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by

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Surviving Loss: Coping Strategies among Widow Households in Thai Rural Areas*

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This study investigates the impact of the death of the primary earner of the household on the labor supply decision of the remaining household member in rural areas, in contrast to literature which often focuses on more developed societies with complete public insurance coverage. We found widow households could maintain the same level of consumption with only a temporary decline in savings. They achieved this by taking over the household business and receiving support from children and other relatives who moved in to assist, with the responsibility falling on daughters rather than sons. On the contrary, widowers withdrew from the labor force after the death of their wives. The difference in responses could be explained by the income gain to the remaining household members. Widows also experienced a rise in gift income and a decrease in public transfer.

JEL codes: J12, J14, J22, I31

Keywords: Family structure, Labor supply, Elderly population

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1 Introduction

Economists have long been interested in analyzing the effects of adverse employment shocks, and uncover the household coping mechanism. Deaths of primary earners are one of the major income shocks households face over a life cycle. If the shock is negative and not sufficiently mitigated by the social security program, household members may respond by taking several measures.

Several studies have investigated the effect of health or employment shocks on the household. Focusing on non-fatal health shock, adverse health shock has been reported to reduce the worker's labor supply but has ambiguous effect on the spouse in the United States (Coile, 2004). Studies that focus on fatal health shocks include Baldini et al. (2018), in which negative unemployment shock of a household member increases the family labor supply in Italy, and a study by Fadlon and Nielsen (2021) which finds that in the event of spousal death in Denmark, widows increase labor supply, but widowers decrease labor supply after death of spouse. Nevertheless, little is known about how death of a primary earner affects households in non-OECD countries.

This study aims to investigate the effect of death of a spouse on the household in a developing economy with limited coverage for survivor benefits. It especially focuses on the elderly population to allow for more death occurrences. Moreover, combining with the fact that the majority of older male populations in developing economies are still labor force participants, death can also lead to income loss to surviving household members.

This study utilizes a novel household panel data set from the Townsend Thai Data Collection, which is a long-running panel data set, to investigate the effect of death of a spouse on the household. Although the survey may not be nationally representative of the Thai population, its advantage is that it contains household balance sheet that can be used to understand the coping mechanism in the event of death of a household member. The sample is restricted to household with married male household heads aged 51–70 years old at the start of the observation period. Moreover, the employment rate of husbands in the sample was around 93 percent whereas that of wives was about 89 percent, with husbands more likely to be employed in the market or own a business and

wives more likely to be employed as an unpaid family worker, suggesting that husbands are the primary earner of most households in the sample.

Employing the Townsend Thai Survey, we used an event study framework to investigate the impact of death over a wide range of outcome variables. Households that experienced the death of head at some point during the sample period were considered treated households, while those that did not become the control group. However, since households are treated at different times, there are several issues to be considered. For instance, when treatment is staggered as in this case, parameters identified by the simple two-way fixed effect estimator suffer from several problems such as under-identification, or negative weighting which stem from using an earlier treated group as a control for a later treated group (De Chaisemartin and d’Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021; Wooldridge, 2021). To address these issues, we employed an Imputing Difference-in-differences estimator proposed by Borusyak et al. (2021). This estimator fixes this problem by using never-treated and yet-to-treat groups to identify the household and year fixed effects.

First, we focused on the death of the male head and examined effects on the earned income of widow households. There was a decline in earned income by about 30 percent. We also found no evidence in a pre-trends in income when compared between widow households and households of women who continued to be married, suggesting a decline in income was not the cause of death of male spouses. However, after adjusting for the change in the number of household members, there was no evidence for a decline in the earned income per capita.

We found widow households could maintain almost the same level of consumption with only a temporary decline in saving. There was no evidence for a decline in the household monthly rice consumption, although there was a decrease in the share of home-grown rice. Nevertheless, meat consumption per head was also found to decline by about 40 percent. Savings were also found to decline by approximately 100 percent one year prior to up to two years after the event, but recovered in the third year.

The lack of persistent negative effect on consumption and savings suggested there

were some coping mechanisms widow households employed. First, we examined the self-insurance mechanism through own labor supply. We found widows transitioned from being unpaid family worker to being an owner of the business. Widows could substitute the labor of her late husband by taking in children and other relatives to assist with the household business, with the responsibility fell on daughters rather than sons.

Next, we investigated the insurance mechanism from outside the household, such as remittance, gift transfers, or public assistance. We found there was a decrease in the probability that widows received remittances from children, suggesting that coresidence could substitute remittance. Moreover, it was found widows also experienced a rise in gift income in the year of her husband's death, but there was no evidence that this support continued in the subsequent years. Results also showed public transfer decreased, suggesting public assistance was attached to her husband. These results suggest widows mainly relied on family members after the death of her husband.

In addition, we also investigated the effects on widowers. However, unlike households of widows, widower households experienced a decline in earned income and earned income per capita even before the event, suggesting deaths of female spouses may be a result of a reduction in income. This is not surprising because wives tend to be younger than their husbands and their deaths could be deemed as premature and more closely associated with a decline in household income. To tackle this issue, we restricted the sample to only widowers who had older or same-age wives and found income pre-trend disappeared. Widowers of this subgroup appeared to withdraw from the labor force after the deaths of their wives.

Differences in labor supply response between widows and widowers could be because males tend to be the primary earners, and the primary earners experience an increase in the income available to them after the death of their dependent. To further examine this hypothesis, we focused only on widows who were initially the primary earners of the household. Similar to findings on widowers, widows who were primary earners were also more likely to become inactive after the deaths of their spouses.

This study contributes to several strands of literature. Firstly, it is related to volumi-

nous studies on the added worker effect. Added worker effect refers to an increase in labor supply of married women when their husbands become unemployed. Theoretical models of family labor supply predict that the unemployment of one spouse should increase the labor supply of the other spouse, that is, the spouse behaves like a secondary worker of the household. Studies in this literature often use mass laid-offs as an exogenous shock for the unemployment of the primary earner. This often complicates the analysis because most of the time unemployment is deemed temporary, and the primary earner may return to the labor market. Like most studies in this literature, this paper investigated whether the spouse is the secondary worker of households. However, instead of using mass laid-offs as the exogenous unemployment shock, we considered death as the cause of permanent unemployment shock. Using death as a permanent employment shock would not be possible in most OECD countries because death of a primary earner is not a common event among working-age population. On the other hand, in a developing country like Thailand, a large proportion of the elderly are still labor force participants, allowing us to examine the impact of their permanent unemployment shock.

It is also a part of a broader literature on risk coping strategies. This strand of literature focuses not only on labor supply as a mean to cope with household income instabilities, but also the role of precautionary savings and the insurance system (Jacoby and Skoufias, 1997; Rosenzweig and Wolpin, 1993; Fafchamps et al., 1998).

In addition, it also contributes to the literature on the widowhood. While widows constitute more than half of the elderly population (The LoomBa Foundation, 2016), there is little research on their well-beings. Some studies have examined their time use and adjustment process to their widowhood (Utz et al., 2004; Hahn et al., 2011; Hamermesh et al., 2021), or their living arrangements (Bethencourt and Rios-Rull, 2009). On the other hand, relatively fewer studies have examined the economic wellbeing of widows, which is not surprising, because most widows are among the elderly population, and more likely to live on pension rather than being in the labor force. This study focuses on the livelihood of widows in a developing country, in which the pension system is less well-established, and lifetime work more prevalent.

This paper is organized as follows. Data sources and variable definitions are described in Section 2. Section 3 outlines the econometric framework. Results on widows are reported in Section 4, whereas that of widowers in Section 5. Section 6 discusses results of widows whose husbands were not primary earners. Technical limitations of this study are detailed in Section 7, and Section 8 concludes the study.

2 Data and Definitions

This section explains the data set used, and describes details on sample construction. Finally, we present summary statistics of the sample.

2.1 Setting and Data Sources

We used the Townsend Thai Annual Household Survey as the main data set. The Townsend Thai Annual Household Survey is a novel household panel data covering several provinces in Thailand since late 1990s.¹ Within each province, a stratified random sample of 12 subdistricts, or *tambons*, was selected; in each tambon, four villages were selected at random; and within each village, a random sample of 15 households were interviewed. The surveys begin at the start of May, and take up to five or six weeks to complete.

Compared to Bangkok, most of the surveyed provinces are relatively poorer, and are closer to the average provinces not surveyed. Figure A2 compares the gross provincial product (GPP) per capita in million Thai Baht over 2000–2015 in provinces covered by the Townsend Thai Annual Household Survey and those not surveyed. Most of the provinces, except for Chachoengsao, have GPP per capita close to the rest of the country. On the other hand, Chachoengsao’s GPP per capita was similar to the country’s average in early 2000s. However, from 2005 onward, it experienced a rapid growth making it almost caught up with Bangkok. Households in Chachoengsao accounted for 20 percent of the

¹At the beginning of the data collection in 1997, only rural areas in four provinces were surveyed: Chachoengsao, Buriram, Lopburi, and Sisaket. In 2003, households in rural areas of Satun were added to the survey. In 2005, households in rural Phrae and rural Petchabun were added. However, households in Petchabun were surveyed only in 2005 because the Thai Federal Agricultural Bank pulled funding for the resurvey. In 2008, urban areas of the original four provinces were added to the survey. Geographical location of provinces surveyed is shown in Figure A1.

households in the sample.

Although the survey may not be nationally representative of the Thai population, its advantage over other survey data sets administered by government agency in Thailand is that the data set has a panel structure, whereas data from other surveys such as the Labor Force Survey or the Socio-economic Survey are repeated cross-section. It also contains data on socio-economic activities of household members which can be used to aid the understanding of the coping mechanism of survivors in the event of death of a household member.

2.2 Sample Selection

2.2.1 Identifying Death Events

We identified death events using the data on relationship to head, focusing only on households with a married male head transitioning to households having widowed female head. Since individual identification is not available, this identification ignores the transitioning of headship to other household members who is not the spouse of the head. However, we maintain that the effect of household transitioning to having widowed female head can be viewed as the effect on the most vulnerable households to the death of the male primary earner, which is an upper bound effect households transitioning to other types of heads. We further discuss this issue on sample construction in Section 7.4.²

We confirmed the validity of this method by using the answer to the question: “Comparing this past year to the year before that, which was the worse year for household income, and why?” Using a sample of household in which the transition from married male head to widowed male head or widowed female head was observed, we found the timing of the transition and the year household lists death as one of the reasons for income loss coincide (Figures 1a and 1c). Nevertheless, note that the downside of using this variable is that it is not exclusively the death of the household head.

We could also use households’ answer to this question to infer the cause of death.

²Some studies such as Fadlon and Nielsen (2021) in Denmark limit the analysis to only two-person households. However, restricting the sample in the same manner would shrink the sample size by a large amount since the average Thai households size is about four.

Since the cause of death is not reported, we used the same variable to attempt to gauge whether chronic illness could potentially be the cause of death. Among households in which a change of household head was observed, we found no evidence that the income-affecting illness were chronic and preceded the change from household head to widowed household head (or spouse of household head to widowed household head), indicating that either the illness occurs within the year of the death and the illness itself was overshadowed by the event of death, or there were other unobserved factors that caused death (Figures 1b and 1d).

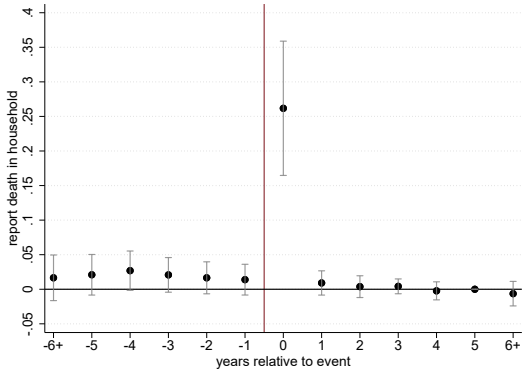
Comparing the results with the mortality pattern in Thailand, it is not improbable to not observe any illnesses reported before the event of death. Porapakham et al. (2010) conducted verbal autopsy interviews over a sample of almost 12,000 recorded deaths in 2005, and find primary causes of deaths for male aged 50–74 years old are stroke (12.3 percent), ischaemic heart disease (11.1 percent), and liver cancer (7.5 percent), where that for females are diabetes mellitus (12.3 percent), stroke (10.5 percent), and ischaemic heart disease (9.6 percent).³ Considering the high in-hospital mortality rate of strokes in Thailand,⁴ it is not surprising that no illnesses were reported before the event of death.

2.2.2 Age of widows and widowers

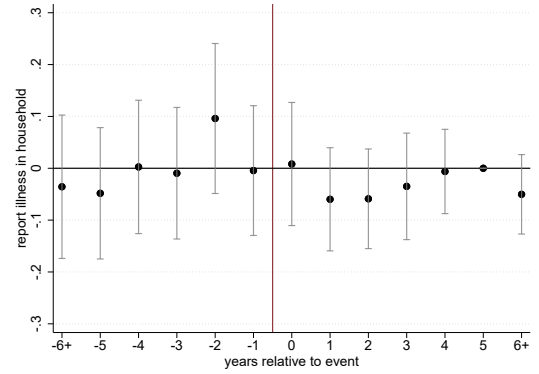
For our analysis, we limited the sample to include only widows and widowers born between 1930 and 1949, along with their female or male counterparts, resulting in individuals aged 51 to 70 years at the beginning of the sample period. We made this restriction because death was not prevalent among younger individuals in our sample, which could have led to low statistical power in our analysis. Therefore, the estimates derived from our study should be interpreted as effects on an older population. However, it's important to note that these individuals were not necessarily retired, as the labor force participation rates for elderly individuals in our sample were 89 percent for females and 93 percent for males

³Stroke and heart disease are more prevalent for the Thai elderly population as leading causes of death for males aged 15–49 years old are HIV/AIDS (22.6 percent), road accidents (19 percent), and liver cirrhosis (6.6 percent), while that of females aged 15–49 years old are HIV/AIDS (30.7 percent), road accidents (6.5 percent), and cervix cancer (5.8 percent)

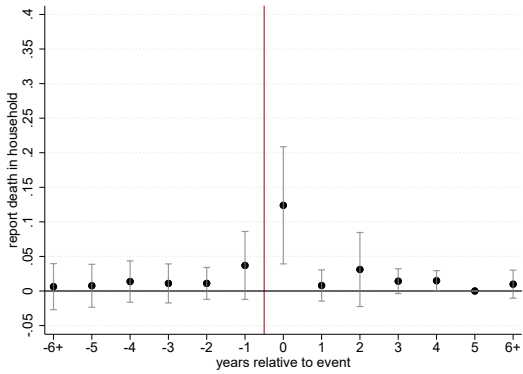
⁴The in-hospital mortality rate of cerebral infarction stroke in Thailand in 2010 is 7 percent and that of intracerebral hemorrhage stroke is 27 percent (Suwanwela, 2014)



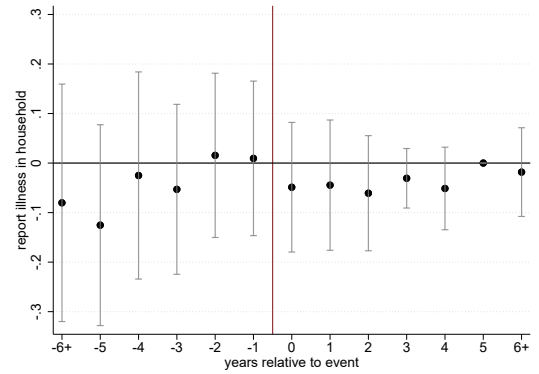
(a) Death reported in widow households



(b) Illness reported in widow households



(c) Death reported in widower households



(d) Illness reported in widower households

Figure 1: Probability of reporting death or illness

Notes: These figures report the coefficient estimates and the 90 percent confidence interval of the probability of reporting any deaths or illnesses on time relative to the event identified based on the relationship to head variable. The reference level is 5 years after the event. The sample is restricted to only treated households. All specifications include household and year fixed effects. The confidence interval is calculated based on robust standard errors clustered at household level.

(Tables 1 and 2).

2.3 Summary Statistics

Tables 1 and 2 show summary statistics of widow and widower households with their comparison households, which are households of females or males who continued to be married. Compared to the comparison group, treated households are older. To account for this systematic difference between the treated and control households, we also included the year of birth of husbands and wives interacting with year dummies in our main specification.

Wives are younger than their husband by about 2–5 years. Male spouses passed away when they were about 70 years old, with their eldest children around 40-50 years old (Figure 2). In contrast, the deaths of female spouses were more concentrated around the age of 60 (Figure A4). Since the life expectancy in Thailand is estimated to be around 68.5 years for males and 75.6 years for females in 2005 (Porapakham et al., 2010), female deaths in our sample may not be representative of the overall female population in Thailand.

Treated households also have about 0.2–1 years of education less than comparison households, consistent with findings in the literature that widow households tend to be less educated (Holden and Smock, 1991; Hurd and Wise, 1989). To account for this difference, we also included years of education of the couple interacting with year dummies as control variables.

Among the sample of household of married couples, summary statistics showed husbands are more represented as a business owner or a paid worker, while wives are more represented as an unpaid family worker (Figure A3).

2.4 Outcomes

We examined results across four main areas: the direct impact on the household balance sheet including income, consumption, and savings, outcomes linked to self-insurance mechanisms, outcomes associated with family-insurance mechanisms, and finally, out-

Table 1: Descriptive statistics of widow households

	(1)		(2)	
	Control HH		Treated HH	
	Count	Mean	Count	Mean
Panel A: Household characteristics				
No. of HH members	2,561	3.90	711	3.83
Husband's death	2,561	0.00	711	1.00
Wife's death	2,561	0.00	711	0.00
Wife's year of birth	2,561	1943.57	711	1941.29
Husband's year of birth	2,561	1941.21	711	1937.31
Wife's years of education	2,561	3.74	711	3.31
Husband's years of education	2,561	4.52	711	4.24
Live with child	2,561	0.52	711	0.48
Live with daughter	2,561	0.32	711	0.32
Live with son	2,561	0.29	711	0.29
Panel B: Household balance sheet				
Rice consumption(kg/head)	2,561	9.50	711	9.19
Consumption of rice grown (share)	2,561	0.35	711	0.29
Earned income (10K Baht)	2,561	27.99	711	20.65
Saving (10K Baht)	2,561	5.23	711	3.82
Positive asset income	2,561	0.33	711	0.33
Borrow in the past year	2,561	0.55	711	0.52
Receive remittance	2,561	0.68	711	0.80
Send remittance	2,561	0.06	711	0.05
Gift income (10K Baht)	2,561	3.23	711	3.25
Public transfer (10K Baht)	2,561	3.35	711	2.54
Panel C: Household labor supply				
Wife inactive	2,561	0.11	711	0.16
Wife in market employment	2,561	0.10	711	0.18
Wife in household employment	2,561	0.79	711	0.66
Wife in household employment(owner)	2,561	0.15	711	0.20
Wife in household employment (worker)	2,561	0.63	711	0.47
Other HH member in HH emp	2,561	0.31	711	0.28

Notes: This table shows the summary statistics of widow households and their comparison households.

comes tied to community and government-based insurance mechanisms. Description of main outcome variables are detailed as follows.

Earned income: Earned income is collected annually at household level. It is the sum of salary, agricultural income, and income from household businesses.

Consumption: Households are asked about their consumption information during a typical month in the past year. We examined outcomes related to the consumption of various items, including rice, meat (chicken, beef, pork), alcohol beverages, and tobacco. Household participants were allowed to report the amount consumed using their preferred

Table 2: Descriptive statistics of widower households

	(1)		(2)	
	Control HH		Treated HH	
	Count	Mean	Count	Mean
Panel A: Household characteristics				
No. of HH members	3,835	4.02	491	4.27
Husband's death	3,835	0.00	491	0.00
Wife's death	3,835	0.00	491	1.00
Wife's year of birth	3,835	1947.15	491	1944.93
Husband's year of birth	3,835	1942.65	491	1940.03
Wife's years of education	3,835	3.89	491	2.83
Husband's years of education	3,835	4.50	491	4.43
Live with child	3,835	0.57	491	0.75
Live with daughter	3,835	0.37	491	0.42
Live with son	3,835	0.31	491	0.46
Panel B: Household balance sheet				
Rice consumption(kg/head)	3,835	9.39	491	8.65
Consumption of rice grown (share)	3,835	0.32	491	0.30
Earned income (10K Baht)	3,835	30.73	491	18.16
Saving (10K Baht)	3,835	4.99	491	2.34
Positive asset income	3,835	0.34	491	0.31
Borrow in the past year	3,835	0.56	491	0.59
Receive remittance	3,835	0.64	491	0.69
Send remittance	3,835	0.07	491	0.06
Gift income (10K Baht)	3,835	3.03	491	3.13
Public transfer (10K Baht)	3,835	3.06	491	1.21
Panel C: Household labor supply				
Husband inactive	3,835	0.07	491	0.14
Husband in market employment	3,835	0.20	491	0.20
Husband in household employment	3,835	0.73	491	0.66
Husband in household employment (owner)	3,835	0.64	491	0.58
Husband in household employment (worker)	3,835	0.09	491	0.08
Other HH member in HH emp	3,835	0.31	491	0.38

Notes: This table shows the summary statistics of widower households and their comparison households.

units, such as kilograms, bags, packs, bottles, or other measures. To ensure consistency, we converted the reported amounts of rice, alcohol beverages, and tobacco to kilograms, bottles, and packs, respectively. However, due to the diverse range of observation units for the meat item, we opted to use the total consumption value for analysis.

We could also distinguish between rice produced at home and rice household bought. We employed the share of rice produced at home to total rice consumption as the measure for household rice production.

Savings: Households were inquired about the amount they currently have saved in

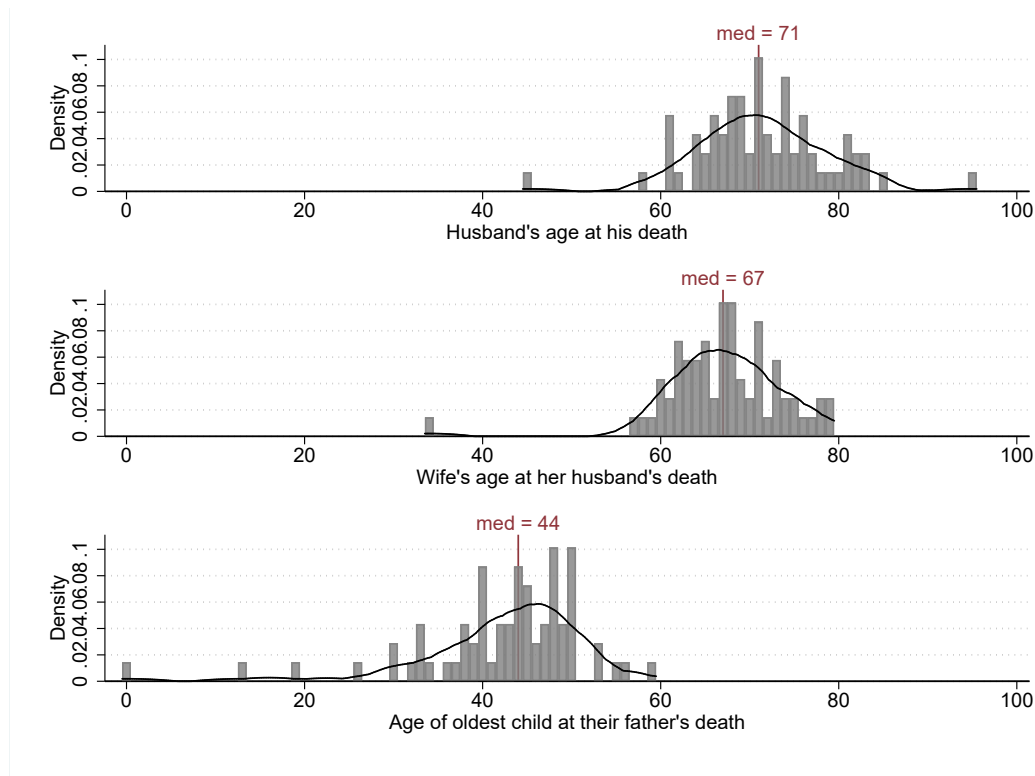


Figure 2: Age of family members in widow households in the year of death

Notes: This figure shows distributions of age of family members in widow households in the year of death.

different forms of assets, such as savings in commercial banks, agricultural banks, gold and jewelry, rice and other crops in storage, and cash. However, for our analysis, we focused solely on savings held in banks.

Savings were used as a measure to determine whether households have liquidated their savings to mitigate the shock. Apart from savings, households might also have liquidated other property or durable assets. To determine this, we examined the amount of asset income received by households in the past year. Asset income was defined as the total income generated from selling and leasing land or buildings or other durable assets.

Labor supply: We determined the employment status of each household member based on their responses to two questions. The first question asked about their primary occupation during the past 12 months, specifically inquiring about the occupation from which they earned the most income. The second question inquired about the type of worker the household member was in that job, offering options such as business owner, unpaid family worker, daily wage employee, monthly wage employee, piece rate employee,

or government worker.

If the household member was reported as inactive or unemployed in the first question, we classified them as inactive. If they were reported as business owners or unpaid family workers, they were classified as being in household employment, while all other responses were categorized as market employment.

Coresidence: Using information of each household member’s relation to the household head, we identified coresidence with any of the widow/widower’s children, daughters, sons, grandchildren, as well as son or daughter-in-laws.

Gift income: Households were asked about the amount of income they received as gifts during the past 12 months. Gift income includes transfers from relatives or friends, as well as income made from other religious ceremonies such as funerals or weddings.

Remittance: Details about household remittances from or to children were obtained through a section specifically dedicated to children living outside the household. Participants were asked to provide approximate amounts for two questions: "How much money did the child send in total over the past 12 months?" and "How much money did the household send to the child in total over the past 12 months?" However, due to the skewed nature of the data and a significant number of zero entries, in our analysis, we opted to utilize only a binary variable indicating whether the household had received or sent remittances in the past year.

Public transfer and government assistance: Households were queried about the amount of money they received in the past 12 months from the government or local authorities. This encompassed transfers from the government, retirement fund, scholarships, social security payments, or village funds. For our analysis, we standardized the received amount for each household at yearly level to accommodate changes in government policies throughout the years.

3 Econometric Framework

In this section, we describe our empirical strategy to estimate the effect of household head’s death on remaining household members. Households that experienced the death of head

at some point during the sample period can be considered the treated household, while those that did not become the control group. However, since households are treated at different times⁵, there are several issues to be considered. For instance, when treatment is staggered as in this case, parameters identified by the simple two-way fixed effect estimator suffer from several problems. For instance, it uses an earlier treated group as a control for a later treated group (Goodman-Bacon, 2021; Borusyak et al., 2021), and the estimand is a weighted average of certain causal effects, and some weights can be negative (De Chaisemartin and d’Haultfoeuille, 2020; Borusyak et al., 2021).

To address these issues, we employed the Imputing Difference-in-differences proposed by Borusyak et al. (2021). Suppose there are N observations in a panel of units i and periods t , and $it \in \Omega$. E_i is the time in which unit i is treated. Units that are never treated have $E_i = \infty$. Treatment, D_{it} , is binary and

$$D_{it} = \mathbf{1}[K_{it} \geq 0], \quad (1)$$

where $K_{it} = t - E_i$. The set of treated observations is denoted by $\Omega_1 = \{it \in \Omega : D_{it} = 1\}$ of size N_1 and the set of untreated observations (never-treated and not-yet-treated) is denoted by $\Omega_0 = \{it \in \Omega : D_{it} = 0\}$ of size N_0 .

This method assumes the potential outcome, $Y_{it}(0)$, can be written using only time and individual fixed effects. In other words, there exists non-stochastic α_i and β_t such that

$$\mathbb{E}[Y_{it}(0)] = \alpha_i + \beta_t, \quad (2)$$

for all $it \in \Omega$. $\hat{\alpha}_i$ and $\hat{\beta}_t$ are then fitted by regressions using untreated observations only, and later used to impute the untreated potential outcomes, then the estimated treatment effect is obtained as follows,

$$\hat{\tau}_{it} = Y_{it} - \hat{\alpha}_i - \hat{\beta}_t. \quad (3)$$

The treatment effects are then weighted with weights corresponding to the estimation

⁵Figure A5 shows the distribution of the year of death, pooling across widow and widower households.

target, that is,

$$\tau_w = \sum_{it \in \Omega_1} w_{it} \tau_{it} \quad (4)$$

For baseline estimation, we used the weight that corresponds to the average treatment effect on the treated (ATT), that is $w_{it} = 1/N_1$ for any $it \in \Omega_1$. Moreover, to capture cohort effects, we also controlled for wife’s year of birth by interacting it with year dummies.

To check the robustness of the results from the Imputing Difference-in-differences estimator, we also compared the estimates with estimates from the conventional event study estimator and the estimator proposed by De Chaisemartin and d’Haultfoeuille (2020) in Section 7.5.

4 Results and Discussion

This section reports the estimated of spousal death on the economic well-being of the household of the remaining spouse.

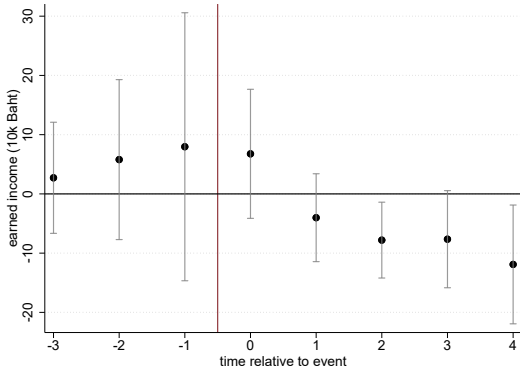
4.1 Earned Income and Consumption

4.1.1 Effects on Earned Income

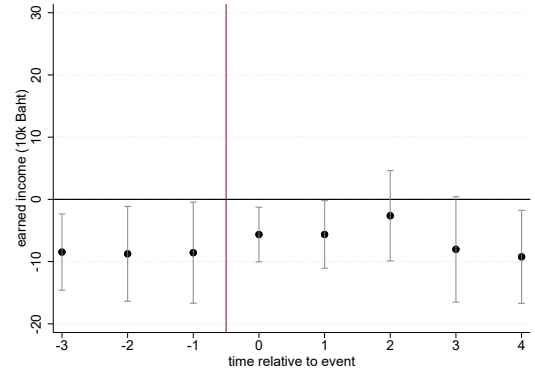
First, we investigated how household earned income was affected by the death of the male household head or his spouse. In the event of the death of the male head, there was a decrease in the earned income to almost 100,000 Baht per year, with the effect becoming statistically significant only after the third year (Figure 3a). There was also no evidence for a decline in income prior to the death of the male household head, as pre-trends were rejected for all the three years before the event, suggesting a decrease in earned income was unlikely to be the cause of the male head.

Next, we examined the effect on earned income in household of widowers. Unlike the result of widow households, pre-trends could not be rejected for household of widowers (Figure 3b), indicating that death of wives may be endogenous to a decline in household income.⁶ This observation is not surprising, given that wives typically tend to be younger

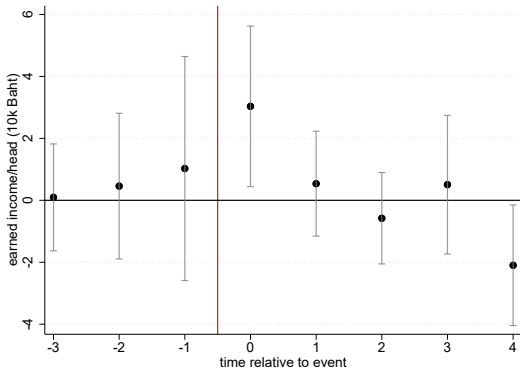
⁶One may argue the decline in income before the actual death may also be a result of chronic illness



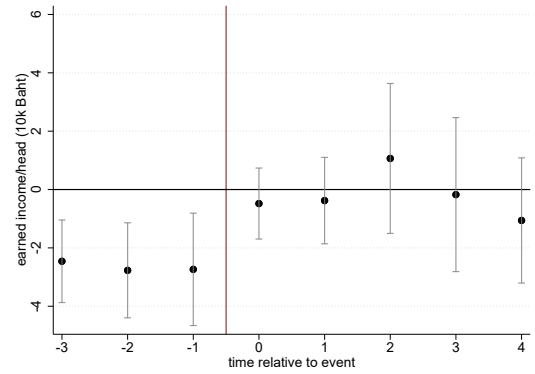
(a) Earned income in widow households



(b) Earned income in widower households



(c) Earned income/head in widow households



(d) Earned income/head in widower households

Figure 3: Changes in earned income of households

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the earned income of households. The earned income refers to the sum of the salary income and business income of the household over the past year. All specifications control for wife or husband's year of birth by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

than their husbands (Figure A6), resulting in their deaths being premature and more closely associated with other socio-economic factors. Furthermore, restricting the sample to only widowers whose wife was of the same age or older showed pre-trends in income disappeared (Figure A18a). As husbands with an older or same-age wife accounted only for 20 percent of the sample (Figure A6), the estimated overall effects on widower households may be a combination of the effects of death and the income effect. Therefore, in the subsequent sections, we focus on results on widow households and delegate results of widowers to Section 5.

In addition to examining the impact on household earned income, we also considered how the income measure adjusting for the number of household members would be affected, as the overall decline in total income might not necessarily lead to a proportional decrease in income per individual. Specifically, after adjusting for the number of household members, we found no persistent reduction in the earned income per person within widow households (Figure 3c). However, we did observe an increase of approximately 30,000 Baht in income per person within the first year of her husband's death, which could be attributed to the time lag in annual income observation and the count of household members.⁷

4.1.2 Effects on Consumption

Next, we examined the impact on household economic well-being through their consumption patterns, focusing specifically on rice consumption as it serves as the primary staple food for Thai households. We found no evidence that widow households reduced the monthly rice consumption per head (Figures 4a), which is not unexpected since rice is

before the event. However, it is unclear why such pattern was only observed in widower households. Moreover, there was also no evidence for health-related problems to be the cause of death. By shifting the event year one, three, and five years before the actual death, we found no observable increase in the probability of treated households reporting health issues prior to the death event compared to households in the comparison group (Figure A7).

⁷Household income is collected at the yearly level, while the number of household members is recorded on the day of the survey. If changes in the number of household members occurred around the time of the primary earner's death, interpreting the estimates becomes more complex. As shown later in Figure 9, children of widows tend to move in with their mother one year after their father's death, while children of widowers move in with their father immediately after their mother's death, keeping the number of household members unchanged. Consequently, a difference arose between widows' and widowers' households.

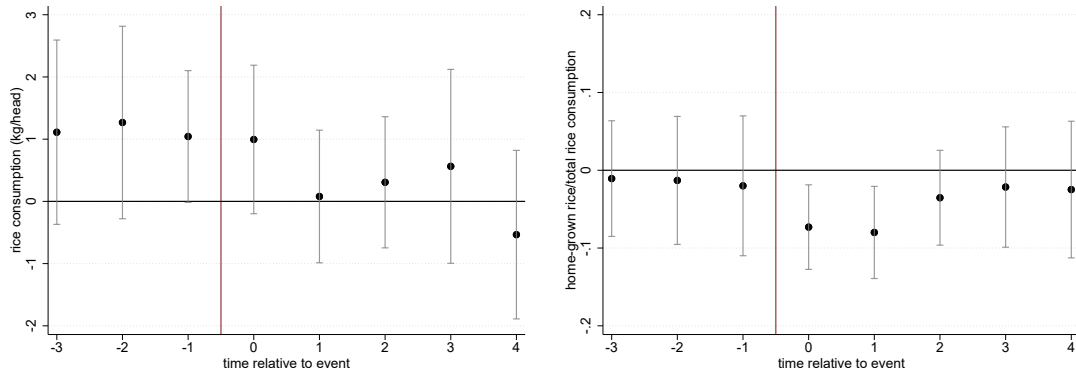
one of the necessity goods within Thai households.

However, how households obtained rice seemed to change. The level of household self-sufficiency dropped by about 20–25 percent, as observed in the decrease in the share of home-grown rice to total rice in the household of widows (Figures 4b) in the first two years following the death of her husband. The substitution of home-grown rice for store-bought rice may mean one of the two things: either widows benefit from the death of her husband that she could afford to work less in the field and enjoy more leisure, or that they could not sustain the same level of rice production and were forced to substitute with store-bought rice. The former would indicate that the economic-wellbeing widows were not negatively affected by the death of her husband.

Subsequently, we considered the consumption of goods with higher income elasticities such as meat, alcohol, and cigarettes. There was some evidence that widow households reduced the consumption expense per head on meat (Figures 4c) by about 40 percent, but the effect was not immediate and only statistically significant for some periods.

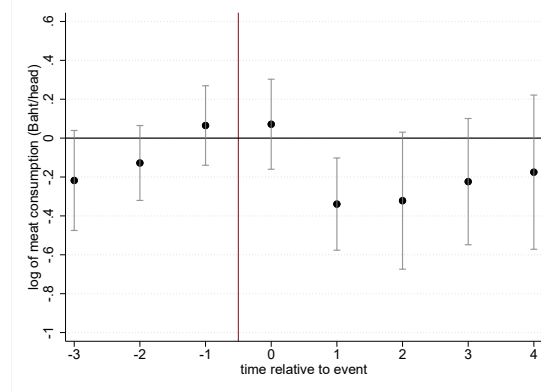
The evidence regarding whether households adjusted their alcohol and cigarette consumption to compensate for the income loss was inconclusive. The impact on alcohol and cigarette consumption differed between widow and widower households. Widow households experienced a decrease of approximately 0.25 liters in monthly alcohol consumption, while widower households saw an increase of 0.25 liters (Figures A10a–b). Similarly, widower households exhibited an increase in cigarette consumption, but no clear trend was discernible for widow (Figures A10c–d). The contrasting effects between widow and widower households could potentially be attributed to changes in intrahousehold bargaining power, considering that alcohol and cigarettes are typically preferred by men (Hoddinott and Haddad, 1995). Thus, while it might suggest that widows reduce alcohol consumption, the variations between the two groups may be driven by shifts in power dynamics within the household.

Results suggested households could smoothen their consumption following the death of the primary earner. However, it is unclear what was the mechanism behind. In the following sections, we explore the coping mechanism in households of survivors.



(a) Rice consumption (kg/head)

(b) Rice production



(c) Meat consumption (Baht/head)

Figure 4: Changes in household consumption and production: widow households

Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the monthly rice consumption per head (Figures a–b), the share of consumed rice which was produced in the household to total rice consumption (Figures c–d), and meat consumption (Figures e–f). All specifications control for wife and husband’s year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

4.2 Savings and Assets

Next, we explored how death could affect household savings and other assets. We found households of widows experienced a decline in savings by approximately 100 percent, from one year before the death to up to two years after. The saving level, however, seemed to recover in the third year, suggesting there may be some other means widows used to replenish the household saving account (Figure 5). Similar patterns could also be observed in household of widowers (Figure A9). Nevertheless, like the effect on income, pre-trends of a drop in saving in widower households could not be rejected, indicating death of female spouses may not be random and a consequence of a decline in household income.

Some may argue the reduction in saving level of widow and widower households came from the transfer of wealth to children (Kopczuk and Lupton, 2007; Erixson and Escobar, 2020). However, as shown in Figure A12, this appeared unlikely to be the case, since there was no evidence that widows or widowers were more likely to send money to their children before death.

Besides savings, effects of death on asset income, such as income from rent, income from selling land, or interest payment were also considered. We found little evidence on an increase in the asset income (Figure A13a), suggesting households did not liquidate their assets in response to death. We also investigated the impact on household borrowing behavior, as households may use future money to cope with the negative shock. However, we found no evidence that widow households were more likely to create new loans (Figure A13c).

The decline in savings observed in Thai widow households were similar to findings in Hurd and Wise (1989) in which American widows were found to have lower non-housing assets than married women. However, whereas it has been unclear in the previous study whether the wealth level recovers, our study showed the saving level recovered after three years. In addition, like results in Hurd and Wise (1989), we also found that transfer of wealth to children when the husband dies did not explain the loss of wealth at his death.

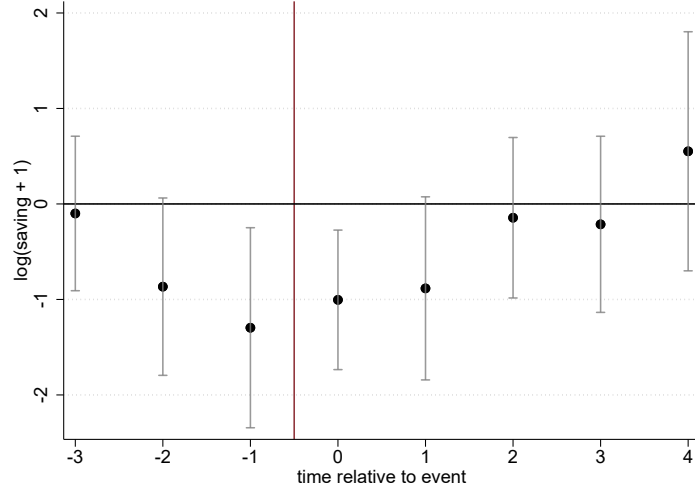


Figure 5: Changes in household savings: widow households

Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the log of household savings. All specifications control for wife and husband’s year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

4.3 Household Labor Supply

In this section, we consider the household labor supply response in widow households. First, we examined how widows self-insure against the shock by looking at the change their labor supply. Then, we investigated how other household members might contribute to insuring the widows.

First, effects of husband’s death on labor supply decision of widows were considered. We found there was no clear evidence that widows became inactive or supply more labor to market work (Figures 6a–c). Rather, we found widows were 20–30 percentage points more likely to report themselves being a business owner rather than an unpaid family worker, suggesting they continue supplying their labor to the household business even after her husband’s death (Figures 6d–e).

Our findings slightly differed from results in Fadlon and Nielsen (2021) where it is found Danish widows increased their labor force participation by 11 percent. The difference could be attributed to the baseline labor force participation rate. Since approximately 90 percent of elderly females in Thailand were already employed as unpaid family workers (Table 1), there was not much room for adjustment in their labor supply. Nevertheless,

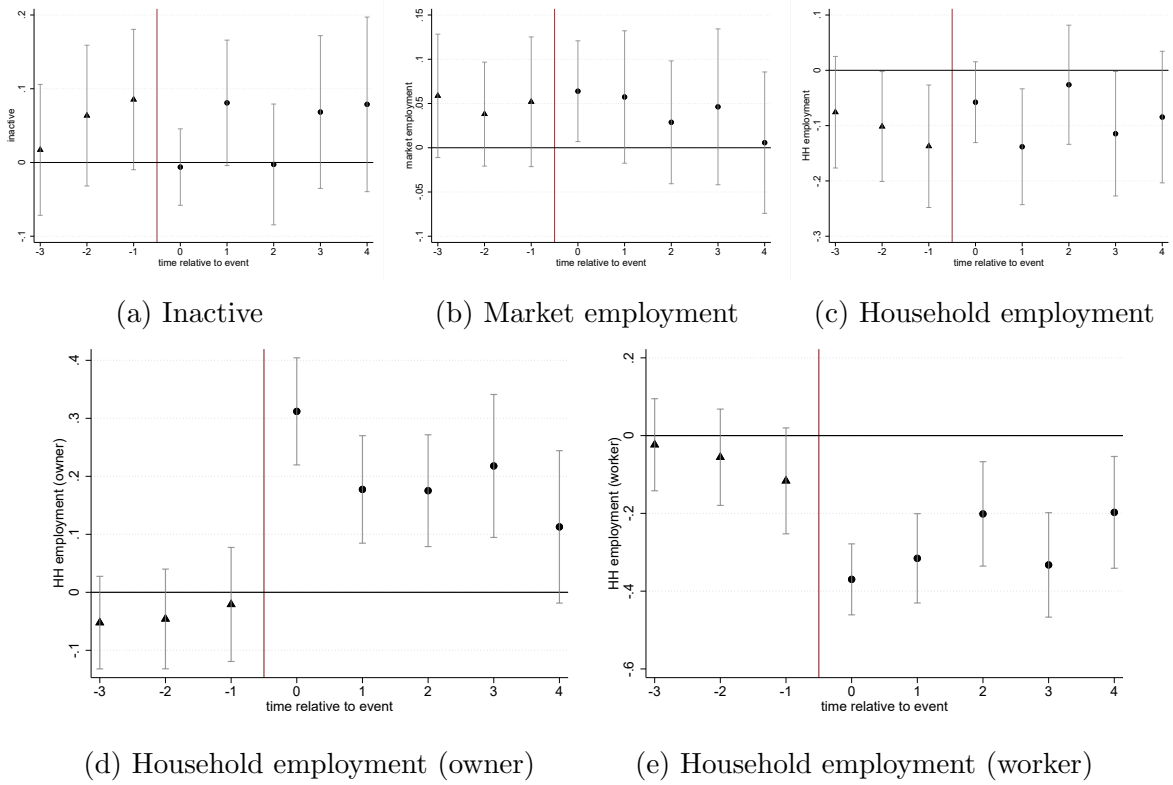


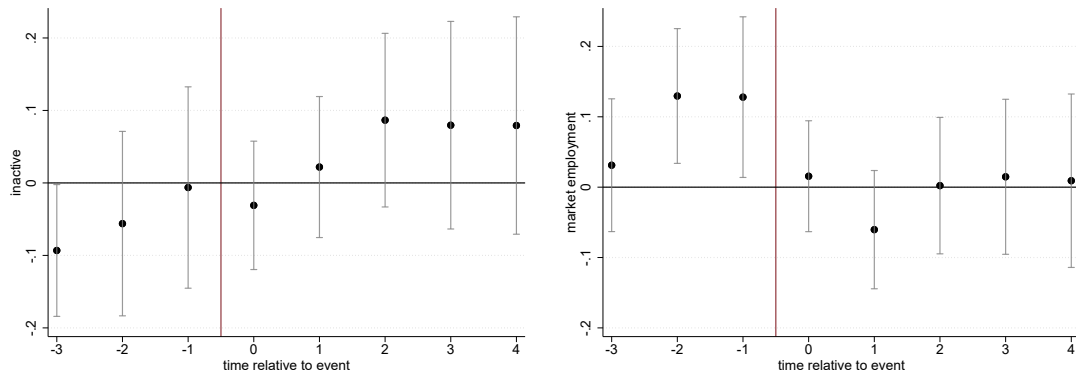
Figure 6: Employment of widows

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the employment status of widows around the time of the event. All specifications control for wife and husband’s year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

our results indicated they continued working assuming the role of the business owner.

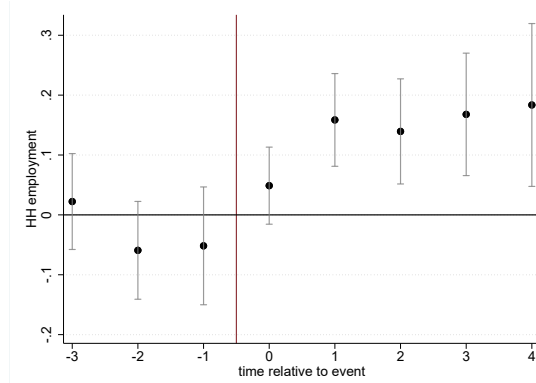
The results raise a question about how widows managed to run the business in the absence of their husbands. To answer this question, we examined the labor supply decision of other individuals in the widow households. Our findings revealed that the probability of other household members were employed in the household business increased by about 50 percentage points, and the effect was persistent up to at least after five years after the death of the household head (Figure 7).

Separating the effects by the relationship of the added household member to the widow, we found the labor supply response was divided into that of the child and other relatives of the widow. Up to three years after the death of her husband, there was an increase in the probability of having an inactive child in the widow household by more than 100 percent, and the probability of having a child engaged in the household business by about 40–50



(a) Inactive

(b) Market employment



(c) Household employment

Figure 7: Employment of other household members: widow households

Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the employment status of widows around the time of the event. All specifications control for wife and husband's year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

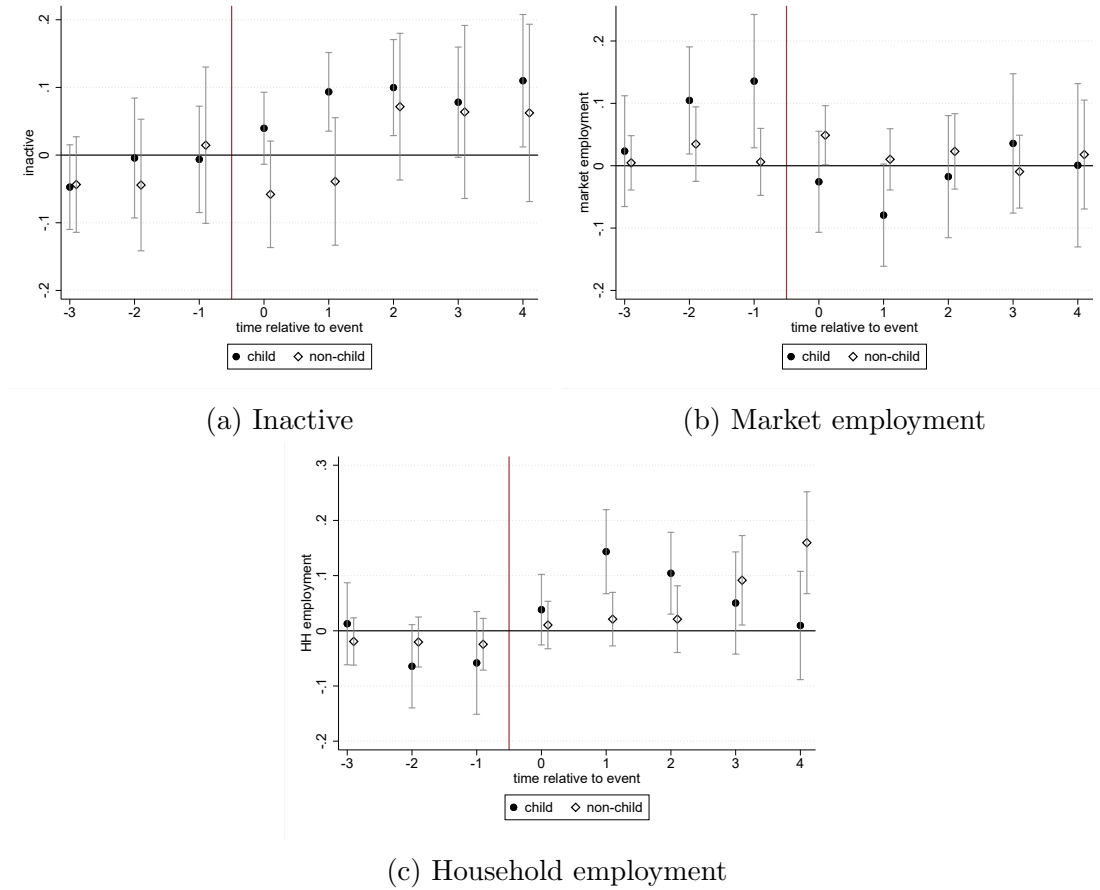


Figure 8: Employment of child VS non-child: widow households

Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the employment status of widows around the time of the event. All specifications control for wife and husband’s year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

percent (Figure 8a). From the third year, an increase in the household employment came from other relatives added to the household (Figure 8c). This suggests the immediate response of widow households was to take in a child, and after 2–3 years, the child was replaced by other relatives of the widows.

Note that from Figure 7, no reduction in the probability of being inactive, or being engaged in paid employment was observed, suggesting widows could sustain the household business by adding another individual to the household. To further investigate this issue, we examined the change in the widow household structure after her husband’s death.

Confirming the findings related to household labor supply in Figures 7 and 8, there was a change in the widow household structure. There was an increase in the probability

of widows living with at least one adult child by about 20 percent from the second year after her husband’s death. Separating the impact by the gender of the child, it was found daughters were more likely to move in with their widowed mothers than sons (Figure 9).

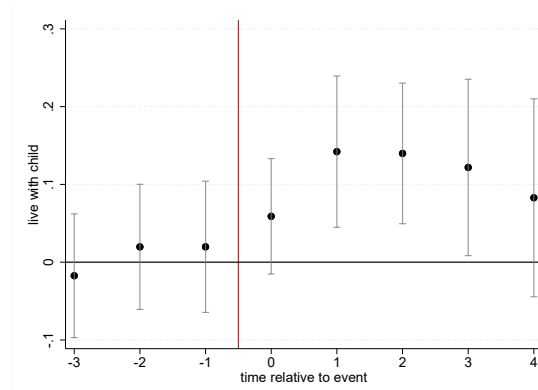
The increase in the probability of coresidence with child after the death of the husband may also disrupt the household of the children of widows. However, it was unclear from the data whether the daughter moving in was married or single since the marital status was not observed. However, there was no evidence for an increase in the probability of living with a son-in-law on any grandchildren (Figure A14). This means it is either the single daughter moved in to live with the widowed mother, or a married daughter moved in, leaving her family behind.⁸ Nevertheless, coresidence with children reversed to the original level from the fourth year, and the responsibility in the household business seemed to be passed to other relatives of the widows from the fifth year.

The importance of children in widowhood has also been highlighted in other studies such as Utz et al. (2004), where it is found that adult children assist their parents with household chores, and Baldini et al. (2018), which show that children supply labor in response to the employment shock. However, due to the absence of time-use data, it remained uncertain in our study about the specific role of the additional household member. It is possible that they moved in to serve as a caretaker for the widow, to provide assistance in the household business, or even both roles. While the evidence is only suggestive, an increase in both the probability of having an inactive child in the household (Figure 8a) and the probability of having a child engaged in household business (Figure 8c) imply widows may need both, and the roles mainly fell on the child at least for the first few years after the death of her husband.

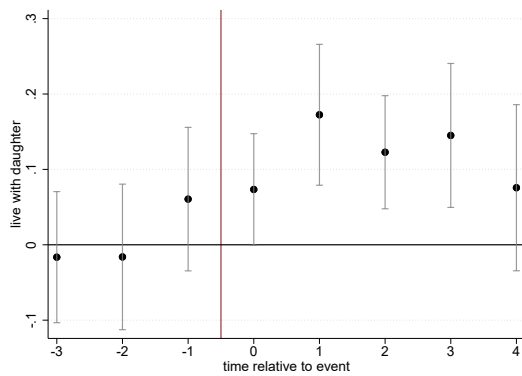
4.4 Financial Gifts

In addition to the insurance mechanism through family labor supply, we examined how widows may receive financial support from their children or other individuals in the com-

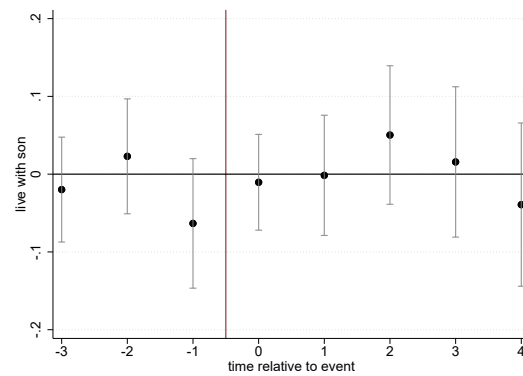
⁸According to the Thai Labor Force Survey, the share of married women among the female aged 35–50 years old between 2004–2018 is about 80 percent. Since the number is not close to 100 percent, we are unable to rule out the possibility that the responsibility on widows falls on either the single or married daughters.



(a) Live with child



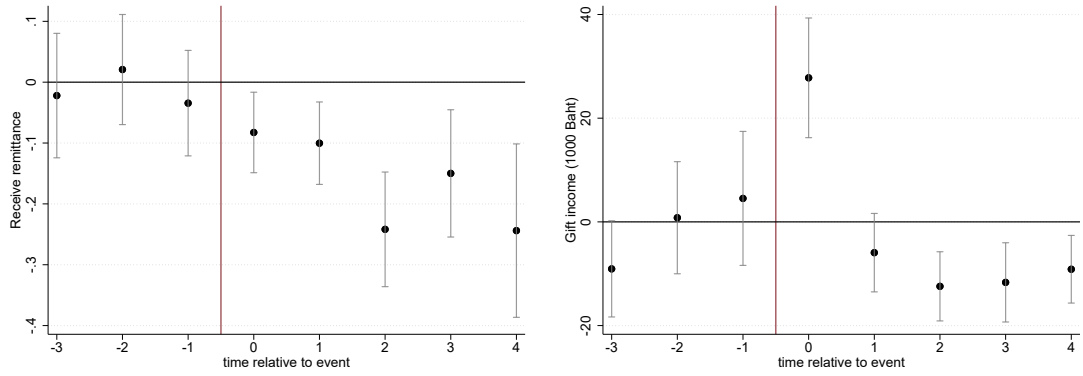
(b) Live with daughter



(c) Live with son

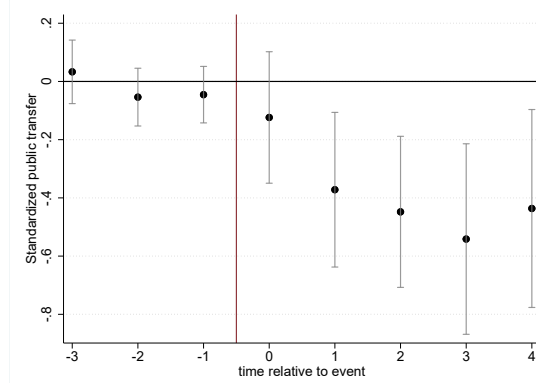
Figure 9: Changes in living arrangement

Notes: These figures report the coefficient estimates on changes in the probability for widows to live with a child (Figure a), a daughter (Figure b), or a son (Figure c). All specifications control for wife or husband's year of birth by interacting them with year dummies. The 90 percent confidence interval is calculated based on standard errors clustered at household level.



(a) Receive any remittance

(b) Total household gift income



(c) Public transfer

Figure 10: Changes in financial transfer: widow households

Notes: These figures report the coefficient estimates on changes in the probability for widows to receive any remittance (Figure a), the amount of gift income (Figure b), and the public transfer standardized by yearly average and standard deviation (Figure c). All specifications control for wife or husband’s year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

munity.

First, we investigated the changes in the probability of receiving remittance from children living outside the household. There was a decrease in the probability of receiving remittance by 10–30 percentage points (Figure 10). However, this is not unexpected since our findings revealed children moved in with their mother after their father’s death (Figure 9). A decrease in the occurrence of remittance implied children labor supply could substitute remittance.

We also examined if widows receive other monetary gifts from outside the household. The gift income variable includes transfer households receive as a gift, including those received through religious ceremonies. Compared to the control households, the amount

of gift income per year in widow households was on average 28,000 Baht higher in the year the husband passes away. (Figure 10b).⁹ However, the amount in subsequent years seem to offset the surplus amount. The aggregated effect on the amount of gift income was also negative, implying that the gift transfer was also adjusted following the reduction in the number of household members.

The result indicates while non-family members may play a role in the short run insurance mechanism through monetary gifts, assistance in the long run comes from household members through labor supply and coresidence.

4.5 Public Transfer

Besides support from other household members and friends and neighbors, the government or local authorities may support widow households through social security survivor benefits, mitigating the negative effect. The Thai social security program pays survivor benefits to widows and widowers immediately after the death of a covered worker. We examined how the amount of the public assistance changes around the event of death.

Our findings showed the amount of public transfer decreased by up to 0.6 standard deviation in widow households, compared to continuing couples (Figure 10c). This could be because the measure for the government transfer constituted not only financial support in the event of death, but also payment from the retirement fund, social security, and other cash transfer programs. As a result, since the survivor benefits were given in lump sum in the year of death, explaining the delay in the drop of public transfer.

The decrease in the amount of public assistance suggested government assistance was unlikely to play the role in mitigating the negative shock faced by Thai widow households. If anything, the reduction in public assistance in widow households was a consequence of the death of male spouses. In other words, in marriage, public transfer to husbands insure wives against lower earnings.

Our result contradicted findings in Burkhauser et al. (2005), where it is found the rise in social security benefits was the largest source of increase in income among widows in

⁹It is customary in Thailand for funeral attendees to gift the host some amount of money (Knodel and Im-Em, 2004; Morgan, 2020).

the United States, Germany, Great Britain, and Canada. This could be attributed to the fact that the Thai social security survivor benefits are less generous, offering only one-time payment immediately after death, resulting in the reduction in retirement benefits driving the decline.

5 Results of Widower Households

Many studies on widowhood have shown there are some gender differentials, with widows facing worse economic experience (Holden and Smock, 1991; Zick and Smith, 1991; Streeter, 2020). However, as shown in Figure 3b, the impact of female deaths could not be isolated from the decrease in household income for most of the widower households. This could be because most wives are younger than their husbands (Figure A6), so husbands surviving by their wives may be closely associated with other socio-economic factors. This is confirmed when no pre-trends in income was found when restricting the sample to only couples with wives older or same age as husbands (Figure A18).

Therefore, in this section, we investigate the effects of spousal death on widower households from two perspectives: first, using the entire widower sample, and second, focusing on widowers whose wives were older or of the same age.

5.1 Overall effects on widowers

Changes in consumption, saving, and widower's labor supply are reported in Figures A8, A9, and A11. Unlike widow households, there was no evidence in the decline for rice production, meat consumption per head, or savings. Widowers were also more likely than male who continue to be married to abandon household employment and become inactive.

Next, we examined the living arrangement of widowers. Similar to widows, widowers were more likely than married males to live with child after the death of his wife (Figure A15a). However, there was also an increase in the probability of coresidence even before the death of his wife, implying that children may substitute their sick mother in taking care of their father and the household, supporting the hypothesis that children also serve

as a caretaker for their widowed parents. Like widow households, the role was more likely to fall on daughters rather than sons (Figures A15b–c).

Unlike widow households, children who moved in with their father did not become employed in the household business. Results suggested when they moved in with their father before their mother’s death, they were employed in the household business (Figure A16c). However, after their father became inactive, they switched to market employment (Figure A16b). Note that this may be an intergenerational consequence of a decline in income.

Like widow households, a reduction in remittance was also observed (Figure A17a), but unlike widow households, there was no evidence for an increase in gift income in the year of death (Figure A17c). The decline in the amount of government assistance for widowers could also not be observed, suggesting that payment from social security or retirement funds was more likely to be attached to the male partner, as there was a decrease in the public transfer in widow households (Figure A17e).

However, it should be noted that overall effects on employment of widowers may be potentially confounded by the negative income effect prior to the death of the female partner. To further tackle this issue, in the next subsection, we restricted the sample of widowers to only those with older or same-age wives.

5.2 Effects on widowers with older or same-age wives

Although we could not deny the possibility that the decline in income prior to death could be correlated with most female deaths, restricting the sample to only households with wives older or same age as the husband showed no evidence for the association between a decline in income and death (Figure A18a), indicating that female deaths could be correlated with the decrease in income when the wife is younger than her husband.

Employing such sample restriction, we attempted to draw causal inferences in the responses of widowers. Results showed widowers with older or same-age wives transitioned from household employment to becoming inactive (Figure A19). There was a statistically significant decrease of about 20 percentage points in the probability of the widowers being

engaged in household employment. Although the effect was less precisely estimated, there was also an increase in the probability of them being inactive.

Our results were somewhat similar to findings in Fadlon and Nielsen (2021), where it is found there was an asymmetry in the labor supply decision of the survivor, with Danish widowers decreasing their labor supply and widows increasing theirs. On a similar note, we found that Thai widows continued supplying labor, transitioning from unpaid family workers to business owners, and widowers decreased their labor force participation. Fadlon and Nielsen (2021) interpret the asymmetry as the income effect, with widowers withdrawing from the labor market because they have one less mouth to feed.

Besides the labor supply response, we also considered effects on gift income and public transfer of widowers who had older wives. Unlike widow households who experienced an increase in gift income and a decrease in public transfer, there was no discernible effect on the two outcomes for widowers (Figure A17).

In conclusion, after mitigating the endogeneity of female deaths, there was still an increase in the probability of dropping out of the labor force for widowers, but little effects on gift income or public transfer. Different labor responses may also be attributed to gender differences in bereavement. For instance, females may be more likely to cope with grief by continuing their routines, while males may withdraw. Evidence on gender differences in bereavement is mixed. While some qualitative studies have shown widowers are more likely to become distressed and isolated after the loss of their spouse (Berardo, 1970; Post, 1965), some suggest there was no systematic difference (Feinson, 1986). To better investigate the source of this asymmetry, in the next section, we show the impact heterogeneity across initial employment statuses of widows relative to their deceased husbands. If gender differences in bereavement behavior explain discrepancies in labor supply response, there should be no systematic difference between widows who were primary earners and those who were not.

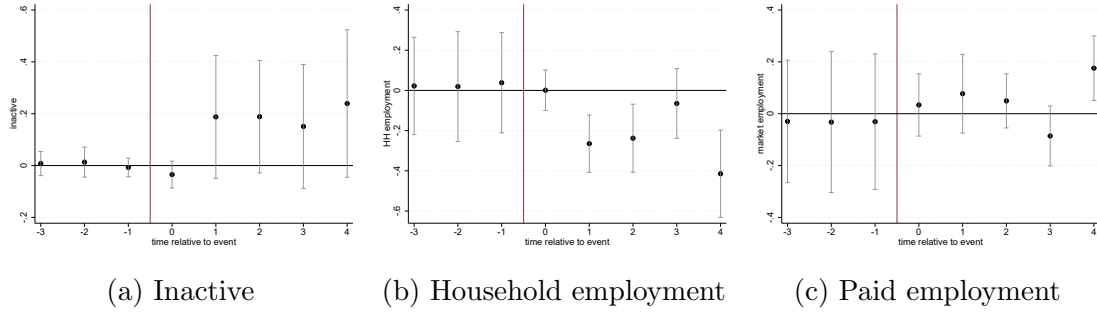


Figure 11: Labor supply of widowers: widowers with older or same-age wife

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the employment status of widows around the time of the event. The sample is restricted to widowers with an older or same-age wife. All specifications control for wife and husband’s year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

6 Effects on widows whose husbands were not primary earners

In this section, we investigate the labor supply response of wives in the event of their husband’s death when their husbands were initially not primary earners, that is, when widows themselves were primary earners, and when their child was the primary earner.

One direct method to determine the primary earner of the household is to calculate the share of income earned by each household member and examine impact heterogeneity based on the measure. However, this is a challenging exercise in our setting since most individuals are not involved in the formal labor market, and income is measured at the household level, making the majority of individual wage data unobserved.

To overcome the lack of individual wage measures, we determined the household’s primary earner using their employment status relative to other household members in 2008. The rationale for choosing the year 2008 is because all households were included in the survey only after 2008.¹⁰ First, we confirmed the robustness of the main results by restricting the sample to only households in which the husband was the primary earner,

¹⁰Recall the data collection started to cover all targeted provinces only after 2008. Therefore, the year that each household was first surveyed is different across households. As a result, including all households in the subset analysis based on predetermined household characteristics becomes complicated as it may be confounded with time-specific shocks. In order to mitigate the issue, we restricted the sample to only data from 2008 to 2015. Households that were treated before 2008 were also excluded. Restricting the sample in this way limited our effective sample size. Therefore, only aggregated effects were estimated.

Table 3: Employment of widows: wife was the primary earner in 2008

	(1)	(2)	(3)	(4)	(5)	(6)
	Inactive	HH emp	Paid emp	Inactive	HH emp	Paid emp
Treatment effect	0.287*** (0.018)	-0.396*** (0.037)	0.109*** (0.028)	0.162** (0.070)	-0.222*** (0.083)	0.061 (0.048)
Observations	235	235	235	368	368	368
Control mean	0.018	0.886	0.095	0.029	0.668	0.303
p-value of pre-trend test	0.586	0.160	0.582	0.576	0.041	0.088
Obs with wage observed	No	No	No	Yes	Yes	Yes

Notes: This table shows aggregated effects of spousal death on labor supply decision of widows. The sample is restricted to households with wife as the primary earner (in columns 1–3, wife is the business owner and husband is non-employed or an unpaid family worker, and in columns 4–6, those in the first three columns and wives who earn more than 1.5 times of their husband) in 2008. The sample includes only data from 2008–2015. Households that were treated before 2008 were also excluded. All specifications control for wife and husband’s schooling by interacting them with year dummies. Standard errors are in parenthesis and clustered by household. Significance levels are $*p < 0.1$, $**p < 0.05$, and $***p < 0.01$. *p-value of pre-trend test* is the p-value for the joint hypothesis test when the null hypothesis is there is no pre-trends.

i.e. the husband was the business owner and the wife was inactive or an unpaid family worker in 2008. Findings were similar to the main result, with the wife taking over the role of the household business owner (Table A1). This suggests that the main result was driven by this type of household.

Next, we turned to households in which the wife was the primary earner, i.e. the wife was the business owner and the husband was non-employed or an unpaid family worker in 2008. It was found the labor supply response of widows differed from the main outcome as widows became 30 percent less likely to be employed in the household business, but more likely to become inactive (Columns 1–3 of Table 3). This result was similar to findings in Fadlon and Nielsen (2021), in which it was found that the death of the wife results in the husband dropping out of the labor force. Results were also robust to including wives who earned more than husbands in 2008 (Columns 4–6 of Table 3).

Finally, we examined the labor supply response of widows when her child was the primary earner, i.e. her child was the business owner and the couple family workers, or the child employed and the couple non-employed in 2008. Findings showed there was no evidence for a change in the labor supply decision of widows after her husband’s death (Table A2), suggesting that when the husband was not the primary earner, the income

shock was not substantial enough for widows to alter her labor supply decision.

Results showed that widows had a different labor supply response when they were the primary earner, which is similar to responses of widowers who had older or same-age wives (Figure A19). These findings suggest there was a gain in the income available to the primary earner after the death of the secondary earner or the dependent causing them to consume more leisure.

7 Technical Limitations

In this section, we discussed technical limitations in our study.

7.1 Unobserved Month of Death

Our first technical limitation was due to the fact that the month of death was not observed in our data, and the survey was conducted on an annual basis.¹¹ Some respondents will have been widowed the entire or most of the year, but for others the death occurred some months later. Therefore, the average treatment effect in year 0, τ_0 , would be the average effect of all widows, regardless of the month of death. Hence, it is not unexpected that the estimated τ_0 's were smaller than the treatment effects in later years.

7.2 Attrition of the Treated Group due to Migration or Death

Our estimates could also be biased because of attrition of the treated group. If the probability of dropping out of the sample is positively correlated with death, and whether household drops out is influenced by the outcome variable, there is an endogenous sample selection issue. For instance, attrition due to migration may be expected especially when we have observed that adult children moved in with their widowed mother (Figure 9), it is highly possible that the opposite may happen: widows may migrate out of the Townsend villages after the death of her husband to live with their children. Similarly, attrition due to death of the widows may also be expected as many studies find adverse effects of

¹¹While the monthly Townsend data is available, no information on the family structure is recorded.

spousal death on the physical health and mortality of the survivor (Allegra et al., 2015; Ásgeirsdóttir et al., 2013; Buckley et al., 2011; Elwert and Christakis, 2008; Moon et al., 2014; Oliveira et al., 2014; Seifter et al., 2014; Stahl et al., 2016; Tseng et al., 2018).

Although our data does not allow us to distinguish between attrition due to migration and death, we may confirm the direction of the bias by examining the correlation between the probability of dropping out and whether the household experienced death, assuming that relocation or death of widows did not occur in the same year as the death of her husband. We found there was no systematic correlation between the two (Table A3). In addition, by dropping treated households that did not stay until the last year of the survey in 2015, we found there was no significant change in the effect size on the employment of other household member, suggesting that the bias was not substantial in our study (Figure A20).

7.3 Unobserved Death within the Control Group

Another issue arises because death was identified based on the change in head marital status over time, that is, head of the household changing between calendar year T and $T + 1$. However, if household dropped out in year $T + 1$, death could not be observed, and the household would be put in a control group. Generally, this would not pose a problem if there was zero pre-trends since the imputation method employs both yet-to-treat and never-treated households to fit the expected potential outcome $Y_{it}(0)$. Nevertheless, this may cause a problem if there were some anticipation effects.

We checked the possibility of this narrative by confirming drop out patterns among control households. Denoting the last year household i was surveyed as LY_i , we estimated the following equation using the sample of control households that dropped out before the last year of the survey in 2015:

$$\mathbb{I}(\text{report health issue})_{it} = \alpha + \sum_{k=0, k \neq 5}^{6+} \beta^k \mathbb{I}(k = LY_i - t) + \phi_i + \phi_t + \epsilon_{it} \quad (5)$$

Among control households that dropped out before the last year of the survey in 2015,

compared to five years before, there was an increase in the probability of reporting illness as one of the issues that affected household income one year before the drop out (Figure A21). Although the increase was not statistically significant, this suggests there may be death that were unobserved among control households.

To better ensure we have a clean control group, control households that dropped out of the sample before 2015 were omitted from the sample. Results showed the baseline estimates were still robust to the modification of the control group (Figure A20).

7.4 Unobserved Death outside the Sample

Similar to the previous point, since death was only identified based on the marital status of the household head and the relation-to-head variable, if death occurred, but the head changed to other household member that was not the spouse of the head, the household would not be included in the analysis sample. This suggests our estimates are the upper bound effect of the estimate that included households that the household head became other household members other than the spouse of the head.

Since individual identifier was not available in the data, we checked the possibility of this issue by matching individuals based on their year of birth, sex, and highest educational attainment. We found this would pose only a small problem, since there were only 5 households (55 observations) that the head been replaced by someone else that was not the spouse of the original head. This number is not substantial compared to about 233 households that switched to a male or female widowed head.

7.5 Comparison with Alternate Estimators

One of the main concerns in the difference-in-difference literature is when units are treated at different times, or so-called the staggered design setting. Comparing the outcome of units that were treated earlier to those that were treated later poses an identification problem (Goodman-Bacon, 2021; De Chaisemartin and d’Haultfoeuille, 2020). While our main estimates employed the imputation estimator proposed by Borusyak et al. (2021), many estimators were also developed in the recent difference-in-differences literature.

Firstly, we checked the robustness of the result using the conventional event study method. More specifically, we estimated the following equation,

$$Y_{it} = \alpha + \sum_{h=-3}^4 \tau_h \mathbf{1}[K_{it} = h] + \tau_{5+} \mathbf{1}[K_{it} \geq 5] + \tau_{-5+} \mathbf{1}[K_{it} \leq -5] + X_{it} \times \phi_t \gamma + \phi_i + \phi_t + \tilde{\epsilon}_{it}, \quad (6)$$

where K_{it} is the relative time to the event, and period -4 was used as the reference level.

Compared to the baseline estimates, the coefficients using the conventional event study method showed slightly smaller results (Figure A22), but the differences were not substantial, suggesting the issue on treatment effect heterogeneity was minimal in our setting.

We also compared our estimates to that of De Chaisemartin and d’Haultfoeuille (2020). Results were robust to an alternate estimator, with the estimates from the Borusyak et al. (2021) yielded slightly smaller effect size (Figure A22).

8 Conclusion

This study examined the impact of spousal death on households in Thailand, where there is a limited survivor benefits coverage by analyzing a unique household panel data set from the Townsend Thai Data Collection.

For widow households, there was a decline in earned income and a temporary decrease in savings after the spousal death. However, the earned income per capita did not show a persistent reduction. Widow households managed to maintain their consumption levels, although meat consumption per person declined.

The study identifies several coping mechanisms used by widow households. Widows transitioned from being unpaid family workers to becoming business owners, and they relied on the assistance of children and other relatives in the household business, mainly with daughters taking on a significant role.

The research also investigated insurance mechanisms outside the household, such as remittances, gifts, and public assistance. It was found that coresidence replaced remittances in widow households, and while there was an increase in gift income in the year of the husband’s death, this support did not continue afterward. Public transfers also

decreased after the husband's death, indicating that they were linked to the deceased spouse.

On the other hand, widower households experienced a decline in earned income and earned income per capita even before the event of death, suggesting that deaths of female spouses may result from income reduction. This aligns with the fact that wives are typically younger than their husbands, and their deaths are considered premature and correlated with a decline in household income, making it impossible to disentangle between the effect of the income reduction and death per se.

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A Figures and tables appendix



Figure A1: Geographical location of provinces surveyed

Notes: This figure shows the geographical location of provinces surveyed in the Townsend Thai Annual Household Survey. The provinces surveyed are highlighted in gray.

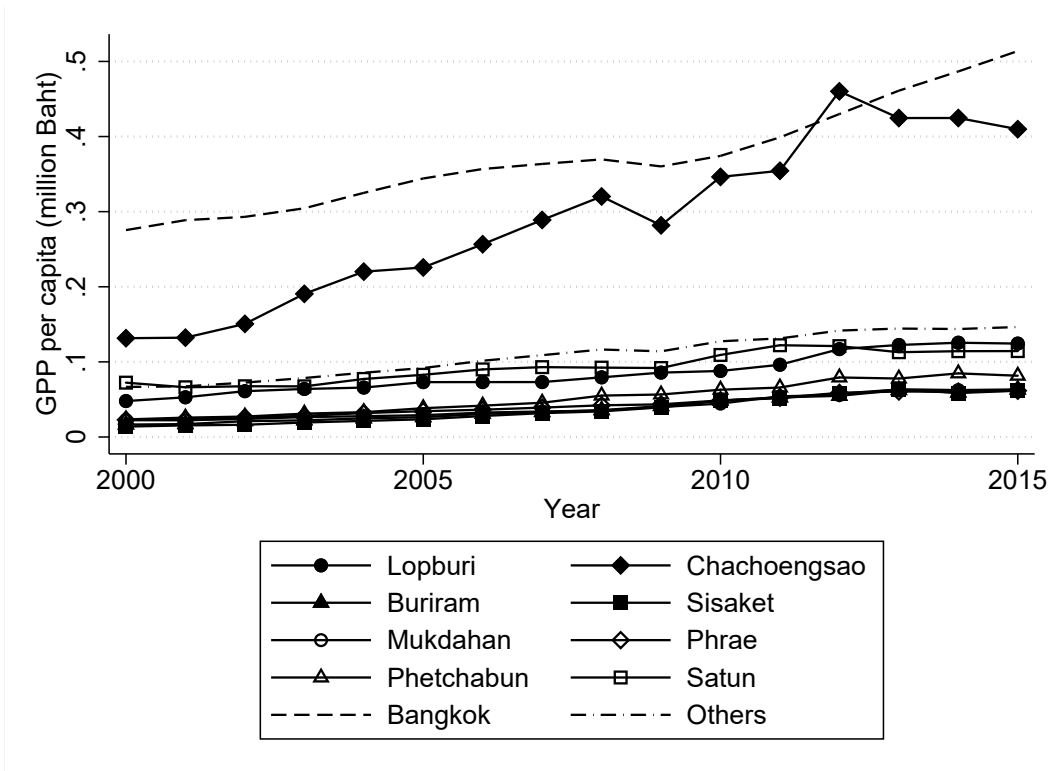


Figure A2: Gross provincial product per capita of provinces surveyed VS the rest of the country

Notes: This figure compares the gross provincial product (GPP) per capita in million Thai Baht over 2000–2015 in provinces covered by the Townsend Thai Annual Household Survey and those not surveyed. The GPP of the surveyed province is in solid line whereas that of Bangkok is in dashed line, and the average GPP of other provinces besides Bangkok and the surveyed provinces is in dashed-dotted line.

Source: Office of the National Economic and Social Development Council

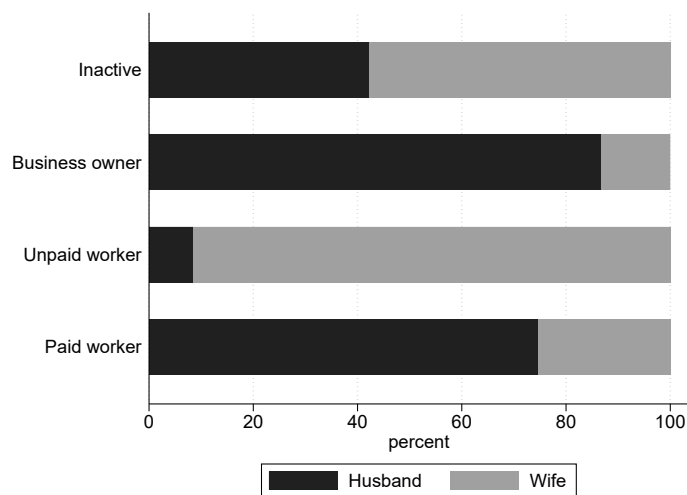


Figure A3: Male ratio at each employment status

Notes: This figure compares the male ratio across employment statuses. The sample is restricted to only married individuals who were born between 1920–1949.

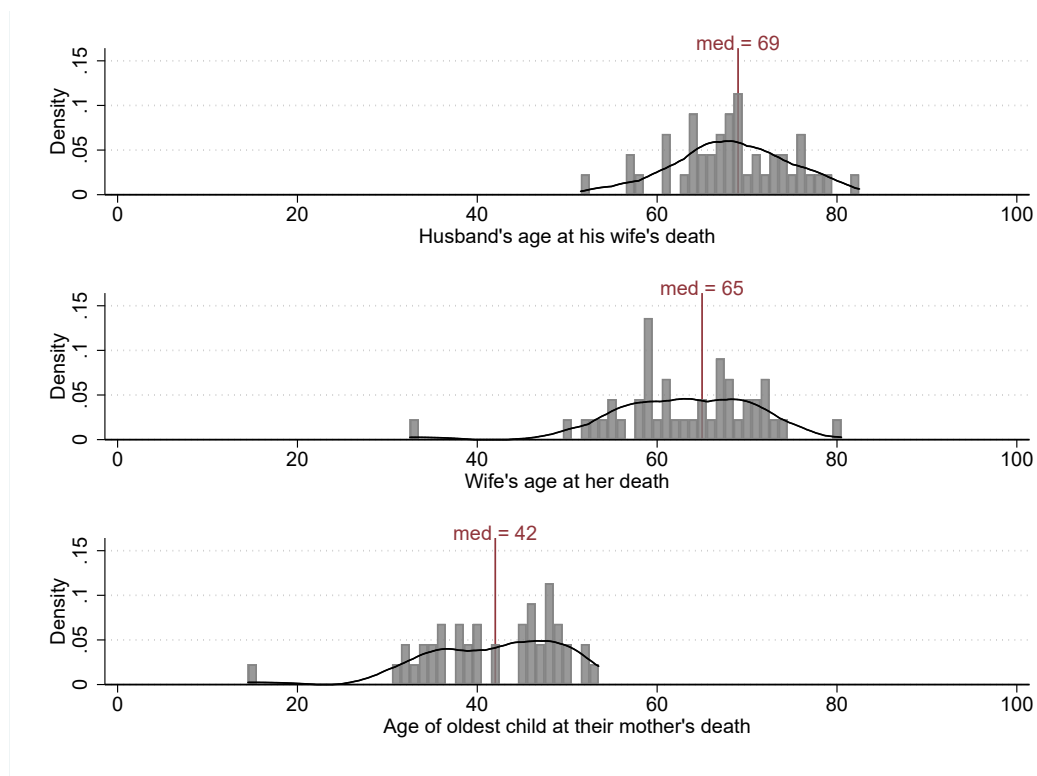


Figure A4: Age of family members in widower households in the year of death

Notes: This figure shows distributions of age of family members in widower households in the year of death.

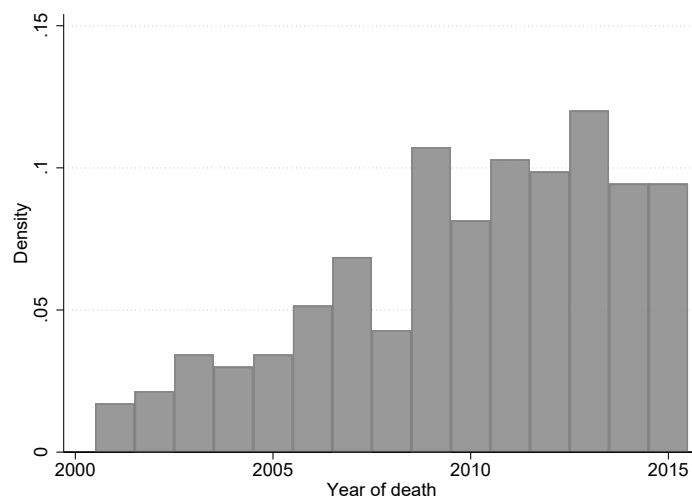


Figure A5: Distribution of the year of death

Notes: This figure plots the histogram of the year of death of the male head or his spouse.

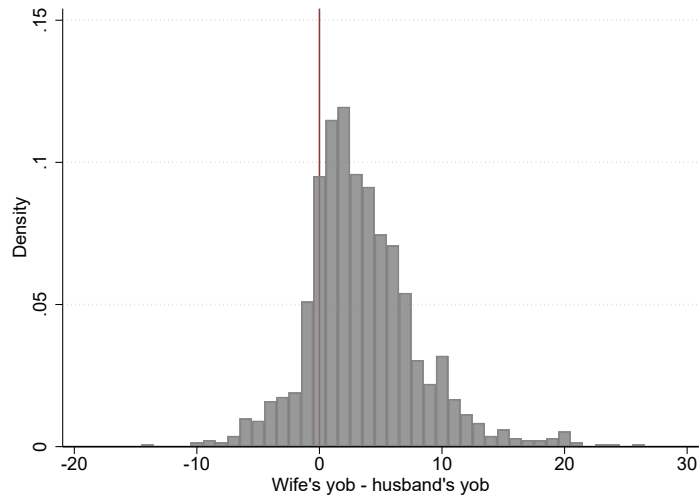


Figure A6: Distribution of the age difference within couple

Notes: This figure plots the histogram of the age difference between husbands and wives.

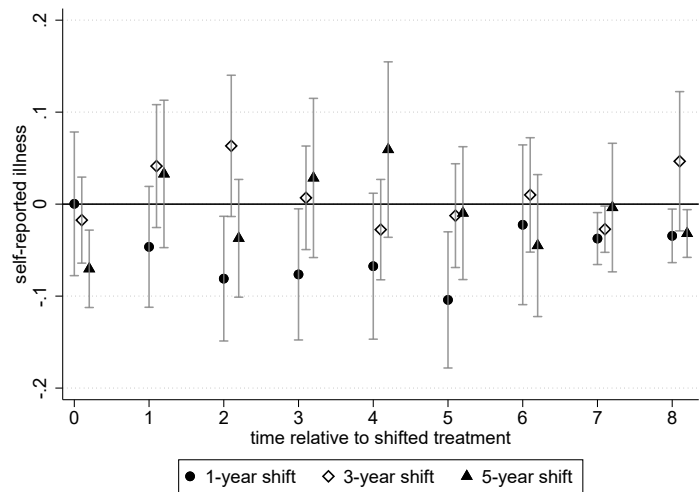
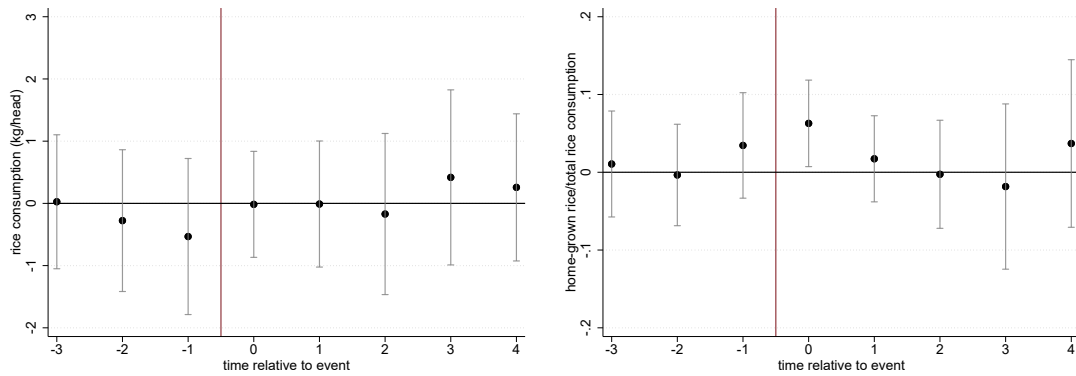


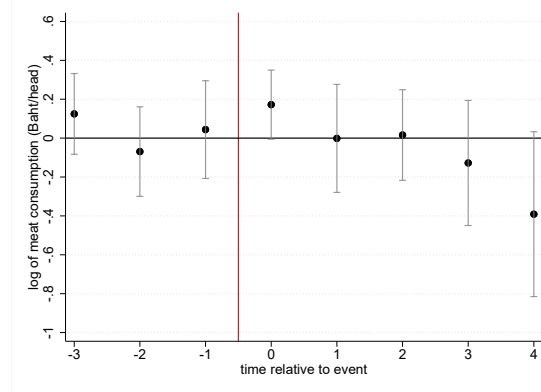
Figure A7: Coefficient of shifted event on self-reported health issues

Notes: This figure reports the coefficient estimates and 90 percent confidence interval of the probability of households reporting having health issues, shifting the event date one, three, and five years before the actual death. The sample is restricted to widowers. All specifications control for wife and husband's year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.



(a) Rice consumption (kg/head)

(b) Rice production



(c) Meat consumption (Baht/head)

Figure A8: Changes in household consumption and production: widower households

Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the monthly rice consumption per head (Figures a–b), the share of consumed rice which was produced in the household to total rice consumption (Figures c–d), and meat consumption (Figures e–f). All specifications control for wife and husband’s year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

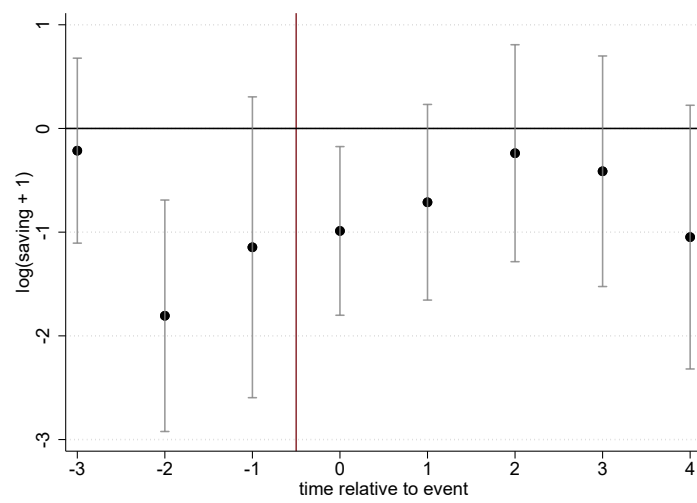
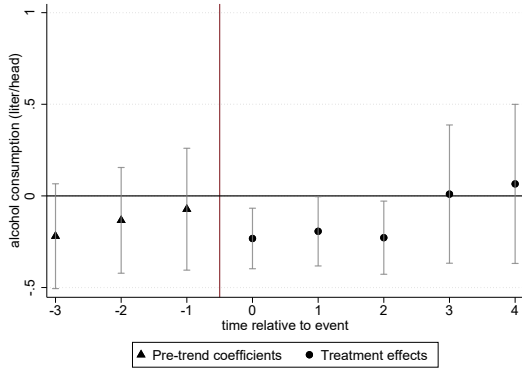
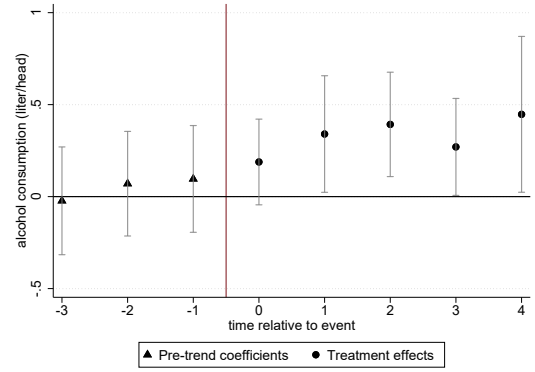


Figure A9: Changes in household savings: widower households

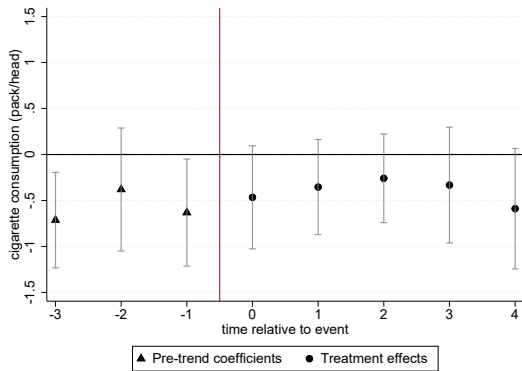
Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the log of household savings. All specifications control for wife and husband's year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.



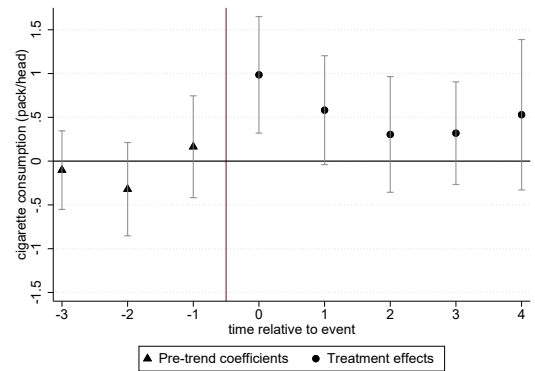
(a) Alcohol consumption (liter/head) in widow households



(b) Alcohol consumption (liter/head) in widower households



(c) Cigarette consumption (pack/head) in widow households



(d) Cigarette consumption (pack/head) in widower households

Figure A10: Changes in household alcohol and cigarette consumption

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the monthly consumption of alcohol, and cigarette in households of widows and widowers. All specifications control for wife and husband's year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

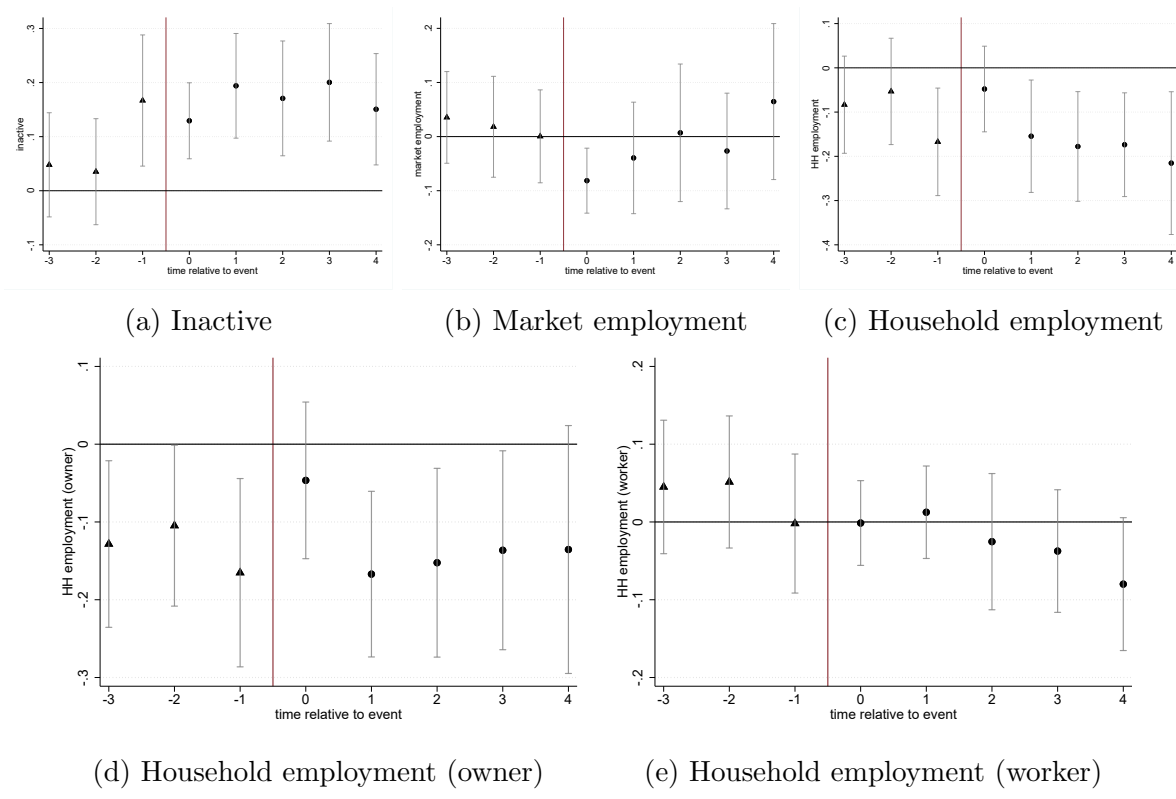


Figure A11: Employment of widowers

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the employment status of widows around the time of the event. All specifications control for wife and husband's year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

Table A1: Employment of widows: husband was the primary earner in 2008

	(1)	(2)	(3)	(4)	(5)
	Inactive	HH emp	Paid emp	HH emp (owner)	HH emp (worker)
Treatment effect	-0.008 (0.034)	-0.053 (0.044)	0.061* (0.034)	0.463*** (0.077)	-0.515*** (0.076)
Observations	2,056	2,056	2,056	2,056	2,056
Control mean	0.050	0.922	0.028	0.113	0.809
p-value of pre-trend test	0.537	0.264	0.187	0.619	0.159

Notes: This table shows aggregated effects of spousal death on labor supply decision of widows. The sample is restricted to households with husband as the primary earner (husband is the business owner and wife is non-employed or an unpaid family worker) in 2008. The sample includes only data from 2008–2015. Households that were treated before 2008 were also excluded. All specifications control for wife and husband’s schooling by interacting them with year dummies. Standard errors are in parenthesis and clustered by household. Significance levels are $*p < 0.1$, $**p < 0.05$, and $***p < 0.01$. *p-value of pre-trend test* is the p-value for the joint hypothesis test when the null hypothesis is there is no pre-trends.

Table A2: Employment of widows: child was the primary earner in 2008

	(1)	(2)	(3)	(4)	(5)
	Inactive	HH emp	Paid emp	HH emp (owner)	HH emp (worker)
Treatment effect	0.061 (0.063)	-0.062 (0.062)	0.001 (0.006)	0.001 (0.003)	-0.063 (0.062)
Observations	227	227	227	227	227
Control mean	0.206	0.603	0.192	0.037	0.565
p-value of pre-trend test	0.553	0.549	0.631	0.660	0.527

Notes: This table shows aggregated effects of spousal death on labor supply decision of widows. The sample is restricted to households with child as the primary earner (child is the business owner and the couple family workers, or the child employed and the couple non-employed) in 2008. The sample includes only data from 2008–2015. Households that were treated before 2008 were also excluded. All specifications control for wife and husband’s schooling by interacting them with year dummies. Standard errors are in parenthesis and clustered by household. Significance levels are $*p < 0.1$, $**p < 0.05$, and $***p < 0.01$. *p-value of pre-trend test* is the p-value for the joint hypothesis test when the null hypothesis is there is no pre-trends.

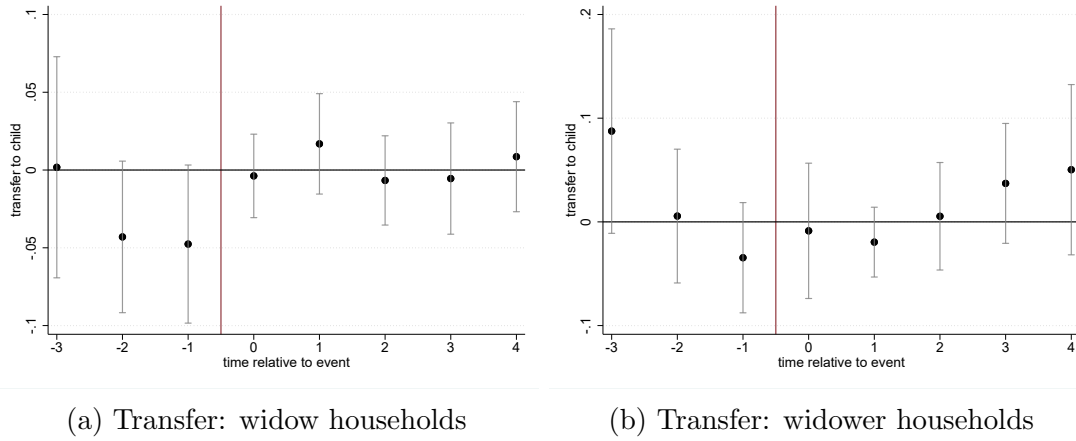


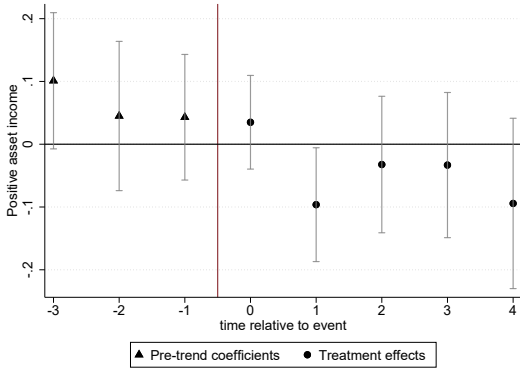
Figure A12: Changes in the probability of monetary transfer to children

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the probability of sending money to children. All specifications control for wife and husband's year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

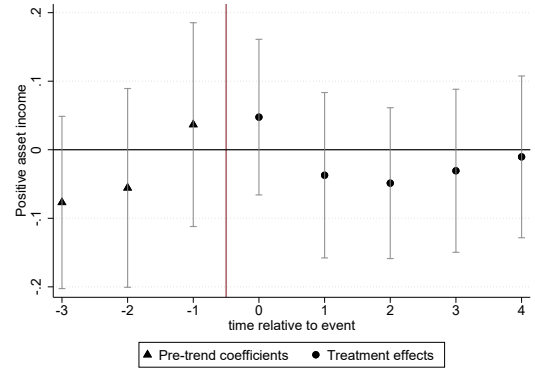
Table A3: Effects of death on the probability of dropping out of the sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop	Drop
Spousal death	-0.003 (0.042)	0.054 (0.040)	0.020 (0.041)						
Husband's death				-0.063 (0.059)	0.000 (0.054)	-0.040 (0.053)			
Wife's death							-0.016 (0.067)	-0.005 (0.063)	-0.011 (0.063)
Observations	590	590	590	397	397	397	549	549	549
Sample	full	full	full	widows	widows	widows	widowers	widowers	widowers
R-squared	0.000	0.303	0.320	0.003	0.376	0.407	0.000	0.312	0.317
Area cont.		X	X		X	X		X	X
YOB cont.			X			X			X
Dep var mean	0.251	0.251	0.251	0.270	0.270	0.270	0.242	0.242	0.242

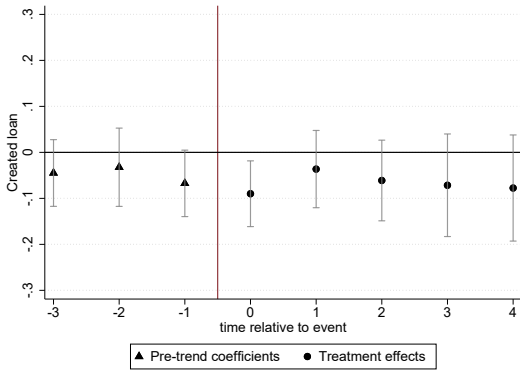
Notes: This table shows the correlation between death and the probability of dropping out of the sample. All specifications control for wife or husband's year of birth. Significance levels are * $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$.



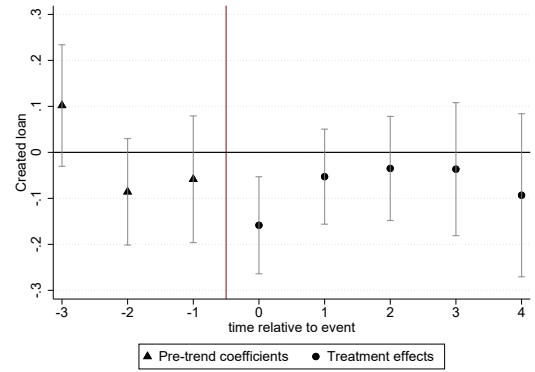
(a) Asset liquidation of widow households



(b) Asset liquidation of widower households



(c) Borrowing behavior of widow households



(d) Borrowing behavior of widower households

Figure A13: Changes in the probability of liquidating asset and borrowing behavior

Notes: These figures report the coefficient estimates with 90 percent confidence interval of changes in the probability of having positive asset income (Figures a and b) and the probability of creating new loans in the past year (Figures c and d) in widow and widower households. All specifications control for wife or husband's year of birth by interacting them with year dummies. The 90 percent confidence interval is calculated based on standard errors clustered at household level.

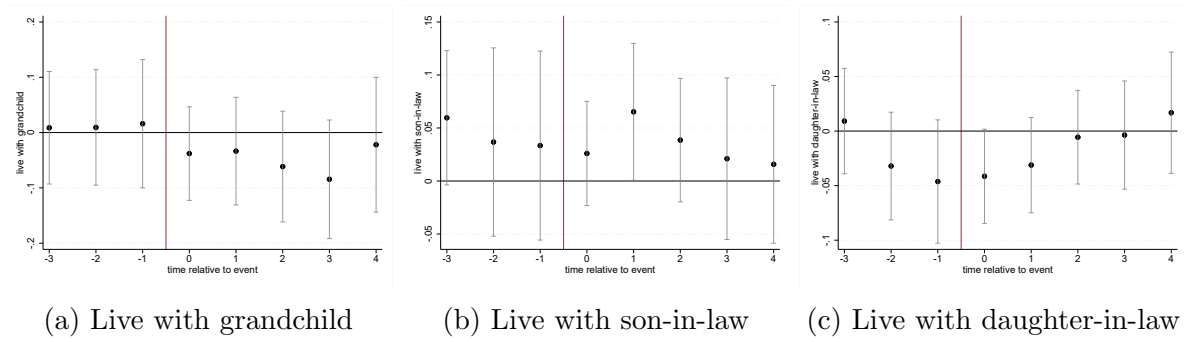


Figure A14: Changes in living arrangement of widows

Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the probability for widows to receive any remittance (Figure a), the amount of gift income (Figure b), and the probability of reporting receiving any financial assistance from neighbors (Figure c). All specifications control for wife or husband's year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

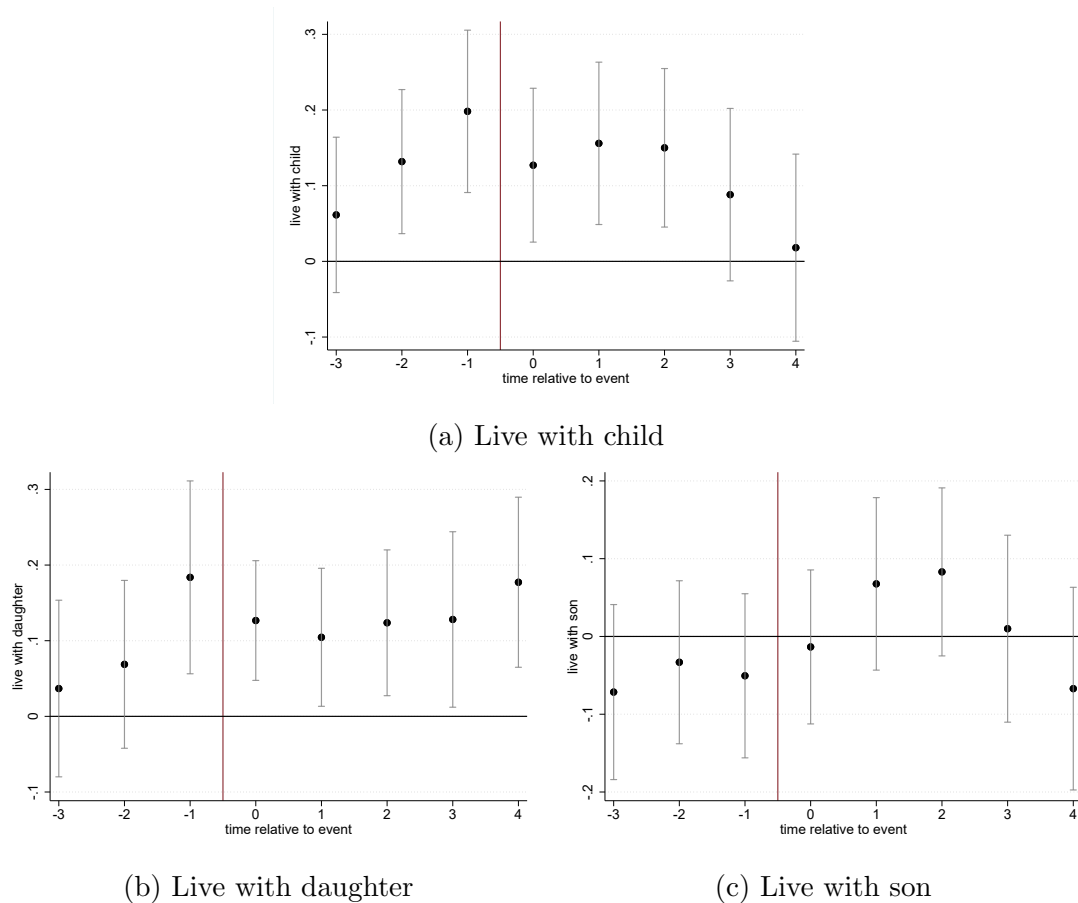
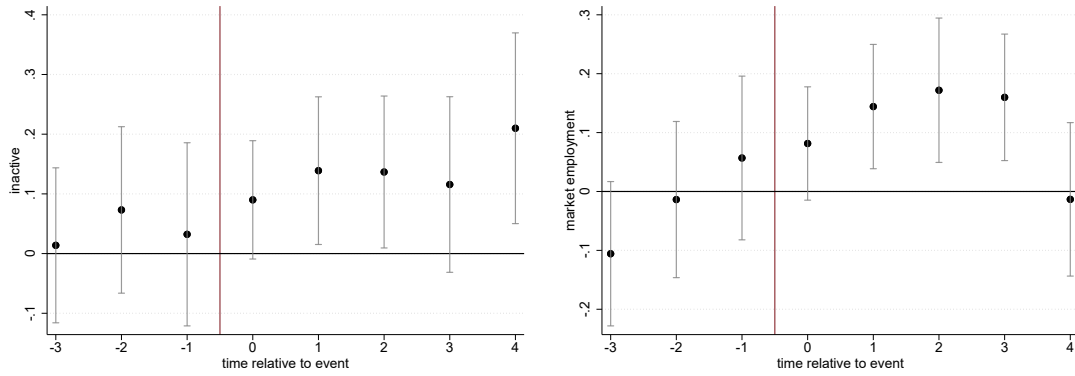


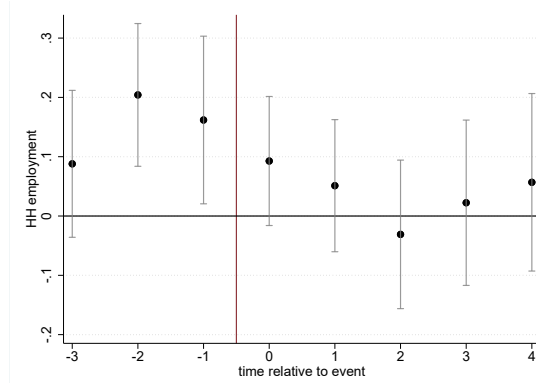
Figure A15: Changes in living arrangement: widower households

Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the probability for widowers to live with a child (Figure a), a daughter (Figure b), or a son (Figure c). All specifications control for wife or husband's year of birth by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.



(a) Inactive

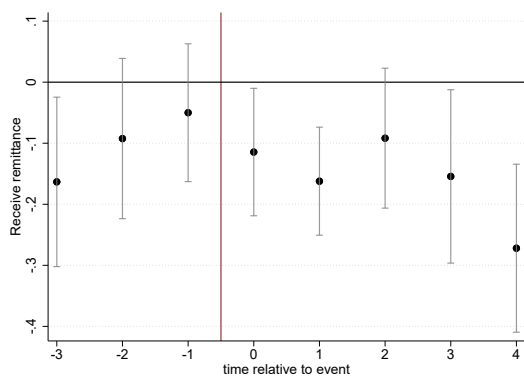
(b) Market employment



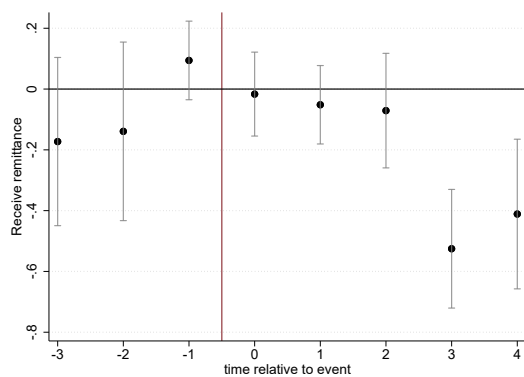
(c) Household employment

Figure A16: Employment of other household members: widower households

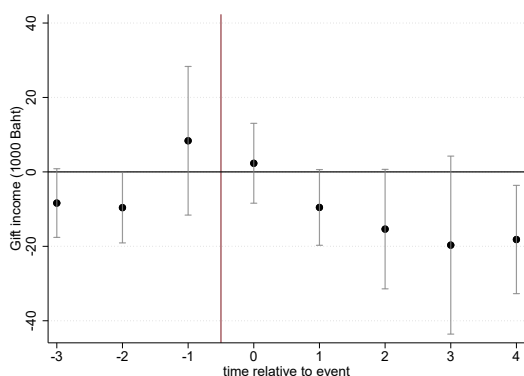
Notes: These figures report the coefficient estimates and 90 percent confidence interval on changes in the employment status of other household members in widower households around the time of the event. All specifications control for wife and husband's year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.



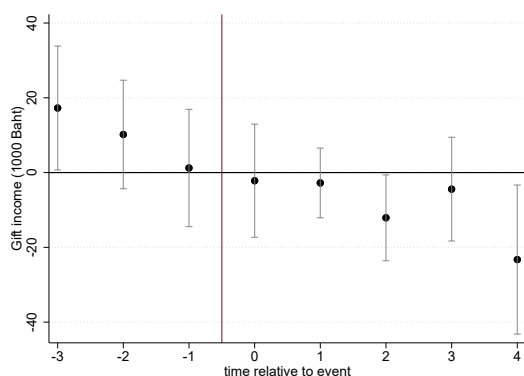
(a) Receive any remittance



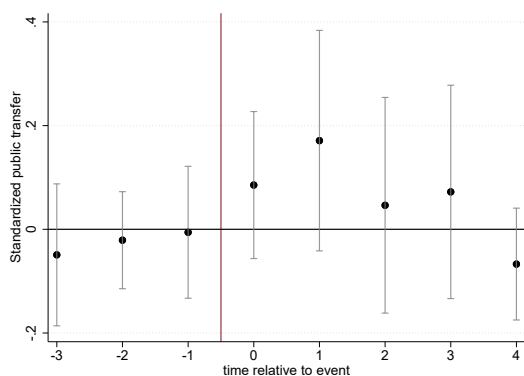
(b) Receive any remittance: widowers with older or same-age wives



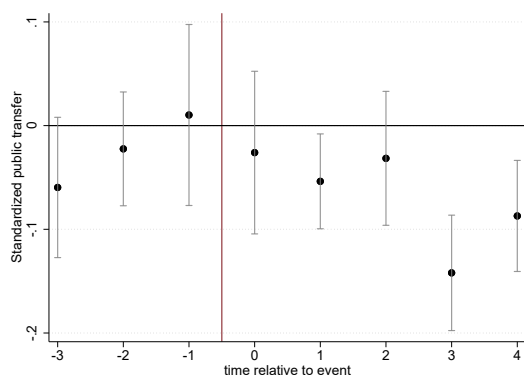
(c) Gift income



(d) Gift income: widowers with older or same-age wives



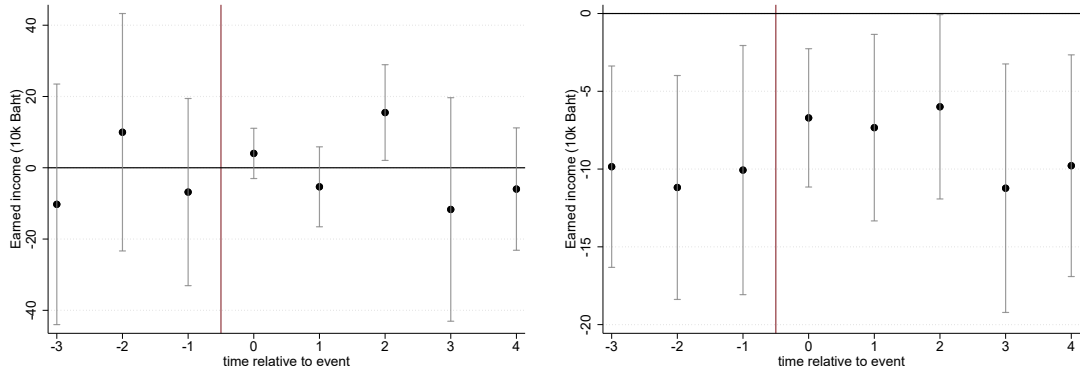
(e) Public transfer



(f) Public transfer: widowers with older or same-age wives

Figure A17: Changes in financial transfer: widower households

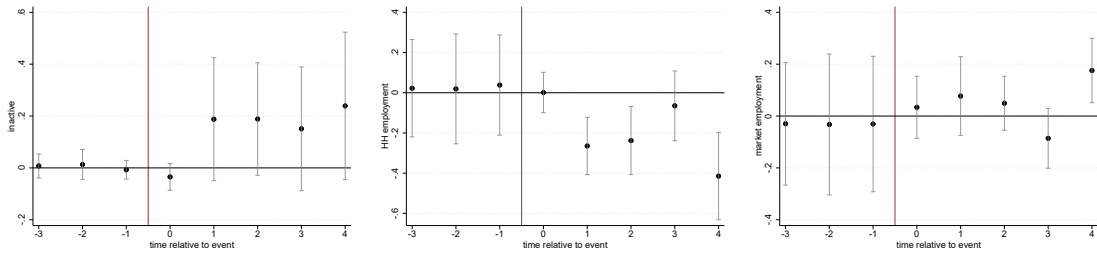
Notes: These figures report the coefficient estimates on changes in the probability for widows to receive any remittance (Figures a–b), the amount of gift income (Figures c–d), and the public transfer standardized by the yearly average and standard deviation of all households (Figures e–f). All specifications control for wife or husband’s year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.



(a) Households with older or same-age wife (b) Households with younger wife

Figure A18: Income effects: households with younger VS older wife

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the earned income of households, comparing couples with the wife older than the husband and vice versa. The earned income refers to the sum of the salary income and business income of the household over the past year. All specifications control for wife or husband’s year of birth by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.



(a) Inactive (b) Household employment (c) Paid employment

Figure A19: Labor supply of widowers: widowers with older or same-age wife

Notes: These figures report the coefficient estimates and 90 percent confidence interval of changes in the employment status of widows around the time of the event. The sample is restricted to widowers with an older or same-age wife. All specifications control for wife and husband’s year of birth and schooling by interacting them with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

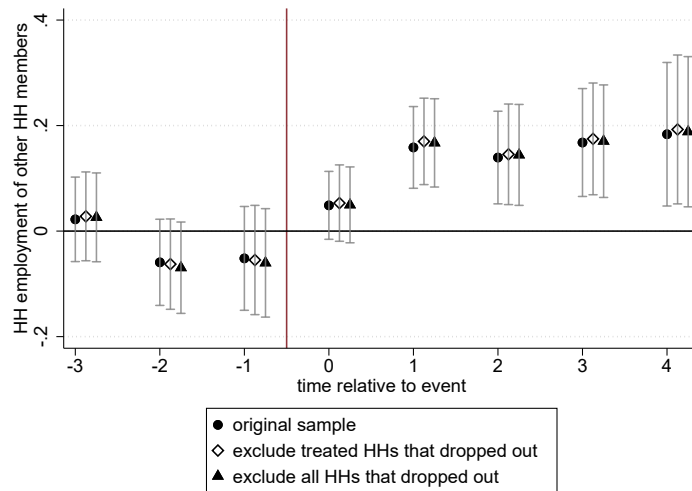


Figure A20: Estimates excluding households that dropped out

Notes: This figure reports the coefficient estimates and 90 percent confidence interval on the probability of having other individuals in the widow household being employed in the household, using the original sample, a sample excluding treated households that dropped out before the last year of the survey, and a sample excluding all households that dropped out before the last year of the survey. All specifications control for wife or husband's year of birth and schooling interacting with year dummies. The confidence interval is calculated based on standard errors clustered at household level.

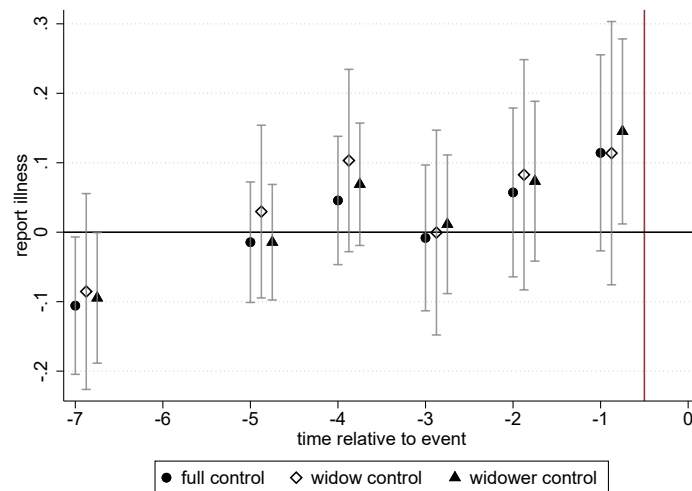


Figure A21: Probability of reporting illness before dropping out: control households

Notes: This figure reports the coefficient estimates and 90 percent confidence interval on the probability of reporting illness of any household members relative to the time of drop out within the control observations that dropped out before the last year of the survey in 2015. The vertical line represents the drop out.

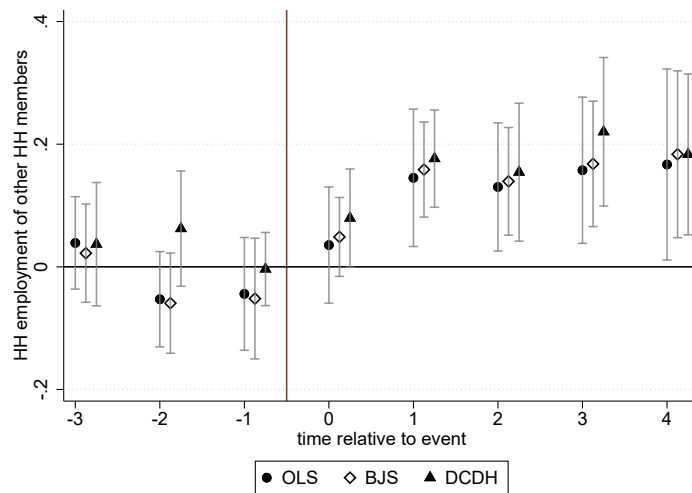


Figure A22: Comparisons across various difference-in-differences estimates

Notes: This figure reports the coefficient estimates and 90 percent confidence interval on the probability of having other household members employed in the household business. All specifications control for wife and husband's year of birth and schooling interacting with year dummies. OLS refers to the estimates from the conventional event study method, BJS that from the method proposed by Borusyak et al. (2021), and DCDH that from the method proposed by De Chaisemartin and d'Haultfoeuille (2020). The confidence interval is calculated based on standard errors clustered at household level.