Effects of Parental Death on Labor Market Outcomes and Gender Inequalities*

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Abstract

Nearly everyone experiences the death of a parent in adulthood, but little is known about the effects of parental death on adult children's labor market outcomes and the underlying mechanisms. In this paper, we use Danish administrative data to examine the effects of losing a parent on individual labor market outcomes and its contribution to gender earnings inequalities. Our empirical design leverages the timing of sudden, first parental deaths, allowing us to focus on the health and family support channels. Our findings reveal enduring negative effects on the earnings of both adult sons and daughters: sons' earnings drop by 2% in the fifth year after parental death, while daughters' earnings drop by 3% during the same period. Exploring the underlying mechanisms, we observe that both women and men experience increased mental health issues after parental loss, albeit manifesting differently: women tend to seek psychological assistance more frequently, while men receive more mental health-related and opioid prescriptions. Furthermore, we find that women with young children experience a comparatively larger drop (around 4%) in earnings after parental death due to the loss of informal childcare, a factor that significantly contributes to the gender pay gap. Lastly, we show that women experience a greater decline in earnings if their surviving parent requires higher levels of eldercare. These findings collectively underscore a substantial labor market penalty for individuals who experience parental death and emphasize the role of informal care in contributing to gender pay disparities.

JEL classifications: D64, J10, J16

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"Death ends a life, but it does not end a relationship, which struggles on in the survivor's mind toward some final resolution, some clear meaning, which it perhaps never finds." (Anderson, 1968)

1 Introduction

Due to the age difference between parents and children, nearly everyone experiences the loss of a parent at some point in life. Parental death is most likely to occur when children reach adulthood, with 96% of the Danish population experiencing their first parental death at age 18 or older (Figure A.1). Given its prevalence, even small effects of parental death on individuals will have a substantial impact on aggregate economic outcomes. In this paper, we investigate how parental death influences individual earnings and emphasize its impact through the mental health and family support channels. In addition, we examine the long-term effects of parental death and explore the interaction effects between parents and children based on gender within each operative channel. The combination of the prevalence of parental death in children's adulthood and its enduring effects significantly contributes to aggregate gender inequality in the labor market. Although parental death is ultimately unavoidable, understanding the mechanisms by which it affects labor market outcomes and gender inequalities can empower policymakers to design policies to address the negative consequences of parental death on labor market outcomes and subsequent gender inequalities; such policies are currently rare and tend to be modest.[1]

The impact of parental death on individual labor market outcomes and gender inequality can be influenced by multiple mechanisms. First, bereavement can give rise to mental health crises (van den Berg *et al.*, 2017). Research by psychologists suggests that women are more prone to internal disorders, such as depression and anxiety, whereas men tend to exhibit more external disorders, such as substance abuse and antisocial behavior (Rosenfield and Mouzon, 2013). Second, the loss of grandparents, who often provide informal childcare, can have a negative effect on the labor market outcomes of adult children, particularly women (Garcia-Moran and Kuehn, 2017; Anstreicher *et al.*, 2022; Marcos, 2022). Furthermore, the labor market outcomes of adult children can be influenced by other factors following parental death, such as adult children assuming caregiving responsibilities for their parents or receiving inheritances from the deceased parent (Arrieta and Li, 2022; Nekoei and Seim, 2023). Despite these potential mechanisms, there is limited empirical evidence on how parental death affects the labor market outcomes of adult children. Our study aims to fill this gap and untangle the various mechanisms at play.

[1]The absence of substantial policies targeted at mediating the effects of parental death also make policy evaluations infeasible.

We use administrative data covering the full Danish population from 1980 to 2019, and we adopt a unique empirical design to study the impact of losing a parent on the earnings of women and men, as well as its implications for gender inequalities in labor market outcomes. Our empirical strategy allows us to focus primarily on the mental health and family support channels (childcare and eldercare) while controlling for other potential mechanisms. Specifically, we leverage the exogenous timing of *sudden* and *first* parental death to study the causal impact of losing a parent. We then use detailed mental health data on psychologist and psychiatrist consultations, as well as medical prescriptions, to shed light on the mental health effect. We also explore heterogeneous effects on families with or without young children, on surviving parents with differential health status and eldercare needs to examine the informal childcare and eldercare mechanisms.

Furthermore, our empirical design, which focuses on sudden and first parental deaths, largely addresses potential confounding factors associated with bequests and elderly care specifically for the first deceased parent. The bequest channel becomes relevant primarily after the second parental death, while elderly care for the first parent will be limited when they die suddenly despite relatively good health and as the first parent is not widowed at the time of death.[2] Furthermore, by leveraging the variation in the timing of sudden death, we mitigate concerns related to anticipatory effects prior to the first parental death, reverse causality, and selection bias arising from certain groups of parents being more prone to premature deaths. Lastly, the extensive time span and large size of our panel data enable us to examine gender effects at two levels: the impact of mothers' vs. fathers' deaths on daughters vs. sons. We emphasize that our focus on first and sudden parental deaths is driven by identification and empirical considerations. We show that the effects of sudden parental death carry external validity to other causes of death.

We begin by presenting a set of stylized facts regarding changes in the employment and earnings of adult children following the first parental death. Our findings reveal persistent and long-term declines in both employment and earnings for adult children, commencing immediately after the occurrence of parental death. Subsequently, we formally introduce our empirical strategy, which leverages the timing of sudden and first parental death, and employs generalized difference-in-differences analysis to examine the effects of parental death on the labor market outcomes of adult children. Our analysis shows that the loss of a parent has a long-term negative impact on the earnings of both women and men, with a more pronounced effect observed for women. Specifically, men experience a persistent decline in earnings, amounting to 2% in the fifth year after parental death. In contrast, women's continuous drop in earnings amounts to

[2] A parent with a cohabiting partner is likely to receive care from their partner before death if necessary, see e.g., Pinquart and Sörensen (2011); Mommaerts (2015).

almost 3% in the fifth year after parental death. Furthermore, when distinguishing between the impact of mothers' and fathers' deaths, we find that compared to fathers' deaths, mothers' deaths exert a larger negative influence on both sons' and daugters' earnings. We also find that, relative to the effects on sons, the negative effects on earnings of both fathers' and mothers' deaths are larger for daughters.

Next, we examine the potential role of health and family support in driving the effect of parental death on adult children's earnings, and consequently, on the gender earnings gap. First, we examine whether parental death causes more mental and physical health problems amongst adult children and whether there are gender differences in the effects. Using detailed administrative data, we find that both mothers' and fathers' deaths result in more visits to psychologists and more mental health-related prescriptions. Specifically, compared to their matched controls, women visit psychologists 0.09 more times per year after mothers' deaths and 0.054 more times after fathers' deaths, which are 130% and 78% relative to the baseline mean, respectively. On the other hand, the increase in psychologist visits for men is 0.03 and 0.016 after mothers' and fathers' deaths, which are 150% and 80% relative to the baseline mean.

We also observe an increase in the fraction of people receiving mental health-related prescriptions, with an increase of 1.3 (0.85) percentage points (pp) for women and 1.1 (0.7) pp for men following mothers' (fathers') deaths, which represents 10.2% (6.7%) and 13% (8.5%) relative to the baseline mean for women and men, respectively. Specifically for men, there is a notable increase in opioid prescriptions after parental death – an 8.8% (5%) increase relative to the baseline mean following mothers' (fathers') deaths. Together, this evidence suggests that both men and women experience more mental health problems after parental death, but the effects manifest differently by gender. We also find that parental deaths increase men's and women's visits to hospitals and GPs, with a larger effect of mothers' death. However, we do not find a noticeable gender difference in the effect of parental death on GP or hospital visits.

Second, we investigate how parental death impacts labor market outcomes through the informal childcare channel. Given that families with children aged 6 or younger typically have the greatest demand for informal childcare, we explore the heterogeneity of the effect of parental death on the earnings of men and women with or without young children in this age group. Our findings indicate that men and women without young children experience comparable declines in earnings following the deaths of both mothers and fathers. In contrast, the results for men and women with young children unveil a distinct gender disparity, as women's earnings exhibit a significantly greater reduction after parental death. Specifically, women with young

children experience a 3.7% (3.3%) decrease in earnings following the deaths of mothers (fathers), whereas men's drop in earnings is much smaller, around 1% after the death of mothers and fathers. Consequently, the family support channel emerges as a prominent contributor to the observed gender-specific effects on labor market outcomes.

Third, we examine how parental death impacts labor market outcomes through the eldercare channel. This channel is more relevant when adult children lose their first parent; after first parental death, the second, widowed parent may require additional eldercare. Given that widowed parents with high health risks require more eldercare, we explore heterogeneous effects of parental death on the earnings of men and women with widowed parents of different health status. Additionally, since children (parents) may relocate to provide (receive) informal eldercare, we estimate the effect of first parental death on proximity between adult children and their widowed parents. Our findings show that women experience a slightly larger drop in earnings if their widowed parents have a higher health risk. Furthermore, men and women are slightly more likely to reside in the same region as their widowed parents after first parental death. These findings suggest that eldercare for widowed parents may contribute to the effect of parental death, although this effect is relatively small.

We undertake a series of robustness checks and supplementary analyses to confirm the validity of our findings. First, we investigate possible alternative mechanisms, including fertility and cohabitation, inheritance, and preferences for certain types of work and leisure. Next, we consider heterogeneity across geographic proximity between parents and adult children, causes of parental death, and parental age at death. Third, we investigate the within-family spillover effect of parental death by examining how it influences spousal labor market outcomes. Finally, we discuss the external validity of our results.

Our paper contributes to the understanding of how mental health and family support affect individual labor market outcomes and gender inequalities (Banerjee *et al.*, 2017; Garcia-Moran and Kuehn, 2017; Anstreicher *et al.*, 2022; Ciccarelli and Van Soest, 2018; Fu *et al.*, 2017; Marcos, 2022). We exploit comprehensive data on individual health outcomes to examine the impact of parental death on both mental and physical health. We also leverage the variation of family composition, i.e., families with or without young children, surviving parents' health risk, and region of residence, to shed light on the family support channel (childcare and eldercare). We find significant evidence that parental death negatively affects individual earnings and amplifies the gender earnings gap by deteriorating mental health and by the loss of informal childcare.

We also contribute significantly to the literature on the impact of family health shocks on

individual labor market outcomes (van den Berg *et al.*, 2017; Fadlon and Nielsen, 2021; Breivik and Costa-Ramón, 2022). Existing research in this field primarily examines the effects of fatal health shocks experienced by spouses or children on individual employment and earnings. While the consequences of such shocks are substantial and hold important policy implications, their rare occurrence limits their generalizability to the broader working-age population. Our study differentiates itself by focusing on the effects of losing a parent during adulthood on individual outcomes and, given the prevalence of this event, on aggregate outcomes such as the gender earnings gap.

Our paper also aligns closely with the literature that examines the impact of parental health shocks on children's outcomes. Several studies have investigated the effects of parental health shocks during children's upbringing on their mental health and educational outcomes (see e.g., Aaskoven *et al.*, 2022; Alam, 2015; Adda *et al.*, 2011; Chen *et al.*, 2009; Corak, 2001; Kristiansen, 2021). In contrast, our study focuses on the labor market outcomes of *adult* children following the loss of a parent, which is much more prevalent. Furthermore, the mechanisms driving the effects of parental health shocks on young children's outcomes differ significantly from those impacting the outcomes of adult children following parental death. Parental death influences young children through human capital investment and the development of non-cognitive skills, while it affects adult children through family support and health. Given the prevalence of the event we examine, the results presented in our paper have wider implications for assessing population-level well-being compared to the existing literature in this field.

Finally, our paper contributes to the understanding of factors that contribute to the gender gap in employment and earnings. In their review of the literature, Blau and Kahn (2017) highlight various socioeconomic factors that explain the gender pay gap. In our study, we provide novel evidence demonstrating that parental death and the underlying mechanisms of mental health and family support play a significant role in the gender earnings gap.

The rest of the paper is structured as follows. Section 2 briefly outlines the institutional setting in Denmark. Section 3 presents the data and descriptive analyses. Section 4 describes our empirical strategy. Section 5 discusses the main results, and Section 6 the underlying mechanisms. Section 7 includes a series of robustness analyses. The final section concludes the paper and discusses the policy implications of our results.

2 Institutional background

For many of the outcomes that we consider in the paper, it is necessary to understand the institutional background in Denmark. For example, when considering health outcomes, it is important to know that healthcare is generally provided free of charge in Denmark. Therefore, we provide more details on the institutional setting in this section.

2.1 Healthcare

The Danish health care system is described in detail by the Danish Ministry of Health (2017) and Olejaz *et al.* (2012), but we provide an overview here. In the Danish healthcare system, general practitioners (GPs) serve as the initial point of contact for most health concerns. While GPs typically operate in private practices, they are predominantly funded by public authorities, and patients receive treatment free of charge. GPs play a crucial role in referring patients to specialized practitioners, such as psychiatrists or dermatologists, or to hospitals for more specialized or inpatient treatments. Both treatments by specialized practitioners and hospitals are also provided free of charge to patients.

However, there are a few exceptions to the provision of free healthcare in Denmark. Patients may be required to pay a co-payment for accessing certain services, such as psychologists and physiotherapists, after obtaining a referral from their GP. In the case of psychologists, treatment is partially funded by the authorities for specific conditions, including suicide attempts, serious somatic illnesses, and, importantly for our analysis, after the bereavement of close relatives.

Prescribed medications are subject to a co-payment that decreases proportionally to the total amount spent on medication within a year. Once the annual expense threshold (DKK 4,110 or USD 590 in 2019) is reached, medications are provided free of charge. Medications administered in hospitals are also provided free of charge to patients. All interactions with the publicly funded healthcare system in Denmark are recorded in the Danish health registers, allowing comprehensive data collection and analysis.

2.2 Childcare

In Denmark, children are entitled to access formal children from the age of 26 weeks until they reach school age (European Commission, 2022). Child care is heavily subsidized; local municipalities pay at least 75% of the cost of childcare provision (European Commission, 2022). In 2012, the average annual cost of full-time childcare for children under school age ranged between ap-

proximately 18,000 DKK (≈ 2,400 USD) and 33,000 DKK (≈ 4,400 USD) depending on the type of care chosen (Naumann *et al.*, 2013). Large discounts are offered to low-income parents as well as to families with more than one child. The relatively cheap provision of child care transmits to large take-up rates in formal child care. In 2012, 90-98% of children under the age of 6 enrolled in formal childcare (Naumann *et al.*, 2013). However, most childcare providers are only open during core working hours (6:30/7:00am) to around 16:00pm, Monday to Friday. Out-of-hours childcare provision is sometimes available for shift workers, but it is rare. More details are provided by the Ministry of Social Affairs (2000), the European Commission (2022) and Naumann *et al.* (2013).

Despite the extensive provision of formal childcare in Denmark, informal childcare provision by grandparents is also very common, partly due to women's high labor market participation rate. For example, Glaser *et al.* (2013, p. 8) reports that Danish grandparents are among the most likely to be involved in the care of grandchildren throughout Europe: "The highest incidence of grandparents providing any childcare is in the Netherlands and Denmark, with around 57% of grandparents looking after a grandchild in the past 12 months."

2.3 Elderly care

Extensive care for elderly people is provided free of charge by Danish municipalities. Initially, elderly care tends to be provided in the home of individuals in need of care. Care assistants employed by municipalities visit individuals on a needs basis. If individuals need more extensive care, municipalities offer them the opportunity to move to a care home where full-time care is available. Although care is provided free of charge, individuals moving into care homes pay rent and pay for the food provided. More details are provided by the Danish Ministry of Health (2017) and Olejaz *et al.* (2012). Gørtz *et al.* (2023) use Danish survey data to provide a comprehensive analysis of long-term care in Denmark. The authors show that given the favorable health situation of the elderly in Denmark, a large fraction of the elderly receive relatively few hours of care per week (3 hours at the median). Among those who need eldercare, eldercare is provided both formally from municipalities and informally from family, friends, and neighbors, but informal care is primarily offered by older individuals and retirees.

2.4 Inheritance

When one of the spouses of a married couple dies in Denmark, a commonly used option in Danish inheritance law allows the surviving spouse to choose not to share the estate of the deceased spouse with any potential children until the surviving spouse dies too (Grønborg and Ravn-

Petersen, 2022). For example, this would allow a surviving spouse to continue living in a house owned by the deceased spouse, and thus, minimize disruption for the surviving spouse. Thus, research on the effects of inheritance tends to consider only the death of the second biological parent (see e.g., Boserup *et al.*, 2016). However, if the deceased spouse has one or more children with a third party, those children may object to the surviving spouse remaining in an undivided estate and demand the estate of the spouses to be split, resulting in immediate inheritance to the children after parental death. By default, the remaining spouse and any children split the estate of the deceased spouse 50-50. If the deceased parent has signed a will, this ratio may be different (Grønborg and Ravn-Petersen, 2022).

3 Data and descriptive analysis

3.1 Data

Throughout the paper, we rely on population-level register data from Denmark. The main advantage of these data is that we observe child-parent linkages for children born in the 1950s or later. Starting in 1980, we observe a wide range of demographics for the entire population, including links between spouses and cohabiting partners, individual's ages, ages of their children, and home region (FAIN/BEF). Furthermore, we observe deaths and causes of death back to 1970 (DODSAARS/DODSAARG). These data allow us to identify our treatment sample of individuals with first and sudden parental deaths.

We estimate the effect of the first parental death on a wide range of outcomes that are observed for the entire population. Firstly, from 1980 we observe earnings and labor market outcomes, including participation, unemployment, as well as a proxy for hours worked (IND/AKM/IDAS/IDAN/IDAP).[3] Earnings include income from both employment and self-employment. When considering earnings as an outcome, we normalize individual earnings by the average of men's and women's earnings one year before parental death.[4] Therefore, the estimated treatment effects can be interpreted as a % earnings change relative to the baseline mean for men and women, respectively.

Starting in 1990, we have data on the number of consultations with private practicing GPs,

[3]The proxy for hours worked is derived from ATP pension payments, see Kleven *et al.* (2019) for details.

[4]To exclude extreme outliers, we also implement a 98% winsorization on earnings. As we want to keep individuals with zero earnings in our estimation sample, an alternative to normalization would be a log-like transformation, such as the inverse hyperbolic sine transformation. We follow the advice by Chen and Roth (2023) and avoid such transformations, although our results are qualitatively similar when considering the inverse hyperbolic sine transformation of earnings as an outcome instead.

psychologists, and psychiatrists (SYSI/SSSY), and from 1994 we also observe both in- and outpatient hospital visits due to somatic illness (LPR_ADM/ LPR_DIAG). From 1995, we observe all hospital visits due to psychiatric treatment (PSYK_ADM/ PSYK_DIAG), as as well as all medications prescribed by doctors for relevant diagnoses (LMDB).[5] We focus on prescriptions related to mental health and the use of painkillers, and we are able to observe the purchase of opioid painkillers separately. Also from 1995, data are available on formal childcare enrollment at the child level (DAGI/ BOERNFB), although the childcare registers are the only registers with partial coverage in some municipalities, particularly before 2005. We are interested in formal childcare before children reach school age, so we focus on childcare provision for children 6 years old or younger.

3.2 Treatment group

To identify the effects of losing a parent on individual labor market outcomes, we use population data and leverage the timing of the first parental sudden death to overcome the following empirical challenges. First, elderly parents may fall ill before death. Adult children may anticipate the death of their parents, given their parents' health conditions and adjust their labor market behavior. Second, there may be a reverse causality. Adult children may first lose their employment and earnings, which affects the total level of family resources and thus cause a deterioration of elderly parents' health. To address the anticipation effect and the reverse causality problem, we focus on the parental deaths that are sudden and unexpected (about one third of all parental deaths). Specifically, from the register that contains information on causes of death, we select parental deaths due to heart diseases, cerebrovascular diseases, acute respiratory infections, and traffic or other (external) accidents. The use of such sudden causes of death to examine the causal effect of family members' fatal health shocks is already documented in existing literature (van den Berg *et al.*, 2017; Fadlon and Nielsen, 2021). The focus on the first parental death also helps to control for both the bequest channel and effects through elderly care for the first deceased parent. Specifically, the bequest channel is more relevant after the second parental death when adult children become the primary heir of the deceased parents' estate. The elderly care channel is less relevant for *sudden* and first parental deaths. Before sudden deaths, parents are relatively healthy, and their spouses would typically be their primary caregivers.

We emphasize that the focus on the sudden death of one's first parent is primarily out of

[5] We have access to prescriptions for the following indications: 1) Musculo-skeletal system: M01AA01-M09AX10. 2) Nervous system: N01AB01-N07XX12. 3) Various: V03AB01-V03AX03.

identification concerns, though our descriptive analysis suggests similar effects of parental death independently of cause of death. Furthermore, we find that there are no systematic differences between children experiencing sudden and anticipated parental deaths. Therefore, the effects that we document in this paper, including the underlying mental health and family support mechanisms, can likely be generalized to all causes of parental deaths; this is discussed further in Section 7.8.

Although we can observe parental deaths back to 1970, for most of our analyses, we need to include pre- and post-trends in outcomes, typically 3 years before and 5 years after the first parental death. Most of our outcomes are available from 1980-2019, so we limit the treatment group to the first parental deaths occurring between 1983 and 2014. We further limit our treatment group to individuals with two known parents present in the population the year before the first parental death is observed. This excludes a small subset of individuals with one unknown parent or with a parent living abroad, as we do not know the timing of death for this small group of parents. Finally, we limit the treatment group to individuals of prime working age, 25 to 50 years old at the time of first parental death, as we are particularly interested in labor market outcomes and most people experience the loss of their first parent in this age range.[6]

3.3 Summary statistics

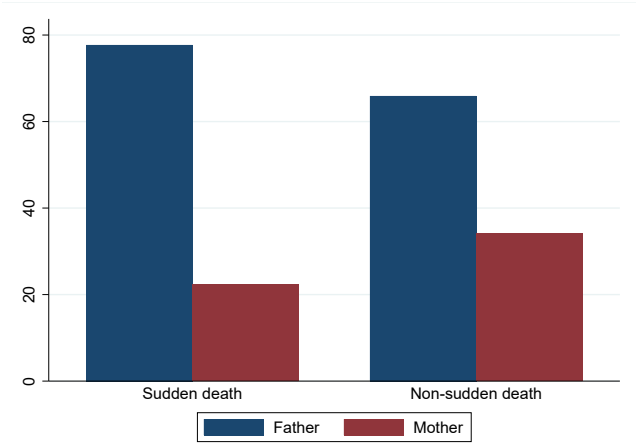
In this section, we explore whether the sample of sudden deaths is generally comparable to the full population of deaths. A comparison between sudden and non-sudden parental deaths will show if we introduce selection bias by focusing on sudden parental deaths in our main analyses. Although this is not important for the identification of the effects of unexpected deaths, potential selection is relevant for the external validity of our estimates. We discuss external validity in more detail in Section 7.8.

Figure 1 shows that first deceased parents are more likely to be fathers for the subsample of unexpected deaths relative to expected deaths. In our analyses, we consider this by separately estimating the effects of mothers' and fathers' deaths. In Table 1, we further explore the characteristics of children whose first parent dies suddenly and non-suddenly, respectively. Parents dying unexpectedly tend to be slightly older than parents whose death can be anticipated because of pre-existing illnesses. This age difference is driven by the likelihood of dying from heart diseases and cerebrovascular diseases, which increases with age. However, we also see that although

[6]Our calculation shows that 73% of the Danish population lost their first parent between age 25-50 from 1980-2020. 12% of the Danish population lost their first parent before age 25 and 15% lost their first parent after age 50.

parents are slightly older when dying unexpectedly, this only translates into a marginal age difference between children losing their unexpectedly and expectedly.[7] We see that the two groups of children appear very similar across characteristics. We conclude that our sample of children whose first parent dies suddenly does not differ systematically from the general population of children experiencing parental death.

Figure 1: Gender of first deceased parent



Notes: This figure presents the gender composition of the first deceased parent by sudden deaths vs. nonsudden death. Sudden deaths include heart diseases, cerebrovascular diseases, and traffic or other (external) accidents. Non-sudden deaths include the remainder of deaths. We include the first parental deaths occurring between 1983 and 2014 for children aged 25-50 in the year of the first parental death and with two known parents. See Table A.1 for details on the sample.

3.4 Descriptive analysis

To motivate our analysis of the effects of parental death on adult-child outcomes, we first provide a set of event studies, largely following the specification of Kleven *et al.* (2019). This provides estimates of the effect of parental death on adult-child outcomes without the need for a control group. We use the treatment group described above and a panel of observations ranging from 3 years before parental death to 5 years after parental death.[8]

[7] In Figure A.2, we show the full age distribution of deceased parents split by sudden vs. non-sudden cause of death. Figure A.3 shows the corresponding age distribution of children.

[8] We run the following regression for the various outcomes we consider:

$$Y_{ity} = \sum_{k=-3, k\neq -1}^{5} \delta_k \cdot \mathbb{1}[k = t] + AgeYear_{iy} + EduYear_{iy} + \epsilon_{ity} \quad (1)$$

where Y_{ity} represents the outcomes of interest, e.g., earnings, at calendar year y for individual i whose first parent died $t = -3, ..., 5$ years from year y. δ_k are the coefficients of interest, identifying the effects of parental death on individual labor market outcomes relative to the omitted year before the incident. δ_k is identified from the variation

Table 1: Summary statistics for adult children at $t = -1$

	Sudden death Mean	Non-sudden death Mean	p-value
Age	36.77	36.74	0.06
Male	0.53	0.52	0.00
Share with college or above	0.21	0.22	0.00
Share with high school	0.50	0.52	0.00
Share without high school	0.29	0.26	0.00
Cohabitation	0.71	0.70	0.00
Number of children	1.38	1.37	0.07
Age of youngest child	7.88	7.72	0.00
Share with children under 6	0.34	0.34	0.00
Mother age	65.29	64.17	0.00
Father age	69.42	67.83	0.00
Mother married	0.85	0.81	0.00
Father married	0.86	0.82	0.00
First death age	69.85	67.90	0.00
Employment	0.84	0.84	0.21
Intensive margin	1012.68	1017.37	0.00
Annual earnings	295.11	302.30	0.00
N	215654	543515	759169

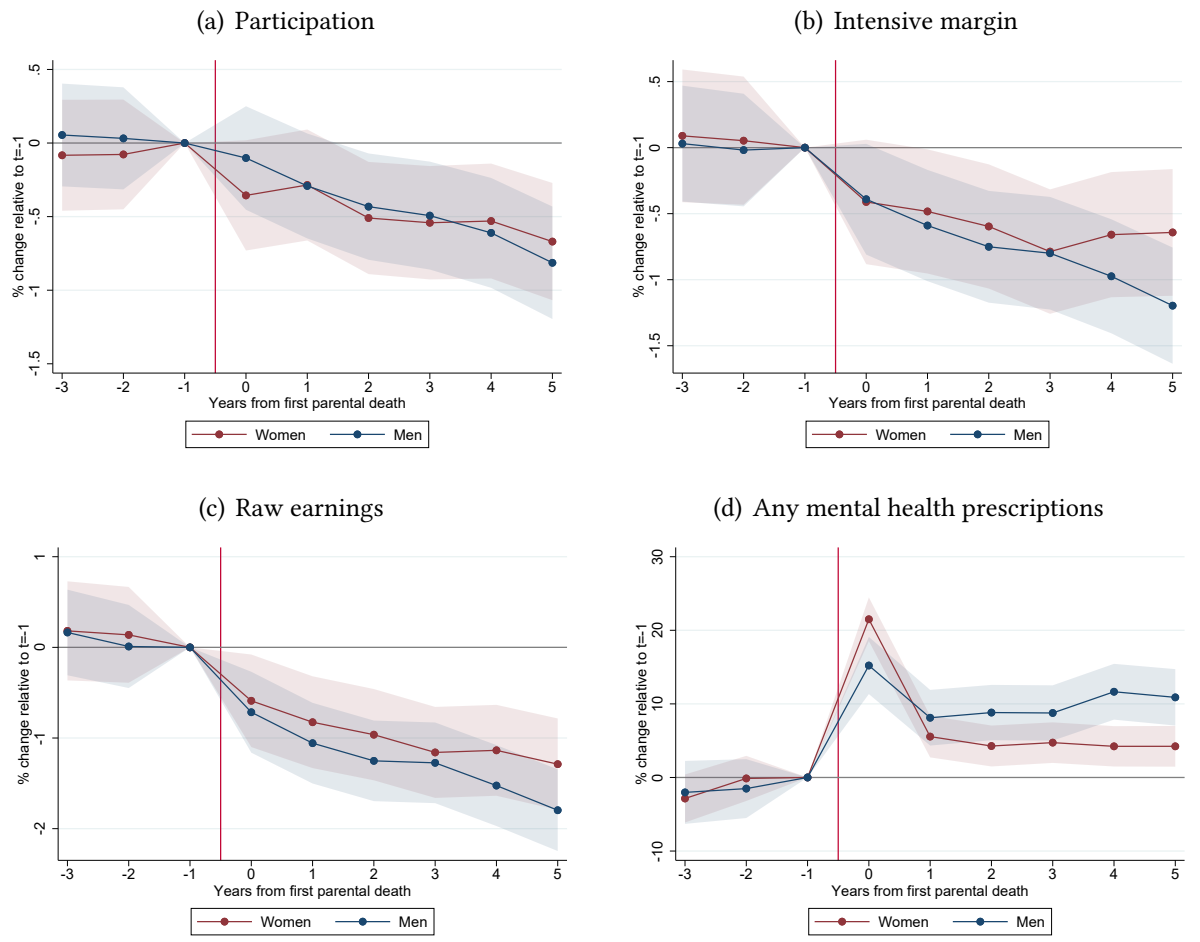
Notes: This table shows the summary statistics for children in the calendar year preceding the first parental death, split by first parent sudden vs. non-sudden death. We include the first parental deaths occurring between 1983 and 2014 for children aged 25-50 in the year of the first parental death and with two known parents. All statistics are derived from Danish population-level register data; the specific datasets used for this exercise are described in Section 3. Table A.1 in Appendix A further splits the two groups by the gender of the deceased parent.

Figure 2 shows that the labor supply of both women and men is affected by sudden parental deaths. Panels (a) and (b) illustrate that both the extensive and intensive margins of men's and women's employment are impacted: five years after the first parental death, the participation rate of both genders is approximately 0.7% lower. This effect on labor supply also results in lower earnings following the first parental death for both women and men. In Panel (c), there is a noticeable drop in earnings of around 1.5% relative to their pre-parental death earnings for both genders. Additionally, we observe the dynamics of men's and women's mental health around the first parental death event in Panel (d). We find a significant impact on mental health-related prescriptions for both genders immediately following parental death: compared to one year prior to parental death, there is a 20% increase for women and a 15% increase for men in the year they lose their parents, with a persistent 5% increase for women and a 10% increase for men five years after parental death.

in age at the time of the first parental death. However, as returns to age may change over time, and there is no control group experiencing a similar change in returns to age in this setup, we control for age in years dummies interacted with year-fixed effects ($AgeYear_{iy}$); this interaction allows the effect of age to change over time, which is important because of our long sample period. Finally, we control for education-level fixed effects ($EduYear_{iy}$), which similarly interacted with year-fixed effects. We run regressions separately for women and men.

However, other dynamics will affect the outcomes of women and men differentially across the panel, e.g., if women have young children at the start of the panel, they will age through the panel, and women's labor supply increases as a result. Men will be less affected by this. Therefore, informative comparisons of the effect of parental death on women vs. men require appropriate control groups. In the next section, we describe our empirical strategy that targets these concerns.

Figure 2: Descriptives: Effect of sudden parental death



Notes: This figure plots the estimated coefficients from Equation 1 for men's and women's labor market outcomes, and if using any mental health prescriptions. We follow Kleven *et al.* (2019, p. 188) and convert the estimated coefficients into percentage change relative to the baseline. Participation is measured as strictly positive ATP contributions. The intensive margin is based on ATP contributions, similar to Kleven *et al.* (2019). ATP-pension contributions are paid proportionally to hours worked. Earnings are inflated to 2020 levels and include earnings from both employment and self-employment. The sample consists of all sudden, first parental deaths from 1983 to 2014 for children aged 25-50 in the year of first parental death and with two known parents. See Table A.2 for details on the sample for the analyses of labor market outcomes. The prescription data are available from 1995, leaving a balanced panel of 55,877 women and 60,950 men for the analysis in Panel (d). 95%-confidence intervals indicated.

4 Empirical strategy

Although the descriptive analysis above provides some initial evidence of the effects of parental death, both individual labor market outcomes and parental health conditions (and the timing of parental death) could be endogenously determined by both observed or unobserved factors. For example, adult children who lose their parents in their 20s may be very different in terms of socioeconomic characteristics compared to those who lose their parents in their 50s. To address this selection concern, we employ panel data with matched controls, which allows us to estimate a model controlling for individual fixed effects. Specifically, we use nearest-neighbor matching to find a control individual for each treated individual that has similar socioeconomic characteristics but does not experience the death of either of their parents in the 5-year window following the parental death of their matched treated individual. Thus, the matched control individuals serve as suitable counterfactuals for the treated individuals. We apply nearest-neighbor matching on age, gender, education level, sector (public or private), cohabitation status, residential region, number of children, age of the mother and father, and age of the youngest child one year prior to the treated individual's first parental death. We also match on employment and earnings history in the 3 years preceding the treated individual's first parental death.[9] Because the effects of the first parental death may persist in the long run, and thus, affect the estimates of the second parental death effect, we restrict our attention to the first parental death.[10]

Formally, with our data on matched controls as well as on our treatment group, we can estimate the following event study separately for women and men:

$$Y_{ity} = \sum_{k=-3, k\neq -1}^{5} \left(\delta_k \cdot \mathbb{1}[k=t] \cdot D_i + \theta_k \cdot \mathbb{1}[k=t]\right) + \gamma_i + \gamma_y + Age_{iy} + \epsilon_{ity} \tag{2}$$

where Y_{ity} represents the outcomes of interest: employment and earnings for worker i in calendar year y whose first parent died $t = -3, ..., 5$ years from year y. D_i is an indicator variable equal to 1 for the treated (those experiencing parental sudden death), and equal to 0 for the matched controls. In the regressions, we omit this indicator for the year prior to the event (-1), and thus,

[9] All variables are included as fixed effects in the matching procedure. Continuous variables such as earnings are first discretized into several quantile groups, and the resulting categorical variables are then used as fixed effects. In the main analysis, we include mothers' and fathers' age to control for parental related health risk. As a robustness check, we further include the number of fathers' and mothers' inpatient hospital visits in the matching as a control for parental health risks. Results are similar with or without including this variable.

[10] The adult children in the treatment group may experience a second parental death within the sample period. We find that the gap between parental deaths is more than 5 years for 91% of our sample, and our results are similar if we limit our treatment group to these children.

this serves as the reference year. The term δ_k are the coefficients of interest, identifying the effects of parental death on individual labor market outcomes relative to the matched counterfactual and the omitted year before the incident. Additionally, we also control for year fixed effects (γ_y), individual fixed effects (γ_i), time since event fixed effects (θ_k), and age fixed effects (Age_{it}). Standard errors are clustered at the individual-by-match ID level.

The key identifying assumption for our analysis is that the earnings and employment of the individuals who have lost a parent would otherwise have evolved similarly to their matched controls following the event. Estimates from Equation 2 will provide visual support for the parallel trends assumption.[11]

The event study analysis will show the dynamic long-term effects of parental death on individual employment and earnings, but to obtain aggregate estimates of how parental death affects our outcomes of interest, we estimate the following difference-in-difference model. We use the same time window and estimate the following equation separately for women and men:

$$Y_{ity} = \beta D_i \cdot post_t + \gamma_i + \gamma_t + \gamma_y + Age_{iy} + \epsilon_{ity} \tag{3}$$

where D_i is an indicator variable equal to 1 for the treated individuals, and $post_t$ is an indicator variable equal to 1 for observations after parental death. We also control for sets of fixed effects similar to the event study analysis, including time-from-event fixed effects, γ_t, and calendar year fixed effects γ_y. We still use the observations within 3 years before and 5 years after parental death and their matched controls. The coefficient of interest is β, which measures the effect of parental death on employment and earnings relative to the matched controls. We estimate Equation 3 separately for men and women.[12]

As an alternative to the combination of fixed effects and a control group of matched nearest-neighbours (also used by van den Berg *et al.*, 2017), another widely used identification strategy

[11] A recent literature raises a number of concerns about using of staggered difference-in-differences designs (see e.g. de Chaisemartin and D'Haultfœuille, 2020, 2023; Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Roth *et al.*, 2023). "Staggered" indicates variation in treatment timing and that individuals/units can only change status from untreated to treated, not from treated to untreated. Because our design only allows one, permanent switch from untreated to treated, because our treatment is binary (first parent dead or alive), *and* because we do not include already-treated individuals in our matched controls, we avoid "forbidden" comparisons, and our strategy is robust to these concerns.

[12] When considering the differential effect of mothers' and fathers' deaths, we estimate:

$$Y_{ity} = \beta_m M_i \cdot post_t + \beta_f F_i \cdot post_t + \gamma_i + \gamma_t + \gamma_y + Age_{iy} + \epsilon_{ity} \tag{4}$$

where M_i is an indicator equal to one if the first deceased parent is the mother, and F_i is an indicator equal to one if it is the father. Notice that a time-invariant mother/father death term is not included as that is absorbed by the individual fixed effects.

relies on a control group of individuals who experience the same treatment but Δ years later. This approach is applied in, e.g., Fadlon and Nielsen (2019, 2021). The control groups in Fadlon and Nielsen (2019, 2021) consist of individuals that will be treated in the future outside the estimation window. Our combination of fixed effects and a control group of matched nearest-neighbours, however, is largely in the same spirit as that of Fadlon and Nielsen (2019): Our control group does not lose either of their parents in the estimation window, but they will lose their parents in the future, though it may be due to sudden or non-sudden reasons. In the data section, we show that the group of children whose parents die suddenly are very similar to the children whose parents die non-suddenly. Hence, there is no systematic difference between using adult children whose parents die suddenly in the future as the control group, and using the combination of children whose first parent dies of both sudden and non-sudden reasons in the future as the control group.

One may still worry that even if adult children whose parents die suddenly look similar to the adult children whose parents die expectedly on aggregate, the anticipatory effect of non-sudden deaths may still bias the results. For example, if we find a matched control for a treated individual whose parent dies suddenly, and the control individual's parents are both alive during the window but are seriously ill. Parental illness generates an anticipatory effect for the control group as the matched control downward adjusts their employment and earnings during parental illness. If so, comparing the treated individual employment and earnings behavior to their matched controls would lead to a downward biased estimate of the negative impact of parental death. Then, our estimates comparing individuals who experience sudden parental death to control individuals whose first parental death may be anticipated in the future will yield a lower bound. In the context of our paper, we prefer a combination of fixed effects and a control group of matched nearest-neighbours as we need a large sample size in order to gauge the two layers of gender effects. We also include a robustness check following exactly the strategy of Fadlon and Nielsen (2019, 2021) in Section 7.7.

5 Results

In this section, we focus on the effects of parental death on labor market outcomes. We present the results from our dynamic event study, which allows us to inspect pre-trends in outcomes as well as dynamics in treatment effects. Next, we discuss the aggregate effects of parental death by gender of the deceased parent and by gender of the adult children.

5.1 Dynamic effects

Figure 3 shows the event study analysis of the impact of parental death on the employment and earnings of women and men. We see that prior to the occurrence of the first parental death, the raw earnings and employment for both the treated individuals and their matched controls are almost identical. The absence of differential pre-trends in the outcome variables provides support for our empirical strategy.

We find that right after the first parental death, treated individuals experience a persistent drop in employment and earnings. This is the case for both men and women. Men's employment drops slightly in the first year after parental death, but further decreases to 0.7pp in the fifth year after parental death. For earnings, we observe a persistent drop after parental death. After the fifth year of parental death, the earnings of the treated men have decreased by around 2% relative to their matched controls. The drop is more striking in the employment and earnings dynamics of women: female employment rate decreases by 0.9pp after 5 years of parental death; female earnings drop by 1% right after parental death and drop by as much as 2.8% after 5 years from parental death, again compared to their matched controls.

5.2 Aggregate effects

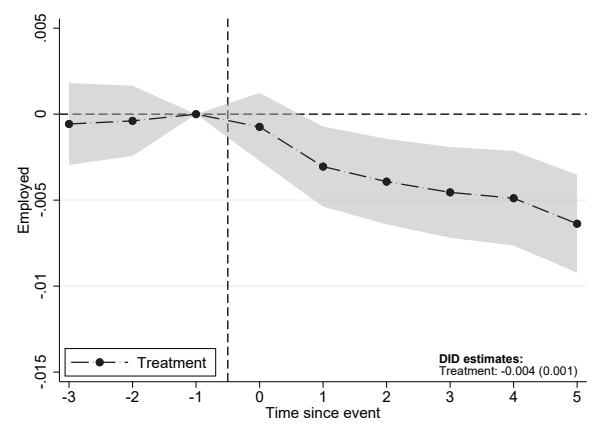
To visualize the aggregate impact of first parental death on gender employment and the earnings gap, we report the difference-in-differences estimates for men and women in Figure 4. We find that first parental death contributes to a meaningful share of gender employment and earnings gap. Specifically, the impact of first death on men's overall employment within 5 years is 0.3pp; while that for women is 0.6pp, i.e., double the effect for women compared to men. Similarly, the impact of the first parental death on men's overall earnings is a drop of 1.5%, while that for women is 2%, i.e., a third higher for women than for men.

We further disaggregate the first deaths by mothers' deaths versus fathers' deaths and examine the gendered effect on earnings for adult children. Figure 5 displays both the event studies (Panel (a)) and the Difference-in-Difference estimates (Panel (b)). It demonstrates that compared to fathers' deaths, mothers' deaths result in a significantly larger drop in the earnings of both men and women. In contrast, compared to men, women's earnings decrease much more following both mothers' and fathers' deaths. For instance, the negative effect on women's earnings due to mothers' deaths is 2.6%, while that for men is 1.9%. Thus, women experience the most significant earnings penalty after mothers' deaths.

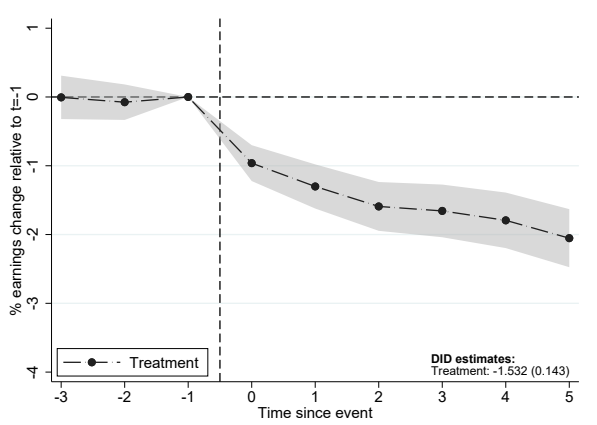
Since parental death is prevalent among adults (96% of the population experience their first

Figure 3: Event study: Effect of parental death by gender

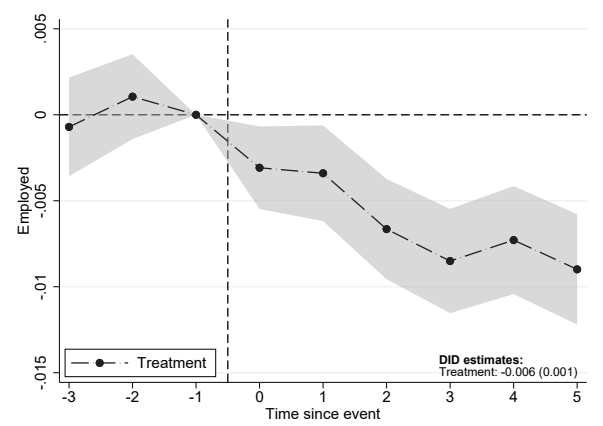
(a) Men's employment



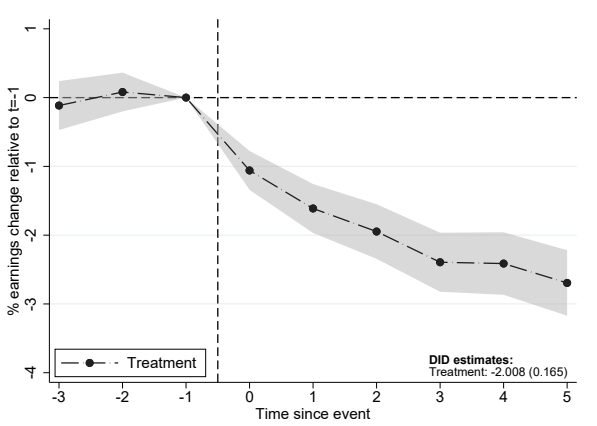
(b) Men's earnings



(c) Women's employment



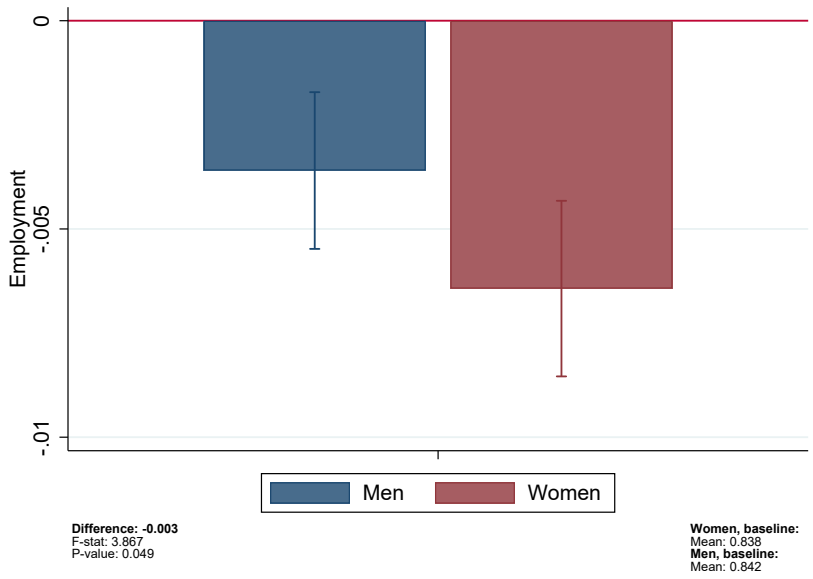
(d) Women's earnings



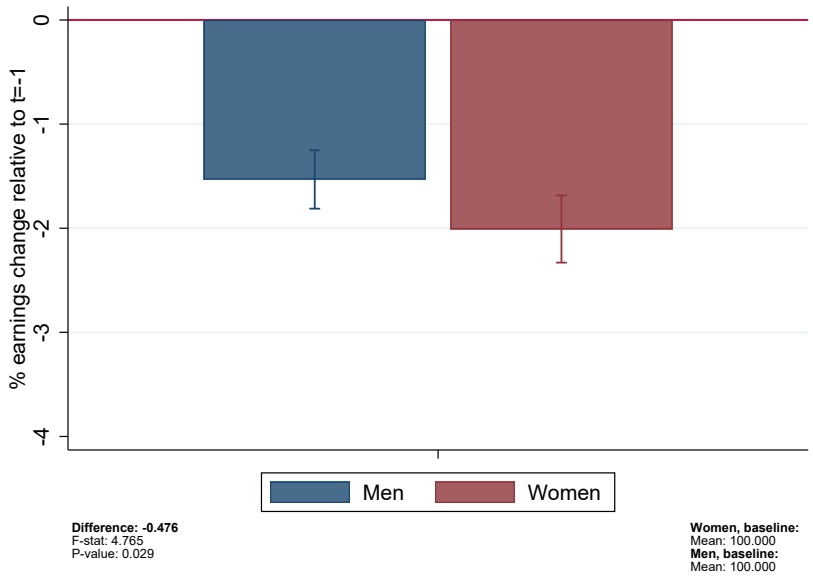
Notes: This figure plots the estimated coefficients from Equation 2 for men's and women's employment and earnings. Employment is measured as strictly positive ATP contributions. ATP-pension contributions are paid proportionally to hours worked. Earnings are normalized by the average earnings of men and women one year before parental death. The sample consists of all unexpected, first parental deaths from 1983 to 2014 and their matched controls for children aged 25-50 in the year of first parental death and with two known parents. See Table A.2 for details on the sample. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

Figure 4: Matched control: Overall effect of parental death by gender

(a) Employment



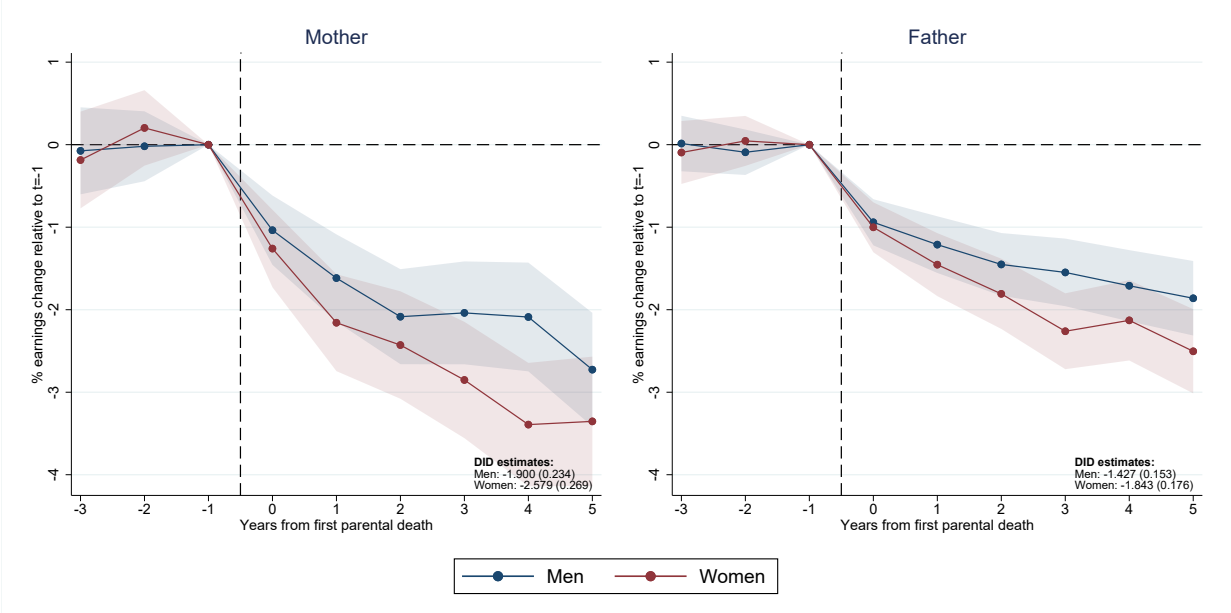
(b) Earnings



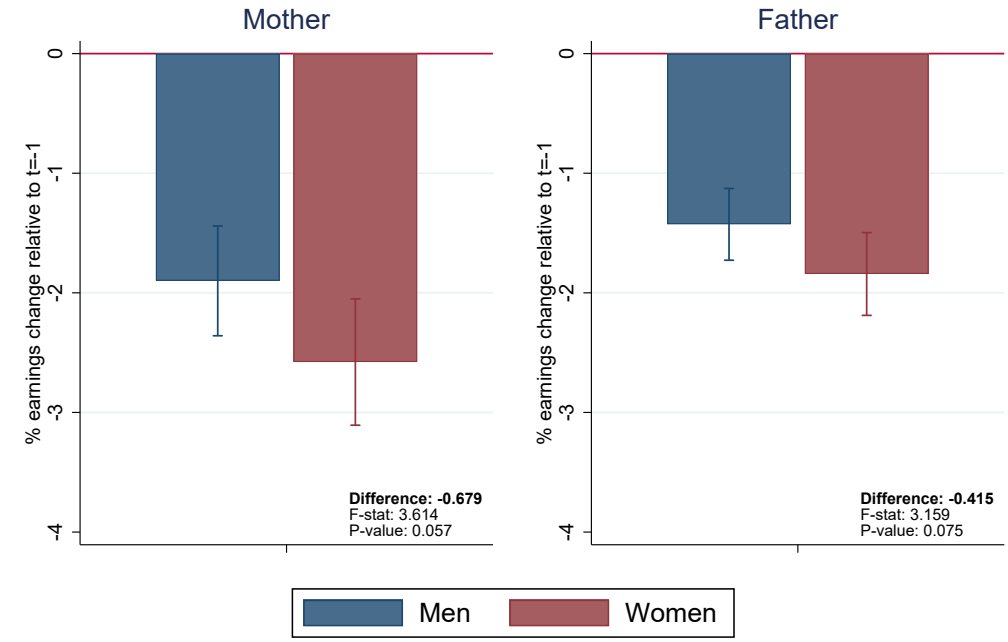
Notes: This figure plots the estimated coefficients from Equation 3 for men's and women's employment and earnings. Employment is measured as strictly positive ATP contributions. ATP-pension contributions are paid proportionally to hours worked. Earnings are normalized by the average earnings of men and women one year before parental death. The sample consists of all unexpected, first parental deaths from 1983 to 2014 and their matched controls for children aged 25-50 in the year of first parental death and with two known parents. See Table A.2 for details on the sample. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

Figure 5: Matched control: Earnings, mothers' vs. fathers' deaths

(a) Event Study



(b) Difference in Difference



Women, mother vs. father:
Dif.: 0.736, F-stat: 7.066, P-value: 0.008
Men, mother vs. father:
Dif.: 0.473, F-stat: 3.879, P-value: 0.049

Notes: This figure plots the estimated coefficients from Equation 2 (Panel (a)) and 4 (Panel (b)) for men's and women's earnings. Earnings are normalized by the average earnings of men and women one year before parental death. The sample consists of all unexpected, first parental deaths from 1983 to 2014 and their matched controls for children aged 25-50 in the year of first parental death and with two known parents. See Table A.2 for details on the sample. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

parental death in adulthood), almost everyone in the economy will be affected by parental death. Thus, the individual treatment effect would effectively be aggregated into the treatment effect of the entire population. Considering that the average age at first parental death is just above 36 years, these negative effects will affect children for many years in the labor market, having profound implications for aggregate economic outcomes in the labor market and beyond.

6 Mechanisms

In this section, we discuss the mechanisms driving the impact of parental death on men's and women's earnings, and the underlying channels for the resulting gender inequalities. The primary mechanisms are the effects of parental death on mental health, and the informal childcare and eldercare channels.

6.1 Health

One important channel through which parental death affects adult children's labor market outcomes is health. This includes the effects of parental death on both physical health and mental health. The existing literature has thoroughly documented the effect of physical and mental health on labor market outcomes (Biasi *et al.*, 2021; Stephens Jr and Toohey, 2022). For example, Biasi *et al.* (2021) use Danish administrative data, finding that mental health disorders carry large earnings penalties, ranging from 34-74 percent. To examine the effect of parental death on individual physical and mental health conditions, we harness rich administrative data on individual visits to privately practicing health professionals and hospitals. Our data on visits to private practitioners include primary doctors / general practitioners (GP), clinical psychologists, and psychiatrists. For visits to hospitals, we also observe detailed diagnoses of the treated individuals.

6.1.1 Mental health

In this subsection, we examine the effect of parental death on mental health outcomes. We consider three different ways mental health issues can be treated and manifest. We look at the effects of mothers' vs. fathers' deaths on men's and women's: 1) Visits to clinical psychologists and psychiatrists. 2) Medical prescriptions related to mental health, e.g. anti-depressants.[13] 3) Substance

[13] All medical prescriptions are classified into ATC-codes. We classify ATC-codes N05*, N06A*, N06B*, and N06C* as mental health related.

abuse and alcohol abuse behavior, using prescription data on opioids and alcohol dependence treatment.[14]

We first consider the effect of parental death on consultations with psychologists and psychiatrists. Figure 6, Panel (a), shows that both men and women visit clinical psychologists more after parental death compared to their matched control. Focusing on gender-specific effects, we first find that women visit psychologists more than men after both mothers' and fathers' deaths. Second, we find that mothers' deaths lead to more psychologist visits for both men and women.[15] In particular, for women, mothers' deaths cause 0.037 more visits per year relative to fathers' deaths. Figure 6, Panel (b), shows that parental deaths also cause an increase in consultations with psychiatrists for women after mothers' deaths (although the effect is not significant at the 5%-level).

Figure 7 shows that both men and women increase their mental health prescriptions after mothers' deaths, 1.1pp for men and 1.3pp for women. The baseline averages are 8.2% for men and 12.7% for women, suggesting that men see an increase in mental health prescriptions of 13%, compared to women's increase of 10.2%. The effect on mental health-related prescriptions is significantly smaller after fathers' deaths compared to mothers' deaths. Only for men, we find a noticeable increase in opioid prescriptions after parental death – a 8.8% increase after mothers' deaths relative to the baseline mean; the effect of fathers' death is slightly smaller. Because opioids are likely to be misused (Fadlon and Nielsen, 2019), we interpret opioid usage as a proxy for substance abuse. In Figure A.4, we also show suggestive evidence that the uptake of treatment for alcohol dependence increases after parental death. For both opioid prescriptions and treatment of alcohol dependence, we see that the effect of parental death is positive and significant for men but not for women, suggesting that mental health reactions following parental death manifest differently for women and men.

In Figure A.5 and Figure A.6, we conduct the event study analysis for the psychologist visits and mental health prescriptions. These results suggest that the effect on mental health is more pronounced in the first few years right after parental death, with a smaller persistent effect in the long run. Moreover, there is no pre-trend in any of the mental health outcomes, even if we do

[14] In the prescription data, we extract information on both treatment of alcohol dependence (ATC-codes N07BB*, including Antabuse), and on opioid painkillers (ATC-codes N02A*). Opioid painkillers are often misused (Fadlon and Nielsen, 2019).

[15] Mothers' deaths may cause additional mental health effects for a number of reasons, e.g. because children have a stronger attachment with their mothers. Another reason could be that children expect their father to die before their mother (which is the most common, see Figure 1); the unexpected order of parental deaths could cause additional mental health effects.

not explicitly match on individual mental health before parental death.

6.1.2 General health

Figure 8 reports the effect of mothers' vs. fathers' deaths on individuals' annual number of visits to GP and hospitals. We find that both mothers' and fathers' deaths increase men's and women's total number of visits to GPs and hospitals compared to their matched controls. In addition, mothers' deaths have a larger impact on men's and women's hospital visits and men's GP visits. For instance, after maternal deaths, men increase their GP (hospital) visits by 0.22 (0.025) per year, 6.3% (5.2%) relative to their baseline mean; women increase their GP (hospital) visits by 0.21 (0.04) per year, 2.7% (5.5%) relative to the baseline mean. The effect of paternal deaths on men's and women's hospital and GP visits is smaller. In sum, we see that mothers' and fathers' deaths have different effects on adult children's visits to GPs and hospitals. However, gender differences in the effects of parental death on daughters' and sons' GP and hospital visits are small and not statistically different from zero.[16]

Rather than an actual deterioration in health status, the increase in GP and hospital visits could be caused by a higher level of self-screening after parental death. Family members' fatal health shocks may incentivize individuals to undertake more rigorous health monitoring and screening (Fadlon and Nielsen, 2019). To rule out that our results are driven by self-screening, we further explore the effects of parental death on hospital visits due to screening in Section 7.5. We do not find evidence of our results being driven by self-screening, and thus, we conclude that the observed increase in GP and hospital visits reflect a deterioration of physical health after parental death.

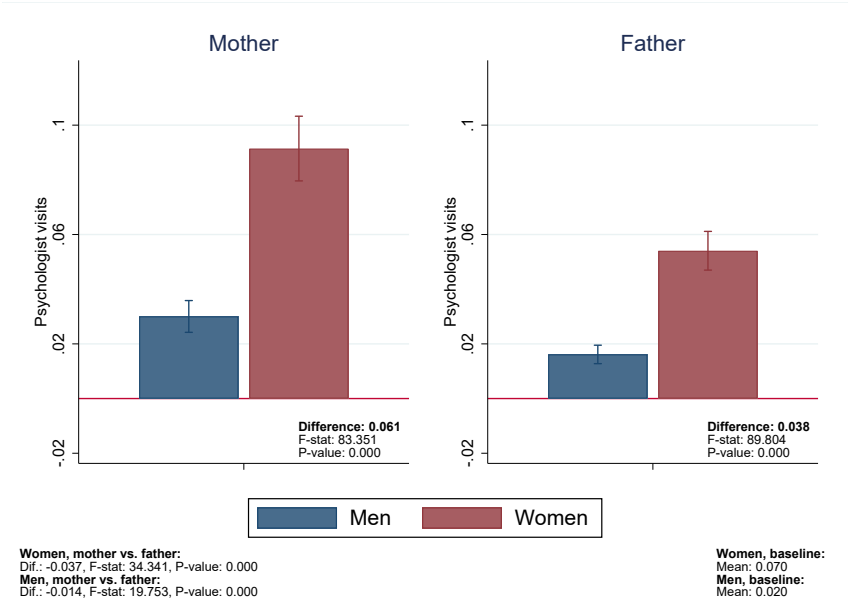
6.2 Informal childcare

In this subsection, we investigate the effects of parental death on earnings and gender inequality through the family support channel. The existing literature has focused intensively on family support in terms of informal childcare (Garcia-Moran and Kuehn, 2017; Anstreicher *et al.*, 2022; Bick, 2016). Households with children aged 6 or younger (most children have started school at age 6) are in greatest need of informal childcare, especially at times when formal childcare is not available. To examine the family support channel through informal childcare, we estimate Equation 4 on men and women with or without young children (age 0-6 one year before parental death) separately. If the family support channel plays a role in contributing to the effects of parental

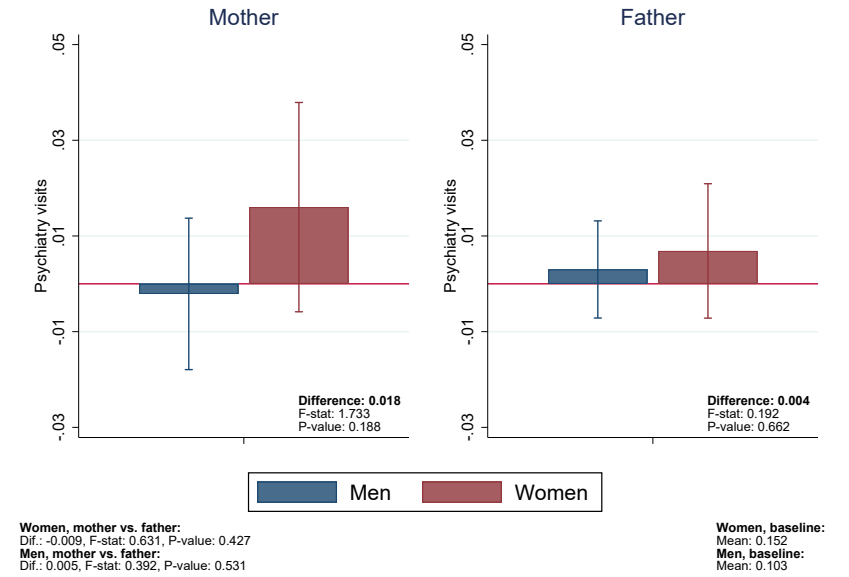
[16]Figure A.7 provides the event studies for the hospital and GP visits before and after parental death.

Figure 6: Matched control: Psychologist and psychiatrist visits, mothers' vs. fathers' deaths

(a) Psychologist visits



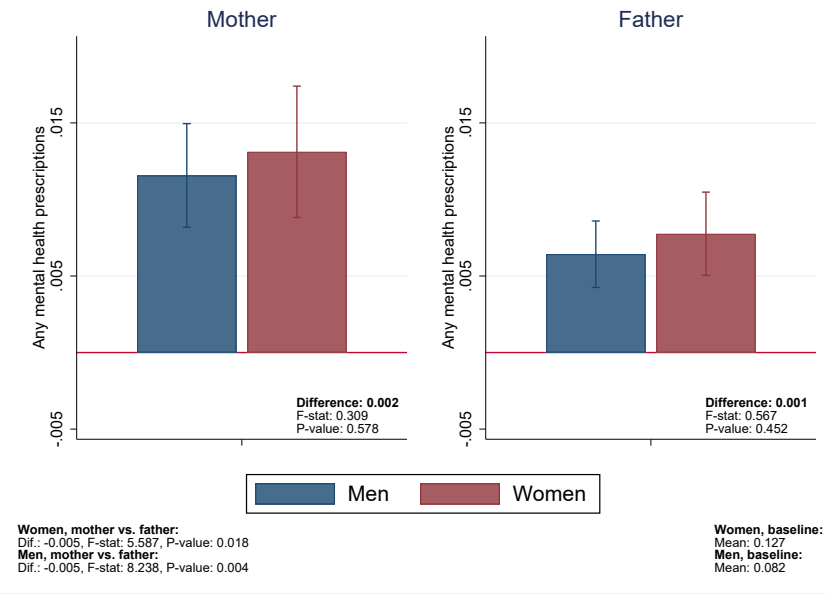
(b) Psychiatrist visits



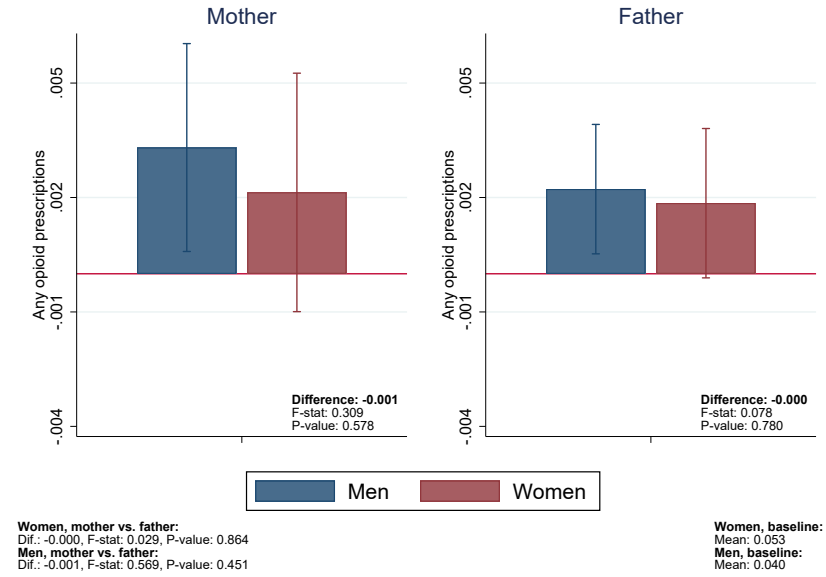
Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's psychologist and psychiatrist visits. Psychiatrist visits include both consultations with psychiatrists at psychiatric hospital wards and private practicing psychiatrists. Data on psychologist visits are available from 1990-2019, leaving a balanced panel of 149,614 women and 166,074 men. The combined psychiatry data are available from 1995-2014, leaving a balanced panel of 106,970 women and 117,110 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

Figure 7: Matched control: Prescriptions, mothers' vs. fathers' deaths

(a) Any prescribed medicine related to mental health



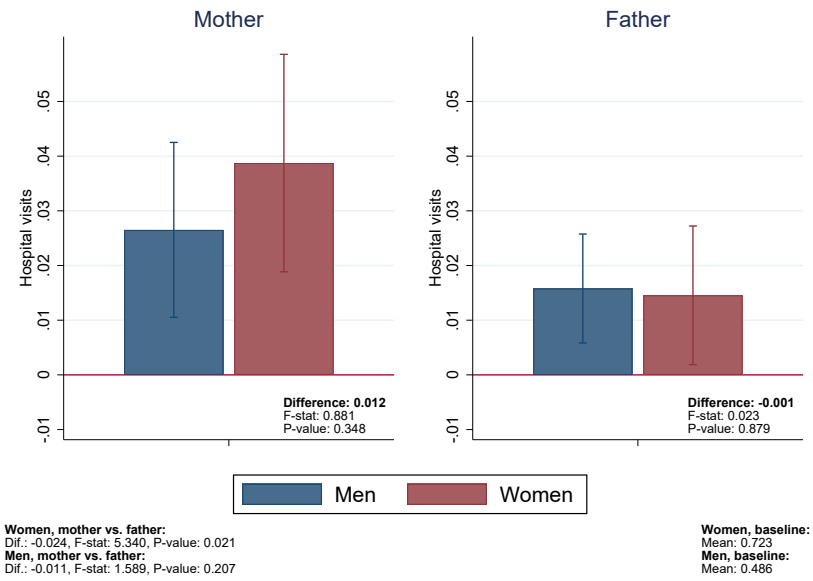
(b) Any prescribed opioid painkillers



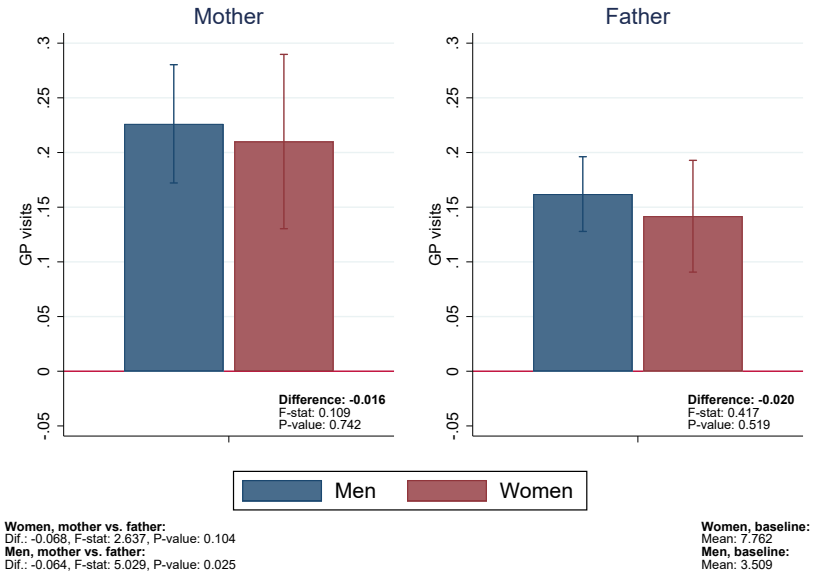
Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's mental health and opioid prescriptions. All medical prescriptions are classified into ATC codes. We classify ATC-codes N05*, N06A*, N06B*, and N06C* as mental health related, ATC-codes N02A* as opioid painkillers. The prescription data are available from 1995, leaving a balanced panel of 111,744 women and 121,896 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

Figure 8: Matched control: Hospital and GP visits, mothers' vs. fathers' deaths

(a) Hospital visits



(b) GP visits



Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's hospital and GP visits. Hospital visits include both in- and outpatient visits at non-psychiatric hospital wards, these data are available from 1994-2018, leaving a balanced panel of 114,500 women and 125,952 men. Data on GP visits are available from 1990-2019, leaving a balanced panel of 149,614 women and 166,074 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

death, we would see that those with young children have a larger earnings drop compared to those without young children.

Figure 9 presents the estimated effects of first parental death on men's and women's earnings for those with or without young children, respectively. We also examine gender-specific effects by mothers' vs. fathers' deaths. Overall, women with young children experience a much larger earnings penalty after the first parental death compared to women without young children. Specifically, the earnings of women with young children drop by almost 4% after parental death, whereas the earnings of men with young children are only marginally affected. Comparing the differential effect of mothers' vs. fathers' deaths, we find that mothers' deaths have a slightly larger impact on women with young children, and thus, contribute to the gender earnings inequality resulting from parental death. The difference in earnings penalties from parental death between women with and without young children, and between men and women with young children, suggests that family support is an important channel for explaining women's employment and earnings drop after parental death, and contributes markedly to the gender earnings gap generated by parental death.[17]

If a family loses access to informal childcare, they can substitute this with formal childcare. Thus, we check if men and women with young children switch to formal childcare after parental death. If so, to what extent is there a gender difference? To answer this, we examine the effect of first parental death on the probability of men and women with young children enrolling children in formal childcare. In Figure A.8, we find that first parental death significantly increases men's and women's uptake of formal childcare. This suggests that formal childcare and parental informal childcare are substitutes for each other. Considering the effects of mothers' vs. fathers' deaths on enrollment in formal childcare, we find that mothers' deaths, as opposed to fathers' deaths, lead men to enroll their youngest children more in formal childcare, though the difference is small and insignificant.

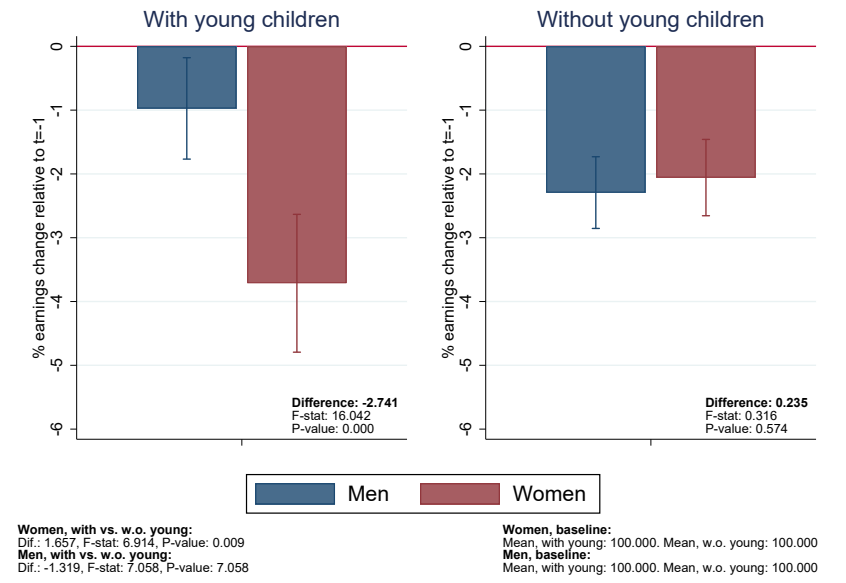
6.3 Eldercare for parents

Parental death can potentially affect adult children's labor market outcomes through the elderly care channel. On the one hand, elderly parents may require care from their adult children before death. When parents pass away, adult children would be released from elderly care and be able to increase their labor supply and earnings. On the other hand, when the first parent passes away,

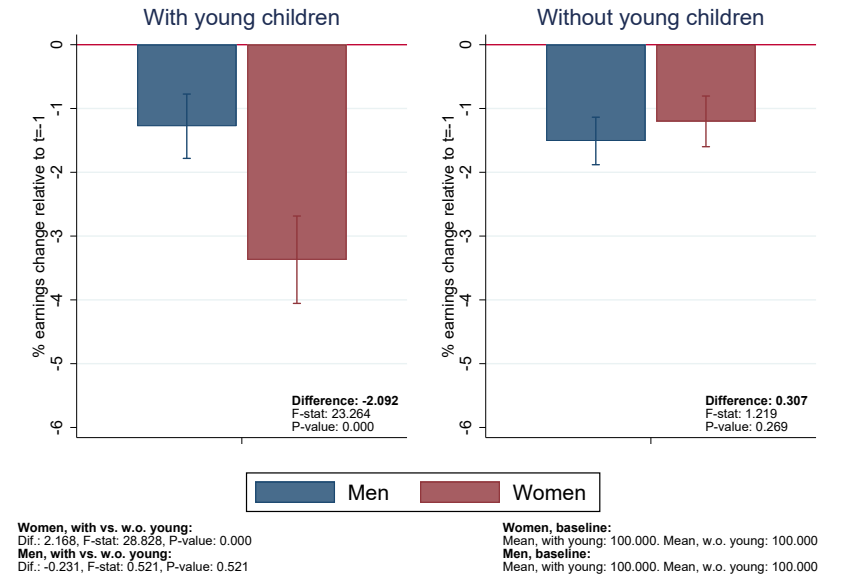
[17] We also examine the heterogeneity by age of the youngest child between 0-6 and 7-14 and reported it in Figure A.9. We find that women with children under 6 years of age experience the largest decline, consistent with the fact that younger children need intensive care.

Figure 9: Matched control: Earnings by young children, mothers' vs. fathers' deaths

(a) Mothers' deaths



(b) Fathers' deaths



Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's earnings, but the sample is divided depending on whether individuals have a child aged 6 or younger. Earnings are normalized by the average earnings of each group of men and women one year before parental death. The sample consists of all unexpected, first parental deaths from 1983 to 2014 and their matched controls, see Table A.2 for details on the sample. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

the remaining parent becomes widowed and may need more care from their adult children.

Due to our empirical design, the former channel is less relevant because we focus on the sudden death of the first parent: parents are generally healthy before death. Even if the first deceased parent requires elderly care, our data show that more than 90% of the parents are married, and existing studies and data have shown that the primary caregiver for sick elderly is their spouses (Pinquart and Sörensen, 2011; Mommaerts, 2015). Thus, they are more likely to receive care from their spouses rather than their adult children. The latter channel might be relevant even in the Danish context where an extensive public elderly care system is in place (Danish Ministry of Health, 2017; Olejaz *et al.*, 2012), although the literature using data from the Netherlands (Rellstab *et al.*, 2020) finds a null effect of elderly parents' care on adult children's labor market outcomes due to a similarly extensive public elderly care system.

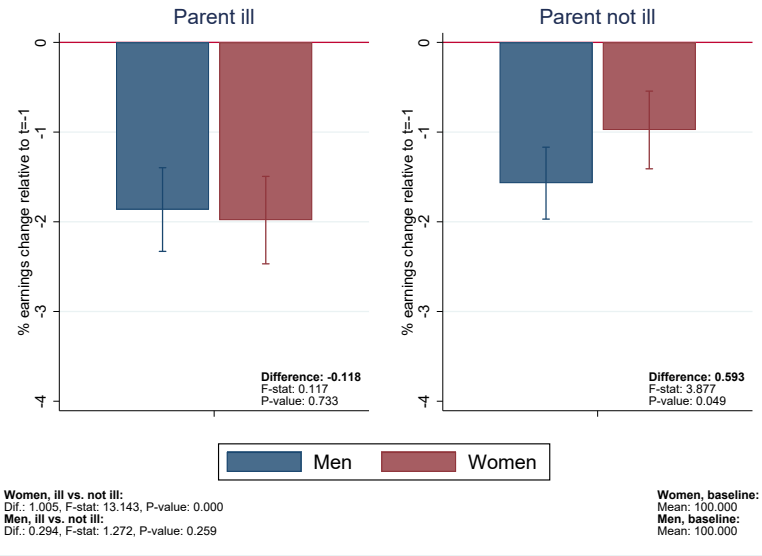
To examine the effect of care for widowed parents, we follow the existing literature (Rellstab *et al.*, 2020; Arrieta and Li, 2022) and exploit variation in whether the surviving widowed parent is ill. Ill widowed parents are more likely to require care from adult children than healthy parents, allowing us to identify a potential elderly care effect. Using hospitalization data, we examine the heterogeneous effects on labor market outcomes by parental health status. In our sample, around 20% of widowed parents have undergone hospital treatment for more than three months within five years after the first parent's death (including continuous outpatient care). The heterogeneity analysis by parental health status in Figure 10 shows that men and women experience a larger drop in earnings if their surviving parent is ill, but the difference is only statistically different for women.

Furthermore, we examine whether men and women are more likely to move to live in the same region as their widowed parent after first parental death. We create a dummy variable indicating whether adult children live in the same region as their widowed parent and report the results in Figure A.10.[18] We find a very small positive effect on the likelihood that men and women live in the same region as their widowed parent after first parental death, but the effect does not differ by parental health status. Therefore, the labor market effect of parental death is unlikely to be driven by the fact that men and women tend to relocate close to their surviving parents.

However, heterogeneous effects by whether widowed parents are ill can also confound with the informal childcare or the mental health channels. Specifically, ill parents are less likely to provide informal childcare to adult children, thus affecting adult children's earnings through informal childcare channels. Furthermore, adult children may experience different mental health

[18]For this exercise, we consider NUTS3 regions, which divides Denmark into 11 regions

Figure 10: Matched control: Surviving parent ill or not



Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's earnings. Earnings are normalized by the average earnings of men and women one year before parental death. We divide the sample by the surviving parents' health status, based on their hospital visits. Hospital visits include in- and outpatient visits at non-psychiatric hospital wards; these data are available from 1994-2018. We restrict the sample to men and women without young children, i.e., children age below 6, leaving a balanced panel of 136,276 women and 154,900 men. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

effects if their widowed parent is ill. To control for the informal childcare channel, we restrict our sample to men and women without young children for the analysis above, as this group of people is less likely to need family support from their parents. To check heterogeneous effects on mental health, we estimate the effect of parental death on visits to psychologists by the widowed parent's health status. We find that when widowed parents are ill, men and women take slightly more mental health prescriptions than when widowed parents are healthy, but the effects are quantitatively small. We do not find any difference in psychologist visits by parental health status for women and men. To this end, the differential effect on women's earnings by the widowed parent's health status is not driven by mental health channel, leaving the effect through the elderly care channel more plausible.

Lastly, we emphasize that even if we had found suggestive evidence of the elderly care channel affecting adult children, this channel will affect only a small share of adult children, given that 80% of widowed parents generally are healthy within 5 years after spousal death. Therefore, we conclude that this channel is not a primary driver of the general decline in earnings after parental death. These results are consistent with the recent findings of Gørtz *et al.* (2023), who use survey data to provide facts about eldercare in Denmark. The authors show that around 1/3 of the elderly

aged 65+ received a positive number of hours of informal care. Among those who receive informal eldercare, 30% of them receive care from their children and the median number of weekly hours of care is around 3 hours. Moreover, informal care is more likely to be offered by older individuals and retirees, who are already out of the labor market. Taken together, these pieces of evidence suggest that the eldercare channel may play a role, but it is unlikely to be a primary mechanism behind the effects of parental death on adult children's labor market outcomes.

7 Supplementary outcomes and robustness checks

We conduct a series of robustness checks and supplementary analyses to ensure the validity of our findings. First, we explore the interaction effect of first parental death and parental wealth on individual labor market outcomes, finding no evidence to suggest that the decline in earnings following parental death is driven by the bequest channel. Second, we investigate the impact of parental death on fertility and cohabitation, ruling out the possibility that changes in these behaviors are driving the observed deterioration in labor market outcomes. Third, we investigate the within-family spillover effect of parental death by examining how it influences spousal labor market outcomes. Specifically, we find a meaningful negative impact of parents-in-law deaths on women's earnings through the informal childcare channel. Fourth, we find no evidence to support the notion that parental death affects earnings through its impact on preferences for certain types of jobs and leisure. Fifth, we consider whether the effect of parental death on health outcomes is driven by an increase in screening for illnesses, rather than an actual deterioration in health. Sixth, we conduct further analyses to consider heterogeneity based on factors such as geographic proximity between parents and adult children, causes of parental death, and parental age at death. Seventh, we show that our results are robust to using of a control group similar to Fadlon and Nielsen (2019, 2021). Finally, we discuss the external validity of our findings.

7.1 Inheritance

Our empirical design focuses on the first parental death. As described in Section 2, after the first parental death, the entire estate of the deceased parent is usually held by their spouse for married couples. Thus, by focusing on the first parental death, this channel is less relevant in driving the effect of parental death on adult children's labor market outcomes. However, to ensure that bequest is not a significant driver of our results, we conduct a heterogeneity analysis exploiting information on parental wealth before death (bequests are not observed directly). We regress

adult children's earnings on the interaction term between a treatment indicator and parental wealth one year before the first parental death. If parents are wealthy, adult children tend to receive more bequests. If bequests are driving the earnings decline, we would expect the interaction term to be negative.

We report the results by gender of parental death and adult children in Table A.3. We find no impact of any of the interaction terms on adult children's earnings. As an alternative, we also interact the treatment indicator with adult children's own assets and regress the interaction term on adult children's earnings. The coefficient of the interaction term measures the impact of own wealth increase on adult children's earnings after parental death. We still do not find a statistically or economically meaningful impact on individual earnings. Collectively, this evidence suggests that the bequest channel does not drive the decline in earnings after the first parental death.[19]

7.2 Effects on cohabitation and fertility

Parental death could also affect adult children's labor market outcomes by impacting family behavior. For example, if parental death changes cohabitation and marital status, or affects fertility, we would expect derived effects on adult children's labor market outcomes. Figure A.11 shows the effect of parental death on fertility and cohabitation.

We find no effect of mothers' or fathers' death on men's and women's cohabitation status, suggesting that changes in cohabitation do not drive the labor market effects. In addition, we find that first parental death reduces the fertility rate of adult children. Compared to matched controls, the total number of children is 0.012 lower for both men and women after losing a mother, while the total number of children is 0.003 lower after paternal death. Because higher fertility is associated with lower employment and earnings, especially for women, a reduction in fertility would predict an increase in employment and earnings. This suggests that the change in fertility behavior cannot drive the observed deterioration in labor market outcomes for men and women after parental death.

[19] As a further robustness check, we also replicate the results by only using the wealth of the deceased parents and the wealth of the widowed parents separately. The interaction between the treatment and wealth of the widowed parents can provide suggestive evidence if widowed parent uses inter-vivo transfers to induce more care from their adult children, and thus, affect adult children's labor market outcomes. We do not find any effects supporting this argument.

7.3 Effects on spouses

Parental death may not only affect the labor market outcomes of daughters and sons, it could also have a spillover effect on the labor market outcomes of daughters-in-law and sons-in-law. In this subsection, we explore the spillover effect of parental death on the earnings of daughters-in-law and sons-in-law. Because the treated individuals are men and women who lost their first parent-in-law, the sample is restricted to those who cohabit or are married. Our control group is again obtained through nearest-neighbor matching. For each treated individual, we identify an observationally similar matched control who is also married or cohabiting, but who does not lose either of their parents-in-law in the sample window. When obtaining the matched controls, we also control for whether the individual's own parents are still alive to ensure that the two groups are comparable in terms of their own parent death status.

We find that the death of parents-in-law has a negative impact on the earnings of men and women with young children (children below age 6), which is shown in Figure A.12. Specifically, compared to men, women with young children experience a larger decline in earnings, around 2pp. This suggests that the death of parents has a greater spillover effect on female spouses through the informal childcare channel.

7.4 Preference change: Type of work and leisure

Parental death could also affect labor market outcomes by changing adult children's preferences for work. First, after parental death, adult children may switch to occupations that they enjoy more or find more meaningful but earn less money. To test whether this channel is operative, we examine the impact of parental death on switching occupations and present the results in Figure A.13. We find no effect of parental death on occupational switching, suggesting that parental death does not affect labor market choice by changing their preferences for certain types of jobs.

Second, after losing a family member, people may value time spent with the rest of their families more, and thus, change their relative preference between the economic benefits from work and leisure. Without further data on preferences for leisure and time use, we cannot rule out this channel directly. However, if this is the case, we would also expect that adult children would be more likely to form a family and have more children to enjoy the time spent with family. However, as described in Section 7.2, we do not find such an effect. Taken together, the evidence suggests that it is implausible that parental death affects adult children's labor market outcomes through its impact on preferences for certain types of jobs or for leisure.

7.5 Health effect: Screening vs. non-screening

In the main analysis, we show that women and men visit hospitals and GPs more after parental death. However, they could visit hospitals for screening purposes because sudden parental death may induce people to be more cautious about their health (Fadlon and Nielsen, 2019). In this sense, it is not an actual health deterioration that drives the increase in hospital and GP visits, but rather screening incentives. To examine if this is the case, we take advantage of our detailed hospital diagnosis data to distinguish the hospital visits due to self-screening vs. non-screening purposes. In particular, self-screening hospital visits are defined as visits to hospitals to do tests and examinations without a definitive symptom or condition.

We examine the effect of parental death on hospital visits for screening and non-screening purposes and report the effects in Figure A.14. Panel (a) and (b) show the effect of parental death on hospital visits due to screening and non-screening purposes, respectively. We find that the effect on visits to hospitals due to screening purposes is minimal and not statistically different from zero, but the effect on hospitals due to non-screening purposes is large and significant. This suggests that parental death has a negative impact on adult children's actual health, rather than health screening behavior.

7.6 Heterogeneity analysis

We conduct further heterogeneity analyses to examine the effect of parental death by whether parents and adult children live in the same region, by parental reasons of death, and by parental age at death. We present the results in Figure A.15 and Table A.4.

We find that if parents and adult children live in the same region before parental death, the effect of parental death on adult child earnings is greater (Figure A.15). To further examine this result, we create a categorical variable with an intensive measure of distance, that is, whether parents and adult children live in the: 1) same municipality (99 regions), 2) same NUTS3 region (but not same municipality; there are 11 NUTS3 regions in Denmark), 3) same NUTS2 region (but not same NUTS3 region; there are 5 NUTS2 regions in Denmark), 4) further distance than that. This approach gives us four levels of distance, and we find that the negative earnings effects of parental death decrease monotonically with regional distance (Figure A.16). This result can be driven by both the family support and mental health channels. In particular, parents are more likely to provide informal childcare and receive eldercare if they live close to their adult children. In addition, living in the same region may suggest that parents and children have a better relationship, and thus, adult children may suffer more from mental health problems after parental

death.

Furthermore, we find that the effects of parental death are similar across different death causes, i.e., heart attack, stroke, car accident, etc., suggesting no heterogeneous effects conditional on sudden death; see Table A.4, Columns 1 and 2.

Finally, we find a larger impact of parental death if parents die at a relatively younger age; see Table A.4, Columns 3 and 4. This could also be due to family support and mental health channels: parents are more likely to provide informal childcare when they are young and healthy, and adult children suffer more mental health problems when parents die unexpectedly at a relatively young age.

7.7 Alternative specifications

Our main empirical strategy adopts nearest-neighbor matching to find an observationally similar matched control for treated individuals. The matched control individual does not lose either of their parents during the observed window, but they lose their parents in the future. As a robustness check, we exactly follow Fadlon and Nielsen (2021) and use an alternative empirical strategy that uses future-treated individuals as the control group. We consider a time gap in the treatment of 6 years. For example, we use individuals whose first parents died out of sudden reasons in 2010 as the control for individuals who lost their parents in 2004. Then we compare the labor market trajectories of the two individuals over the period 2001 to 2009. We present the results in Figure A.17. Using this alternative specification, we find results similar to those from our main specification using matched nearest-neighbours as the control group.

7.8 External validity

In this paper, we focus on first and sudden parental deaths for identification concerns. However, our results have significant implications for non-sudden death as well. The main mechanisms we documented in this paper, including family support and mental health channel, could also be effective after non-sudden parental deaths. If adult children lose parents from non-sudden death, they also lose informal childcare provided by parents, and could similarly suffer from mental health problems due to their loss.

To further support this, in Figure A.18, we show event studies for first, *non*-sudden parental deaths, similar to those for sudden deaths presented in Figure 2. Quantitatively, the average reductions in labor supply and earnings following *non*-sudden parental deaths are very similar to those of sudden parental deaths. Furthermore, as shown in Panel (d), there is a sharp increase

in mental health-related prescriptions at the time of parental death. Therefore, these descriptive results suggest that the effects of parental death are very similar regardless of sudden or *non*-sudden causes of death. However, in contrast to Figure 2, in Figure A.18 we see evidence of pre-trends; the increase in mental health prescriptions and the negative effects on labor market outcomes appear to start already before *non*-sudden parental deaths. The pre-trends reflect that the group of parents dying of non-sudden reasons are likely to be ill for significant period of time before death, and parental illness may affect child outcomes. Therefore, for identification purposes, we focus on sudden deaths in this paper, ruling out anticipation effects of parental death and pre-trends in the outcomes that we consider.

8 Conclusion and policy implications

In this paper, we examine the labor market effects of an event that almost everyone experiences at some point in their lives: the death of a parent. Despite the widespread occurrence of parental death, the literature that evaluates its impact on outcomes of adult children is scarce. To contribute to this literature, we use Danish register data from 1980 to 2019 and analyze all sudden, first parental deaths in Denmark between 1983 and 2014. Using both event studies similar to Kleven *et al.* (2019) and a difference-in-differences approach with a control group of matched nearest-neighbors, we find that adult children experience substantial and enduring declines in earnings and employment following the first parental death. The extensive sample of first parental deaths enables us not only to examine the overall impact of parental death on the outcomes of adult children, but also to quantify the parent-child gender interaction effects, i.e., the differential effects of losing a mother vs. a father on daughters vs. sons. We find that the death of mothers has a significantly larger negative impact on both men's and women's earnings. Compared to men, women experience a larger drop in earnings after both mothers' and fathers' deaths. Therefore, first parental death contributes significantly to gender gaps in earnings and employment.

Our findings indicate that the mental health and family support channels are the main drivers of the effects on labor market outcomes and gender inequalities resulting from the first parental death. Although parental death is ultimately unavoidable, this does not imply that policymakers should not address these negative effects on children. Given the near-universal nature of parental death, the individual long-term adverse effects of the event will also have significant effects on the economy as a whole. Kleven et al. (2019) document earnings penalties around childbirth for women but not for men. They find that women's earnings drop by around 20% after childbirth. We find that the earnings for women with young children drop by as much as 4% after losing

a parent, which is close to 20% of the estimated child penalty. Moreover, we also show that parental death negatively affects both women and men. Consequently, a larger proportion of the population is adversely affected by parental death, further amplifying its impact on the aggregate economy.

Currently, policies aimed at assisting bereaved adult children are scarce, as parental death is typically managed without significant intervention from public authorities. Religious institutions, such as the church, typically play a role at death, e.g., by undertaking a funeral. However, with the increasing secularization of societies, public non-religious policies could be developed to address the negative effects of parental death. We suggest that potential policies could draw inspiration from those implemented around childbirth, which represents another event with significant economic and emotional implications.

In Denmark, local authorities organize "mommy groups" to facilitate the interaction among mothers of newborns who share similar experiences and challenges. Similar support groups are also organized by charities or authorities in many other countries (see, e.g., Hanna *et al.*, 2002). In the context of parental death, the establishment of grief groups could offer comparable emotional support by connecting adult children who have recently lost a parent. This approach has the potential to address some of the significant negative mental health effects associated with parental death. Furthermore, just as the health of newborn children and their mothers is closely monitored after childbirth, a similar approach could be adopted in relation to parental death. For example, authorities could organize automatic consultations with psychologists for children following the loss of a parent.

While parents of newborns are entitled to parental leave to help alleviate time constraints surrounding childbirth, children have no legal entitlement to paid leave in Denmark in the context of parental death. Paradoxically, the death of a parent often imposes substantial legal and organizational burdens on children during a time of emotional distress. Therefore, we propose that offering paid leave in connection with parental death could alleviate time constraints and provide bereaved children with the necessary time to address administrative responsibilities and time to mourn. This could potentially mitigate the negative long-term effects of parental death, but further research is necessary to evaluate the efficacy of such policies.

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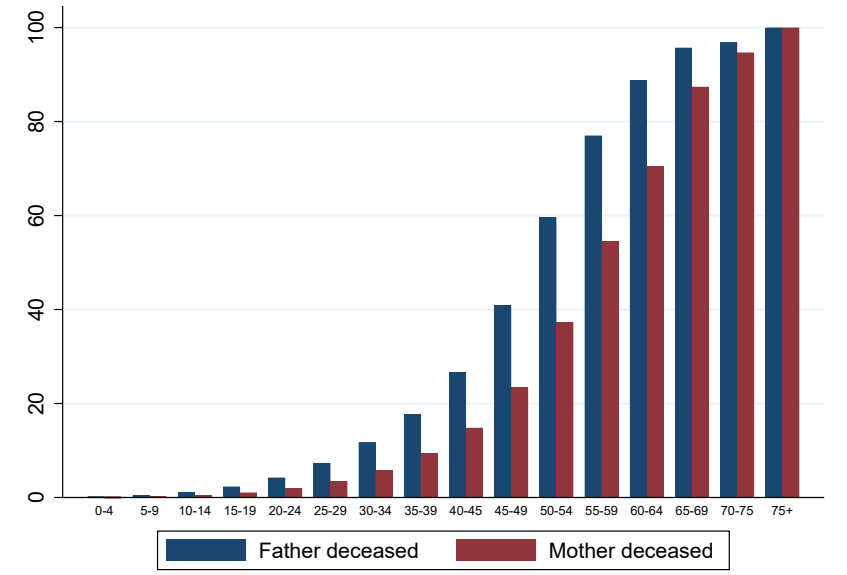
ONLINE APPENDIX:

Effects of Parental Death on Labor Market Outcomes and Gender Inequalities

A Appendix

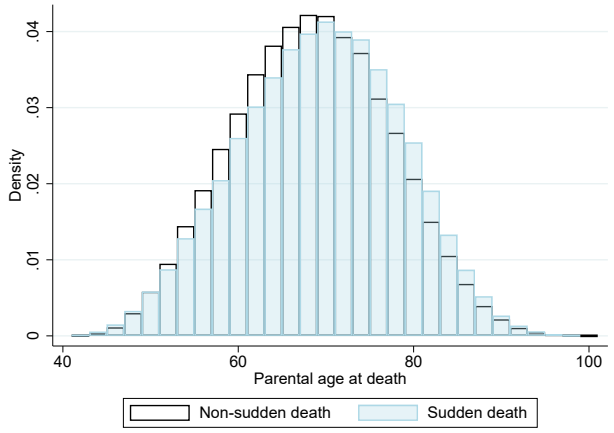
A.1 Additional results

Figure A.1: Percentage of people with deceased parents by age: Denmark



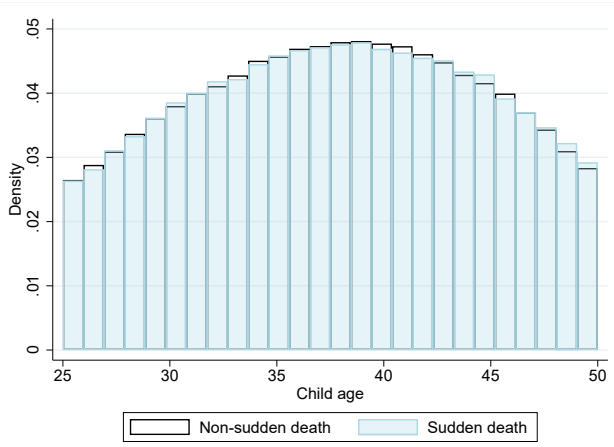
Notes: This figure shows the cumulative percentage of people who have lost their parents by age in 2014. The blue (red) bar shows the cumulative percentage of people losing their mother (father). We consider all causes of death for this figure. Source: Danish population registry, BEF, and the cause of death registers, DODSAARS/DODSAARG.

Figure A.2: Age of first deceased parent distribution



Notes: This figure plots the age distribution of the first deceased parent by sudden vs. nonsudden death. We include the first parental deaths occurring between 1983 and 2014 for children aged 25-50 in the year of first parental death and with two known parents. See Table 1 for sample sizes. Bars including fewer than 5 individuals are dropped due to data confidentiality restrictions. The sample consists of all unexpected, first parental deaths from 1983 to 2014 and their matched controls for children aged 25-50 in the year of first parental death and with two known parents. See Table A.2 for details on the sample.

Figure A.3: Adult children age distribution when first parent deceased



Notes: This figure plots the age distribution of adult children at the time of first parent death and by first parent sudden vs. nonsudden death. We include the first parental deaths occurring between 1983 and 2014 for children aged 25-50 in the year of first parental death and with two known parents. See Table 1 for sample sizes. Bars including fewer than 5 individuals are dropped due to data confidentiality restrictions.

Table A.1: Summary statistics for adult children at $t = -1$, split by gender and suddenness of first parental death

	First death mother		First death father	
	Sudden	Non-sudden	Sudden	Non-sudden
Age	37.48	36.53	36.56	36.84
Male	0.53	0.52	0.53	0.52
Share with college or above	0.20	0.22	0.21	0.22
Share with high school	0.49	0.52	0.51	0.52
Share without high school	0.31	0.27	0.28	0.26
Cohabitation	0.71	0.70	0.71	0.70
Number of children	1.43	1.36	1.37	1.38
Age of youngest child	8.38	7.65	7.73	7.75
Share with children under 6	0.32	0.34	0.34	0.34
Mother age	66.71	64.01	64.88	64.26
Father age	69.27	66.74	69.47	68.39
Mother married	0.83	0.80	0.86	0.82
Father married	0.87	0.85	0.85	0.81
First death age	67.71	65.01	70.47	69.39
Employment	0.83	0.84	0.84	0.84
Intensive margin	1015.83	1014.67	1011.80	1018.77
Annual earnings (1000 DKK)	292.03	299.30	296.00	303.85
N	48089	185272	167565	358243

Notes: This table shows the summary statistics for children in the calendar year preceding first parental death, split by both parent gender and suddenness of parental death. We include the first parental deaths occurring between 1983 and 2014 for children aged 25-50 in the year of first parental death and with two known parents. All statistics are derived from Danish population-level register data; the specific datasets used for this exercise are described in Section 3.

Table A.2: Summary statistics for adult children at $t = -1$ for sudden, first parental deaths

	First death mother: Daughters	First death father: Daughters	First death mother: Sons	First death father: Sons
Age	37.44	36.53	37.52	36.59
Male	0.00	0.00	1.00	1.00
Share with college or above	0.24	0.26	0.16	0.16
Share with high school	0.44	0.46	0.53	0.55
Share without high school	0.31	0.28	0.31	0.28
Cohabitation	0.74	0.74	0.68	0.67
Number of children	1.56	1.50	1.30	1.25
Age of youngest child	8.97	8.30	7.76	7.14
Share with children under 6	0.32	0.35	0.32	0.34
Mother age	66.68	64.84	66.73	64.92
Father age	69.25	69.41	69.30	69.52
Mother married	0.83	0.85	0.83	0.86
Father married	0.87	0.85	0.88	0.86
First death age	67.68	70.41	67.73	70.51
Employment	0.83	0.84	0.83	0.84
Intensive margin	975.92	969.96	1051.37	1048.41
Annual earnings (1000 DKK)	241.50	244.38	337.32	341.38
N	22729	78402	25360	89163

Notes: This table shows the summary statistics for children in the calendar year preceding a sudden and first parental death, split by both child and parent gender. We include the first parental deaths occurring between 1983 and 2014 for children aged 25-50 in the year of the first parental death and with two known parents. All statistics are derived from Danish population-level register data; the specific datasets used for this exercise are described in Section 3.

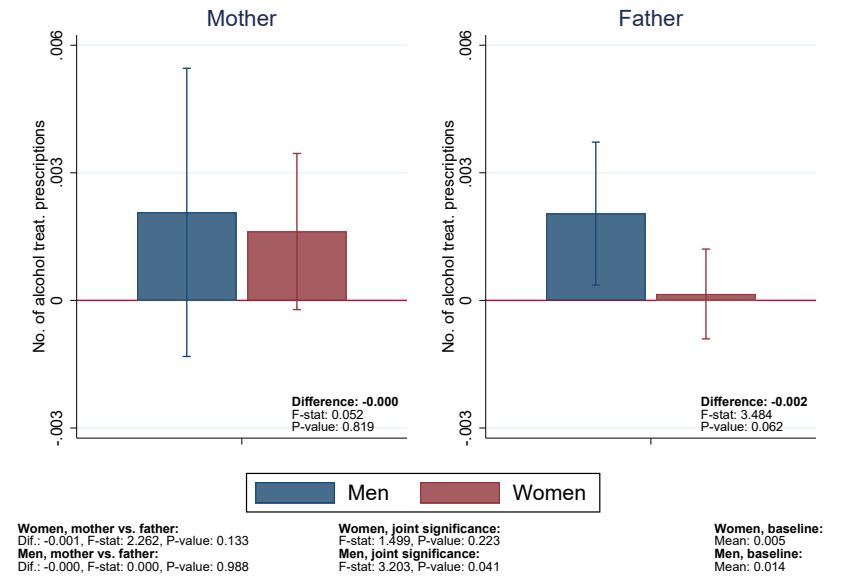
Table A.3: Matched control: Parental net assets and earnings

	(1)	(2)	(3)	(4)
	First death mother		First death father	
VARIABLES	Men Earnings	Women Earnings	Men Earnings	Women Earnings
Treatment × Parental Wealth	0.000	-0.000	-0.000	0.001
	(0.001)	(0.000)	(0.001)	(0.000)
Treatment	-1.950	-2.452	-1.357	-2.150
	(0.392)	(0.348)	(0.189)	(0.201)
Observations	456,478	409,104	1,604,912	1,411,212
Control mean men	104.4	104.4	104.4	104.4
Control mean women	106	106	106	106

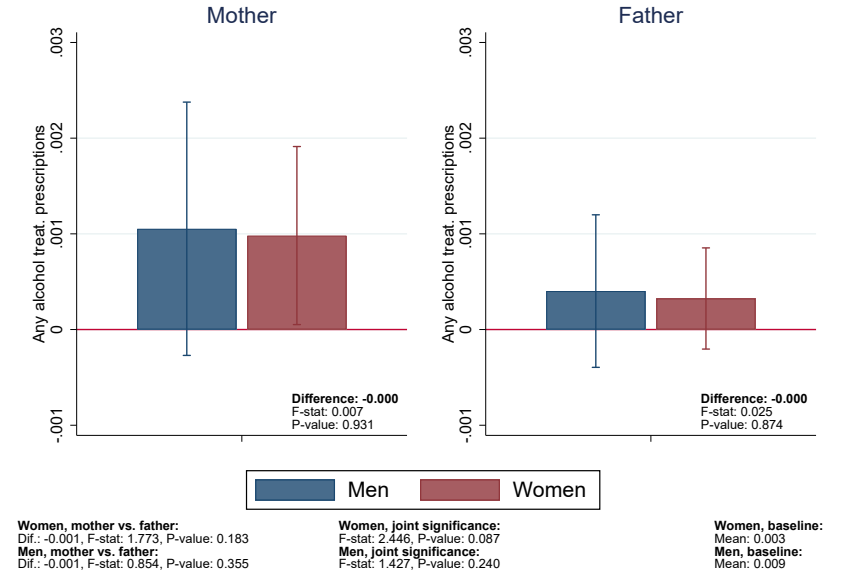
Notes: This table shows the interaction effect of parental wealth and parental death on adult children's earnings by gender. The first two columns show the effect after mothers' death and the last two columns show the effect after fathers' death. Parental wealth includes savings, stocks, etc., as well as the value of any properties owned net of the debt in the property. The value of assets is inflated to 2020 levels.

Figure A.4: Matched control: Treatment of alcohol addiction, mothers' vs. fathers' deaths

(a) No. of prescriptions



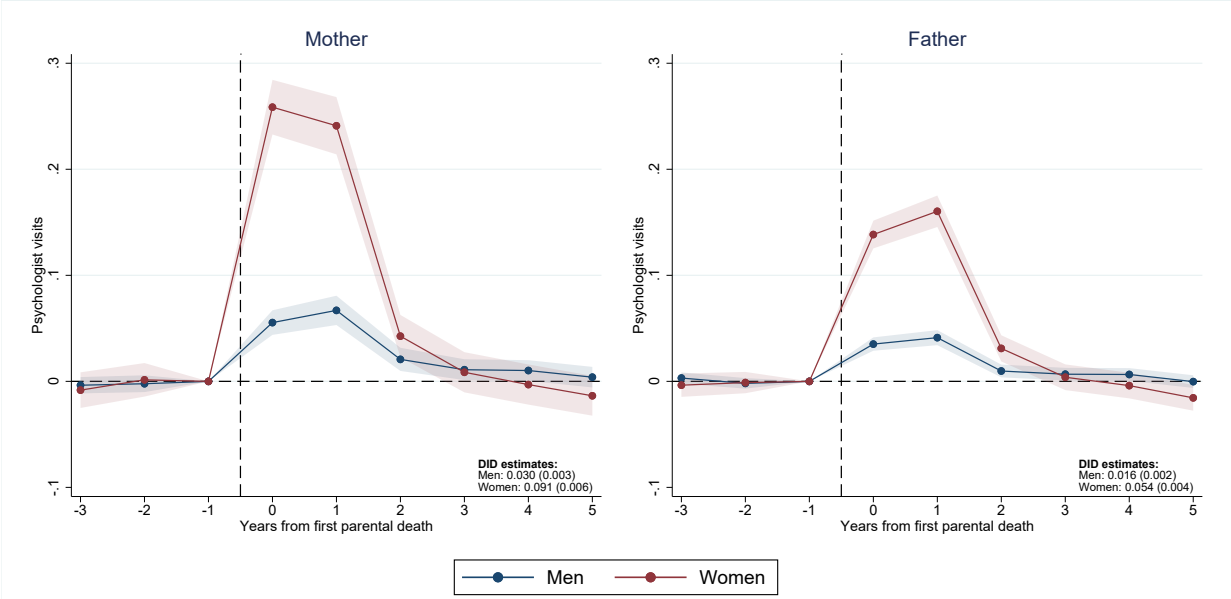
(b) Any prescriptions



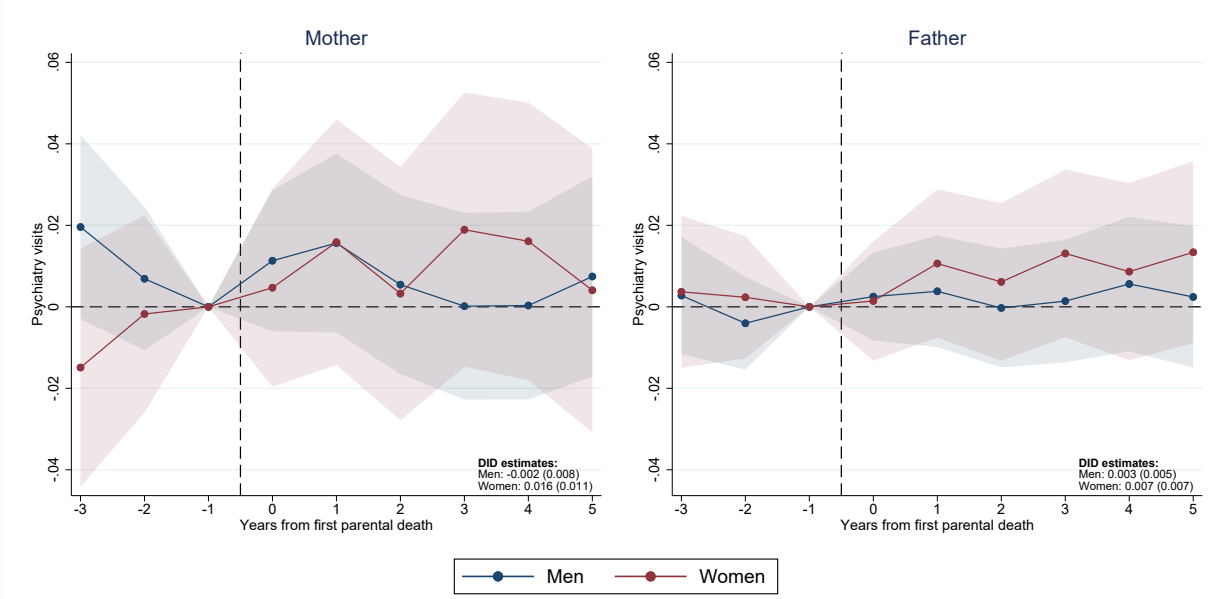
Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's mental health and opioid prescriptions. All medical prescriptions are classified into ATC codes. We classify ATC-codes N07BB as prescriptions related to the treatment of alcohol addiction. The prescription data are available from 1995, leaving a balanced panel of 111,744 women and 121,896 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.5: Matched control: Psychologist and psychiatrist visits, mothers' vs. fathers' deaths

(a) Psychologist visits



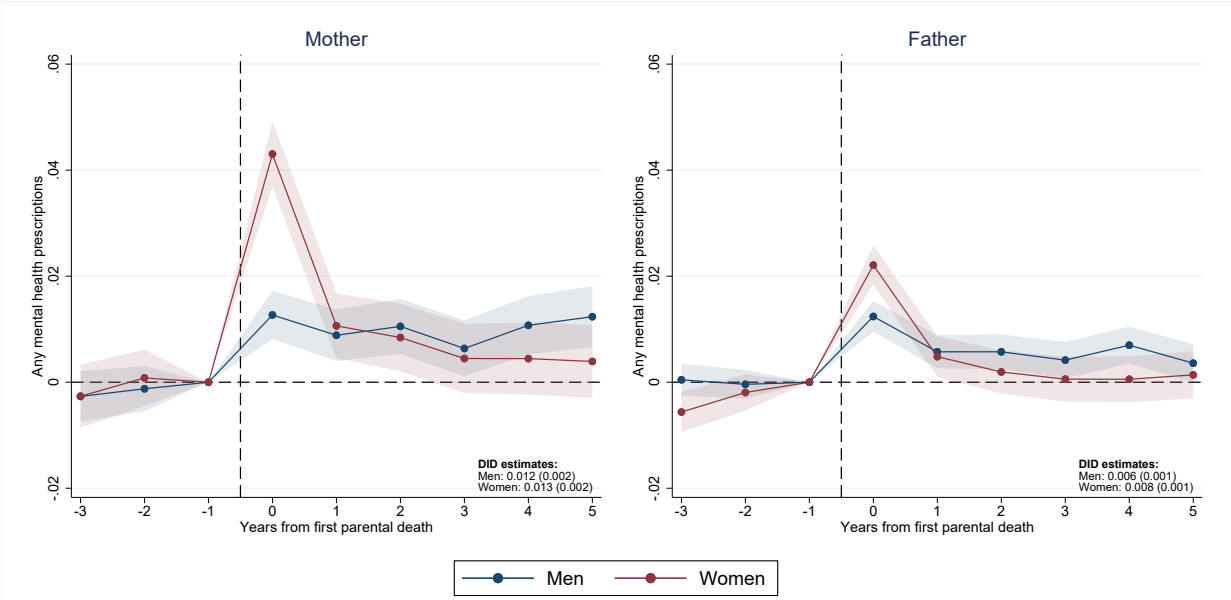
(b) Psychiatrist visit



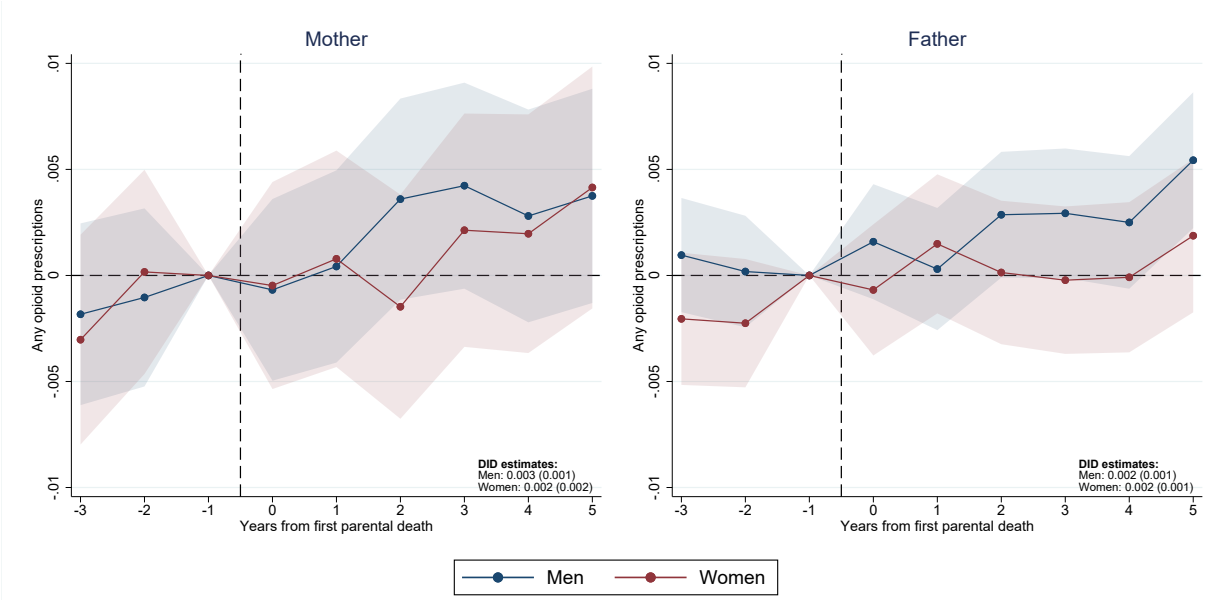
Notes: This figure plots the estimated coefficients from Equation 2 for men's and women's psychologist and psychiatrist visits. Psychiatrist visits include both consultations with psychiatrists at psychiatric hospital wards and private practicing psychiatrists. Data on psychologist visits are available from 1990-2019, leaving a balanced panel of 149,614 women and 166,074 men. The combined psychiatry data are available from 1995-2014, leaving a balanced panel of 106,970 women and 117,110 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

Figure A.6: Matched control: Prescriptions, mothers' vs. fathers' deaths

(a) Any prescribed medicine related to mental health



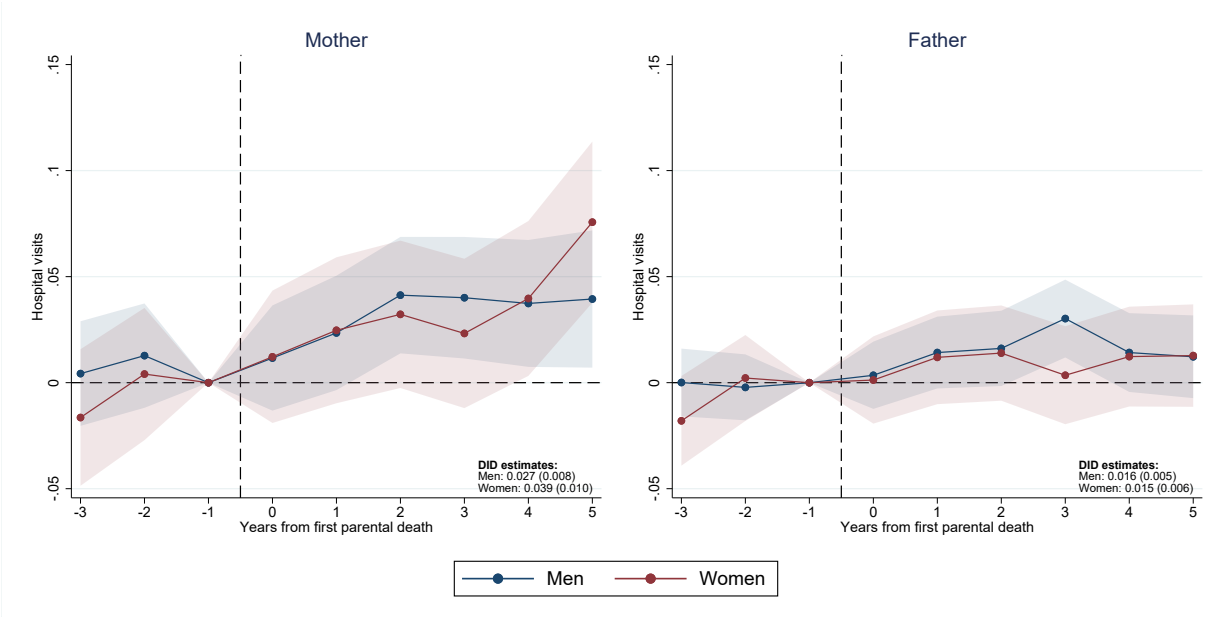
(b) Any prescribed opioid painkillers



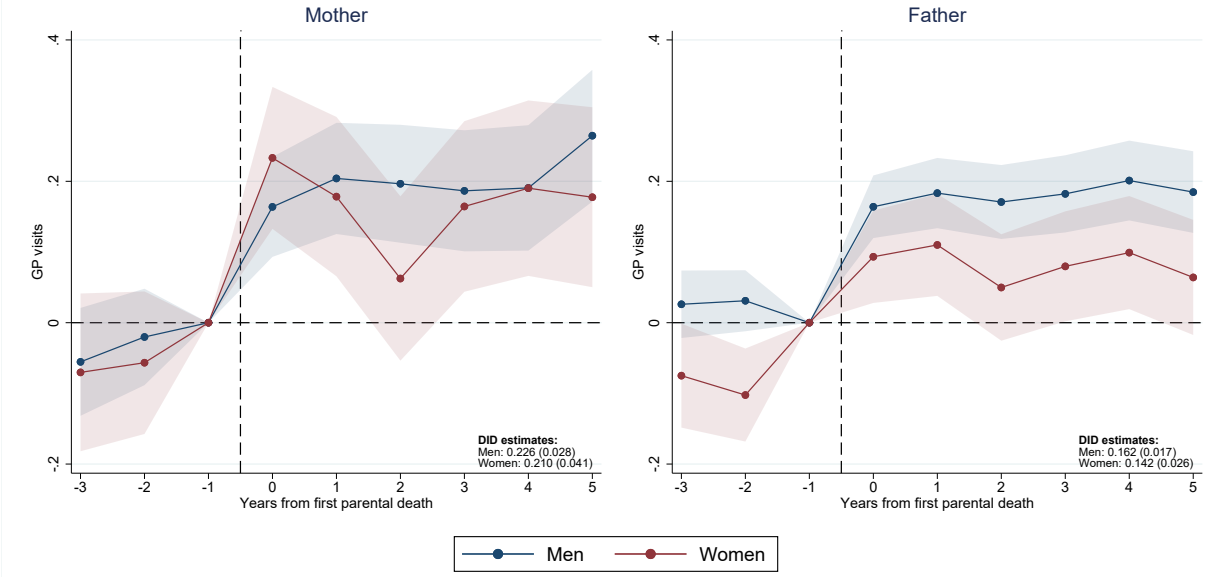
Notes: This figure plots the estimated coefficients from Equation 2 for men's and women's mental health and opioid prescriptions. All medical prescriptions are classified into ATC codes. We classify ATC-codes N05*, N06A*, N06B*, and N06C* as mental health related, ATC-codes N02A* as opioid painkillers. The prescription data are available from 1995, leaving a balanced panel of 111,744 women and 121,896 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

Figure A.7: Matched control: Hospital and GP visits, mothers' vs. fathers' deaths

(a) Hospital visits



(b) GP visits



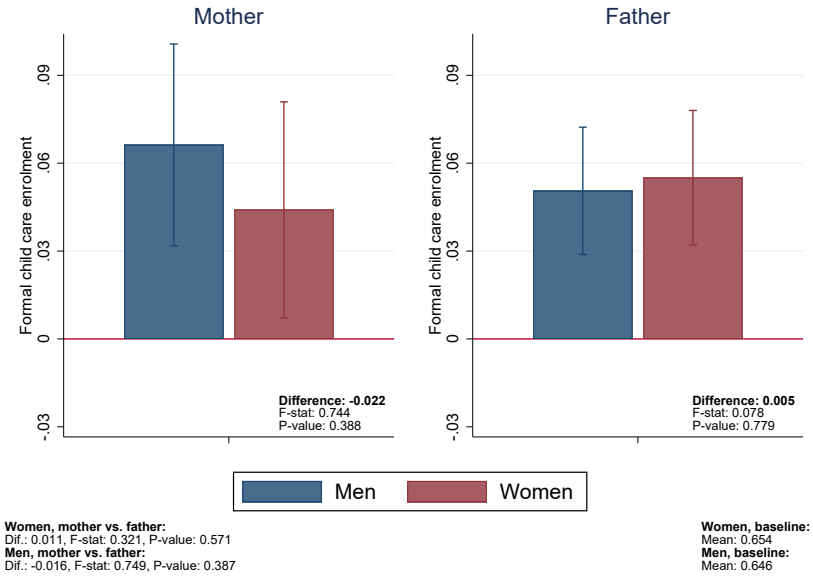
Notes: This figure plots the estimated coefficients from Equation 2 for men's and women's hospital and GP visits. Hospital visits include both in- and outpatient visits at non-psychiatric hospital wards, these data are available from 1994-2018, leaving a balanced panel of 114,500 women and 125,952 men. Data on GP visits are available from 1990-2019, leaving a balanced panel of 149,614 women and 166,074 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

Table A.4: Matched control: Heterogeneity in treatment effect by parental cause of death and age

Dependent variable: Indexed earnings, % change relative to t=-1				
	(1)	(2)	(3)	(4)
	Men	Women	Men	Women
Treat., heart	-1.663***	-1.985***		
	(0.157)	(0.180)		
Treat., stroke	-1.025***	-2.110***		
	(0.236)	(0.280)		
Treat., respiratory	-3.230	-1.682		
	(2.019)	(2.073)		
Treat., accident	-1.762***	-1.930***		
	(0.396)	(0.458)		
Treat., parent young			-2.069***	-2.525***
			(0.175)	(0.206)
Treat, parent old			-0.961***	-1.449***
			(0.179)	(0.202)
Observations	2,061,390	1,820,316	2,061,390	1,820,316
R-squared	0.800	0.807	0.800	0.807

Notes: This table shows heterogeneity in treatment effect by parental cause of death and age. Earnings are normalized by the average earnings of men and women one year before parental death. The sample consists of all unexpected, first parental deaths from 1983 to 2014 and their matched controls for children aged 25-50 in the year of first parental death and with two known parents. See Table A.2 for details on the sample. Effects are within 5 years after the first parental death. "Old" refers to parents older than 71 at the time of parental death, 71 years old is the median age of parental death. Standard errors clustered at the individual-by-match ID level in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

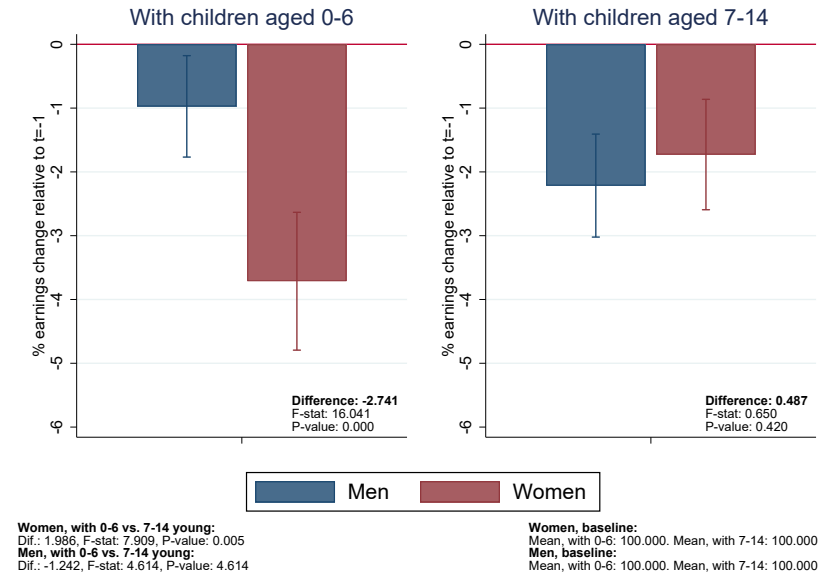
Figure A.8: Matched controls: Formal childcare, mothers' vs. fathers' deaths



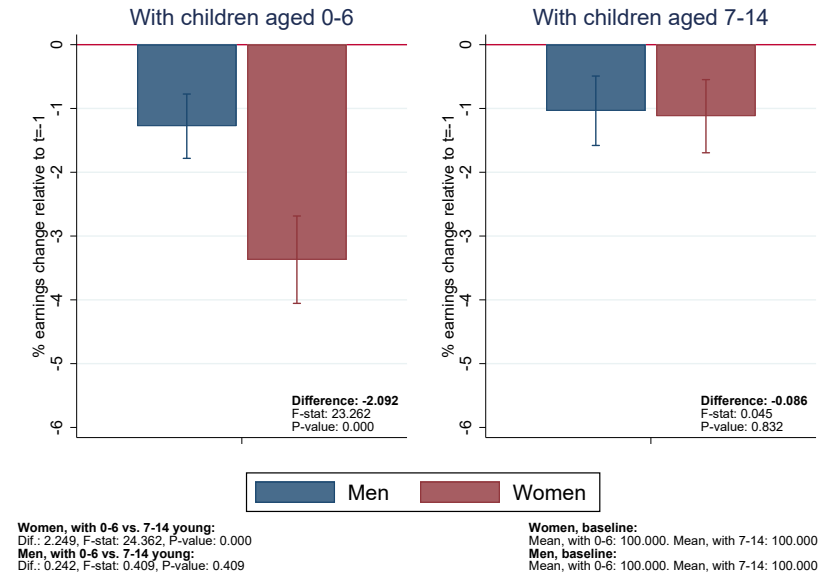
Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's uptake of formal childcare. The data on formal childcare have low coverage before 2005, so we only include data from 2005-2019, we also only include individuals with children aged 6 or younger. This leaves a balanced panel of 7,646 women and 8,758 men. Half of the individuals are treated, the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.9: Matched control: Earnings by child age group, mothers' vs. fathers' deaths

(a) Mothers' deaths

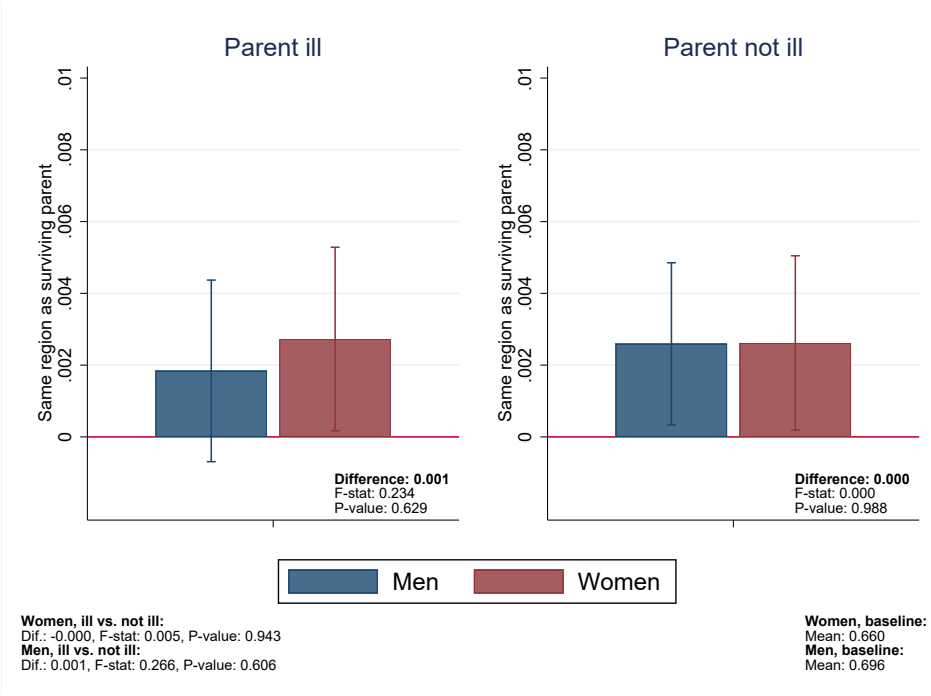


(b) Fathers' deaths



Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's earnings, but where the sampled is divided depending on whether individuals' youngest child is aged 6 or younger, or 7 to 14 years. Earnings are normalized by the average earnings of men and women one year before parental death. The sample consists of all unexpected, first parental deaths from 1983 to 2014 if the individual experiencing parental loss has a child aged 14 or younger, leaving a balanced panel of 121,808 women and 127,038 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

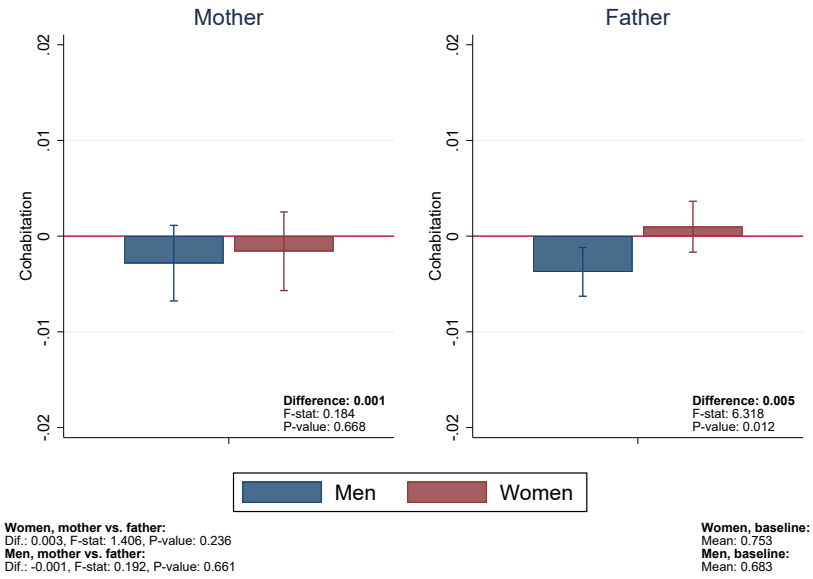
Figure A.10: Matched control: Same region of residence as surviving parent



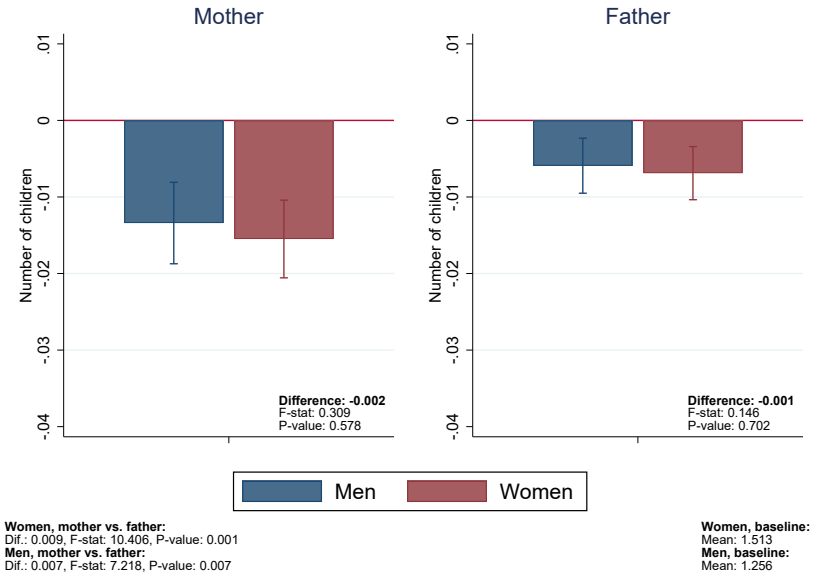
Notes: This figure plots the estimated coefficients from Equation 3 for men's and women's living in the same region with surviving parents by parental health status. We use the 11 NUTS3 regions in Denmark for this exercise. Detailed regional data are available from 1985 and hospital data until 2018, leaving a balanced panel of 151,742 women and 169,548 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.11: Matched control: Other outcomes, mothers' vs. fathers' deaths

(a) Cohabitation

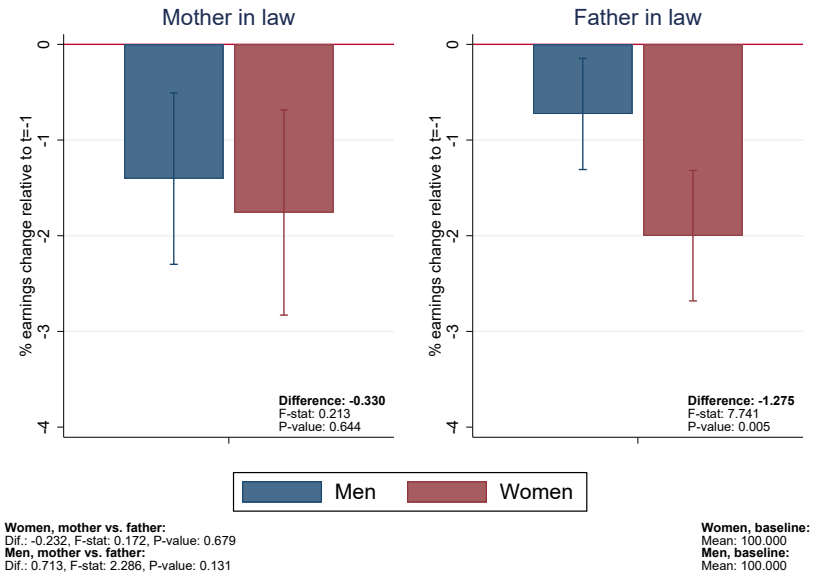


(b) Fertility



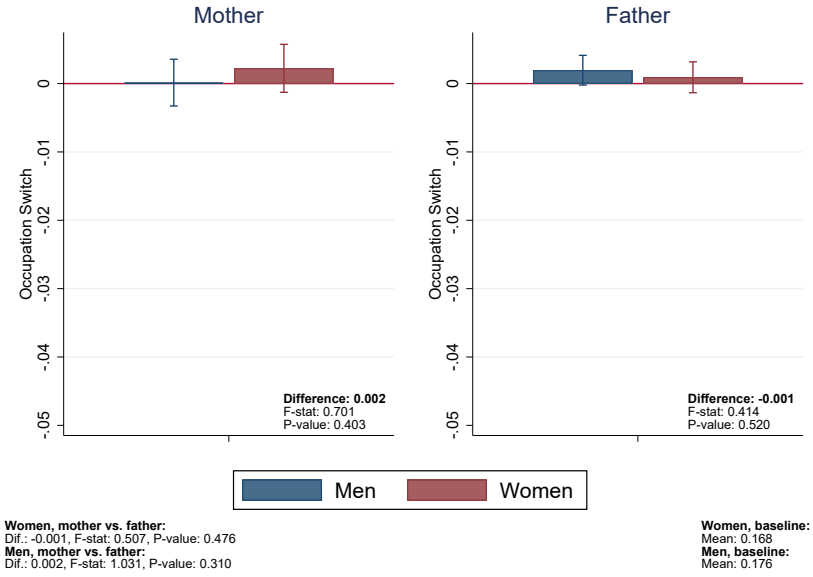
Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's cohabitation rates and the number of children. The sample consists of all unexpected, first parental deaths from 1983 to 2014 and their matched controls, see Table A.2 for details on the sample. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.12: Matched controls: Earnings by deaths of parents-in-law



Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's earnings, but considering the death of a parent-in-law instead. The sample is restricted to men and women with young children, i.e., below age 6, leaving a balanced panel of 109,525 women and 110,461 men. Effects are within 5 years after the first parental death. 95%-confidence interval indicated. Standard errors are clustered at the individual-by-match ID level.

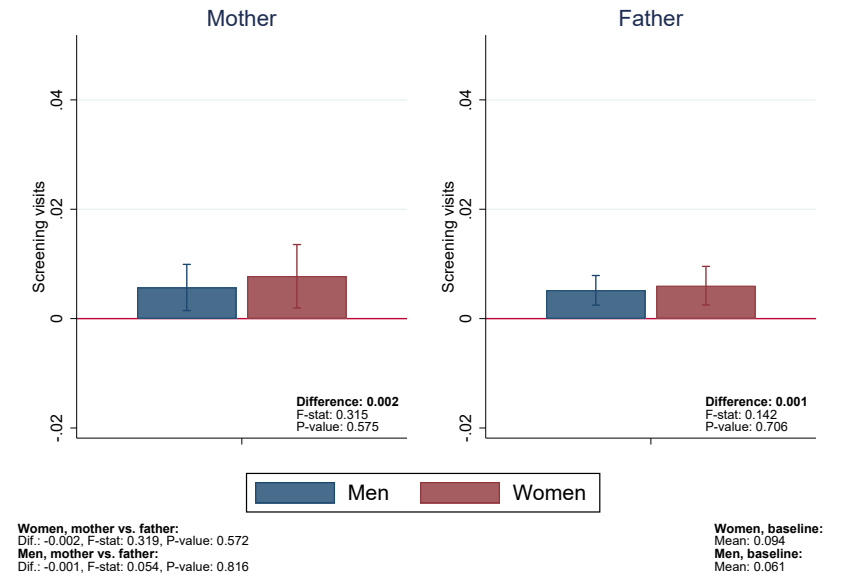
Figure A.13: Matched control: Occupational switches



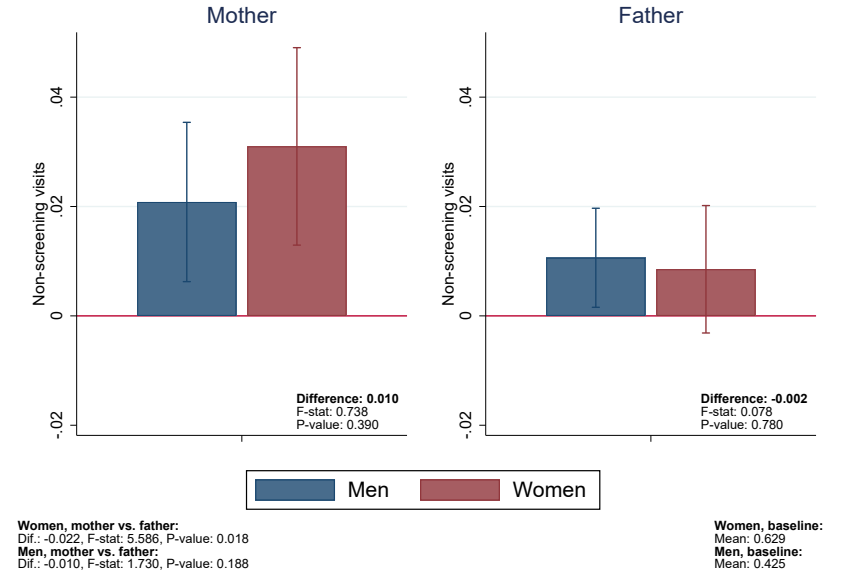
Notes: This figure plots the estimated coefficients from Equation 4 on an indicator of whether or not women and men change their occupations in a given year. We drop individuals with no defined occupation, leaving a balanced panel of 179,872 women and 203,983 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.14: Matched controls: Screening vs. non-screening, mothers' vs. fathers' deaths

(a) Screening related hospital visits

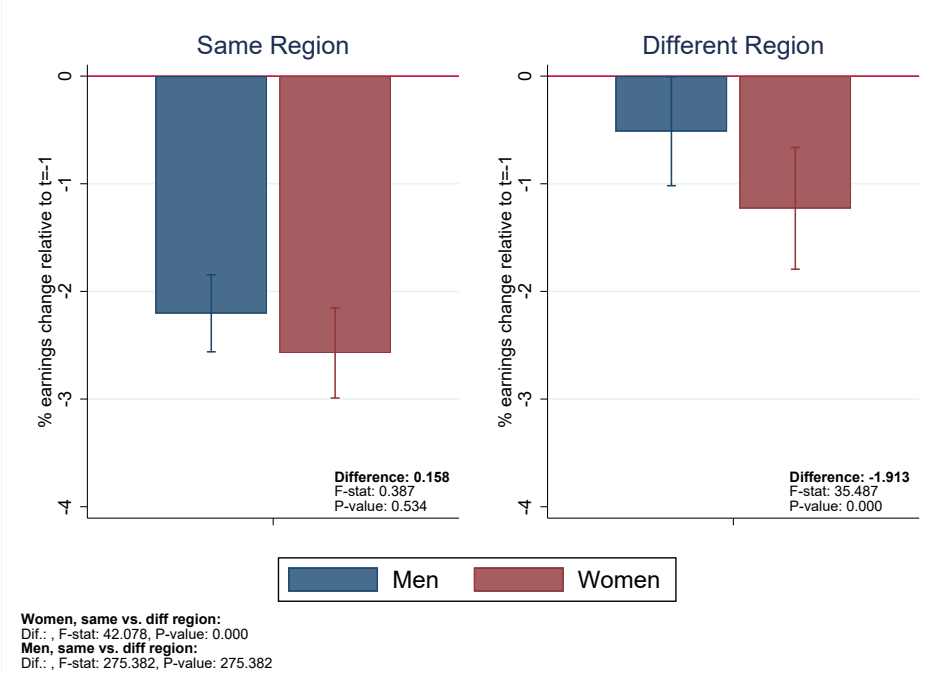


(b) Non-screening related hosital visits



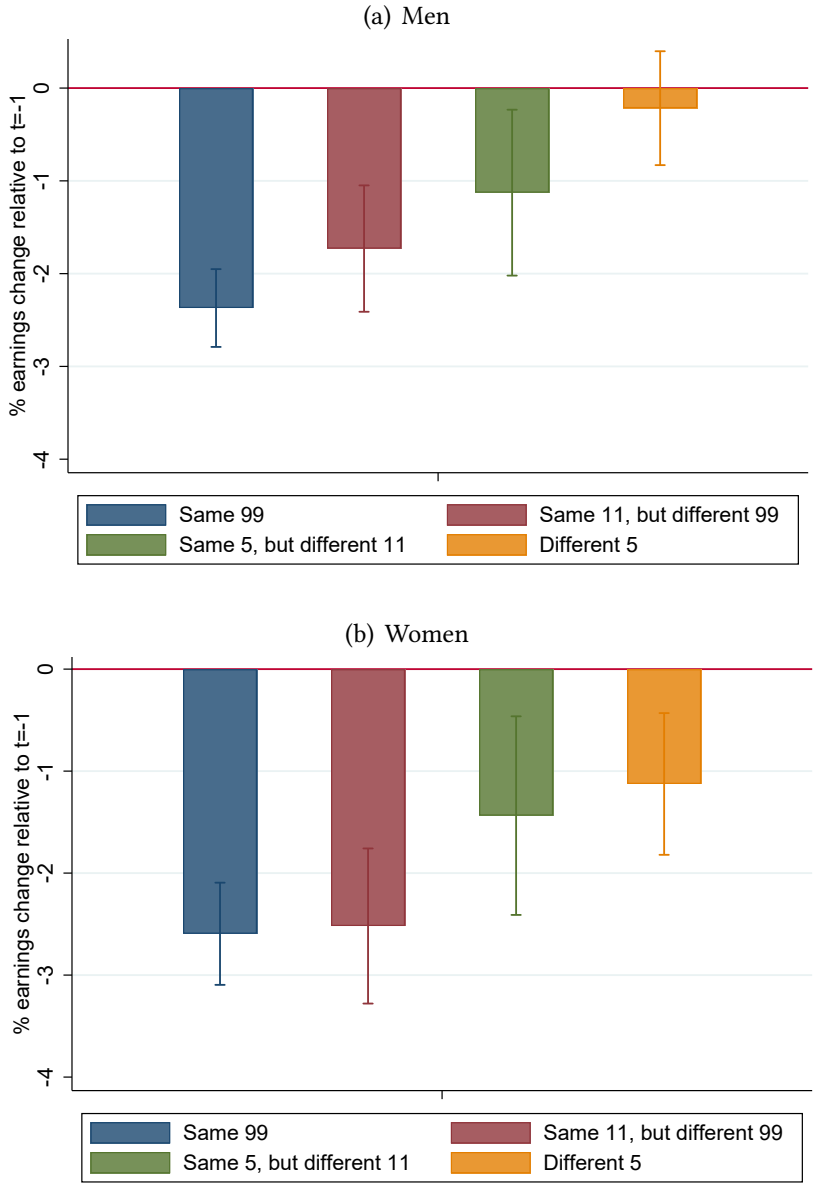
Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's hospital visits, divided by screening and non-screening diagnoses. Hospital visits include both in- and outpatient visits at non-psychiatric hospital wards, these data are available from 1994-2018, leaving a balanced panel of 114,500 women and 125,952 men. Half of the individuals are treated, and the other half are matched controls. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.15: Matched control: Heterogeneity in treatment effect on earnings by home region



Notes: This figure plots the estimated coefficients from Equation 3 for men's and women's earnings, but where we split the sample depending on whether or not the children live in the same region as their deceased parent. There are 5 regions in Denmark. Earnings are normalized by the average earnings of men and women one year before parental death. Detailed regional data are available from 1985, leaving a balanced panel of 180,988 women and 203,152 men. Half of the individuals are treated, and the other half are matched controls. See Table A.2 for details on the sample. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

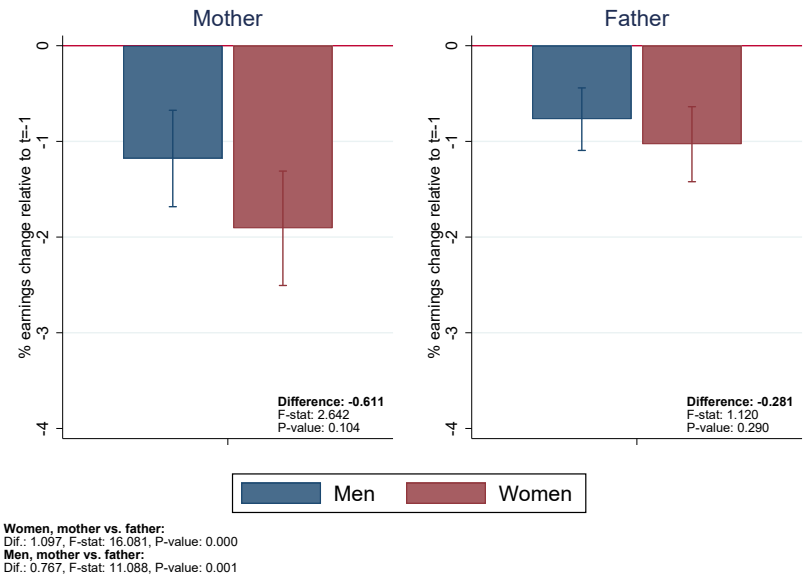
Figure A.16: Matched control: Heterogeneity in treatment effect on earnings by regional proximity to parents



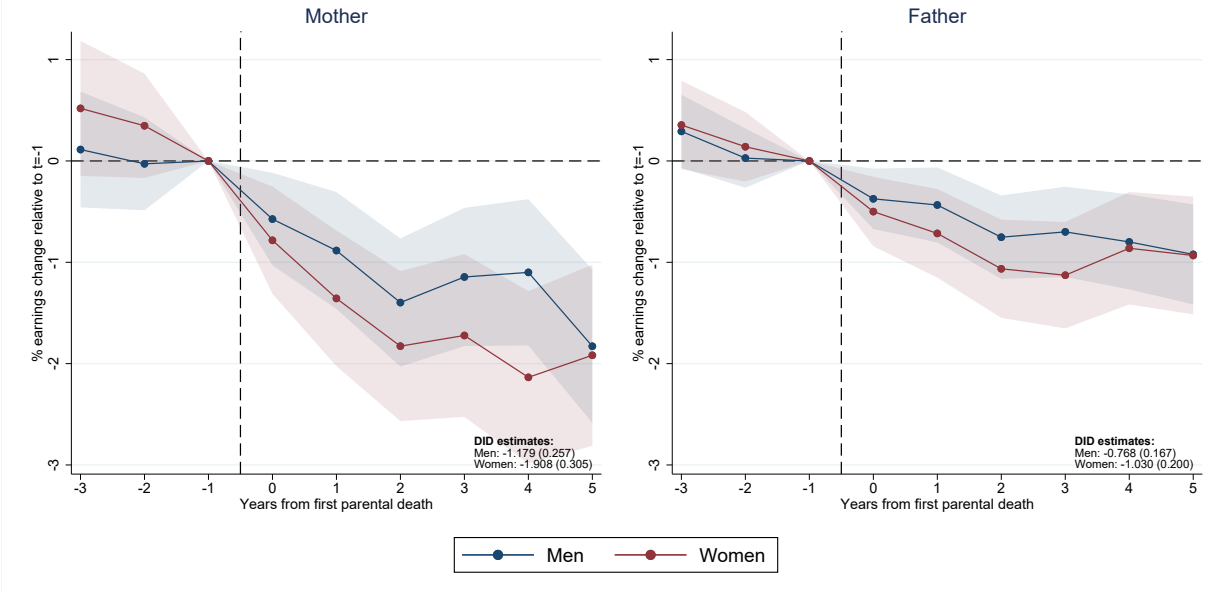
Notes: This figure plots the estimated coefficients from Equation 3 for men's and women's earnings, but where we split the sample depending on children's regional proximity to their deceased parent. We create an intensive measure of distance, that is whether parents and adult children live in the: 1) same municipality (**99** regions), 2) same NUTS3 region (but not same municipality; there are **11** NUTS3 regions in Denmark), 3) same NUTS2 region (but not same NUTS3 region; there are **5** NUTS2 regions in Denmark), 4) further distance than that. This approach gives us four levels of distance, increasing from the left to the right in the figure. Detailed regional data are available from 1985, leaving a balanced panel of 180,988 women and 203,152 men. Half of the individuals are treated, and the other half are matched controls. See Table A.2 for details on the sample. Effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.17: Alternatively specification: Earnings, mothers' vs. fathers' deaths

(a) Average effects

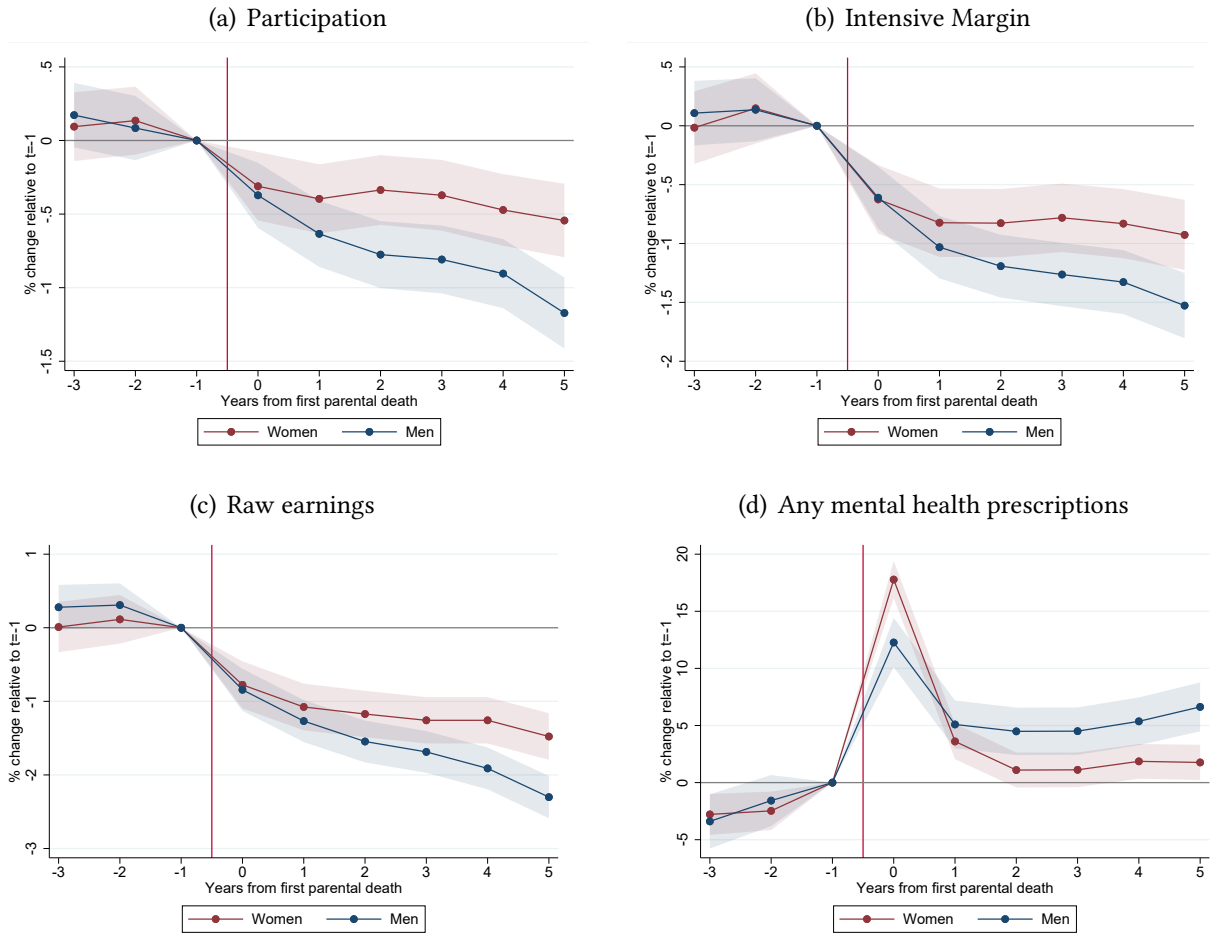


(b) Effects over time



Notes: This figure plots the estimated coefficients from Equation 4 for men's and women's earnings. Earnings are normalized by the average earnings of men and women one year before parental death. To construct an alternative control group, we follow Fadlon and Nielsen (2021) and use individuals who are treated 6 years later as controls for those treated in any given year, leaving a balanced panel of 85,418 women and 98,386 men in the treatment group and 82,184 women and 92,793 men in the control group. Average effects are within 5 years after the first parental death. 95%-confidence interval indicated.

Figure A.18: Descriptives: Effect of non-sudden parental death



Notes: This figure plots the estimated coefficients from Equation 1 for men's and women's labor market outcomes and if using any mental health prescriptions, but focusing on **non-sudden** deaths only. We follow Kleven *et al.* (2019, p. 188) and convert the estimated coefficients into percentage change relative to the baseline. Participation is measured as strictly positive ATP contributions. The intensive margin is based on ATP contributions, similar to Kleven *et al.* (2019). ATP-pension contributions are paid proportionally to hours worked. Earnings are inflated to 2020 levels and include earnings from both employment and self-employment. The sample consists of all non-sudden, first parental deaths from 1983 to 2014 for children aged 25-50 in the year of first parental death and with two known parents. See Table 1 for details on the sample for the analysis of labor market outcomes. The prescription data are available from 1995, leaving a balanced panel of 87,406 women and 93,064 men for the analysis in Panel (d). 95%-confidence intervals indicated.