chess, (iii) reading, or (iv) solving crosswords, puzzles or Sudokus. For all variables, respondents are instructed to indicate whether they participated in these activities in the last 12 months or not. For informal care provision, volunteering and participation in club activities, we therefore use binary variables that indicate whether individuals participated in the respective activity or not. The outcome measuring recreational activities is based on four different activities, and therefore varies between values of 0 and 4.

2.4 Descriptive statistics

Table 1 shows descriptive statistics for our working sample. The large majority of individuals included in our study are women (74.7%). Average age is 73 years. 16% of respondents have high education (i.e., some tertiary education). On average, respondents report around 3 depressive symptoms, and about 38% of respondents are considered to suffer from depression.

Table 1: Descriptive statistics

	N	Mean	SD	Min	Max
Female	27180	0.747	0.434	0	1
Age	27180	72.669	8.832	50	90
Age at widowhood	27180	73.418	8.244	50	90
High education	27180	0.157	0.363	0	1
Retired	27180	0.703	0.457	0	1
Number of children	27006	2.353	1.463	0	17
Euro-D score (0-12)	27180	3.076	2.491	0	12
Depressed (EURO-D>3)	27180	0.379	0.485	0	1
Any help given	24520	0.224	0.417	0	1
Participation in club activities	20464	0.229	0.420	0	1
Volunteering	20464	0.135	0.341	0	1
Recreational activities	27180	1.104	1.137	0	4

Source: SHAREV9, own calculations.

3 Methods

3.1 Empirical challenges

Mortality risks are related to individual characteristics such as, e.g., education (Bijwaard et al., 2019) or income (Rehnberg, 2020), and because individuals tend to choose spouses with similar characteristics (Conley et al., 2016), the mortality risk is likely also related to (observed and unobserved) characteristics of the surviving spouse. This implies that estimates from a simple regression of mental health on widowhood are likely biased due to unobserved individual characteristics that are related to a person's mental health as well as their spouse's risk of dying.

Previous studies have addressed such mortality selection through the use of panel data methods such as fixed effects regressions, which eliminate the influence of time-invariant unobserved confounders (e.g., Bíró, 2013; Siflinger, 2017; Streeter, 2020). In fixed effects regressions, the impact of widowhood on mental health is only identified through changes in mental health within individuals as they experience the loss of their spouse. However, time-varying characteristics that are related to both mental health and the risk of spousal loss remain a concern. This is obviously

the case for age, but shocks such as job loss also affect the mortality risk (Sullivan and von Wachter, 2009) as well as the mental health of spouses (Marcus, 2013).

Bias from such time-varying confounders can be potentially resolved in a difference-in-differences design (DID) (e.g., Tseng et al., 2017) by comparing changes in mental health over the transition to widowhood to changes over time occurring in a control group. DID designs allow for level differences between the treatment and the control group, but require the assumption of parallel trends. Here, this implies that the model allows for differences in average mental health between individuals experiencing spousal bereavement and those who do not, regardless of whether such differences stem from selection on time-invariant or time-varying unobserved confounders. Instead, it assumes that in the absence of spousal loss, trends in mental health over time would have been similar between both groups. The plausibility of this assumption clearly depends on the choice of the control group.

Anticipation effects represent a challenge both for the FE approach as well as for DID designs. Some individuals might experience depressive symptoms already before the eventual death of their spouse, e.g., because they expect their spouse to die in the near future, or because they provide care for their sick spouse (Schmitz and Westphal, 2015). Such anticipation effects violate the parallel trend assumption in a DID design. Likewise, a comparison of depressive symptoms before and after the loss of a spouse in a FE regression will be biased if anticipation effects are neglected. Siflinger (2017) shows in her analysis of US data that such anticipation effects are large and lead to an underestimation of the true effects of widowhood on mental health.

3.2 Event study framework

We estimate the effect of spousal bereavement on mental health in an event study design. Event studies are closely related to both fixed effects regression and DID designs (Miller, 2023). Our event study uses a sample restricted to individuals for whom we observe the transition into widowhood to estimate the effect of this transition as the change in mental health after the loss of a spouse relative to an earlier reference period.

Similar to a fixed effects regression, our event study regression only identifies the effect of spousal loss from changes in mental health within individuals over time, thereby eliminating potential bias from time-invariant unobserved factors. However, in contrast to a fixed effects regression, our event study provides us with estimates of dynamic changes in mental health before the transition

to widowhood, which allows us to detect potential anticipation effects without relying on self-reports (as in Siflinger, 2017).

Moreover, similar to a DID design our event study allows us to examine pre-treatment trends to identify potential bias from time-varying unobserved factors. In the presence of such time-varying confounders, we would expect to find significant changes in mental health before the event, unless the timing of widowhood perfectly coincides with changes in these omitted factors. Put differently, if we assume that the timing (but not the incidence) of spousal death is as good as random during our study period, our results should not be affected by time-varying confounders that affect both mental health and the risk of experiencing bereavement during the study period. An important difference to DID designs is that by excluding "never-treated" individuals from our sample, we do not have to worry about the comparability of our treatment and control group, nor do we have to impute a fictional year of event for the control group (as in Tseng et al., 2017). Instead, we have to assume that there are no significant pre-treatment trends conditional on the covariates in our model.

Formally, we consider the following regression model (Miller, 2023):

$$y_{it} = \sum_{j\in\{-m,\dots,0,\dots n\}} \gamma_j D_{i,t-j} + \alpha_i + \delta_t + \beta_1 age_{it} + \epsilon_{it} \qquad (1)$$

In this model, we observe individual *i* for *m* periods before the event and for *n* periods after the event. $D_{i,t-j}$ is a binary indicator for the time to event, i.e., it takes a value of 1 if the event occurred *j* periods before the current calendar time period *t*. The corresponding coefficient, γ_j, measures average mental health at event time *j*. It is common practice to designate a reference period by setting one of the $\gamma_j's$ to zero and estimating eq. (1) with a constant that captures average mental health in the reference period. In this case, γ_j measures the change in mental health at event time *j* relative to the reference period. We discuss the choice of the reference period in more detail in section 3.3. α_i are individual-fixed effects, δ_t fixed effects for calendar time, and β_1 is the coefficient for age.

As discussed above, the event study model in eq. (1) is closely related to fixed effects regressions and DID designs. A FE regression of mental health on widowhood can be written as

$$y_{it} = \gamma D_{it} + \alpha_i + \delta_t + \beta_1 age_{it} + \epsilon_{it} \qquad (2)$$

Here, D_{it} is a binary indicator for individuals who lost their spouse before period *t*. Equation (2) is nested as a special case within eq. (1) – essentially, we impose the restrictions $\gamma_j = \beta_0 \; \forall j < 0$ and $\gamma_j = \gamma \; \forall j \geq 0$. In other words, we assume that there are no changes in mental health before the event, and the change in mental health after the event is instantaneous and constant over time. Similarly, if the sample used for estimation of eq. (1) includes units who never experience the event, then eq. (1) is a dynamic extension of the standard two-way fixed effects (TWFE) estimator for DID designs:

$$y_{it} = \gamma \cdot Treated_i \cdot Post_{it} + \alpha_i + \delta_t + \beta_1 age_{it} + \epsilon_{it} \qquad (3)$$

Eq. (3) imposes the same constraints as eq. (2), i.e., $\gamma_j = \beta_0 \; \forall j < 0$ and $\gamma_j = \gamma \; \forall j \geq 0$.
In summary, while our event study model in eq. (1) is closely related to FE regressions (eq. 2) and DID designs (eq. 3), it offers two advantages: First, we estimate a fully dynamic specification without imposing constraints on trends before and after the event. In the Appendix, Fig A.1 reports the distribution of the years before and after the event. Second, we do not have to designate a control group of individuals who do not experience the event, rather individuals who experience the death of their spouse later serve as controls for individuals who experience bereavement earlier.

3.3 Interpretation of event study terms

The coefficients γ_j measure changes in mental health at event time *j*. For $j \geq 0$, we interpret these terms as the causal, dynamic effect of spousal bereavement on mental health. The two most common scenarios discussed in the literature on widowhood are that the effect decreases over time as individuals adapt to the loss (e.g., Tseng et al., 2017), or that the effect remains largely constant (Siflinger, 2017). However, it is at least theoretically possible that the effect might also increase over time, e.g., if the loss of a spouse also has a long-lasting effect on, e.g., financial resources.
Interpreting the $\gamma_j's$ for $j \geq 0$ as causal effects requires us to assume that (conditional on the covariates in our model) there are no significant trends in mental health, i.e., in the absence of the event we would observe no systematic changes in mental health (other than those modelled through our covariates, which include an age trend). For $j < 0$, the $\gamma_j's$ capture the pre-event trends in mental health, which we can use as a placebo test for this assumption. In the absence of anticipation effects, any significant changes in mental health before the death of a spouse might

suggest potential problems, e.g., due to omitted variable bias or selection. Conversely, if the $\gamma_j's$ for $j < 0$ are statistically indistinguishable from zero, it seems reasonable to assume that in the absence of the event the $\gamma_j's$ for $j \geq 0$ would also be statistically insignificant, which allows for a causal interpretation of any effects we might find.

However, it is possible that some individuals in our study anticipate the death of their spouse, in which case they might experience an increase in depressive symptoms before the event occurs. In our model, this would imply that some of the $\gamma_j's$ for $j < 0$ are statistically significant. Anticipation effects should occur close to the event and should be in the same direction as the change in mental health observed after the event. Increases in depressive symptoms due to the anticipated death of a spouse should be considered as part of the causal effect of spousal loss on depressive symptoms. This can be achieved by designating an earlier period as the reference period. Siflinger (2017) finds that for expected deaths the risk of depression starts to increase around 7 months before the death of the spouse. For our analysis, we therefore assume that any anticipation effects are likely limited to the year preceding the death of the spouse. We therefore choose $j = -2$ as our reference period. This means that our estimate of the effect of spousal bereavement is based on the estimated change in mental health after the transition to widowhood relative to two years before the death of the spouse.

3.4 Estimation

As noted above, our event study in eq. (1) is closely related to the TWFE estimator for DID designs with staggered treatment timing. Recent work on DID designs shows that this TWFE estimator can be problematic, because the estimate will be a weighted average of all possible 2x2 DID estimates with weights that, first, depend on the timing of treatment and the length of the panel (and are therefore open to manipulation); and, second, which might even be negative due to "forbidden" comparisons that use early-treated units as control groups for late-treated units (Goodman-Bacon, 2021). These concerns apply also to TWFE estimates of our event study, and we therefore use recently proposed alternative estimators for DID designs to estimate our event study regression in eq. (1). For our main specification, we use the estimator proposed by Callaway and Sant'Anna (CS) (2021). One important advantage of the CS estimator over the event study estimator proposed by Sun and Abraham (SA) (2021) is that the CS estimator can accommodate limited anticipation effects by choosing an earlier reference period, whereas the SA estimator

assumes no anticipation. In a sensitivity analysis, we show that the results from our main specification are qualitatively similar to those we obtain using the TWFE estimator and the SA estimator.

We estimate our event study regressions using the inverse probability weights approach proposed by Callaway and Sant'Anna (2021) using not yet treated individuals as the control group. We allow for an unbalanced panel to maximize the number of events in our sample. Standard errors are clustered at the individual level.

4 Results

4.1 Pooled estimation

Fig. 1 shows the estimated event study terms for all individuals in our working sample for a period ranging from 5 years before the event to 5 years after the death of a spouse. All results use $j = -2$ as the reference period, i.e., the estimates show differences in mental health relative to a baseline measured 2 years before the loss of a spouse. The left panel shows estimates for the total EURO-D score (ranging from 0 to 12). We note that the number of depressive symptoms remains constant between 5 to 2 years before the event. The year before the death of a spouse, the number of depressive symptoms appears to increase slightly, although the estimate is not significantly different from the reference period. Our estimates suggest that the loss of a spouse leads to a sharp increase in the number of depressive symptoms in the first two years after bereavement – individuals report approximately one additional depressive symptom. The estimates for later periods seem to indicate an adaptation effect – the estimated change in years 3 and 4 after bereavement are considerably smaller (and not statistically significant in year 3). 5 years after the transition to widowhood the number of depressive symptoms seems to have returned to baseline levels.

The results for our binary indicator of depression are qualitatively similar. We find no evidence of significant pre-trends. After the transition to widowhood, the risk of depression increases sharply by around 20 percentage points in the first two years, but from year 3 onwards the risk returns to baseline. Our estimates of the effect of widowhood are quantitatively similar to Siflinger (2017)'s estimates for the US, although in contrast to Siflinger (2017) we do not find any evidence for significant anticipation effects.

Table 2 reports the aggregate average treatment effect on the treated and Table 3 shows the estimated coefficients (corresponding to Fig. 1) for each period.

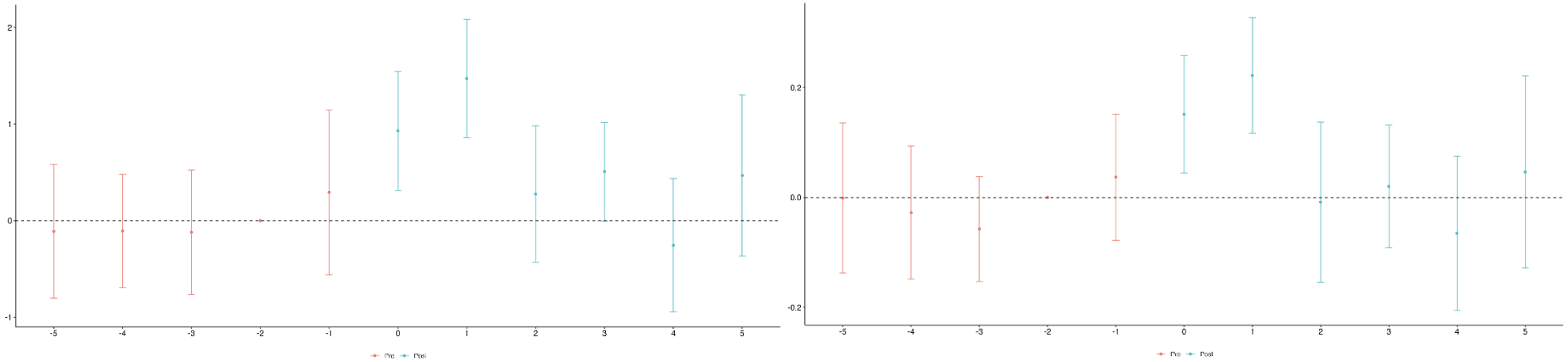
Table 2 Effect of widowhood on the sample

Dep Var	Eurod	Eurodcat
ATT	0.5662*	0.0611
se	(0.1679)	0.0346
CI	[0.2371, 0.8952]	[-0.0068, 0.129]
#obs	21,615	21,615

NOTE: The model is estimated using Callaway and Sant'Anna (2021). The dependent variables are Eurod (score 0-12) and Eurodcat (Dummy). The model includes 5 years before and after the event, t-2 is the reference period. The average treatment effects on treated is reported. The method of estimation exploits inverse probability weighting. Standard errors are reported in parenthesis. P-value: *** p<0.01, ** p<0.05, * p<0.1

Fig. 1 Event study estimates of the effect of spousal loss for the whole sample

a. EURO-D score (0-12) **b. Depression (EURO-D >3)**



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the EURO-D score (panel a) and the risk of depression (panel b). In panel b, the outcome is a binary indicator for individuals who report 4 or more depressive symptoms on the EURO-D scale. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

Table 3 Effect of widowhood on the sample (Dynamic Effects)

Dep Var	Eurod	Eurodcat
Event time		
-5	-0.1112	-0.0011
	(0.2615)	(0.0504)
-4	0.1063	-0.0276
	(0.2213)	(0.0446)
-3	-0.1192	-0.0573
	0.2431	(0.0352)
-1	0.2949	0.0371
	(0.3222)	(0.0423)
0	0.2756 *	0.1514*
	(0.2664)	(0.0394)
1	1.4706 *	0.2223*
	(0.2314)	(0.0386)
2	0.2756	-0.0084
	(0.2664)	(0.0537)
3	0.5092	0.0201
	(0.1929)	(0.0412)
4	-0.2554	-0.0651
	(0.2609)	(0.0517)
5	0.4680	0.0464
	(0.3145)	(0.0644)
Numb obs	21,615	21,615

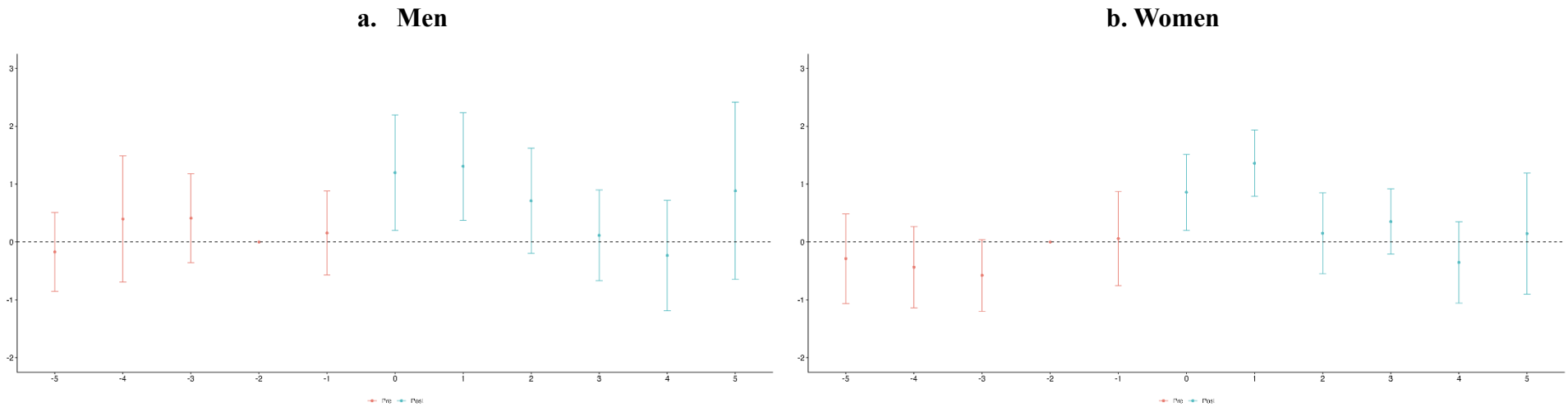
NOTE: The model is estimated using Callaway and Sant'Anna (2021). The dependent variables are Eurod (score 0-12) and Eurodcat (Dummy). The model includes 5 years before and after the event, t-2 is the reference period. The method of estimation exploits inverse probability weighting. Standard errors are reported in parenthesis. P-value: *** p<0.01, ** p<0.05, * p<0.1

4.2 Differences by gender

Next, we examine whether the effect of spousal loss differs for men and women. Women are more likely to survive their partner, because on average women are around 3 years younger than their partners in our sample and women have a longer life expectancy. Especially among older cohorts, the death of the husband has a larger impact on financial resources of the household than the death of the wife (Bíró, 2013), and therefore the impact of widowhood on mental health might also be larger for women. On the other hand, men might not expect to survive their spouse and might therefore be more strongly affected by the loss of their partner (Siflinger, 2017). The empirical evidence is mixed, with studies reporting stronger effects for women (Peña-Longobardo et al., 2021), stronger effects for men (Lee et al., 2001; Streeter, 2020), or no significant differences by gender (Schaan, 2013). Similarly, there might be differences in adaptation to widowhood. Siflinger (2017) finds that men adapt faster to widowhood than women, in part because the financial consequences of widowhood exert a long-lasting influence on women. In contrast, Streeter (2020) finds that women's mental health adapts faster to widowhood, and Espinosa and Evans (2008) find a similar pattern for mortality risks.

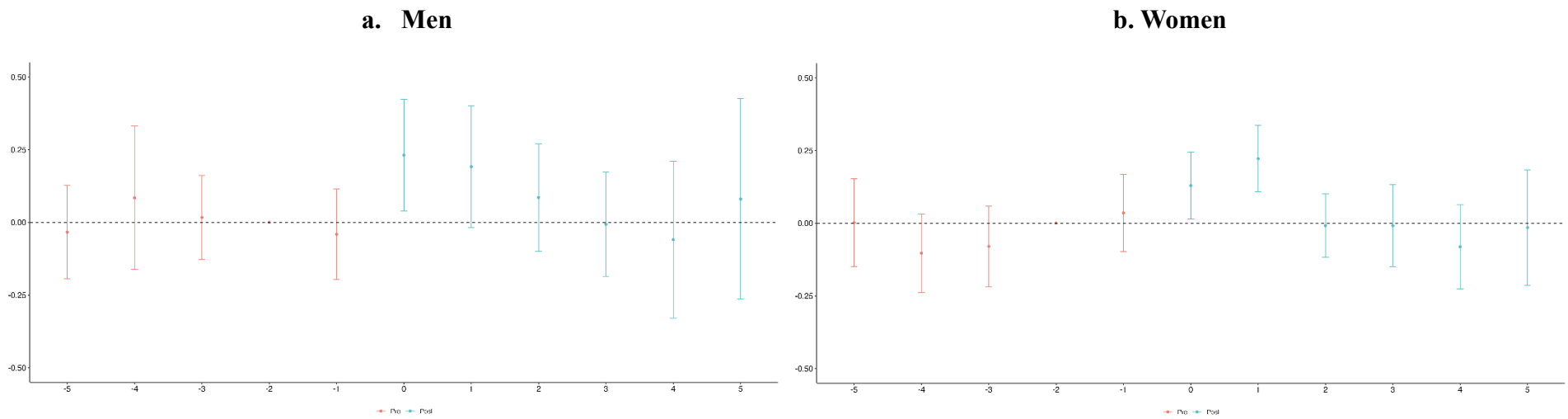
Fig. 2 shows our estimates for the EURO-D score for men (left panel) and women (right panel). The point estimates seem to indicate slightly larger initial effects for men, although there is substantial uncertainty around these estimates and the difference is therefore not statistically significant. Similarly, we do not observe significant differences in the adaptation process – for both men and women we no longer find significant effects of widowhood on mental health three years after the event. Fig. 3 shows that the risk of depression follows the same pattern.

Fig. 2 Event study estimates for the EURO-D score by gender



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the EURO-D score for men (panel a) and women (panel b). All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level

Fig. 3 Event study estimates for the risk of depression by gender



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the risk of depression (EURO-D score>3) for men (panel a) and women (panel b). All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level

4.3 Differences by age

We re-estimate our event study regressions for 10-year age groups (50-59, 60-69, 70-79, and 80-90) without controlling for age. This serves three purposes: First, it appears plausible that the effects of widowhood might differ by age, e.g., because older individuals might be more accustomed to coping with bereavement and grief. Second, the critical assumption that the timing of spousal loss is random is more likely to hold in a more homogeneous sample, where bereavement occurs at similar ages. Third, it effectively accounts for life cycle effects, addressing a primary concern in identifying factors influencing mental health of widowers and widows in our context.

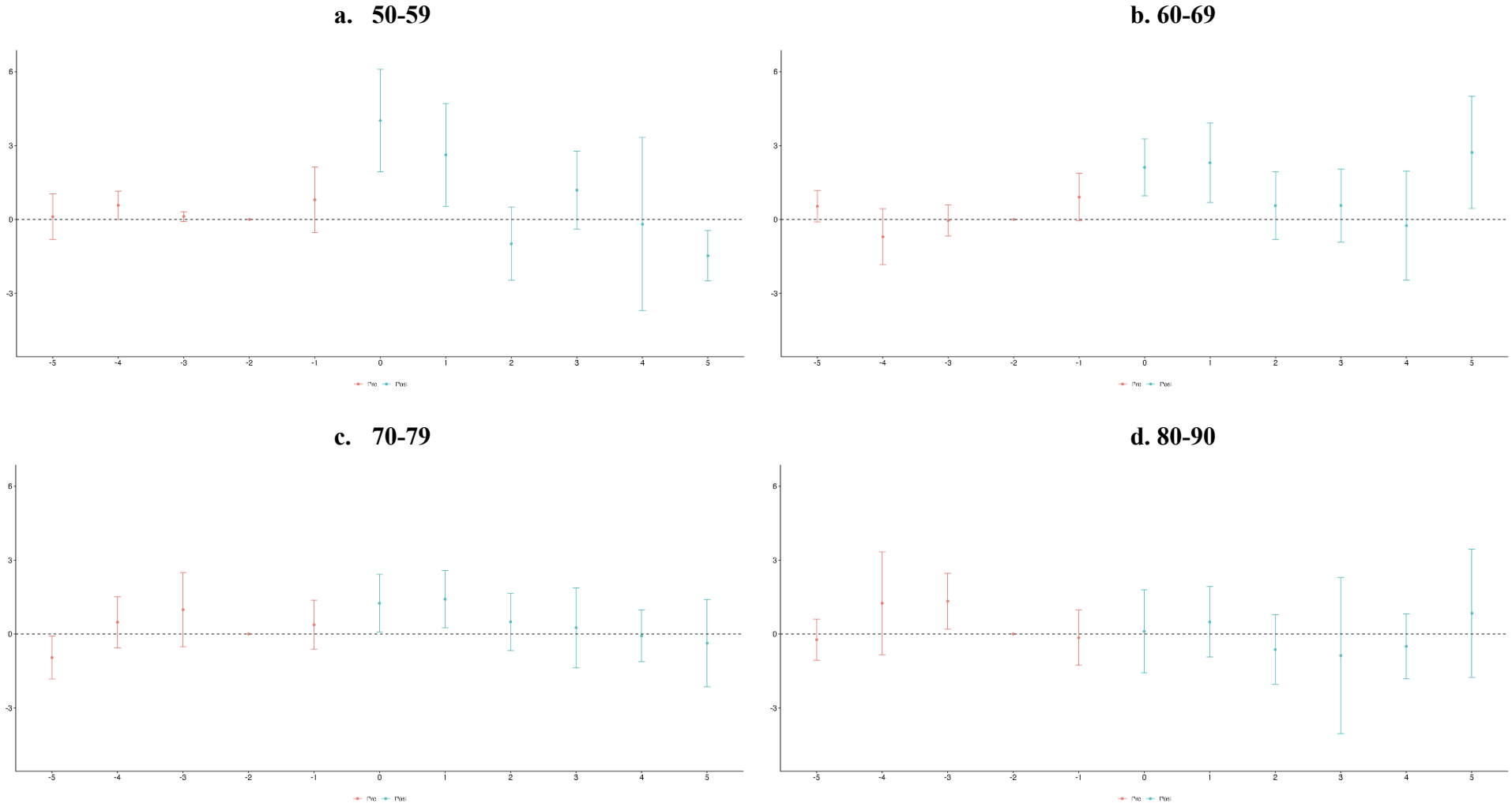
Figs. 4 and 5 show separate estimates for the EURO-D score for each age group for men (Fig. 4) and women (Fig. 5). For men, the effects decrease with age and are no longer statistically significant for men aged 80 to 90 years old. This suggests, in line with Siflinger (2017)'s results, that unexpected deaths exert a particularly strong effect on men. For women, on the other hand, we find no significant effects in the youngest age group. The increase in depressive symptoms only emerges among women aged 60 and older, and it appears to increase with age.

The results for the risk of depression are qualitatively similar (see Figs. A.2 and A.3 in the appendix).

4.4 Informal care provision

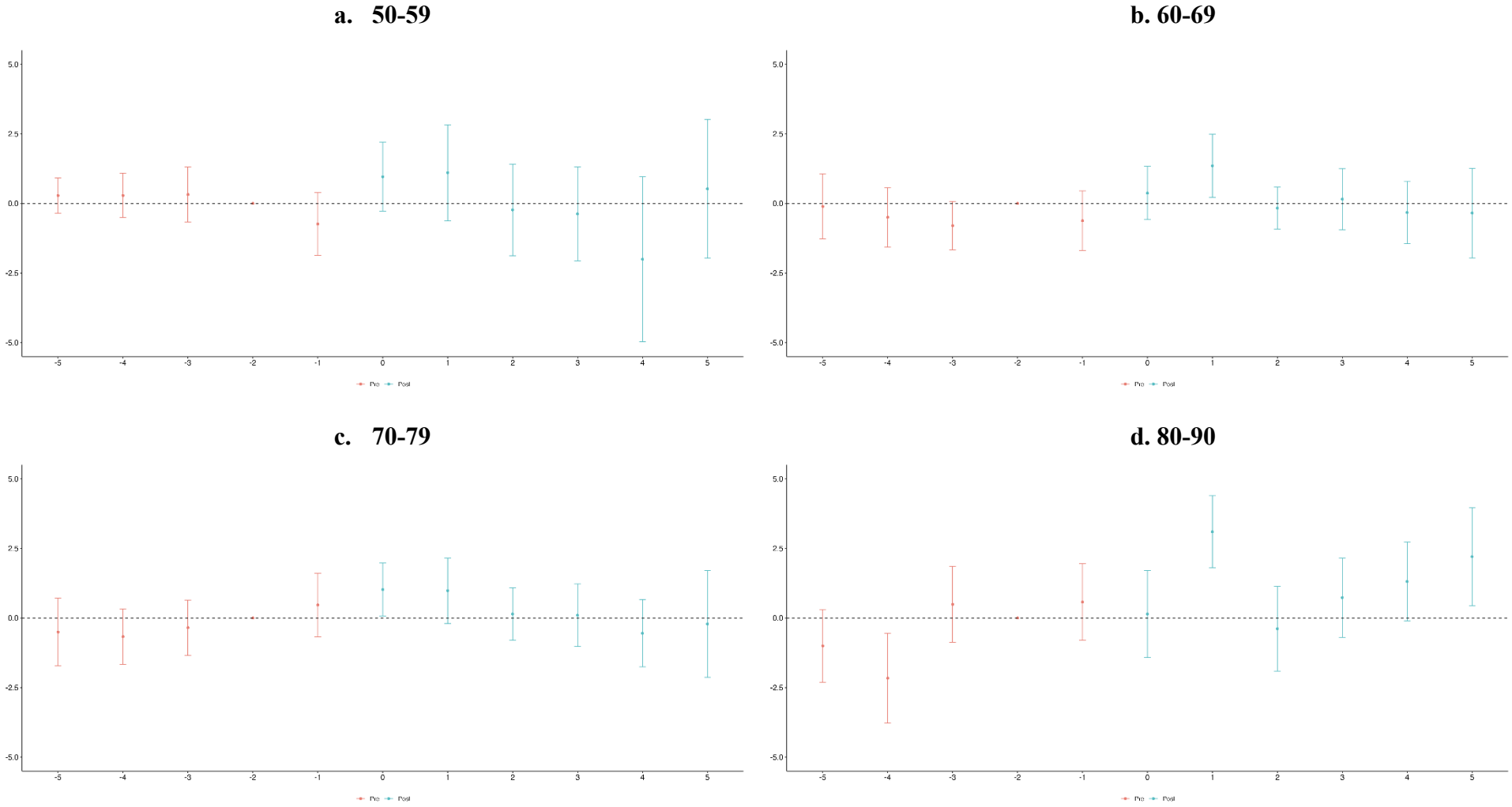
Spouses are one of the most important providers of informal care for older adults (Eibich, 2023) and informal care provision can negatively affect the mental health of the caregiver (Bom and Stöckel, 2021; Schmitz and Westphal, 2015). If individuals provide care for their sick spouse and the care episode ends with their death, then the potential mental health effect of care provision might bias our estimates of the consequences of spousal loss. We therefore examine patterns of informal care provision around the transition to widowhood. Fig. 6 shows estimates from an event study regression, where the outcome measures whether individuals provided help to anyone in the last 12 months. We find no changes before or after the death of the spouse. This finding is in contrast to Siflinger (2017), who argues that caregiving imposes a substantial burden in the years preceding bereavement.

Fig. 4 Event study estimates for the EURO-D score by age group for men



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the EURO-D score for men by age group. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level

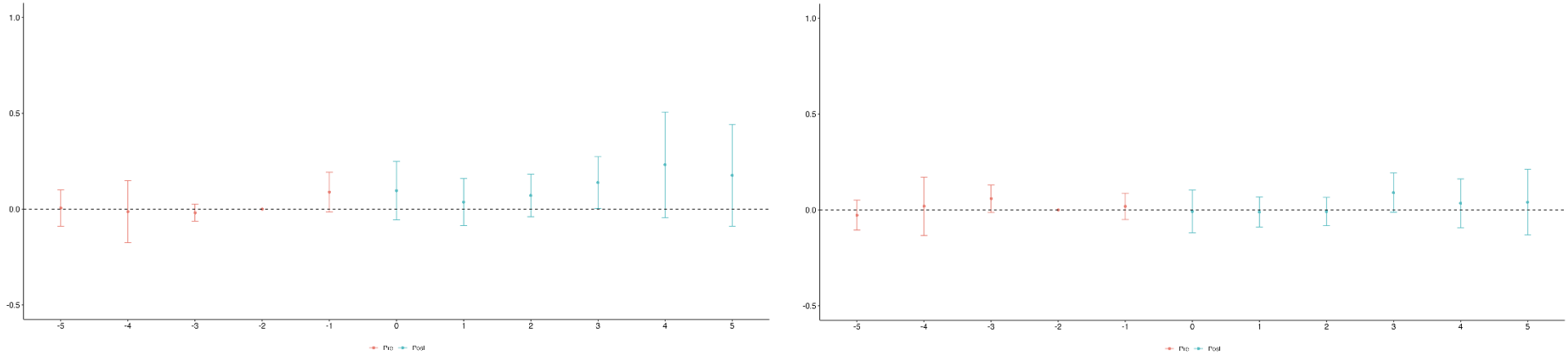
Fig. 5 Event study estimates for the EURO-D score by age group for women



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the EURO-D score for women by age group. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

Fig. 6 Event study estimates for informal care provision

a. Men **b. Women**



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the probability to provide informal care. Informal care provision is measured based on a question whether respondents provided unpaid help to anyone in the past 12 months. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

4.5 Potential mechanisms for adaptation

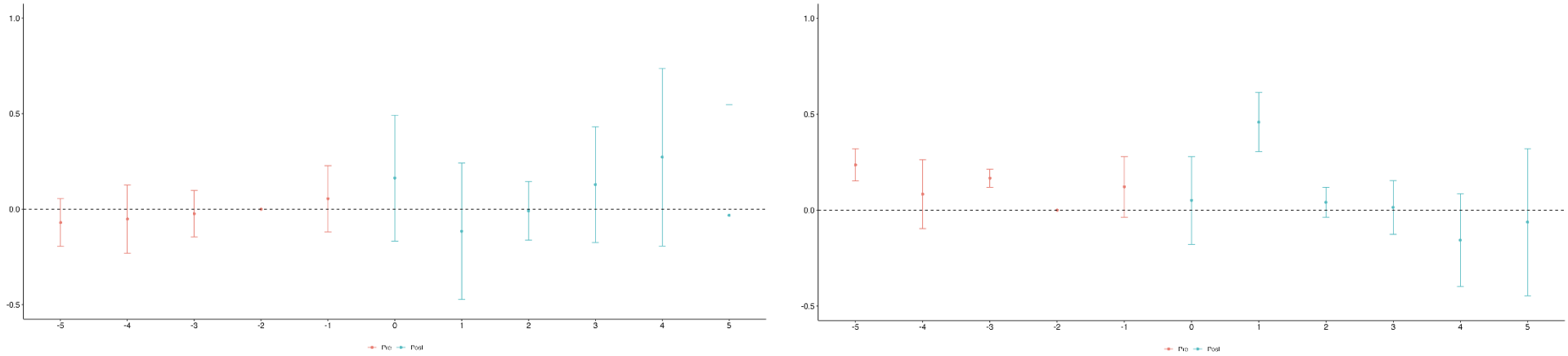
Finally, we consider several mechanisms that might explain the adaptation effects we observe. Fig. 7 shows an event study of participation in clubs, Fig. 8 shows an event study of voluntary work provision around the transition to widowhood, and Fig. 9 shows estimates for recreational activities. For club activities and volunteering, we find suggestive evidence that individuals are more likely to engage in such activities after the loss of their spouse. Since both social participation (Wilding et al., 2023) and volunteering (Mosca and Wright, 2017) are linked to better mental health, it appears plausible that these activities might explain part of the adaptation to widowhood observed in our event study. We find no significant changes in recreational activities.

4.6 Robustness

Figs. A.4 and A.5 in the appendix show estimates from two alternative event study estimators. Fig. A.4 shows estimates from a standard two-way fixed effects regression. The results are qualitatively similar to those from our preferred specification – we find a small anticipation effect one year before the transition to widowhood, followed by a large increase in the risk of depression after the loss of a spouse. In contrast to the estimates from our CS estimator, the TWFE estimates show a considerably slower adaptation. Fig. A.5 shows estimates using the event study estimator proposed by Sun and Abraham (2021). We see no anticipation effect in the years prior to the event. The results are similar in terms of magnitude to our baseline results which follow the Callaway and Sant'Anna (2021) method. The adaptation occurs from the second year after the event and, by the fourth year, depression levels have reverted back to baseline.

Fig. 7 Event study estimates for participation in club activities

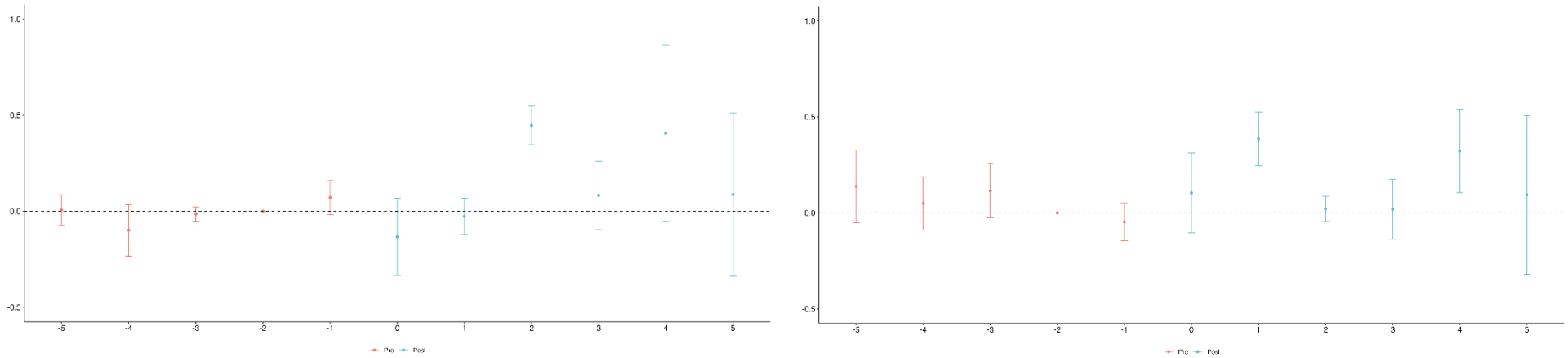
a. Men **b. Women**



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the probability to participate in club activities. Club activities include sports, social or any other clubs. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

Fig. 8 Event study estimates for volunteering

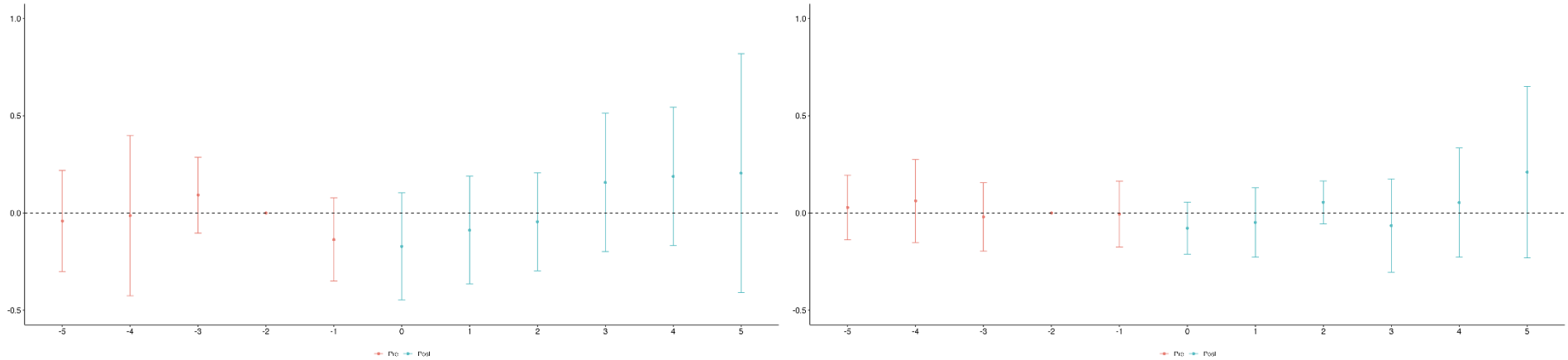
a. Men **b. Women**



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the probability to volunteer. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

Fig. 9 Event study estimates for recreational activities

a. Men **b. Women**



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the sum of recreational activities that individuals participated in in the last 12 months (0-4). All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

5 Discussion

This paper examines the causal effect of spousal loss on the mental health of the surviving spouse. We use data from 28 different European countries participating in the SHARE study. We address the endogeneity of mortality risks by focusing only on individuals for whom we observe the transition into widowhood in our data in an event study. Our regressions estimate the dynamic effects of widowhood on mental health by using individuals who lost their spouse later as a control group for those who lost their spouse earlier in the panel under the assumption that the exact timing of spousal death is random.

Our results suggest that losing a spouse has a strong impact on mental health – bereaved individuals report up to 1.5 additional depressive symptoms, and they experience an increase in the risk of depression by around 20 percentage points. However, widows and widowers tend to adapt relatively fast – depressive symptoms and the risk of depression return to baseline levels within 3 years of the loss. Similar to Schaan (2013) but in contrast to most economic studies (e.g., Espinosa and Evans, 2008; Siflinger, 2017; Streeter, 2020), we find no significant differences between men and women, neither in the initial impact of widowhood nor in the adaptation process. Our results further suggest that informal care provision is unlikely to influence our results. We find that widows and widowers are more likely to participate in club activities and they engage more frequently in voluntary work, and the positive impacts of these activities on mental health might consequently explain part of the adaptation process.

There are some important limitations we need to acknowledge. First, the standard errors of our estimates indicate substantial uncertainty, likely due to the limited number of events we observe. It is therefore possible that we might miss smaller differences in mental health, e.g., anticipation effects or long-term effects beyond year 3. We have also not addressed panel attrition. If individuals who are particularly strongly affected by the loss of their spouse are more likely to drop out of the study (e.g., because of increased mortality risks), we might underestimate the consequences of widowhood. We plan to address this in future analyses through the use of survey weights and by examining selective attrition. We have also not distinguished between different causes of death, or whether the death was expected or unexpected. SHARE includes information on the cause of death for some couples, and we plan to analyse this information in future work. Finally, we plan to further examine heterogeneity by considering the role of different welfare regimes.

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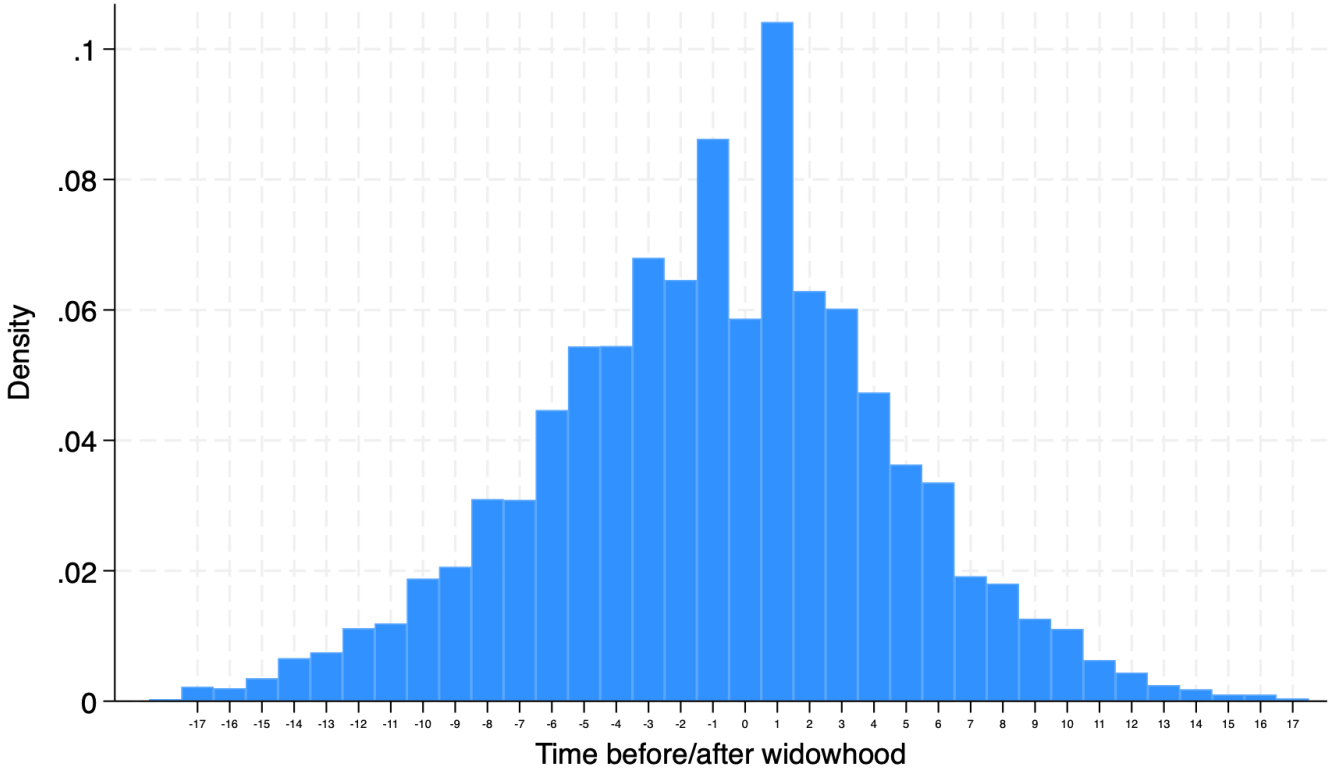
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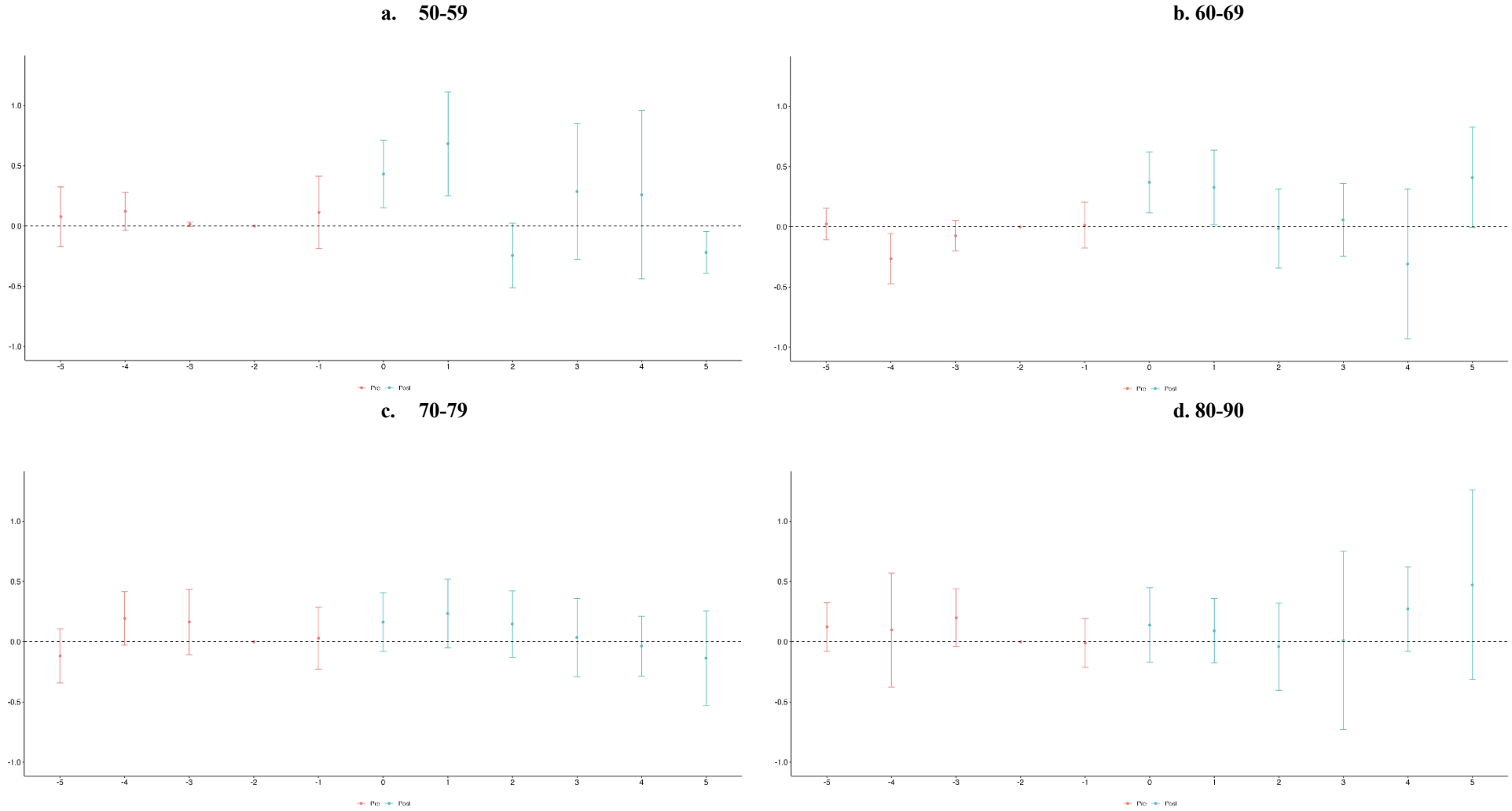
Appendix

Fig. A.1 Distribution of years before and after the event in the overall sample



Source: SHARE v9, own calculations.

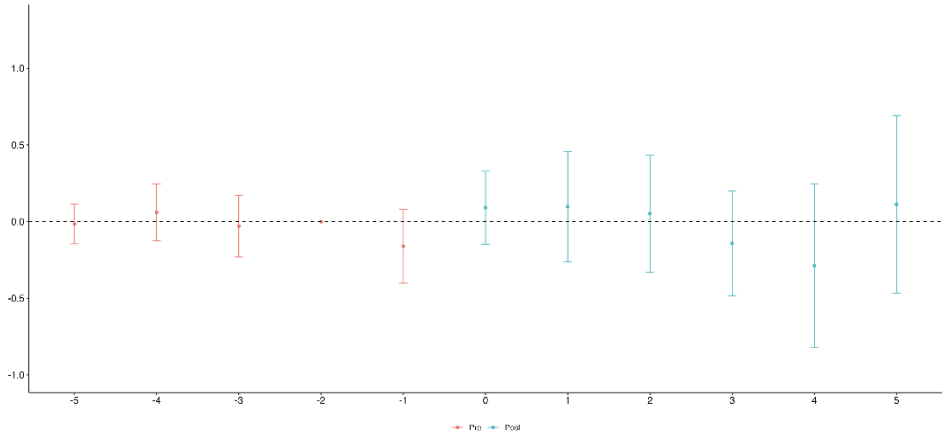
Fig. A.2 Event study estimates for the risk of depression by age group for men



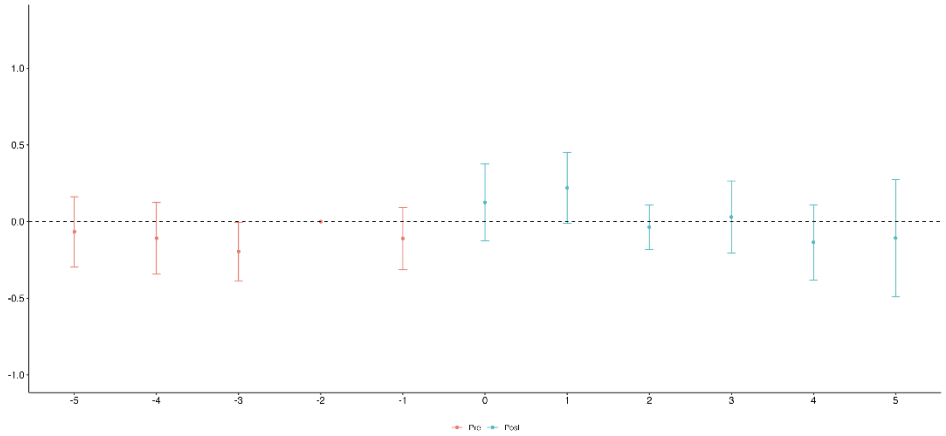
Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the risk of depression (EURO-D score >3) for men by age group. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

Fig. A.3 Event study estimates for the risk of depression by age group for women

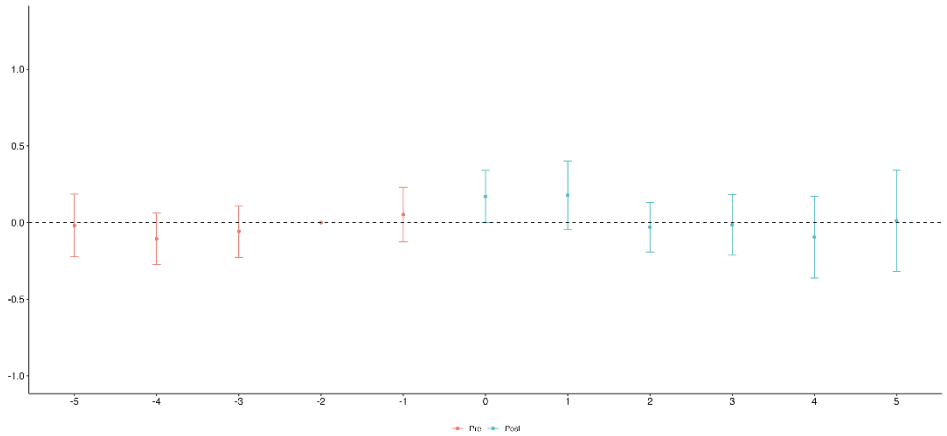
a. 50-59



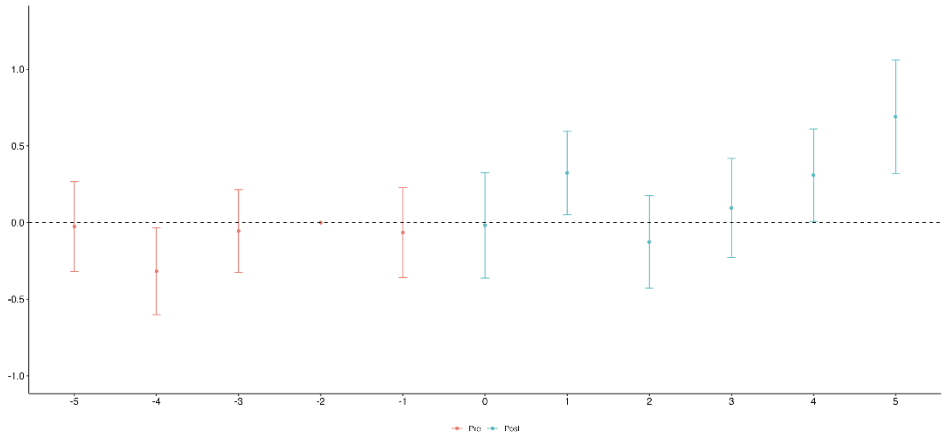
b. 60-69



c. 70-79

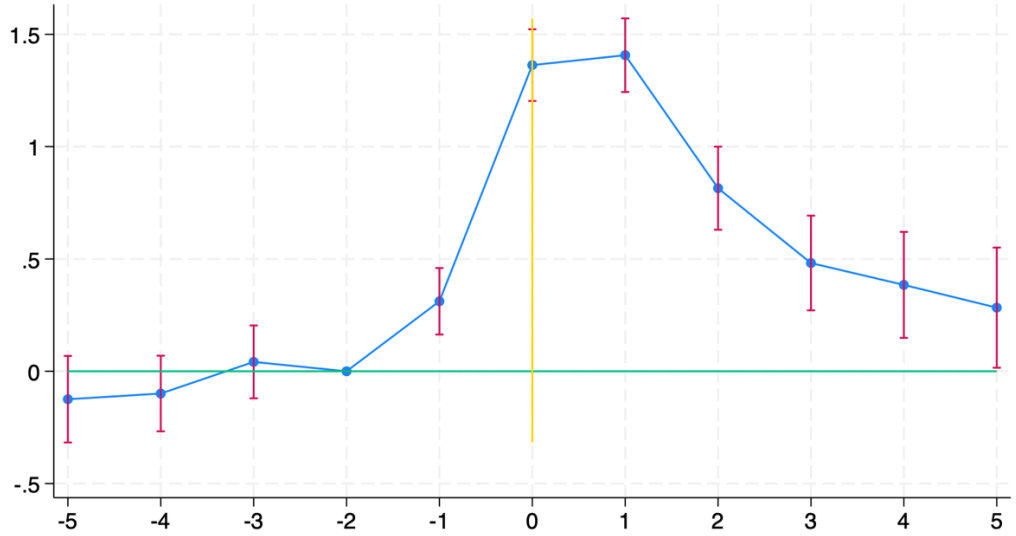


d. 80-90



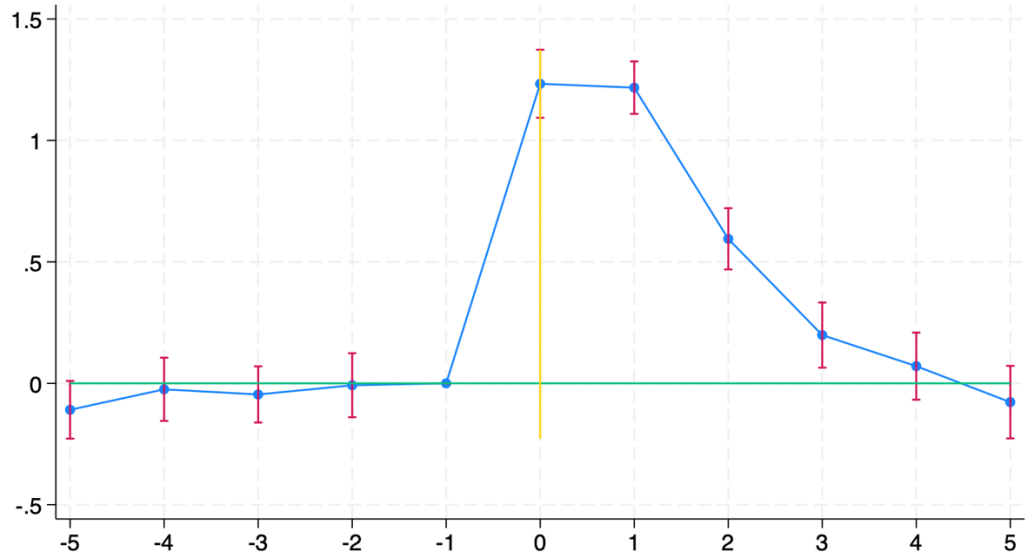
Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on risk of depression (EURO-D score >3) for women by age group. All estimates are derived using the Callaway-Sant'Anna DID estimator with standard errors clustered at the individual level.

Fig. A.4 Event study estimates for the risk of depression using Two Way Fixed Effect Method



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the EURO-D score. The model controls for age. All estimates are derived using the Two Way Fixed effect estimator with standard errors clustered at the individual level.

Fig. A.5 Event study estimates for the risk of depression using Sun and Abraham (2021) method



Source: SHARE v9, own calculations. Notes: The figure shows event study estimates of the effect of spousal loss (occurring at j=0) on the EURO-D score. The model controls for age. All estimates are derived using the Abraham and Sun (2021) estimator with standard errors clustered at the individual level.