*Family Spillovers of Miscarriage**

Lea-Karla Matić

Department of Economics, Johannes Kepler University Linz and Institute of Economics, Zagreb

Abstract

Using Austrian administrative data, I estimate the causal effect of miscarriage on the labour market and health outcomes for women, alongside its spillover effects on close family members. To do so, I construct counterfactuals for affected individuals from those who encounter the same fertility shock at a later point in time. The results suggest that affected women experience short-term labour market detachment, deterioration in mental health, and increased investment in future fertility. However, subsequent pregnancies and births appear to partially mitigate some of the initial negative labour market and mental health effects. For spouses, I find suggestive evidence of an increased likelihood of mental health diagnoses but no significant changes in compensatory behaviours, such as smoking or alcohol consumption, or health investments beyond those observed prior to the loss. In addition, spillover effects on sisters suggest an increase in preventive health measures, not driven by their own upcoming pregnancies.

JEL classification: I10, I12, J13, J22

Keywords: miscarriage, fertility, mental health, labour supply, spillover effects

*Contact: Lea-Karla Matic, Department of Economics, Johannes Kepler University Linz, Altenberger Straße 69, 4040 Linz, Austria, ph. +43 732 2468 7336, e-mail: lea-karla.matic@jku.at. I thank Martina Zweimüller, Alexander Ahammer, Johanna Reuter, and seminar participants at JKU Linz, Andreas Steinmayr and Felipe Lozano Rojas, for their valuable discussions and comments.

1 Introduction

Miscarriage is the most common pathological condition in early pregnancy, affecting approximately 15% of all recognized pregnancies (Quenby et al., 2021). Despite its high prevalence, it remains a relatively understudied event, both medically and socially, with even less attention given to its economic implications. While the estimated direct costs of miscarriage in European countries range from 350€ to 2,038€, depending on the type of treatment received, the true economic burden extends far beyond these immediate medical expenses (Petrou et al., 2006; Niinimäki et al., 2009; Lemmers et al., 2018; Cubo Nava et al., 2019). Miscarriage has been associated with strong emotional and psychological effects on women (Nynas et al., 2015), long-term health risks (Oliver-Williams et al., 2013) and future pregnancy complications (Bhattacharya et al., 2008). Taken together, these factors may have significant long-term consequences, including increased medical needs and costs, disruption to labour market participation and barriers to career progression.

The consequences are, however, not exclusively limited to the experiences of affected women. Growing literature acknowledges the shared grief and the relational strain miscarriage can impose on partners and extended family members (Hiefner and Villareal, 2021). Less is known, however, about the specifics of coping mechanisms, (joint) fertility decisions, and changes in behaviours, especially in anticipation of future pregnancies. Experiencing a miscarriage within a social network can raise awareness of its risks and consequences, shaping choices and priorities in ways that may reduce adverse outcomes. As delayed age at childbearing puts more people at risk, it is therefore crucial to better understand the complexity of this event, its diverse effects, and the spillovers that reach beyond an individual's life.

In this paper, I use rich administrative data from Austria to estimate the causal effects of miscarriage on women and its spillover effects on close family members. To account for potential differences in pretreatment outcomes and isolate the effect of miscarriage independent of previous fertility, I identify a total of 12,745 childless women who experienced first-time early pregnancy loss. Leveraging the random nature of miscarriage, conditional on pregnancy and age, I adopt an identification strategy based on the timing of the event inspired by Fadlon and Nielsen (2019, 2021). The treatment group includes affected women who experienced a miscarriage between 1998 and 2018, while the counterfactual is constructed from those who encountered the same shock at a later time. By focusing on women who share exposure to the event and its underlying risk factors, this approach effectively addresses selection into miscarriage. Under a parallel trends assumption, I estimate the dynamic effect of miscarriage on women, their partners and sisters, and a range of labour market and health-related outcomes.

For women, I find substantial evidence of labour market detachment following a miscarriage. The average probability of unemployment increases by 1.94 pp, while sickness absence rises by 0.8 pp

in the year after the loss. These effects correspond to a 25% increase in unemployment and an 86% increase in sickness absence relative to the pretreatment mean two quarters before the event. At least some of these effects may potentially be due to adverse mental health outcomes, as indicated by an increase in psychologist visits and mental health diagnoses among affected women. Furthermore, given that about half of the women in the sample give birth within two years of a miscarriage, I find that changes in employment and healthcare utilization are primarily driven by future pregnancies. However, there is significant evidence of parental investment in future fertility, indicated by higher rates of switching gynaecologists and increased use of pregnancy-supporting medications. In addition, future childbearing appears to alleviate the grief of a previous loss and some of the initial negative mental health and labour market consequences associated with it.

For spouses, I find no effect of miscarriage on labour market behaviour or any indication of increased mental healthcare utilization. However, I find suggestive evidence of an increase in the probability of being diagnosed with a mental health condition in the quarter of the miscarriage. While this may imply that men do not experience the same level of grief or its associated consequences, it could also reflect differences in coping strategies compared to their female partners, with men potentially avoiding help-seeking behaviours or turning to work as a distraction from loss. Additionally, I find no evidence of changes in risky behaviours, such as alcohol consumption or smoking, either as a compensatory response to the loss or as part of an investment in future fertility. If anything, an average decline of 2.07 pp in the probability of seeing a urologist over the two years following miscarriage suggests a reduction in fertility-related efforts, at least relative to the additional investments preceding the loss.

For sisters, I highlight three main findings. First, despite the close family connection and potential implications for their own fertility, there are no significant changes in mental health diagnoses, medication use, or help-seeking behaviours, indicating that mental health effects may be less pronounced. Second, I observe a 14% increase in gynaecologist appointments in a quarter of miscarriage that persists for up to a year, along with suggestive evidence of an increased probability of switching gynaecologists following the sisters' pregnancy loss. Third, the elevated healthcare utilization is not accompanied by higher childbirth rates within two years after a loss, suggesting that the observed increase reflects greater awareness of reproductive risks and preventive measures rather than prioritized fertility efforts.

This paper contributes to the several strands of literature. First, while miscarriage has often been used as an instrument to study the effects of various fertility-related outcomes, only a few studies directly evaluate the effects of miscarriage as an exogenous shock itself (Hotz et al., 2005; Ermisch and Pevalin, 2005; Miller, 2009, 2011; Buckles and Munnich, 2012; Bratti and Cavalli, 2014; Markussen and Strøm, 2022). The two most closely related studies both recover a causal effect of miscarriage using the event-study framework. Using Dutch administrative data, Rellstab

et al. (2022) compare families of women who experienced a first-time early miscarriage with those who successfully completed a pregnancy as a control group. Their findings indicate an increase in mental health care use among women in the year of miscarriage, a decline in the probability of couples living together, and indicative evidence of income stagnation for those not affected by the subsequent fertility. On the other hand, Kalsi and Liu (2024) match women who have a miscarriage to a re-weighted sample of women who do not to ensure the similarity across various characteristics and fertility patterns. They find a significant drop in income after a miscarriage due to a reduction in labour supply, alongside evidence of psychological distress, partnership dissolution and a decline in educational attainment.

Employing an alternative identification strategy by Fadlon and Nielsen (2019, 2021), I go around some of the challenges raised in this previous work. Similar to Rellstab et al. (2022), I use hospital records to identify first-time miscarriages among women with no prior children. However, recognizing that live birth is a significant event itself with substantial impacts on both the labour market (Kleven et al., 2019) and health outcomes (Ahammer et al., 2023), focusing on miscarriage timing rather than live birth as the counterfactual mitigates the risk of results being driven by changes in the control group. As noted by Kalsi and Liu (2024), this strategy also effectively isolates the effects of miscarriage from broader fertility patterns, as it compares only women with similar fertility trajectories, where the control group includes just one additional unsuccessful pregnancy. Moreover, comparing only women who eventually experience a miscarriage further controls for differences in unobservable characteristics, addressing potential sources of omitted variable bias. I also contribute to the literature in other ways, including the use of high-frequency data and extending the range of outcomes observed. The high-quality administrative records allow me to closely observe the patterns in labour market trajectories aside from employment and wages on a quarterly basis. Additionally, the research questions extend beyond the labour market and mental health effects to explore changes in healthcare utilization, fertility-related behaviours for both partners and spillover effects on other close family members.

I also contribute to the strand of literature examining the effects of pregnancy loss as a health shock on parental investments in future pregnancies and children. In a recent study, Bütikofer et al. (2024) find that pregnancy promotes positive health behaviours, such as increased uptake of supplements, reduced smoking, and greater utilization of prenatal care, alongside a decline in labour market engagement. Their findings of no adverse effects on first live-born children suggest that these positive behaviours may help offset the potential negative consequences of pregnancy loss.

By focusing on a sample of women who experience miscarriage at different times, I control for maternal characteristics that influence both, the probability of miscarriage and subsequent outcomes, while ensuring the results are representative of all women. In addition, Bütikofer et al. (2024) do not consider the potential implication miscarriage has on male partners' behaviour. Emerging

medical literature highlights the role of male factors in sporadic and recurrent miscarriage (Muncey et al., 2024). As both the sperm and the egg contribute equally to the genetic composition of the embryo, issues with either one could cause serious flaws during early development and lead to adverse outcomes (Haddock et al., 2021). Meanwhile, multiple demographic, environmental and lifestyle factors, including age, physical exercise, smoking and stress, have been identified as the important determinants of sperm quality (Li et al., 2011). Thus, it is likely to expect that miscarriage induces some behavioural changes in both partners leading up to the next pregnancy, especially among those who did not have a child before.

Moreover, I also contribute to the literature on family responses to health shocks. Exploiting the randomness of the timing of heart attacks and strokes, Fadlon and Nielsen (2019, 2021) find no changes in spouses' labour supply but evidence of an increase in health investments. The health-related responses are found to be driven by both learning about personal health risks and the salience of the health event and extend beyond the immediate family to include broader social networks, such as co-workers. Given that miscarriage is a major health shock itself with corresponding risks and consequences and that the nature of the event is, to a large extent random, I study its implications in a similar manner (Blue et al., 2019).

Aside from spillover effects on partners, I extend my focus to sisters, a research area that has remained underexplored within a causal framework. Existing studies on sibling dynamics primarily investigate social and observational learning during adolescence, highlighting the transmission of positive or risky behaviours, with stronger mutual effects observed among siblings closer in age or of the same gender (Kracht and Sisson, 2018; Windle, 2000; East and Jacobson, 2001). However, the influence of sibling networks extends into later life, shaping health-related decisions such as smoking cessation (Christakis and Fowler, 2008), dietary choices (Pachucki et al., 2011), and alcohol consumption (Rosenquist et al., 2010), among others. Moreover, there is growing evidence that siblings' demographic behaviours are interconnected, including transitions to parenthood (Kuziemko, 2006; Buyukkececi et al., 2020; Lyngstad and Prskawetz, 2010), decisions to marry (Buyukkececi and Leopold, 2021) or to get divorced (de Vuijst et al., 2017). I further add to this body of literature by examining both sibling spillovers in health investments and family formation in the context of life-changing and widespread female health shock.

2 Background and setting

2.1 Miscarriage

Miscarriage, or spontaneous abortion, is typically defined as the unintentional termination of a pregnancy before the fetus reaches viability. The criteria for fetal viability varies depending on

regional legislation and medical guidelines, with gestational age or fetal weight often being taken into account. The World Health Organization (WHO) defines fetal viability as the point at which the fetus weighs a minimum of 500 grams, corresponding to approximately 22 weeks of gestation (WHO1977). Similarly, Austrian law follows this framework, with the Austrian Midwifery Act *(Hebammengesetz)* defining miscarriage as the loss of a fetus that shows no signs of life, such as respiratory activity or cardiac pulsation, and has a birth weight below 500 grams. If a fetus weighs over 500 grams but does not exhibit vital signs, the term "stillbirth" is used to legally differentiate such cases from miscarriage.[1]

Miscarriage remains a fairly common outcome of pregnancy, with a pooled risk from nine cohort studies estimated to 15.3% (Quenby et al., 2021). The majority of European research is concentrated in the Nordic countries and the UK, with estimates ranging up to 12.7% based on administrative hospital records and 17.2% based on self-reported pregnancy outcomes (Andersen et al., 2000; Adolfsson and Larsson, 2006; Magnus et al., 2019). However, even these figures likely underestimate the full scope of reproductive losses, as many pregnancies go unrecognized and/or do not require medical intervention. The probability of a clinically recognized pregnancy in any given menstrual cycle is 30-40%, with approximately 60% of pregnancy losses occurring before implantation or prior to a missed menstrual period (Macklon et al., 2002). In fact, studies using more sensitive serial human chorionic gonadotropin (hCG) measurements in women trying to conceive have shown that the actual miscarriage rate, including biochemical pregnancy losses, may be as high as 31% (Wilcox et al., 1988). This suggests that historically, miscarriage rates may have been influenced by advancements in medical technology, particularly through the development of more precise pregnancy tests and increased frequency of medical check-ups, which enabled the earlier detection of conceptions that might otherwise have gone unnoticed.

Around 80% are found in the first trimester, with a decreasing risk of miscarriage after 12 weeks gestation (Wilcox et al., 1988). The causes of pregnancy loss vary depending on the timing of the loss, with at least half of first-trimester losses attributed to chromosomal abnormalities (van den Berg et al., 2012; Hardy and Hardy, 2015; Banno et al., 2020). Most chromosomal abnormalities occur randomly, but several factors are linked to an increased risk, with advanced maternal age being the most well-established (Pylyp et al., 2018). Overall, population registry estimates indicate that first-trimester pregnancy loss affects up to 25% of pregnancies in women aged 35–40, increasing to 51% in women aged 40–45, and 75% in those over 45 (Frick, 2021). On the other hand, the relationship between paternal age and pregnancy loss is less definitive. Still, an increasing body of evidence suggests that advanced paternal age may contribute to an increased prevalence of sperm DNA fragmentation linked to a higher risk of miscarriage, especially when paired with an older

[1] In the United States, the majority of states employ a gestational age cut-off of 20 weeks, while in the United Kingdom the same is 24 weeks (Quenby et al., 2021).

female partner (Du Fossé et al., 2020). Aside from that, other factors can also lead to spontaneous pregnancy loss, including immune system problems, blood clotting disorders, and hormonal imbalances, along with physical issues with the uterus and infections (Abdelazim et al., 2017). Several studies have additionally confirmed the association between lifestyle factors and the risk of miscarriage, including smoking (Pineles et al., 2014), alcohol consumption (Sundermann et al., 2019), body mass index (Balsells et al., 2016), as well as the exposure to major psychological stress (Qu et al., 2017).

2.2 Fertility

Austria has a long-standing history of sub-replacement fertility, dating back to 19th-century cohorts (Prskawetz et al., 2008). A temporary increase in fertility rates occurred during the post-war baby boom, reaching a historical peak in 1963. However, by the mid-1980s, the number of children per woman had already fallen below the replacement level of 2.1 and has remained persistently low ever since. While this pattern is not unique to Austria and reflects broader global trends, Austria's fertility rate has stabilized at a lower level compared to similar countries. As illustrated in Figure A1, the total fertility rate (TFR) has consistently remained below the European and OECD average, levelling off at approximately 1.5 children per woman over the past 40 years.

The decline in fertility rates can be attributed to both a decrease in family size and an increase in the number of childless individuals. While some of this trend is intentional, driven by changing family norms and values, an often-overlooked factor is the involuntary decline caused by delays in childbearing efforts. Evolving priorities, such as pursuing higher education, advancing careers, and achieving financial stability, have increasingly shifted family planning to later stages of reproductive life. As illustrated in Figure A2, the mean age at first birth for Austrian women increased from 24.7 years in 1990 to 29.4 years in 2022, with the overall proportion of women giving birth at age 35 and older reaching 21%. Meanwhile, such delays are associated with a higher risk of infertility and increased pregnancy complications, contributing to unmet fertility intentions at later ages. Beaujouan (2022) estimated that approximately 12% of Austrian women born between 1970 and 1974 failed to achieve their desired fertility, with their family size being 13% smaller than intended at the ages of 34–36. This fertility gap has widened significantly compared to earlier cohorts, underscoring the growing challenge of reconciling delayed parenthood with biological and social constraints.

2.3 Austrian healthcare system

Austria has a Bismarckian universal healthcare system built on the foundation of compulsory insurance. This system operates on the principle of solidarity, with social insurance primarily financed

through contributions made to insurance funds. While coverage typically begins with employment, the system also extends its protections to dependents, retirees, and unemployed individuals. By law, all insured individuals are entitled to a broad range of services, including hospitalizations, outpatient care, and medications. Cost-sharing is limited only to minor copayments for drug prescriptions and overnight hospital stays.

Regardless of their employment status or nationality, all women in Austria are entitled to comprehensive prenatal care fully covered under the public health insurance system. Central to this care is the Parent-Child Pass *(Eltern-Kind-Pass)*, a detailed health record provided during the first medical check-up of pregnancy. This pass outlines a series of mandatory medical examinations for pregnant women and children up to the age of five, which are required to claim childcare allowance *(Kinderbetreuungsgeld)*. These examinations are carried out by general practitioners or specialized healthcare providers. During pregnancy, five scheduled medical check-ups are recommended, with the first occurring before the 16th week of pregnancy. This initial examination includes a comprehensive range of services, including a gynaecological exam, blood tests, and an evaluation of maternal and fetal risk factors that could potentially complicate pregnancy or impact the child's development. The Parent-Child Pass also includes access to additional services, such as ultrasound scans and midwife consultations, though these are not mandatory for maintaining eligibility for childcare benefits.

Miscarriage is usually identified through clinical symptoms such as vaginal bleeding and abdominal pain, further confirmed by medical evaluations during routine check-ups. Ultrasound serves as the primary diagnostic tool, while blood tests measuring hCG levels are used to determine non-viability in very early pregnancies. Treatment options vary based on the stage of pregnancy, the woman's health, and her personal preferences. These include expectant management, allowing the miscarriage to resolve naturally, medical management with medications like Misoprostol, or a surgical procedure such as dilation and curettage. This surgical option is performed under short general anaesthesia and is typically completed on an outpatient basis. All treatment options are fully covered by Austria's public health insurance system, unlike voluntary termination of pregnancy, which must be privately financed. Beyond medical care, Austria's healthcare system also provides psychological support to those experiencing pregnancy loss. Counselling services are complemented by midwives who offer outpatient care to address the emotional impact of loss. Until recently, home visits by midwives were covered by health insurance only in cases of stillbirth. However, starting in 2024, this coverage has been extended to include individuals experiencing an advanced miscarriage after the 18th week of pregnancy.

2.4 Austrian labour market

Austria's labour protections for expectant and new mothers are among the most comprehensive in Europe, ensuring financial security and workplace rights during and after pregnancy. Maternity leave *(Mutterschutz)* is a legally mandated protection which prohibits employment eight weeks before and after childbirth. During this time, employees are entitled to maternity allowance *(Wochengeld)*, funded by Austria's public health insurance system. This allowance is approximately equivalent to the employee's average net wages over the three full calendar months prior to the employment prohibition. If a medical certificate confirms that continuing work would endanger the health of the mother or child, the prohibition period can be extended beyond the standard eight weeks, with compensation provided under the same terms. Importantly, the right to maternity allowance extends beyond employment to self-employed and those receiving unemployment benefits.

Pregnant employees benefit from other rights under the Maternity Protection Act *(Mutterschutzgesetz)*, including a prohibition against termination or dismissal. This protection begins as soon as the employee notifies their employer of the pregnancy and remains in effect until four months after childbirth. Employment contracts during pregnancy can only be terminated in exceptional circumstances, which require prior approval from the Labour and Social Court *(Arbeits- und Sozialgericht)*, or through mutual consent between the employer and employee. These protections also apply to cases of stillbirth, granting the same rights to maternity leave, maternity allowance, and protection against termination for up to four months following the loss of the child. In contrast, in cases of miscarriage, employees are protected against dismissal for up to four weeks but are not entitled to maternity leave. Instead, they are eligible for sick leave *(Krankenstand)*, which provides time for physical recovery and emotional healing after the loss.

Sick leave compensates the workers for loss in earnings due to illness or incapacity to work. Employees are entitled to continued remuneration during sick leave, with the duration of full wage compensation increasing based on their length of service from 6 up to 12 weeks. Following the period of full compensation, employees are entitled to an additional 4 weeks at half pay, and if the illness persists, they may receive sickness benefits from the social insurance system. The amount of sick pay depends on the earnings in the last month before the illness and the amount of continued remuneration paid.

3 Data and analytical sample

3.1 Data

The analysis relies on multiple combined administrative data sources. First, I use health records provided by the Upper Austrian Health Insurance Fund (UAHIF) from 1998 to 2018. The UAHIF

serves as the principal statutory health insurance provider in Upper Austria, covering approximately 1.5 million inhabitants, or 17% of the Austrian population. The health register includes detailed individual-level healthcare claims for all private-sector employees and their dependents, including physician visits, drug prescriptions, and hospital stays. Drug prescriptions are classified using the Anatomical Therapeutic Chemical (ATC) classification system, while diagnoses are available exclusively for hospital admissions and are coded according to the International Classification of Diseases (ICD).

To identify miscarriages, I use ICD-10 diagnoses for pregnancies with an abortive outcome.[2] Among all recorded cases, 51.7% are classified as missed miscarriages, defined as the unrecognized intrauterine death of the embryo or fetus, with the products of conception that have not yet been expelled (Wu et al., 2017). In such cases, the success rate of expectant management is lower compared to medical or surgical intervention, which may explain the higher likelihood of these cases being managed in inpatient settings (Jurkovic et al., 1998). The second most common diagnosis in hospital records is spontaneous miscarriage, accounting for 15.8% of cases. Although the dataset provides the exact date of diagnosis, information on the gestational length at the time of the miscarriage is not available.

As illustrated in Figure 1, between 1998 and 2018, the incidence rate of miscarriage in Upper Austria decreased from 112,59 per 1000 (95% CI 107.50 to 117.69) to 97,31 per 1000 (95% CI 92.24 to 102.37) women at risk, a trend consistent with observations in other European countries (Linnakaari et al., 2019; San Lazaro Campillo et al., 2019). During this period, the average incidence rate among women aged 35 and older (210,63/1000) was nearly twice as high as that observed in younger age groups, specifically those under 25 years (115,79/1000) and between 25–34 years (111,49/1000). The most significant decline occurred in the second half of the study period, particularly after 2010, driven by a reduction in the absolute number of miscarriages and a shift towards an increasing number of births. The observed decline in hospital-treated miscarriages can be attributed to several factors, including advances in early detection, improvements in medical management, and a growing preference for less invasive treatments and outpatient care. However, this trend does not necessarily indicate a reduction in overall miscarriage rates over time. If anything, with maternal age being a significant risk factor and an increasing preference for childbearing at advanced age, more women are exposed to the risk of adverse pregnancy outcomes (see Figure A2).

Second, I utilize the Austrian Social Security Database (ASSD) to link health register data with labour market histories and to construct family ties. The ASSD is a matched employer-employee dataset that spans the universe of employment spells from 1972 to 2018. The ASSD provides daily information on labour market status, including periods of sickness absence and maternity leave, and annual data on wages and basic socioeconomic characteristics, such as gender and age. The

[2]ICD-10 diagnoses O01-O06 are counted as a miscarriage. Ectopic pregnancies (ICD-10: O00) are not included.

main drawbacks of the register are missing information on contracted working hours, and wages limited to the maximum social security contribution base.

3.2 Outcome variables

As all outcomes are measured as binary variables (0/1), I focus exclusively on changes at the extensive margin. I categorize labour market status into four positions: employed, unemployed, on sick leave, or maternity leave. The outcome variables are constructed such that an individual is classified into a given category if they experience at least one corresponding spell during the respective quarter. As a result, I allow for individuals to be assigned to more than one status simultaneously.
For health outcomes, I focus on the set of indicators related to the utilization of overall healthcare services, as well as those specifically associated with mental health or pregnancy. For the baseline estimates, I construct the *total healthcare* variable as an aggregated measure indicating whether an individual has had at least one inpatient or outpatient visit in a given quarter or has been prescribed medication. This variable provides a comprehensive overview of the utilization of medical services, which is crucial for understanding potential differences in the health status before treatment, as well as the changes induced by the event itself. For women, it serves as an indication of the health-related consequences of miscarriage, while for other family members, it may reflect health investments or preventative measures taken in response to the pregnancy loss.
To evaluate the effects on mental health, I construct two distinct measures. The first is the *mental healthcare* indicator, which captures whether an individual has seen a psychiatrist or psychologist in a given quarter or has been diagnosed with depression or anxiety (ICD-10: F33, F34, F39, F40-F48). The second is an indicator for the use of *mental health drugs*, including antidepressants (ATC: N06A), anxiolytics (ATC: N05B), and sedatives (ATC: N05C). I analyze these measures separately to account for the possibility that miscarriage may have effects that operate in opposing directions for women.
To evaluate the effects of miscarriage on fertility-related behaviours and future pregnancy investments, I include indicators for gynaecologist and urologist appointments, along with a variable capturing whether an individual has switched gynaecologist and urologist since their last visit. I also examine risky behaviours linked to substance use and abuse disorders (ICD-10: F10-F19, F55) and assess the overall use of vitamin prescriptions (ATC: A11). Iron supplementation (ATC: B03A) is analyzed separately due to its recommended intake for pregnant women (WHO, 2016) and its association with miscarriage risk and adverse pregnancy outcomes (Díaz-López et al., 2021). Additionally, I evaluate the role of progesterone supplementation, given the substantial evidence supporting its efficacy in reducing miscarriage rates (Yan et al., 2021). It is important to note that vitamin supplementation can occur without a prescription, likely leading to an underestimation of

overall intake. In contrast, progesterone requires a physician's prescription and is, therefore, fully captured in the data.

Finally, for the sample of sisters, I include a binary indicator for the probability of live birth. Combined with maternity leave uptake, this variable is used to evaluate the impact of miscarriage on sisters' future fertility intentions.

3.3 Analytical sample

The study population comprises women aged 15 to 50 who experienced their first recorded pregnancy loss in a hospital setting between 1998 and 2018. To focus exclusively on the effects of miscarriage without confounding by previous fertility patterns, I restrict the sample to women who had not given birth prior to their pregnancy loss. This condition eliminates potential differences in the pre-trends between the treatment and control group. It is also likely to better capture the psychological impact of miscarriage and the incentives to invest in future pregnancies, as these women have no previous experience of successfully carrying a pregnancy to term. To further ensure the analysis captures only first miscarriages, I exclude women diagnosed with recurrent miscarriages or with prior hospital admissions related to pregnancy or delivery (live or stillborn). While this restriction cannot fully eliminate the possibility that a small subset of women experienced a miscarriage before 1996, I perform robustness checks by restricting the sample to losses occurring in later years, which yield similar results. The final sample consists of $N = 12,745$ childless women who experienced their first pregnancy loss at various points in time. These observations are used to construct the treatment and control groups, as described in the following section.

Using administrative records, I link women in the study to their sisters and partners. In the analysis for sisters, I focus only on those of reproductive age, i.e. 15 to 50 years old at the time of the event and exclude sisters who have a history of miscarriage themselves. These criteria yield a final sample of $N = 6,720$ sister pairs. For male partners, the analysis is restricted to couples who were married at the time of the miscarriage. Generally, the strong association between marriage and fertility decisions has been well established, with much of it being explained by the closeness and stability of marriage rather than a self-selection (Zhang and Song, 2007). Therefore, these couples are potentially also the ones that are more likely to be actively planning pregnancies and, consequently, more affected by the event. Additionally, since spouses are, on average, older at the time of conception, the sample is limited to men aged 15 to 60 at the time of the pregnancy loss. The final sample includes $N = 3,005$ spouses.

4 Empirical strategy

4.1 Estimation of direct effects

To estimate the causal effect of miscarriage on women's labour market and health outcomes, I employ an identification strategy inspired by Fadlon and Nielsen (2019, 2021). The quasi-experimental approach addresses selection into miscarriage by restricting the sample to women who experienced pregnancy loss at some point in time and leveraging the exact timing of the diagnosis within a dynamic difference-in-differences framework. Specifically, I construct a treatment group from women who experience a miscarriage in quarter q, while the control group includes women who experience the same health shock τ quarters later. When τ is sufficiently small, women in both groups should, on average, share similar observable and unobservable characteristics, effectively addressing potential sources of omitted variable bias. The exact process for constructing the treatment and control groups is illustrated in Figure A3.

A key limitation of this design is the trade-off between the length of the post-treatment period and the similarity between the treated and control groups. For the baseline estimates, I set τ to 10 quarters, restricting the estimation of dynamic treatment effects to up to two and a half years after the loss. This condition ensures that women in both groups are aligned in terms of life circumstances and fertility intentions, minimizing differences in characteristics and pre-trends in outcomes. Additionally, when interpreting the results, I drop two quarters before the real miscarriage in the control group and focus specifically on eight quarters around the event. The exclusion of the last two quarters accounts for systematic changes in control group outcomes related to pregnancy planning, such as increased physician visits or medication use, which could otherwise drive the estimates. Robustness checks are conducted using varying values of τ.

After constructing the treatment and control group, I estimate the following model:

$$y_{itq} = \alpha + \beta \cdot T_{iq} + \sum_{\substack{k \neq -2 \\ k=-8}}^{8} \gamma_k \cdot \mathbb{I}(k = t - q) + \sum_{\substack{k \neq -2 \\ k=-8}}^{8} \delta_k \cdot \mathbb{I}(k = t - q) \cdot T_{iq} + \theta_i + \phi_t + X_{it} + \epsilon_{itq} \quad (1)$$

where y_{itq} denotes the outcome for woman i observed in calendar quarter t, with the (placebo) miscarriage occurring in quarter q. T_{iq} is an indicator variable equal to 1 if woman i experienced a miscarriage in quarter q, and 0 if the miscarriage occurred in quarter $q+10$. $\mathbb{I}(k = t-q)$ represents time indicators capturing the relative timing of quarter t to the (placebo) miscarriage quarter q. θ_i denotes individual fixed effects that account for time-invariant characteristics of the individuals. ϕ_t represents calendar quarter fixed effects that control for shocks common to all women in a specific quarter. Finally, X_{it} adjusts for age at (placebo) miscarriage, addressing differences in age distributions, as women in the control group are, on average, younger than those in the treatment group

when shifted back in time. The coefficient of interest is $\hat{\delta}_k$, which measures the treatment effect of miscarriage on outcomes relative to two quarters before the event ($k = -2$).

The identification strategy relies on two key assumptions. First, in the absence of a miscarriage, differences in health and labour market outcomes between the treatment and control groups would have followed parallel trajectories. The assumption holds well, given that the estimated leading coefficients ($\hat{\delta}_{-8}, ..., \hat{\delta}_{-3}$) are not significantly different from zero across outcomes, indicating no differences in pre-trends. Second, the strategy assumes no anticipation of the treatment. While pregnancy can be planned and anticipated, conditional on age and underlying risk factors, miscarriages are largely random. Moreover, even for couples actively planning to conceive, the exact timing of conception (and consequently, the timing of a potential miscarriage) is inherently uncertain, especially in the early stages of reproductive efforts, typically within one to two years (τ). To account for changes in pregnancy-related behaviour, I set the relative time to two quarters before the event ($k = -2$), as for most women, observed outcomes begin to change approximately one quarter before conception. Additionally, I strengthen the credibility of the assumption by restricting the difference in miscarriage timing between the treatment and control groups to no more than two years in baseline estimates and by controlling for age at the (placebo) miscarriage.

Descriptive statistics for experimental groups are presented in Table 1. Treated women experience miscarriage at an average age of 28.34 years, with 89% holding Austrian nationality and 13% having a university degree. Before miscarriage, 86% of treated women were employed, earning an average daily wage of 55.01€. Among them, 26% visit a gynaecologist, and 1% use fertility-supporting medications before conception. Mental health service utilization is rare, with only 2% consulting a psychiatrist or psychologist using prescribed mental health medication.

Women in the control group experience miscarriage at a similar average age of 28.96 years. However, around the placebo event, control women are, on average, two years younger than their treated counterparts. These differences in age and the relative timing of pregnancy result in slight variations in wage levels and healthcare utilization. Control women earn an average of 5.5€ less per day before the placebo miscarriage and are less likely to use healthcare services or fertility-supporting medications. Nonetheless, all observed differences are quantitatively negligible and do not pose a concern given the inclusion of relevant fixed effects in the regression models and the absence of significant pre-trends across outcomes.

4.2 Estimation of spillover effects

The estimation strategy for examining the spillover effects of miscarriage on spouses and sisters mirrors the approach used for the affected women. In line with Fadlon and Nielsen (2019, 2021), I restrict the analysis to individuals who experienced a miscarriage within their close family between

1998 and 2018, with those who faced it later serving as the control group for those who experienced it earlier. To ensure consistency, I set τ to 10 quarters, which means that the experience of miscarriage in the treatment and control group occurred two and a half years apart. Additionally, I exclude the last two quarters before the pregnancy loss in the control group from interpreting the results. The exact process for constructing the treatment and control groups is illustrated in Figure A3.

Similar to the estimation of direct effects, this approach has a clear advantage over simple comparison outcomes between individuals with and without a pregnancy loss in their close network. By leveraging the timing of the event, it resembles an ideal experiment accounting for potential differences in observable and unobservable characteristics and outcome trajectories between the groups. Under the parallel trends and no anticipation assumption, the following model is used to estimate the treatment effect:

$$y_{itq} = \alpha + \beta \cdot T_{iq} + \sum_{\substack{k \neq -2 \\ k=-8}}^{8} \gamma_k \cdot \mathbb{I}(k = t - q_{j(i)}) + \sum_{\substack{k \neq -2 \\ k=-8}}^{8} \delta_k \cdot \mathbb{I}(k = t - q_{j(i)}) \cdot T_{iq} + \theta_i + \phi_t + X_{it} + \epsilon_{itq} \quad (2)$$

where y_{itq} is outcome for spouse/sister i of woman j observed in calendar quarter t, with the (placebo) miscarriage occurring in quarter q. T_{iq} is indicator variable equal to 1 if woman j experienced a miscarriage in quarter q, and 0 if the miscarriage occurred in quarter $q + 10$. $\mathbb{I}(k = t - q)$ are time indicators representing the relative timing of quarter t to the (placebo) miscarriage quarter q. θ_i, ϕ_t, X_{it} are individual fixed effects, calendar quarter fixed effects and fixed effects for the age at (placebo) miscarriage. $\hat{\delta}_k$ is the coefficient of interest, which measures the treatment effect of miscarriage on outcomes relative to two quarters before the event ($k = -2$). Given that women experiencing miscarriage may have multiple sisters, standard errors in the sister sample are clustered at the family level.

Table 2 and Table 3 present descriptive statistics for spouses and sisters. Spouses experience their first child loss at a later age compared to their wives, with an average age of 32.37 years in the treatment group and 32.90 years in the control group. Similar to the sample of women, when shifted two years back in time, control husbands are, on average, younger and further removed from the pregnancy than their treated counterparts. In both groups, approximately 90% of spouses are employed, however, treated spouses earn, on average, approximately €6 more per day. Healthcare service utilization is observed in roughly half of the sample, with marginally higher rates in the treated group, likely due to their older age at the time of the (placebo) event. Mental health issues appear to be rare, with only 1–2% of spouses accessing mental health services or being prescribed mental health medication before the (placebo) miscarriage.

Sisters experience a family miscarriage at an average age of 24.3 years in the treated group, while by design, the age distribution in the control group is shifted by two years, with an average age of

26.47 years at the time of miscarriage. However, this means that at the time of the placebo event, sisters in the treated and control groups are closer in age, averaging 24.32 and 23.72 years, respectively. Beyond demographic similarities, the two groups also share comparable labour market and healthcare characteristics. Approximately 68.5% of sisters are employed before the event, with average daily wages of 65.17€ in the treated group and 62.65€ in the control group. Around 60% utilize healthcare services, the majority of which are for outpatient care. Fertility patterns between the groups are also closely aligned, with 7% of women having had a child before the (placebo) miscarriage. On average, women in both groups have fewer than one child, with births occurring more than 4 quarters prior to the (placebo) event. This ensures that patterns in outcomes surrounding the sisters' miscarriage are not influenced by behaviours related to their own pregnancies and childbearing. Approximately 1% of sisters use mental health services, and 2% use mental health medication in the pre-treatment period.

5 Direct effects of miscarriage

This section presents the empirical findings on the direct effects of miscarriage on affected women. In Section 5.1, I begin by estimating the impact of pregnancy loss on women's labour market outcomes and their use of (mental) healthcare services. Given the random nature of miscarriage, which often leads to conception shortly after the initial loss, Section 5.2 explores the role of subsequent fertility in shaping these outcomes. Finally, in Section 5.3, I investigate the heterogeneity of effects across different age and educational groups of women.

5.1 Effects of miscarriage on women

Figure 2 illustrates the dynamic effects of miscarriage on labour market outcomes, estimated using Equation (1). The horizontal axis represents quarters relative to the (placebo) miscarriage, while the vertical axis shows point estimates of the treatment effects with corresponding 95% confidence intervals.[3]

The figure implies two main findings. First, the estimates from over a year prior to the miscarriage are insignificant, indicating that the treatment and control groups followed a similar trajectory before the event. Second, miscarriage represents a profound shock with significant implications for women's labour market attachment. Specifically, starting in the quarter of the miscarriage, there is a sustained decline in the probability of employment, culminating in a maximum reduction of 49.63 pp by the end of the observation period. However, the gradual dynamics of the effect that closely resembles that of maternity leave suggest that at least part of the observed decline may be

[3]Detailed event study estimates for labour market outcomes are provided in Table A1.

attributable to subsequent pregnancies rather than being solely a consequence of the miscarriage itself. This matter is further explored in the following section. In contrast, the probability of unemployment and the use of sickness absence show immediate and sharp increases following the pregnancy loss. In the first quarter after the miscarriage, women are 0.77 pp more likely to take sickness absence, corresponding to a 150.98% increase relative to the baseline. Similarly, unemployment peaks during the first quarter, reflecting a 32.81% (2.1 pp) increase from the two quarters before the event. While substantial in magnitude, these effects are short-lived, persisting for up to a year after the loss.

At least part of the observed labour market pattern could potentially be attributed to a deterioration in mental health. To explore this possibility, I focus on the two mental health measures shown in Figure 3.[4] The first is an aggregated measure of mental healthcare utilization, capturing whether an individual visited a psychiatrist or psychologist or was diagnosed with a mental health condition in a given quarter. The second indicator reflects the use of mental health medications, including antidepressants, anxiolytics, and sedatives. Consistent with labour market outcomes, there is virtually no difference in healthcare patterns between the treatment and control groups during the pre-treatment period. However, following the miscarriage, there is an immediate increase in mental healthcare utilization of 39.20% (0.78 pp) relative to baseline, which remains elevated for more than a year after the loss. Meanwhile, as indicated by Figure A4, most of the observed effects come from the higher probability of being diagnosed with a mental health condition during the quarter of the miscarriage, as well as a statistically significant increase in psychologist visits over the two years after the event. On the other hand, the estimated dynamic effects suggest a decrease in the use of mental health medications following a miscarriage. The most prominent and statistically significant estimate is observed in the fifth quarter after the loss, indicating a 43.46% (0.93 pp) decline in medication use compared to the two quarters before the event. Disaggregated measures, shown in Figure A5, reveal that this pattern is almost entirely driven by a reduction in the use of antidepressants, potentially due to concerns about how these medications might affect future pregnancies. Despite recent medical evidence indicating no causal link between antidepressants and miscarriage risk, after accounting for maternal depression, women who have experienced pregnancy loss may become particularly cautious about medication use in later pregnancies (Smith et al., 2024).

Finally, miscarriage may affect women's healthcare utilization through its association with a range of immediate physical effects and intentions regarding future pregnancies. Prior to the miscarriage, there are only quantitatively negligible differences in total healthcare utilization and gynaecologist visits between the treatment and control groups (Figure 4). Beginning from the quarter before conception, healthcare utilization starts to increase, indicating that this might be a common pattern among women with fertility intentions, regardless of the pregnancy outcome. In the quarter of the

[4]Detailed event study estimates for (mental) health outcomes are provided in Table A2.

miscarriage, healthcare utilization increases by 23.47 pp, or 32.63% relative to the second quarter before the event. In the following quarter, the increase drops to 8.05 pp before rising again and peaking in the fourth quarter after the loss. This pattern aligns with trends in gynaecologist visits and is consistent across all disaggregated indicators of healthcare utilization, including inpatient, outpatient care and medication prescriptions (Figure A6).

Given that many couples may attempt to conceive again shortly after a pregnancy loss, I extend the analysis beyond overall healthcare utilization to examine whether women adjust their behaviour to support future pregnancies and reduce the risk of adverse outcomes. Specifically, I examine a set of outcomes that reflect both positive and potentially negative health investments, analysing their dynamics relative to the timing of the event.

Figure 5 reveals no significant change in the overall use of vitamin prescriptions and only a marginally significant decline in risk-associated behaviours following miscarriage. On the other hand, there is clear evidence of increased use of pregnancy-supporting medications after a first experienced pregnancy loss. In the fourth quarter post-miscarriage, the probability of being prescribed iron supplements rises by 7.95 pp. Similarly, progesterone prescriptions peak in the quarter of the miscarriage and again in the second quarter afterwards, increasing by 2.92 pp. Both of these effects represent a 24-fold increase compared to the pre-treatment mean two quarters prior to the event.

As an additional indicator of investment in future pregnancies, I examine the probability of switching gynaecologists following a miscarriage. Such a decision may reflect dissatisfaction with the physical or emotional care received during the miscarriage or a belief that a different approach might have prevented the loss. Consequently, women may seek a second opinion or choose a new provider to better manage their future fertility intentions. As indicated by Figure 6, in the quarter of the miscarriage, the probability of switching gynaecologists increases by 12.94 pp and remains positive and significant throughout the first year following the event. This effect represents a 93.42% increase from the baseline two quarters before the pregnancy loss.

5.2 Miscarriage and subsequent pregnancy

A natural question to ask is to which extent the estimated dynamic treatment effects can be attributed exclusively to the miscarriage itself, rather than being driven by subsequent fertility. Figure 7 illustrates the distribution (Panel a)) and cumulative distribution (Panel b)) of the time to the first live birth following pregnancy loss. Among women who go on to have a successful pregnancy afterwards, 9% give birth to their first child in the third quarter following the loss. This represents the minimum time required to carry a pregnancy to term if conception occurred during the quarter of the miscarriage. By the end of the two-year observational period, 67% of these women had their first live birth, corresponding to 50% of all women in the sample (i.e., including those who do not

go on to have children in the future).

To answer this question, I split the sample into two groups of women - those who give birth in eight quarters following miscarriage and those who do not. The problem is, however, that the grouping variable is endogenous to the outcomes of interest, as the decision or ability to have a child after a miscarriage may be influenced by the factors that also drive the differences in the labour market or health-related behaviour. This would be the case if, for example, women who are generally healthier or well-established in the labour market are more likely to conceive again. Still, while interpreted cautiously, splitting the sample may provide some insights into how subsequent fertility interacts with the effects of miscarriage, potentially amplifying or mitigating its impacts on key outcomes.

The event study results for labour market outcomes are presented in Figure 8.[5] For women who give birth soon after miscarriage, the progressive decline in employment closely mirrors the distribution of live births. The most notable reduction occurs from the fourth quarter after miscarriage, when approximately 25% of the women in the sample become eligible for maternity leave. Similarly, the use of maternity leave offsets the initial increase in unemployment, while the use of sickness absence appears to persist, extending through the whole year after the loss. The findings suggest that miscarriage may amplify the existing motherhood penalty by accelerating absenteeism among women with strong fertility intentions that are soon to be realized. On the other hand, women who do not proceed to have a child use sickness absence predominantly in the quarter following the loss and experience a smaller, yet significant, decline in employment probability. However, the probability of unemployment remains elevated for this group, suggesting that miscarriage may have lasting consequences for labour market detachment, at least until the realization of subsequent pregnancy.

The increase in mental healthcare utilization is evident in both groups (Figure 9).[6] Since this effect is immediate and observed across all women, there is little risk of conflating it with the impacts of an upcoming pregnancy or postpartum depression. While the aggregate effect size appears similar regardless of fertility outcomes, disaggregated indicators reported in Figure A7 highlights important dynamics. Among women who have a child within two years, psychologist visits return to pre-treatment levels, and the probability of being diagnosed with a mental health condition declines starting in the sixth quarter after the loss. Conversely, the observed pattern in medication use is primarily driven by women who have subsequent children, as they temporarily reduce their intake during pregnancy (Figure A8). Although it remains unclear whether women remain childless by choice or due to inability, the evidence suggests that, for those intending to conceive, the negative labour market and mental health effects of miscarriage may be partially mitigated by the

[5]Detailed event study estimates for labour market outcomes by subsequent fertility are provided in Table A3.

[6]Detailed event study estimates for (mental) health outcomes by subsequent fertility are provided in Table A4.

realization of desired fertility.

Finally, the observed trajectory of healthcare utilization discussed in the previous section appears to be almost entirely driven by pregnancies that occur shortly after the initial event. Among women who do not have children within two years, there are no long-term effects on healthcare utilization beyond the immediate impact observed in the quarter of the miscarriage (Figure 10). By the second quarter after the miscarriage, differences in outpatient visits, inpatient stays, and medication prescriptions between the treatment and control groups return to pre-event levels (Figure A9).

Among childless women, the only elevated values are related to the probability of seeing a gynaecologist (Figure 10) and the likelihood of a progesterone prescription (Figure 11). These patterns may indicate fertility intentions among women who wish to but have not yet managed to conceive or sustain a pregnancy. They could also reflect ongoing medical efforts to address underlying health issues or complications arising from the miscarriage itself.

5.3 Effect heterogeneity

In this section, I examine the heterogeneous effects of miscarriage across different groups of women. Specifically, I analyse differences between women above and below the age of 35 at the time of miscarriage and compare outcomes for those with and without a college degree. Figure 13 and Figure 14 present event study estimates for a selected set of labour market and (mental) health outcomes.

The analysis of age groups shows minimal differences in responses to miscarriage, aside from those influenced by future fertility prospects. Older women are significantly less likely to have a subsequent live birth following their first pregnancy loss, as reflected in a lower probability of taking maternity leave and a less pronounced decline in employment. Nevertheless, both age groups experience notable labour market detachment, as indicated by an increase in sickness absence and higher unemployment rates, as well as an increased probability of psychologist appointments that suggests significant deterioration in mental health. Given that only about 17% of women in the sample are in the older age group, the smaller sample size results in less precise estimates, making it difficult to draw definitive conclusions about the magnitude and dynamics of the effects. Healthcare utilization patterns also align with fertility trajectories, with the notable exception of prescriptions for pregnancy-supporting medications. As indicated in Figure 13, women aged 35 and above are more likely to be prescribed progesterone in the quarter of miscarriage. However, this pattern does not persist throughout the rest of the observational period.

In contrast, the likelihood of giving birth after a miscarriage is similar for women with and without a college degree, as reflected in comparable patterns of maternity leave utilization (Figure 14). The key difference in labour market behaviour lies in the use of sick absence, with less-educated

women using sick leave for up to a year following the loss and those with a college degree typically not taking time off from work. Beyond this, there are no significant differences in healthcare utilization or fertility-related behaviours. While psychologist visits seem to be slightly more common among highly educated women, the overlapping confidence intervals prevent confirming this with certainty.

6 Family spillover effects of miscarriage

6.1 Spillover effects of miscarriage on husbands

After establishing that miscarriage significantly impacts women's mental health, labour market outcomes, and future fertility investment, I now turn to evaluating its corresponding effects on their spouses. While miscarriage has historically been regarded as a "women's issue," an expanding body of literature highlights the role of paternal factors in both sporadic and recurrent pregnancy loss, as well as the need to better understand men's experiences following such events (Karali et al., 2021). Given that the male partner contributes half of the genetic material, factors such as advanced paternal age, overall health, genetic composition, sperm quality, and lifestyle choices have all been associated with an increased risk of miscarriage and adverse fetal conditions (Kaltsas et al., 2024). At the same time, a growing body of research indicates that men share experiences of grief, uncertainty, and frustration following pregnancy loss, though their reactions are often shaped by socially constructed identities and traditional gender roles (Williams et al., 2020). In response to loss, men are frequently found to engage in compensatory behaviours such as increased alcohol consumption or participation in risky activities (Due et al., 2017), while less is understood about the positive changes they may make in supporting future fertility and family-building efforts.

To shed light on both the challenges and adaptive strategies of men in the context of miscarriage, I present the event study estimates for a selected set of outcomes depicted in Figure 15.[7] The results show no statistically significant effects of miscarriage on husbands' utilization of mental health services or labour market attachment. However, an analysis of individual components of the mental healthcare indicator reveals a marginally significant 2.5-fold (0.5 pp) increase in the probability of being diagnosed with a mental health condition in the quarter of miscarriage, mirroring a pattern observed in women (Figure A10). Unlike previous findings, there is no evidence of changes in risky behaviours, either as a coping mechanism in response to the loss or as a potential investment in future pregnancy. Similarly, no significant changes are observed in the uptake of vitamin prescriptions among husbands. The only consistent pattern is a decline in the probability of visiting a urologist compared to the second quarter before the loss. This decline, however, should be inter-

[7] Detailed event study estimates for spouses' labour market and (mental) health outcomes are provided in Table A5.

preted with caution, as the reference period reflects a temporary spike in visits, inflating the baseline against which subsequent periods are measured. The negative estimates thus represent a return to typical levels of urologist visits rather than a true reduction caused by the miscarriage. This short lived pre-event increase likely corresponds to fertility related consultations or general health checks in preparation for conception, which naturally decline once these concerns are addressed or men are referred to the appropriate specialist. Notably, the miscarriage itself does not seem to trigger additional proactive health behaviours beyond those observed prior to the loss.

6.2 Spillover effects of miscarriage on sisters

To explore further spillover effects of miscarriage on sisters, I put forward three hypotheses. First, consistent with evidence of shared grief among partners, grandparents, and children, sisters may also experience emotional and mental distress, along with uncertainty about how best to provide support (O'Leary and Gaziano, 2011; Lockton et al., 2020; Williams et al., 2020). These mental health effects may be further intensified by concerns about their own health and fertility. Second, witnessing the loss and struggles of a close family member may influence their reproductive decisions. Sisters might delay childbearing out of fear of similar complications, or alternatively, they might prioritize reproduction due to heightened awareness of age-related risks and the fragility of fertility. This hypothesis aligns with broader findings on how family health events can shape life-course decisions. Finally, as miscarriage represents a significant health event, sisters of reproductive age might become more health-conscious, adopting behaviours such as stress avoidance, healthier habits, or seeking medical advice.

The event study estimates for a selected set of outcomes are presented in Figure 16.[8] Around the time of the sister's miscarriage, no significant changes are observed in the use of psychotherapy services or mental health medication, suggesting that the effects on mental distress may not be as pronounced as hypothesized. However, there is evidence of increased healthcare utilization, specifically in terms of gynaecologist visits. In the quarter of the miscarriage, sisters are 1.66 pp more likely to have a gynaecologist appointment, corresponding to a 14.25% increase relative to the baseline period. This elevated probability of gynaecologist visits persists throughout the first year following the loss. Additionally, there is some indication of an increased probability of switching gynaecologists in the quarter after the loss, though this effect is not statistically significant across various specifications. Importantly, there is no observed increase in the probability of live births or the use of maternity leave, suggesting that the observed pattern in healthcare utilization is not driven by an upcoming pregnancy. Instead, at least part of the effect may be attributable to preventative measures taken by the sisters, potentially driven by increased awareness of reproductive

[8]Detailed event study estimates for sisters' fertility and (mental) health outcomes are provided in Table A6.

risks following the miscarriage. There is, however, no evidence of significant changes in the risky behaviour or uptake of vitamin prescriptions induced by the event.

7 Conclusion

Miscarriage is a severe and common fertility shock, affecting approximately one in seven pregnancies. In this study, I employ an identification strategy leveraging the randomness and timing of miscarriage to estimate the causal impact of pregnancy loss on women, along with its spillover effects on their close family members. Beyond examining the labour market and mental health implications, I explore differences in coping mechanisms, shifts in preventative health behaviours, and the impact of pregnancy loss on future reproductive decisions.

For women, I find strong evidence of short-term labour market detachment and a deterioration in mental health, with subsequent pregnancy and childbirth partially mitigating some of these adverse effects. Additionally, the results suggest increased parental investment in future pregnancies, as evidenced by a greater use of pregnancy-supporting medications. While the labour market status of spouses remains unaffected, the findings indicate a higher likelihood of being diagnosed with a mental health condition during the quarter of the miscarriage. Men, however, do not appear to engage in compensatory behaviour, nor do they make positive health investments beyond those observed prior to the loss. Finally, I do not observe significant mental health effects on sisters, suggesting that the psychological consequences are largely confined to the immediate family. Nevertheless, witnessing a pregnancy loss within the close social network increases sisters' commitment to their own reproductive health and preventative care, as evidenced by a higher frequency of gynaecologist visits following the loss.

From the analysis, I derive three main policy implications. First, efforts should focus on increasing public awareness of miscarriage, including its risk factors, causes, and preventative measures that can be taken before and during pregnancy. Public health campaigns should provide clear, evidence-based information about the importance of reproductive health and early intervention strategies. Given the increased health investments among women and their sisters after experiencing or witnessing pregnancy loss, healthcare systems should encourage more detailed reproductive health check-ups, including regular gynaecologist visits and additional screenings, particularly among high-risk women.

Second, the evidence of significant mental health deterioration in women and their spouses following a miscarriage highlights the critical need for accessible and targeted mental health services. While midwife support is available in Austria for advanced miscarriages (after the 18th week of pregnancy), the increased demand for psychological support among women suggests that mental health care should be extended to address even the earliest pregnancy losses. The prolonged

mental health effects observed in women who do not achieve a successful subsequent pregnancy highlight the importance of specialized support for those facing infertility challenges. Additionally, the observed increase in mental health diagnoses among men without a corresponding rise in service utilization suggests that the stigma around seeking help in Austria still persists. Public health initiatives should aim to normalize mental health care for men, particularly in the context of family-related challenges.

Finally, the prolonged use of sickness absence, along with an increased probability of unemployment, highlights how the consequences of miscarriage intensify the labour market penalties women face. Extensive research has shown that women experience career setbacks due to motherhood, which are further compounded by the emotional toll, physical recovery, and extended time away from work associated with prior fertility struggles. Policy efforts should aim to cultivate a supportive work environment for family planning. Alongside facilitating smooth transitions back to work, policies should promote flexible work arrangements and adaptable schedules, with a strong focus on preventing physical and mental strain for expecting women and those facing fertility struggles.

References

Ibrahim A Abdelazim, Mohannad AbuFaza, Prashant Purohit, and HR Farag. Miscarriage definitions, causes and management: review of literature. *ARC J Gynecol Obstet*, 2(3):20–31, 2017.

Annsofie Adolfsson and Per-Göran Larsson. Cumulative incidence of previous spontaneous abortion in sweden in 1983–2003: a register study. *Acta obstetricia et gynecologica Scandinavica*, 85(6):741–747, 2006.

Alexander Ahammer, Ulrich Glogowsky, Martin Halla, and Timo Hener. The parenthood penalty in mental health: Evidence from austria and denmark. Technical report, Working Paper, 2023.

Anne-Marie Nybo Andersen, Jan Wohlfahrt, Peter Christens, Jørn Olsen, and Mads Melbye. Maternal age and fetal loss: population based register linkage study. *Bmj*, 320(7251):1708–1712, 2000.

Montserrat Balsells, Apolonia García-Patterson, and Rosa Corcoy. Systematic review and meta-analysis on the association of prepregnancy underweight and miscarriage. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 207:73–79, 2016.

Chihiro Banno, Mayumi Sugiura-Ogasawara, Takeshi Ebara, Shoko Ide, Tamao Kitaori, Takeshi Sato, Kiwamu Ando, and Yoko Morita. Attitude and perceptions toward miscarriage: a survey of a general population in japan. *Journal of Human Genetics*, 65(2):155–164, 2020.

Éva Beaujouan. Late fertility intentions increase over time in austria, but chances to have a child at later ages remain low. *Reproductive Biomedicine & Society Online*, 14:125–139, 2022.

Sohinee Bhattacharya, John Townend, Ashalatha Shetty, D Campbell, and Siladitya Bhattacharya. Does miscarriage in an initial pregnancy lead to adverse obstetric and perinatal outcomes in the next continuing pregnancy? *BJOG: An International Journal of Obstetrics & Gynaecology*, 115 (13):1623–1629, 2008.

Nathan R Blue, Jessica M Page, and Robert M Silver. Genetic abnormalities and pregnancy loss. In *Seminars in perinatology*, volume 43, pages 66–73. Elsevier, 2019.

Massimiliano Bratti and Laura Cavalli. Delayed first birth and new mothers' labor market outcomes: Evidence from biological fertility shocks. *European Journal of Population*, 30:35–63, 2014.

Kasey S Buckles and Elizabeth L Munnich. Birth spacing and sibling outcomes. *Journal of Human Resources*, 47(3):613–642, 2012.

Aline Bütikofer, Deirdre Coy, Orla Doyle, and Rita Ginja. The consequences of miscarriage on parental investments. Technical report, UCD Centre for Economic Research Working Paper Series, 2024.

Zafer Buyukkececi and Thomas Leopold. Sibling influence on family formation: A study of social interaction effects on fertility, marriage, and divorce. *Advances in Life Course Research*, 47: 100359, 2021.

Zafer Buyukkececi, Thomas Leopold, Ruben Van Gaalen, and Henriette Engelhardt. Family, firms, and fertility: A study of social interaction effects. *Demography*, 57:243–266, 2020.

Nicholas A Christakis and James H Fowler. The collective dynamics of smoking in a large social network. *New England journal of medicine*, 358(21):2249–2258, 2008.

Ana Cubo Nava, Zandra M Soto Pino, Ana M Haro Pérez, M Estrella Hernández Hernández, M José Doyague Sánchez, and José M Sayagués Manzano. Medical versus surgical treatment of first trimester spontaneous abortion: A cost-minimization analysis. *PloS one*, 14(1):e0210449, 2019.

Elise de Vuijst, Anne-Rigt Poortman, Marjolijn Das, and Ruben van Gaalen. Cross-sibling effects on divorce in the netherlands. *Advances in Life Course Research*, 34:1–9, 2017.

Andrés Díaz-López, Blanca Ribot, Josep Basora, and Victoria Arija. High and low haemoglobin levels in early pregnancy are associated to a higher risk of miscarriage: a population-based cohort study. *Nutrients*, 13(5):1578, 2021.

Nadia A Du Fossé, Marie-Louise P Van der Hoorn, Jan MM van Lith, Saskia le Cessie, and Eileen ELO Lashley. Advanced paternal age is associated with an increased risk of spontaneous miscarriage: a systematic review and meta-analysis. *Human reproduction update*, 26(5): 650–669, 2020.

Clemence Due, Stephanie Chiarolli, and Damien W Riggs. The impact of pregnancy loss on men's health and wellbeing: a systematic review. *BMC pregnancy and childbirth*, 17:1–13, 2017.

Patricia L East and Leanne J Jacobson. The younger siblings of teenage mothers: a follow-up of their pregnancy risk. *Developmental psychology*, 37(2):254, 2001.

John Ermisch and David J Pevalin. Early motherhood and later partnerships. *Journal of Population Economics*, 18:469–489, 2005.

Itzik Fadlon and Torben Heien Nielsen. Family health behaviors. *American Economic Review*, 109 (9):3162–3191, 2019.

Itzik Fadlon and Torben Heien Nielsen. Family labor supply responses to severe health shocks: Evidence from danish administrative records. *American Economic Journal: Applied Economics*, 13(3):1–30, 2021.

Alexander P Frick. Advanced maternal age and adverse pregnancy outcomes. *Best practice & research Clinical obstetrics & gynaecology*, 70:92–100, 2021.

Lesley Haddock, Stephen Gordon, Sheena EM Lewis, Peter Larsen, Amjad Shehata, and Hassan Shehata. Sperm dna fragmentation is a novel biomarker for early pregnancy loss. *Reproductive BioMedicine Online*, 42(1):175–184, 2021.

Kathy Hardy and Philip John Hardy. 1st trimester miscarriage: four decades of study. *Translational pediatrics*, 4(2):189, 2015.

Angela R Hiefner and Astrud Villareal. A multidisciplinary, family-oriented approach to caring for parents after miscarriage: the integrated behavioral health model of care. *Frontiers in Public Health*, 9:725762, 2021.

V Joseph Hotz, Susan Williams McElroy, and Seth G Sanders. Teenage childbearing and its life cycle consequences: Exploiting a natural experiment. *Journal of Human Resources*, 40(3):683–715, 2005.

D Jurkovic, JA Ross, and KH Nicolaides. Expectant management of missed miscarriage. *BJOG: An International Journal of Obstetrics & Gynaecology*, 105(6):670–671, 1998.

Priti Kalsi and Maggie Y Liu. Pregnancy loss and female labor market outcomes. *Available at SSRN 3829769*, 2024.

Aris Kaltsas, Athanasios Zikopoulos, Vladimir Kojovic, Fotios Dimitriadis, Nikolaos Sofikitis, Michael Chrisofos, and Athanasios Zachariou. Paternal contributions to recurrent pregnancy loss: Mechanisms, biomarkers, and therapeutic approaches. *Medicina*, 60(12):1920, 2024.

HF Karali, ES Farhad, DSC Poh, YW Phong, P Soorianarayanan, JS Ting, and MT Zaigham. Comparing psychological impacts on male partners after experiencing various types of early pregnancy loss: A systematic literature review. *International Journal of Clinical Obstetrics and Gynaecology*, 2021.

Henrik Kleven, Camille Landais, and Jakob Egholt Søgaard. Children and gender inequality: Evidence from denmark. *American Economic Journal: Applied Economics*, 11(4):181–209, 2019.

Chelsea L Kracht and Susan B Sisson. Sibling influence on children's objectively measured physical activity: a meta-analysis and systematic review. *BMJ open sport & exercise medicine*, 4(1): e000405, 2018.

Ilyana Kuziemko. Is having babies contagious? estimating fertility peer effects between siblings. *Unpublished manuscript, New Jersey. https://www0. gsb. columbia. edu/faculty/ikuziemko/papers/fertility_11_29_06. pdf*, 2006.

Marike Lemmers, Marianne AC Verschoor, Patrick M Bossuyt, Judith AF Huirne, Teake Spinder, Theodoor E Nieboer, Marlies Y Bongers, Ineke AH Janssen, Marcel HA Van Hooff, Ben WJ Mol, et al. Cost-effectiveness of curettage vs. expectant management in women with an incomplete evacuation after misoprostol treatment for first-trimester miscarriage: a randomized controlled trial and cohort study. *Acta obstetricia et gynecologica Scandinavica*, 97(3):294–300, 2018.

Ying Li, Hui Lin, Yafei Li, and Jia Cao. Association between socio-psycho-behavioral factors and male semen quality: systematic review and meta-analyses. *Fertility and sterility*, 95(1):116–123, 2011.

Reeta Linnakaari, Nea Helle, Maarit Mentula, Aini Bloigu, Mika Gissler, Oskari Heikinheimo, and Maarit Niinimäki. Trends in the incidence, rate and treatment of miscarriage—nationwide register-study in finland, 1998–2016. *Human Reproduction*, 34(11):2120–2128, 2019.

Jane Lockton, Clemence Due, and Melissa Oxlad. Love, listen and learn: grandmothers' experiences of grief following their child's pregnancy loss. *Women and Birth*, 33(4):401–407, 2020.

Torkild Hovde Lyngstad and Alexia Prskawetz. Do siblings' fertility decisions influence each other? *Demography*, 47(4):923–934, 2010.

Nick S Macklon, Joep PM Geraedts, and Ban CJM Fauser. Conception to ongoing pregnancy: the 'black box'of early pregnancy loss. *Human reproduction update*, 8(4):333–343, 2002.

Maria C Magnus, Allen J Wilcox, Nils-Halvdan Morken, Clarice R Weinberg, and Siri E Håberg. Role of maternal age and pregnancy history in risk of miscarriage: prospective register based study. *bmj*, 364, 2019.

Simen Markussen and Marte Strøm. Children and labor market outcomes: separating the effects of the first three children. *Journal of Population Economics*, 35(1):135–167, 2022.

Amalia R Miller. Motherhood delay and the human capital of the next generation. *American Economic Review*, 99(2):154–158, 2009.

Amalia R Miller. The effects of motherhood timing on career path. *Journal of population economics*, 24(3):1071–1100, 2011.

Wade Muncey, Michael Scott, Ruth B Lathi, and Michael L Eisenberg. The paternal role in pregnancy loss. *Andrology*, 2024.

M Niinimäki, P Karinen, A-L Hartikainen, and A Pouta. Treating miscarriages: a randomised study of cost-effectiveness in medical or surgical choice. *BJOG: An International Journal of Obstetrics & Gynaecology*, 116(7):984–990, 2009.

Johnna Nynas, Puneet Narang, Murali K Kolikonda, and Steven Lippmann. Depression and anxiety following early pregnancy loss: recommendations for primary care providers. *The primary care companion for CNS disorders*, 17(1):26225, 2015.

Jonnn M O'Leary and Cecilie Gaziano. Sibling grief after perinatal loss. *Journal of Prenatal & Perinatal Psychology & Health*, 25(3):173, 2011.

Clare Teresa Oliver-Williams, Emma E Heydon, Gordon CS Smith, and Angela M Wood. Miscarriage and future maternal cardiovascular disease: a systematic review and meta-analysis. *Heart*, 99(22):1636–1644, 2013.

Mark A Pachucki, Paul F Jacques, and Nicholas A Christakis. Social network concordance in food choice among spouses, friends, and siblings. *American journal of public health*, 101(11): 2170–2177, 2011.

Stavros Petrou, J Trinder, P Brocklehurst, and L Smith. Economic evaluation of alternative management methods of first-trimester miscarriage based on results from the mist trial. *BJOG: an international journal of obstetrics & gynaecology*, 113(8):879–889, 2006.

Beth L Pineles, Edward Park, and Jonathan M Samet. Systematic review and meta-analysis of miscarriage and maternal exposure to tobacco smoke during pregnancy. *American journal of epidemiology*, 179(7):807–823, 2014.

Alexia Prskawetz, Tomáš Sobotka, Isabella Buber, Henriette Engelhardt, and Richard Gisser. Austria: Persistent low fertility since the mid-1980s. *Demographic Research*, 19:293–360, 2008.

Larysa Y Pylyp, Lyudmyla O Spynenko, Nataliya V Verhoglyad, Anna O Mishenko, Dmytro O Mykytenko, and Valery D Zukin. Chromosomal abnormalities in products of conception of first-trimester miscarriages detected by conventional cytogenetic analysis: a review of 1000 cases. *Journal of assisted reproduction and genetics*, 35:265–271, 2018.

Fan Qu, Yan Wu, Yu-Hang Zhu, John Barry, Tao Ding, Gianluca Baio, Ruth Muscat, Brenda K Todd, Fang-Fang Wang, and Paul J Hardiman. The association between psychological stress and miscarriage: a systematic review and meta-analysis. *Scientific reports*, 7(1):1731, 2017.

Siobhan Quenby, Ioannis D Gallos, Rima K Dhillon-Smith, Marcelina Podesek, Mary D Stephenson, Joanne Fisher, Jan J Brosens, Jane Brewin, Rosanna Ramhorst, Emma S Lucas, et al. Miscarriage matters: the epidemiological, physical, psychological, and economic costs of early pregnancy loss. *The Lancet*, 397(10285):1658–1667, 2021.

Sara Rellstab, Pieter Bakx, and Pilar García-Gómez. Human capital formation: The effect of a miscarriage on mental health, labour market, and family outcomes. Technical report, Tinbergen Institute Discussion Paper, 2022.

J Niels Rosenquist, Joanne Murabito, James H Fowler, and Nicholas A Christakis. The spread of alcohol consumption behavior in a large social network. *Annals of internal medicine*, 152(7): 426–433, 2010.

Indra San Lazaro Campillo, Sarah Meaney, Keelin O'Donoghue, and Paul Corcoran. Miscarriage hospitalisations: a national population-based study of incidence and outcomes, 2005–2016. *Reproductive Health*, 16:1–8, 2019.

Sophie Smith, Flo Martin, Dheeraj Rai, and Harriet Forbes. Association between antidepressant use during pregnancy and miscarriage: a systematic review and meta-analysis. *BMJ open*, 14(1): e074600, 2024.

Alexandra C Sundermann, Sifang Zhao, Chantay L Young, LeAnn Lam, Sarah H Jones, Digna R Velez Edwards, and Katherine E Hartmann. Alcohol use in pregnancy and miscarriage: a systematic review and meta-analysis. *Alcoholism: Clinical and Experimental Research*, 43(8): 1606–1616, 2019.

Merel MJ van den Berg, Merel C van Maarle, Madelon van Wely, and Mariëtte Goddijn. Genetics of early miscarriage. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease*, 1822 (12):1951–1959, 2012.

WHO. *Guideline daily iron supplementation in infants and children*. World Health Organization, 2016.

Allen J Wilcox, Clarice R Weinberg, John F O'Connor, Donna D Baird, John P Schlatterer, Robert E Canfield, E Glenn Armstrong, and Bruce C Nisula. Incidence of early loss of pregnancy. *New England Journal of Medicine*, 319(4):189–194, 1988.

Helen M Williams, Annie Topping, Arri Coomarasamy, and Laura L Jones. Men and miscarriage: a systematic review and thematic synthesis. *Qualitative health research*, 30(1):133–145, 2020.

Michael Windle. Parental, sibling, and peer influences on adolescent substance use and alcohol problems. *Applied Developmental Science*, 4(2):98–110, 2000.

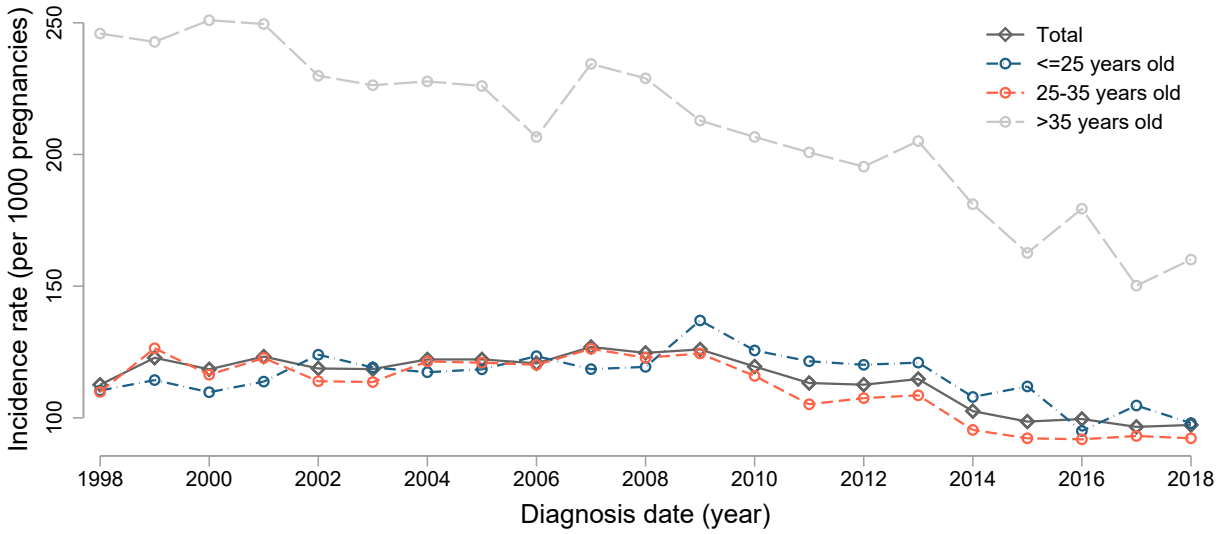
Hang-lin Wu, Sheeba Marwah, Pei Wang, Qiu-meng Wang, and Xiao-wen Chen. Misoprostol for medical treatment of missed abortion: a systematic review and network meta-analysis. *Scientific reports*, 7(1):1664, 2017.

Yuying Yan, Zeping Chen, Ying Yang, Xinkuo Zheng, Meijuan Zou, Gang Cheng, and Zhenting Yuan. Efficacy of progesterone on threatened miscarriage: an updated meta-analysis of randomized trials. *Archives of Gynecology and Obstetrics*, 303:27–36, 2021.

Junfu Zhang and Xue Song. Fertility differences between married and cohabiting couples: A switching regression analysis. 2007.

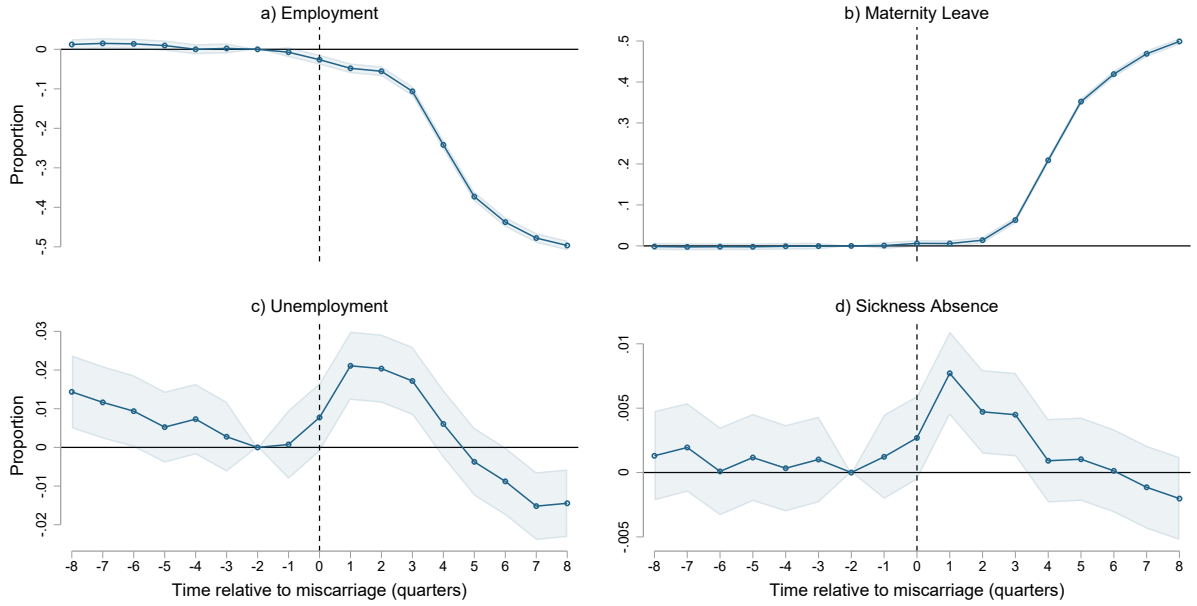
Figures

Figure 1: Incidence Rate of Miscarriage



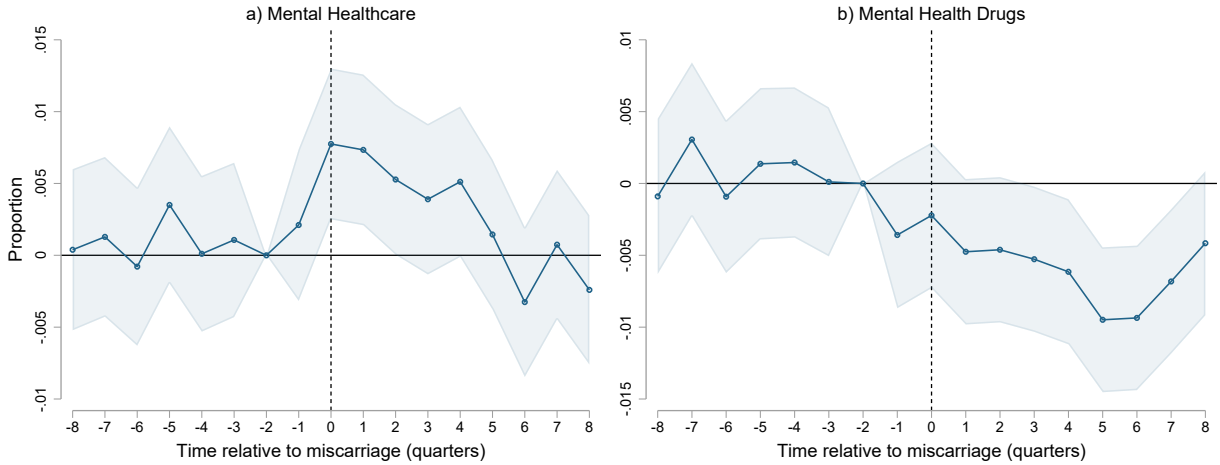
Notes: The figure illustrates the incidence rate of miscarriage in Upper Austria between 1998 and 2018. The incidence rate is calculated as the number of miscarriages per 1,000 pregnancies, where pregnancies are defined as the sum of miscarriages and deliveries in the respective year. The individual-level data is sourced from the Upper Austrian Health Insurance Fund.

Figure 2: Event Study for Labour Market Outcomes



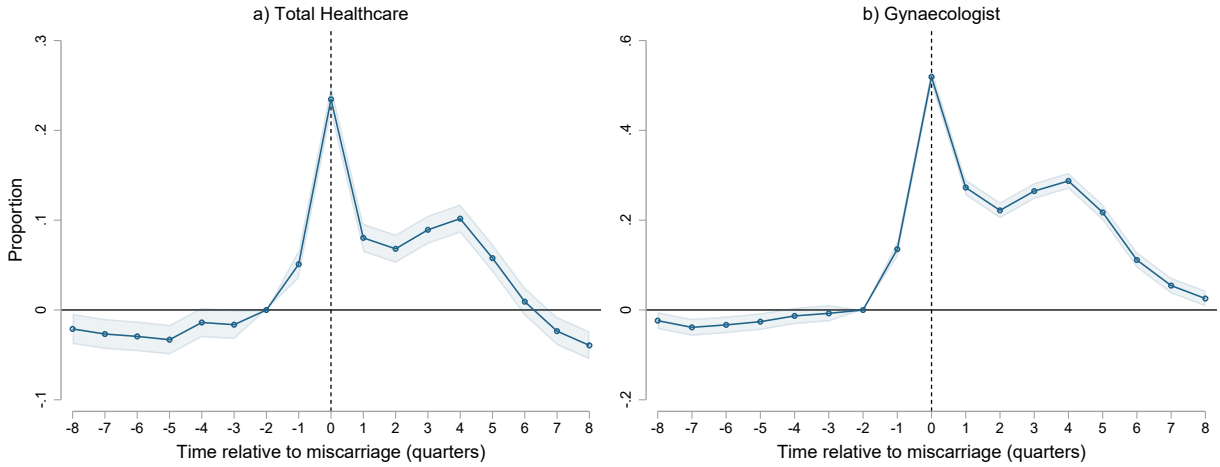
Notes: Each figure displays the estimated effects of miscarriage on labour market outcomes from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018.

Figure 3: Event Study for Mental Health Outcomes



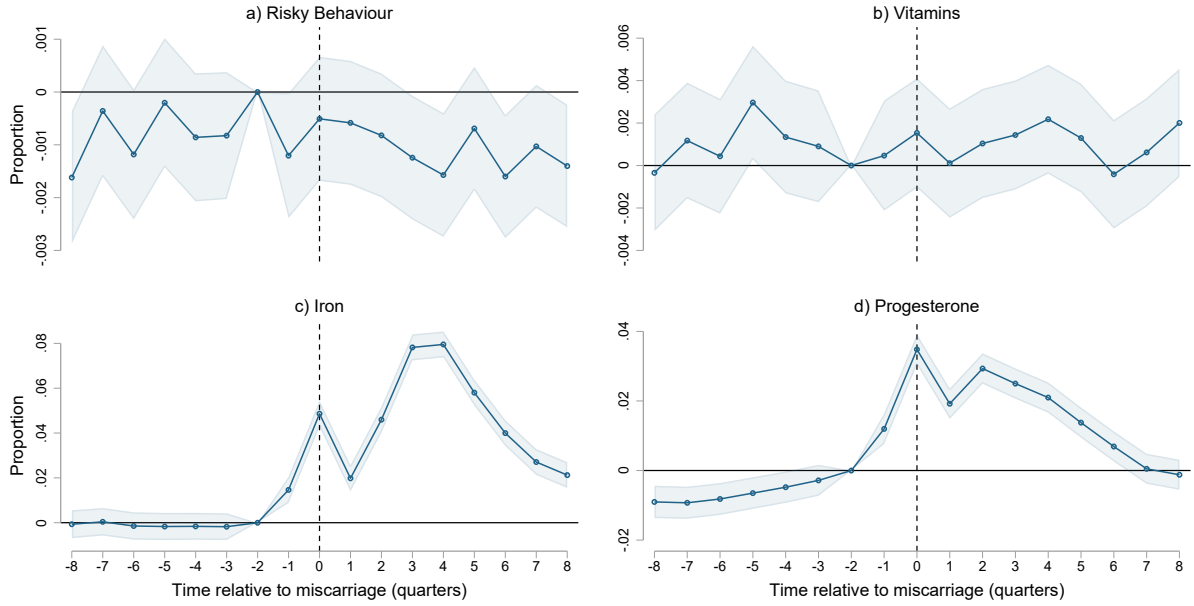
Notes: Each figure displays the estimated effects of miscarriage on utilization of mental healthcare services and medications from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on mental healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 4: Event Study for Health Outcomes



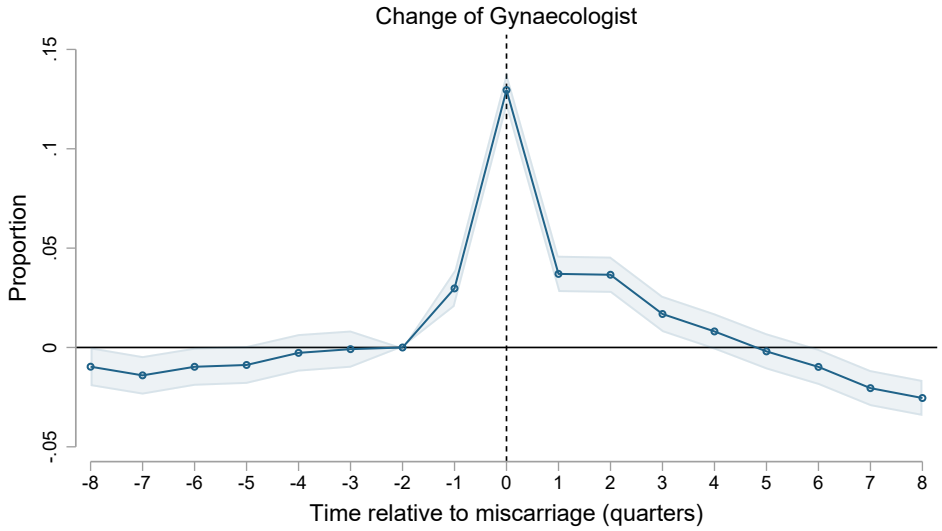
Notes: Each figure displays the estimated effects of miscarriage on utilization of healthcare services from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 5: Event Study for Pregnancy Investments



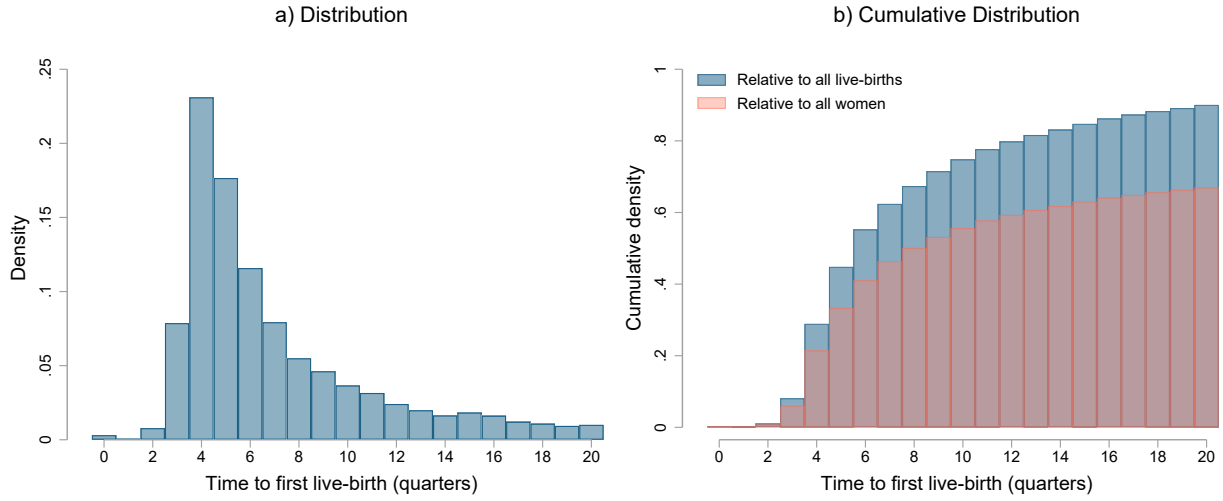
Notes: Each figure displays the estimated effects of miscarriage on future pregnancy investments from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on risky behaviour and supplement prescriptions is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 6: Event Study for Change of Gynaecologist



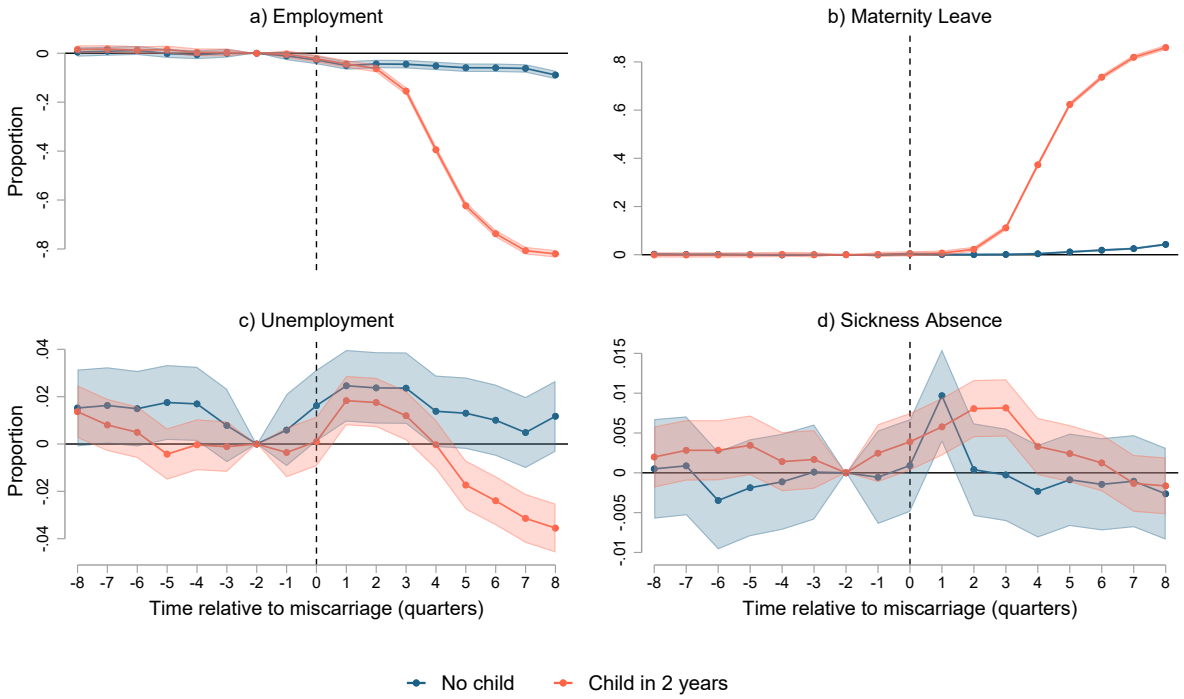
Notes: The figure displays the estimated effects of miscarriage probability of switching gynaecologists from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on gynaecologist visits is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 7: Distribution and Cumulative Distribution of Time until the First Live-Birth



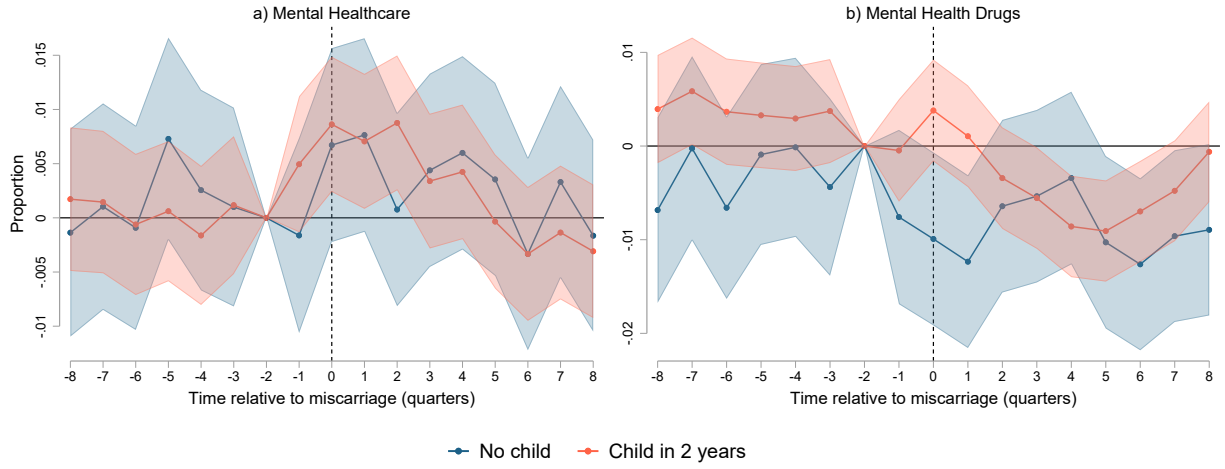
Notes: Panel a) displays the quarterly distribution of time until the first live birth following a miscarriage, covering a period of up to five years. Panel b) displays the cumulative distribution of time until the first live birth after a miscarriage, also up to five years. The cumulative distribution is calculated separately for two groups: i) women who eventually give birth and ii) all women in the sample. The bin size is one quarter. Data on miscarriages is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 8: Event Study for Labour Market Outcomes by Subsequent Fertility



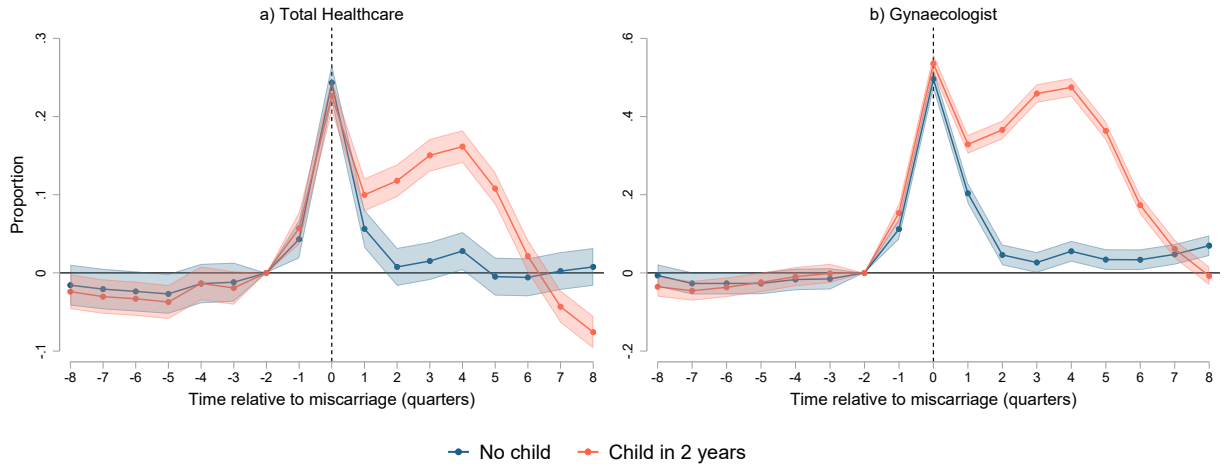
Notes: Each figure displays the estimated effects of miscarriage on labour market outcomes from Equation (1). The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018.

Figure 9: Event Study for Mental Health Outcomes by Subsequent Fertility



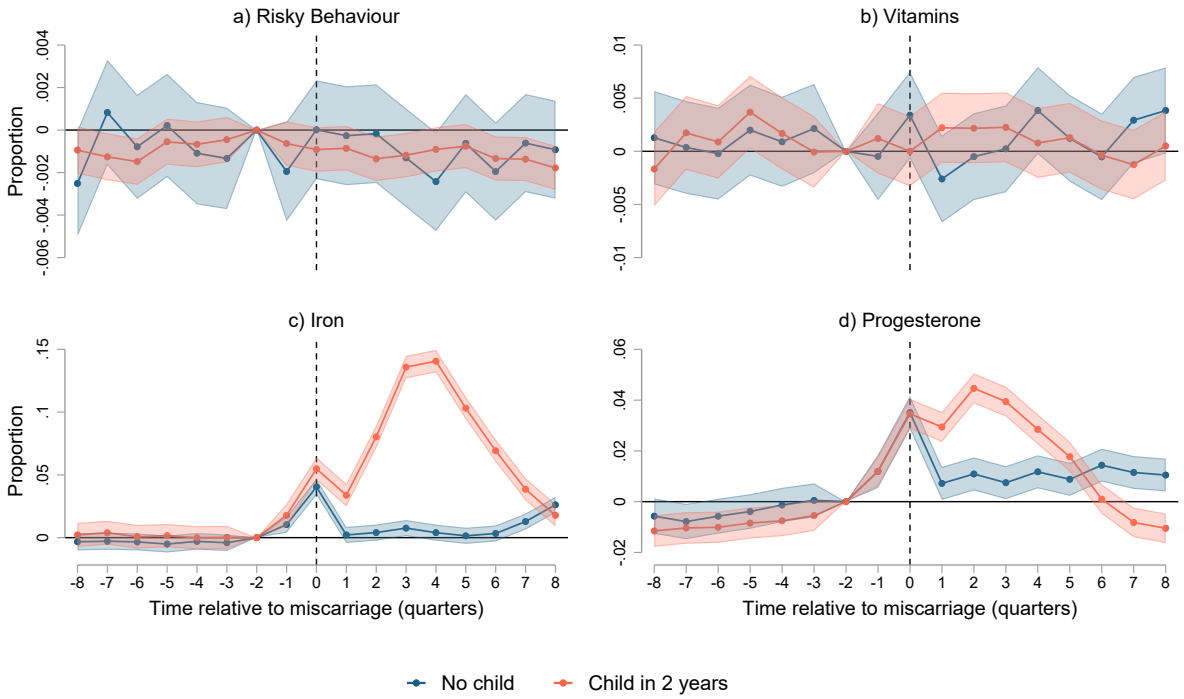
Notes: Each figure displays the estimated effects of miscarriage on utilization of mental healthcare services and medications from Equation (1). The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on mental healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 10: Event Study for Health Outcomes by Subsequent Fertility



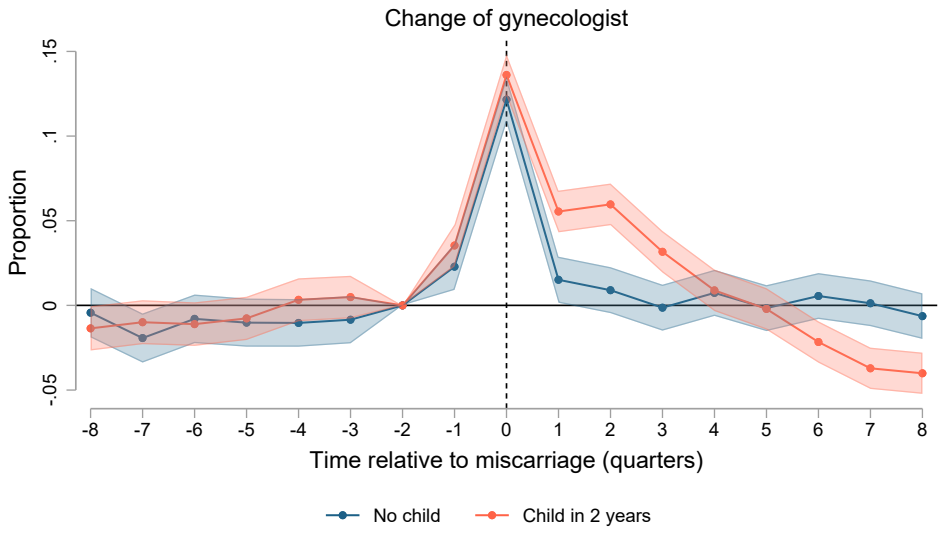
Notes: Each figure displays the estimated effects of miscarriage on utilization of healthcare services from Equation (1). The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 11: Event Study for Pregnancy Investments by Subsequent Fertility



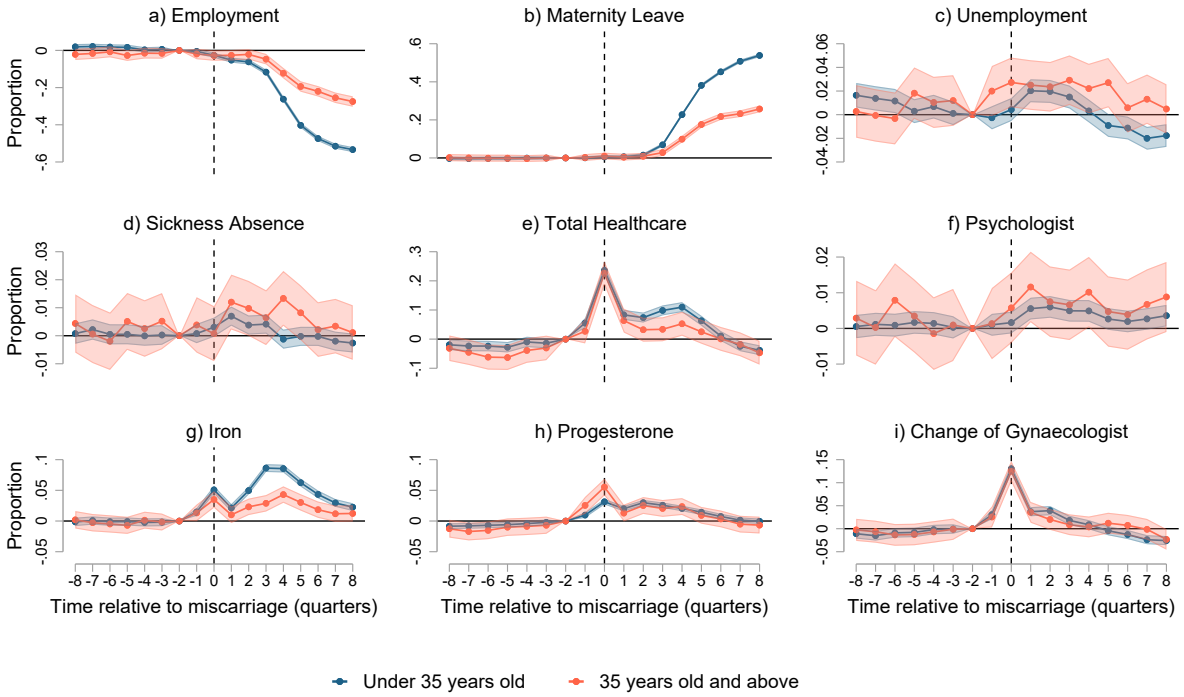
Notes: Each figure displays the estimated effects of miscarriage on future pregnancy investments from Equation (1). The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on risky behaviour and supplement prescriptions is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 12: Event Study for Change of Gynaecologist by Subsequent Fertility



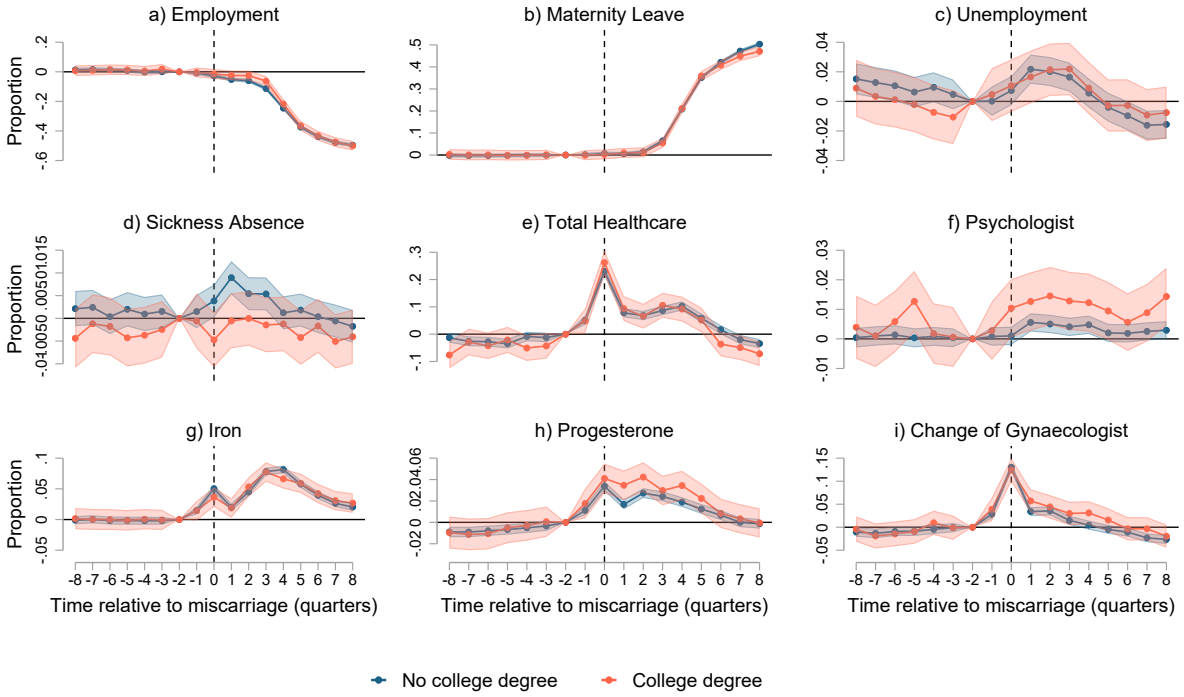
Notes: The figure displays the estimated effects of miscarriage probability of switching gynaecologists from Equation (1). The effect is estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on gynaecologist visits is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 13: Event Study for Labour Market and (Mental) Health Outcomes by Age Group



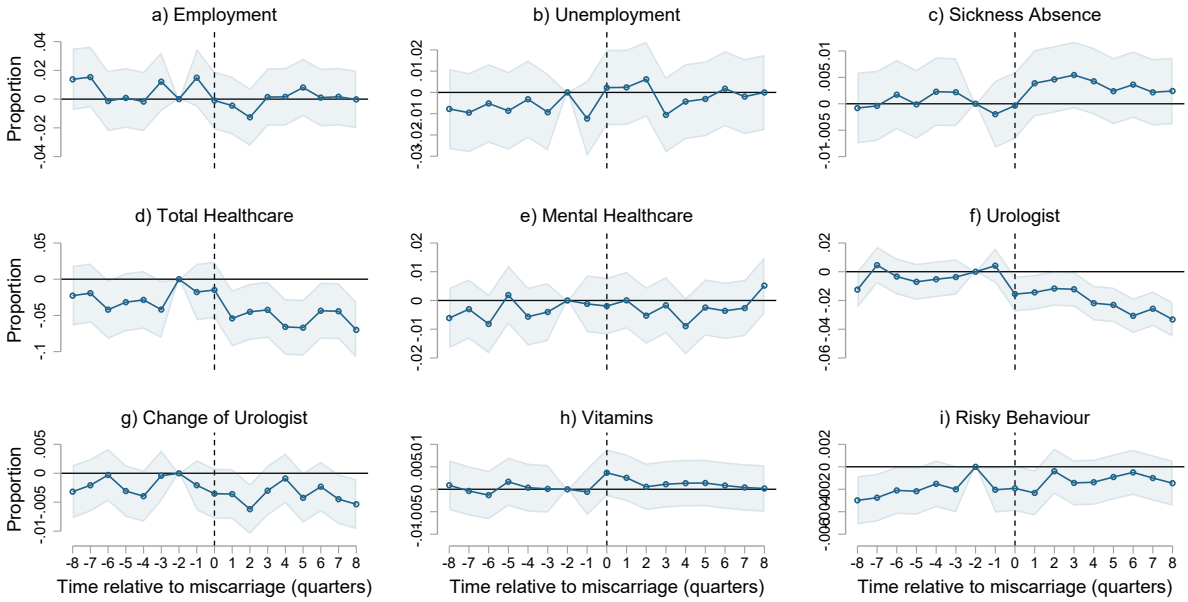
Notes: Each figure displays the estimated effects of miscarriage on selected labour market and (mental) health outcomes from Equation (1). The effects are estimated separately for women above and below the age of 35 at the time of miscarriage. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018. Data on (mental) health outcomes is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 14: Event Study for Labour Market and (Mental) Health Outcomes by Educational Attainment



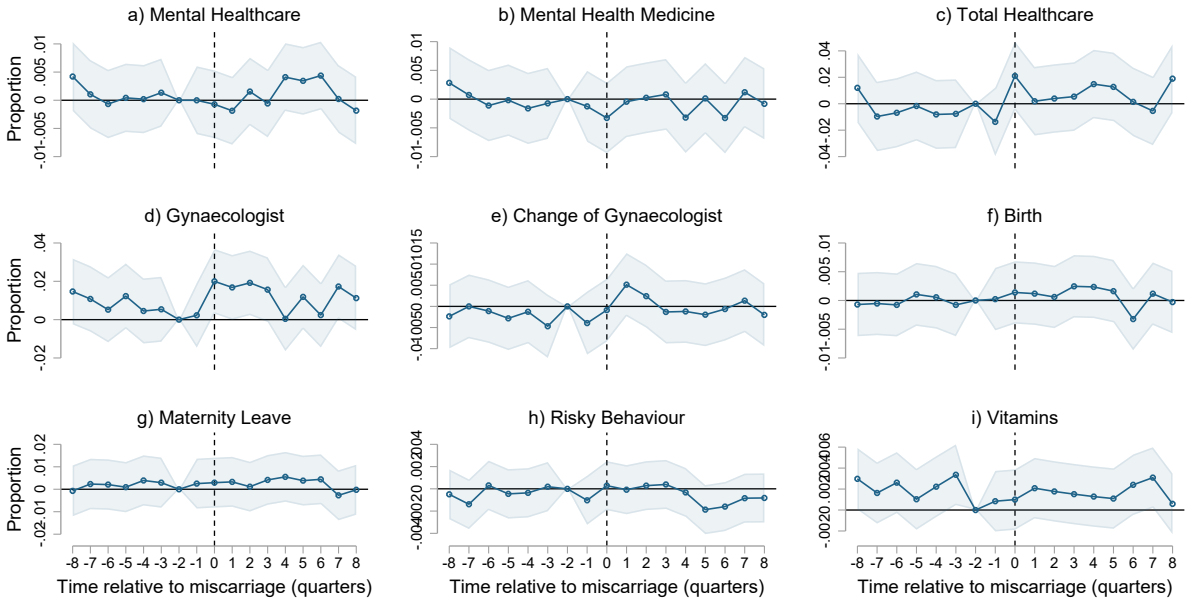
Notes: Each figure displays the estimated effects of miscarriage on selected labour market and (mental) health outcomes from Equation (1). The effects are estimated separately for women with and without a college degree at the time of miscarriage. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018. Data on (mental) health outcomes is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 15: Event Study for Spouses' Labour Market and (Mental) Health Outcomes



Notes: Each figure displays the estimated effects of miscarriage on selected spouses' labour market and (mental) health outcomes based on Equation (2). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018. Data on (mental) healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure 16: Event Study for Sisters' Fertility and (Mental) Health Outcomes



Notes: Each figure displays the estimated effects of miscarriage on selected sisters' labour market and (mental) health outcomes, based on Equation (2). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the family level. Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018. Data on (mental) healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Tables

Table 1: Descriptive Statistics for Women

	Treated		Control	
Variables	Mean	Std. dev.	Mean	Std. dev.
Demographic characteristics				
Age at miscarriage	28.34	6.33	28.96	6.03
Age at (placebo) miscarriage			26.19	6.03
Austrian = 1	0.89	0.31	0.92	0.28
College degree = 1	0.13	0.34	0.13	0.33
Labour market attachment				
Employment	0.86	0.35	0.82	0.39
Unemployment	0.06	0.24	0.06	0.24
Marginal employment	0.03	0.17	0.04	0.19
Sickness absence	0.01	0.08	0.00	0.07
Daily wage (conditional)	55.01	35.03	49.50	34.85
Healthcare utilization				
Total healthcare	0.74	0.44	0.72	0.45
Inpatient	0.05	0.21	0.04	0.19
Outpatient	0.72	0.45	0.70	0.46
Drugs	0.39	0.49	0.35	0.48
Gynaecologist	0.26	0.44	0.23	0.42
Fertility drugs	0.01	0.09	0.00	0.04
Mental healthcare utilization				
Mental healthcare	0.02	0.14	0.02	0.13
Mental health drugs	0.02	0.15	0.02	0.14
Observations	75,170		59,091	

Notes: The table presents descriptive statistics for the listed outcomes among women who experienced miscarriage between 1998 and 2018. The means and standard deviations are calculated separately for the treated and control groups. All variables are measured before the first quarter ($k < -1$) preceding the (placebo) miscarriage. Data on demographic characteristics and labour market attachment is from the Austrian Social Security Database and spans from 1998-2018. Data on miscarriages and (mental) healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998-2018. All indicators, except for age and daily wage, are expressed as dummy variables (0/1).

Table 2: Descriptive Statistics for Spouses

	Treated		Control	
Variables	Mean	Std. dev.	Mean	Std. dev.
Demographic characteristics				
Age at miscarriage	32.37	6.61	32.90	6.77
Age at (placebo) miscarriage			30.17	6.78
Austrian = 1	0.82	0.38	0.84	0.37
College degree = 1	0.11	0.32	0.09	0.29
Labour market attachment				
Employment	0.90	0.30	0.88	0.32
Unemployment	0.05	0.23	0.06	0.24
Marginal employment	0.02	0.15	0.02	0.15
Daily wage (conditional)	88.40	31.39	82.92	31.46
Sickness absence	0.01	0.07	0.01	0.08
Healthcare utilization				
Total healthcare	0.57	0.50	0.54	0.50
Inpatient	0.04	0.19	0.03	0.18
Outpatient	0.55	0.50	0.52	0.50
Drugs	0.29	0.45	0.26	0.44
Urologist	0.02	0.16	0.01	0.12
Fertility drugs	0.00	0.03	0.00	0.01
Mental healthcare utilization				
Mental healthcare	0.01	0.09	0.01	0.09
Mental health drugs	0.01	0.12	0.02	0.12
Observations	17,280		14,105	

Notes: The table presents descriptive statistics for the listed outcomes among men whose spouse experienced miscarriage between 1998 and 2018. The means and standard deviations are calculated separately for the treated and control groups. All variables are measured before the first quarter ($k < -1$) preceding the (placebo) miscarriage. Data on demographic characteristics and labour market attachment is from the Austrian Social Security Database and spans from 1998-2018. Data on miscarriages and (mental) healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998-2018. All indicators, except for age and daily wage, are expressed as dummy variables (0/1).

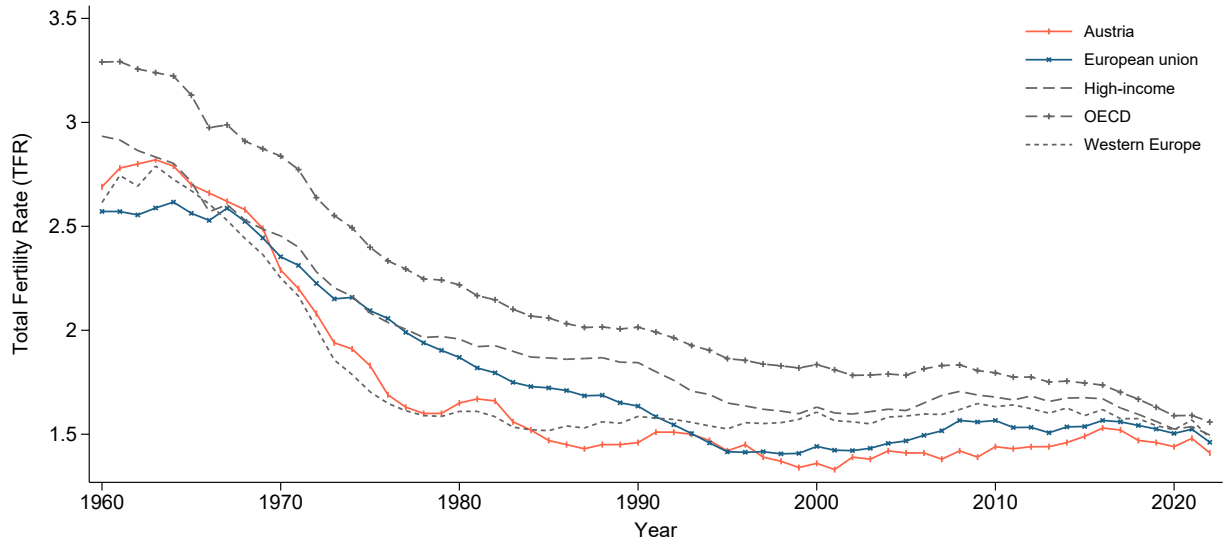
Table 3: Descriptive Statistics for Sisters

	Treated		Control	
Variables	Mean	Std. dev.	Mean	Std. dev.
Demographic characteristics				
Age at miscarriage	24.32	5.55	26.47	5.43
Age at (placebo) miscarriage			23.72	5.44
Austrian = 1	0.98	0.14	0.98	0.14
College degree = 1	0.08	0.27	0.08	0.28
Labour market attachment				
Employment	0.69	0.46	0.68	0.47
Unemployment	0.07	0.25	0.06	0.24
Marginal employment	0.04	0.19	0.04	0.19
Sickness absence	0.01	0.08	0.01	0.07
Daily wage (conditional)	65.17	33.15	62.65	32.80
Healthcare utilization				
Total healthcare	0.62	0.49	0.61	0.49
Inpatient	0.04	0.20	0.04	0.20
Outpatient	0.60	0.49	0.60	0.49
Drugs	0.28	0.45	0.27	0.45
Fertility				
Childbirth	0.07	0.26	0.07	0.25
Number of children	0.08	0.30	0.08	0.29
Quarters since last birth	4.63	3.19	4.42	3.07
Gynaecologist	0.11	0.32	0.11	0.31
Fertility drugs	0.01	0.07	0.00	0.06
Mental healthcare utilization				
Mental healthcare	0.01	0.11	0.01	0.10
Mental health drugs	0.02	0.13	0.02	0.13
Observations	34,413		35,202	

Notes: The table presents descriptive statistics for the listed outcomes among women whose sister experienced miscarriage between 1998 and 2018. The means and standard deviations are calculated separately for the treated and control groups. All variables are measured before the first quarter ($k < -1$) preceding the (placebo) miscarriage. Data on demographic characteristics and labour market attachment is from the Austrian Social Security Database and spans from 1998-2018. Data on miscarriages and (mental) healthcare utilization is from the Upper Austrian Health Insurance Fund and spans from 1998-2018. All indicators, except for age, daily wage, number of children, and quarters since last birth are expressed as dummy variables (0/1).

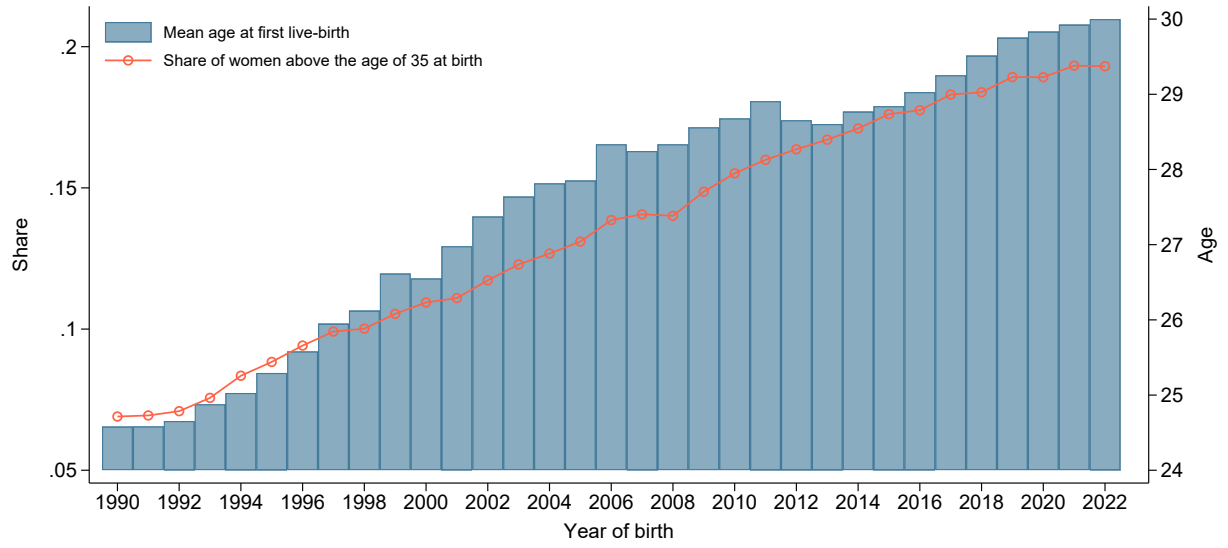
A Appendix

Figure A1: Total Fertility Rate



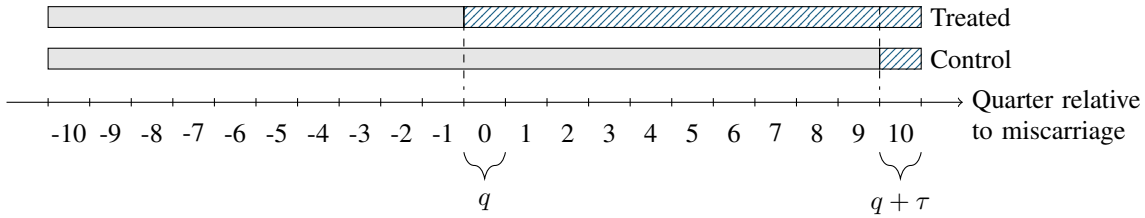
Notes: The figure illustrates the development of the total fertility rate in Austria and selected country groups from 1960-2022. The Western Europe average includes Austria, Belgium, France, Germany, Luxembourg, the Netherlands, and Switzerland. Data is sourced from the World Bank (accessed on 2025-09-01).

Figure A2: Trends in Maternal Age at (First) Birth



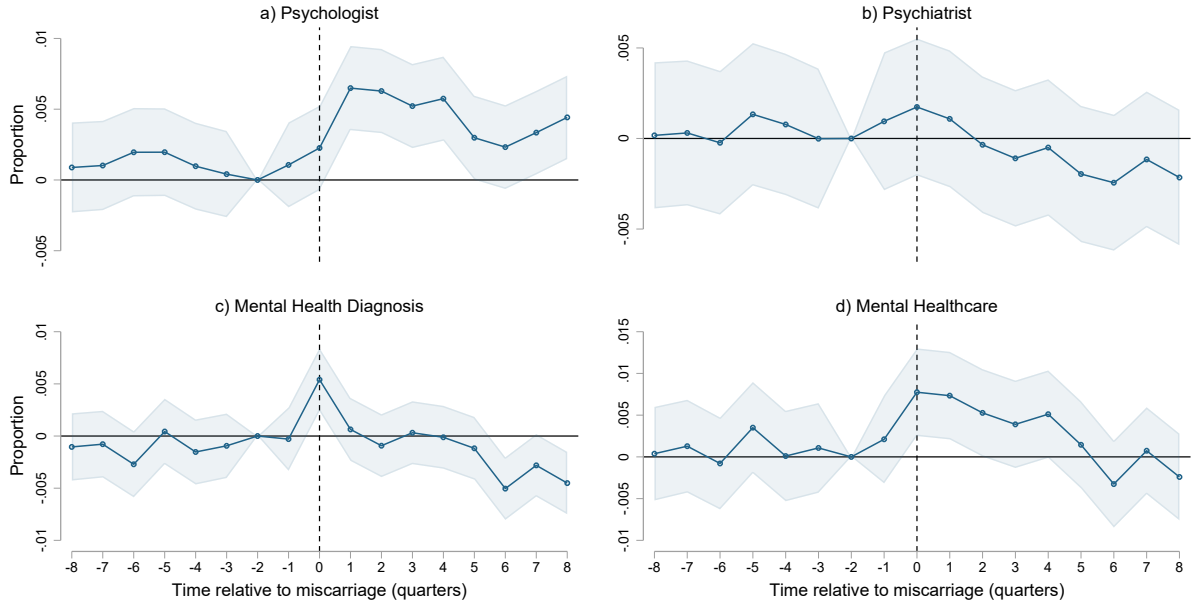
Notes: The figure provides an overview of trends in maternal age from 1990 to 2022. It illustrates the percentage of women aged 35 or older at the time of childbirth (primary y-axis) and the average age at first birth (secondary y-axis). The data is sourced from Statistics Austria and covers the period from 1990-2022 (accessed on 2025-09-01).

Figure A3: Construction of Treatment and Control Group



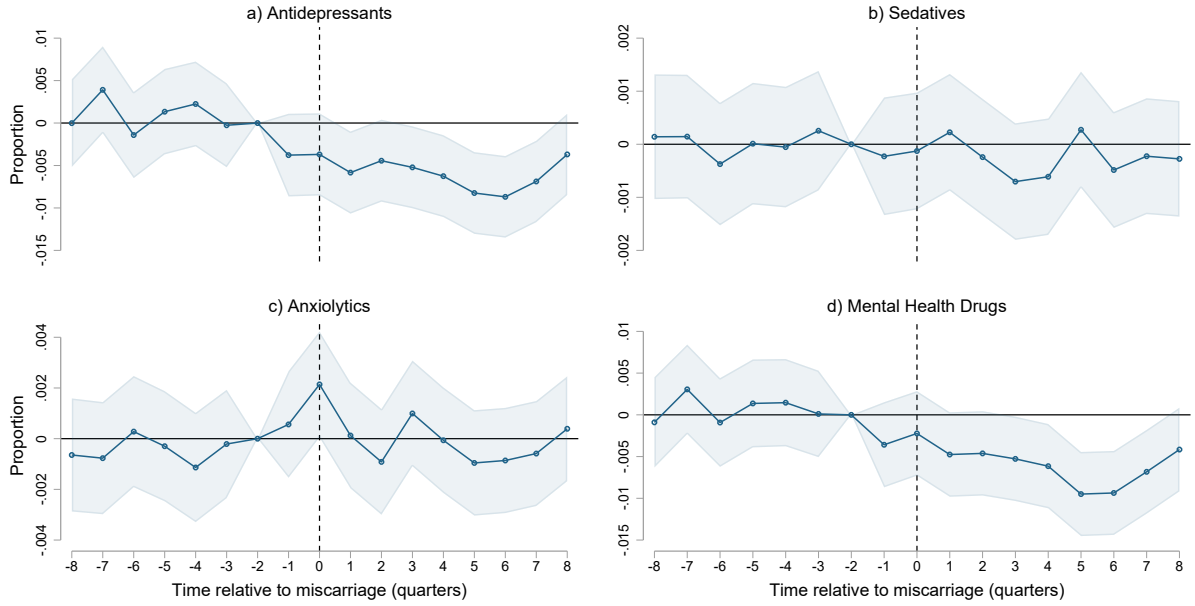
Notes: The figure illustrates the process of constructing the treatment and control group. For the baseline estimates, individuals in the treatment group experience a miscarriage in quarter q. Individuals in the control group experience miscarriage 10 quarters later, at $q + 10$, but are assigned a placebo loss occurring at q. The process is repeated for each quarter, with the same individuals being included in the treatment and control group, but no individual serving as a control for themselves.

Figure A4: Event Study for Mental Healthcare Utilization



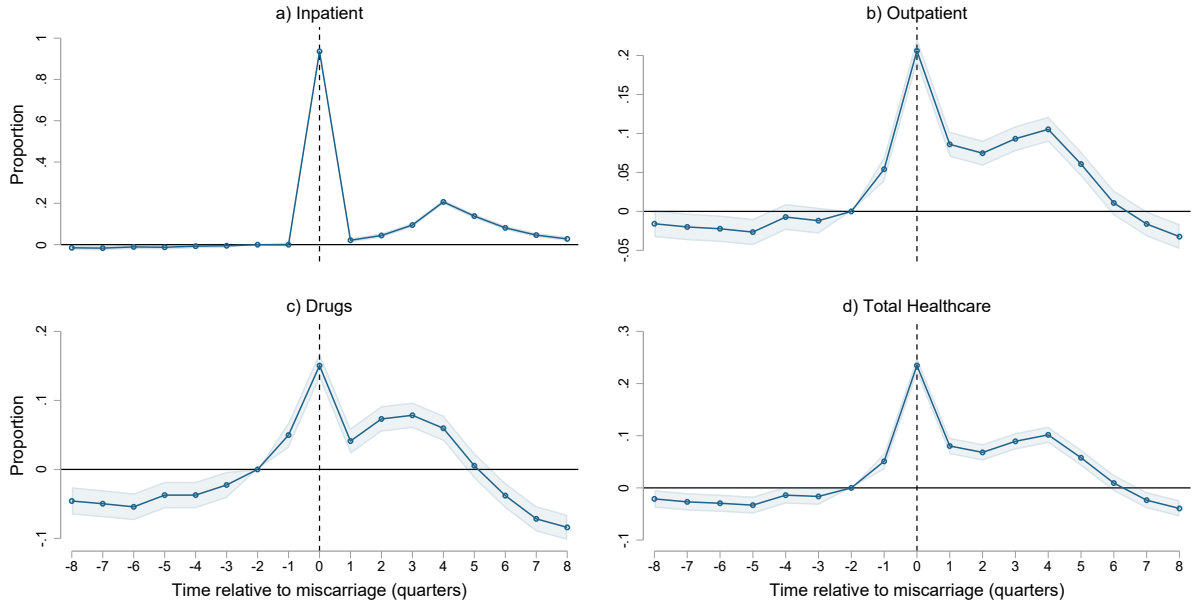
Notes: Each figure displays the estimated effects of miscarriage on utilization of mental healthcare services from Equation (1). Panels a)-c) present disaggregated indicators, and Panel d) presents an aggregate measure of mental healthcare utilization. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on mental healthcare services is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure A5: Event Study for Mental Health Drugs



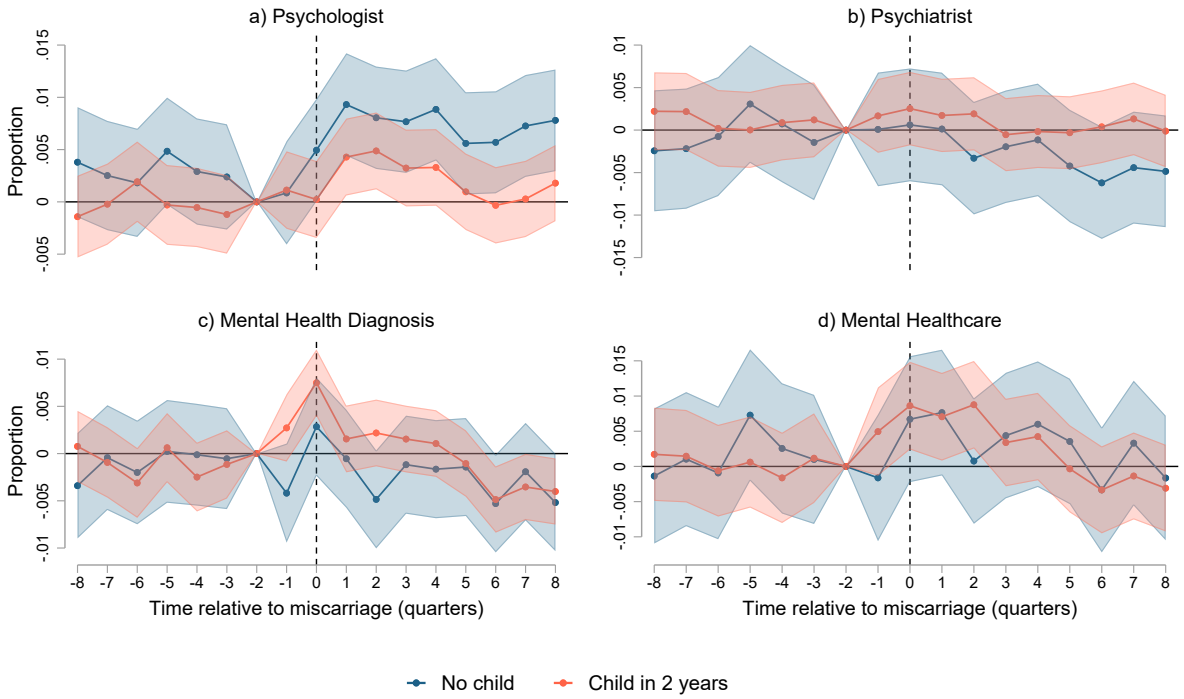
Notes: Each figure displays the estimated effects of miscarriage on prescriptions for mental health drugs from Equation (1). Panels a)-c) present disaggregated indicators, and Panel d) presents an aggregate measure of mental health drugs. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on drug prescriptions is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure A6: Event Study for Healthcare Utilization



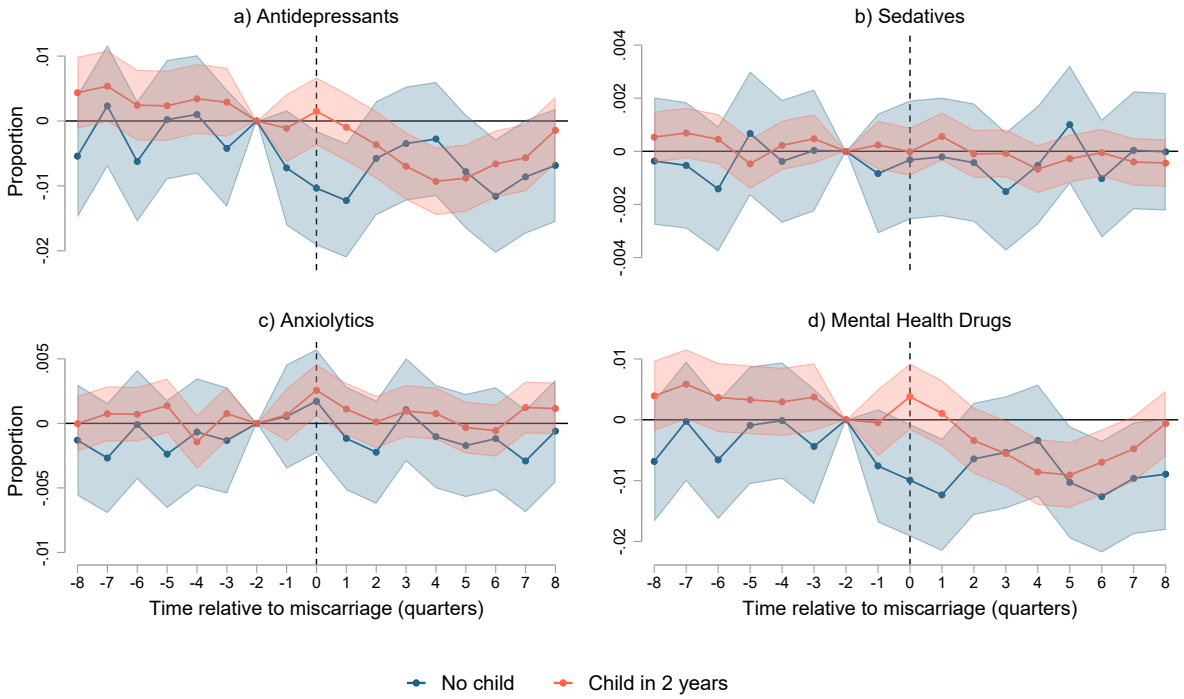
Notes: Each figure displays the estimated effects of miscarriage on utilization of healthcare services from Equation (1). Panels a)-c) present disaggregated indicators, and Panel d) presents an aggregate measure of healthcare utilization. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on healthcare services is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure A7: Event Study for Mental Healthcare Utilization by Subsequent Fertility



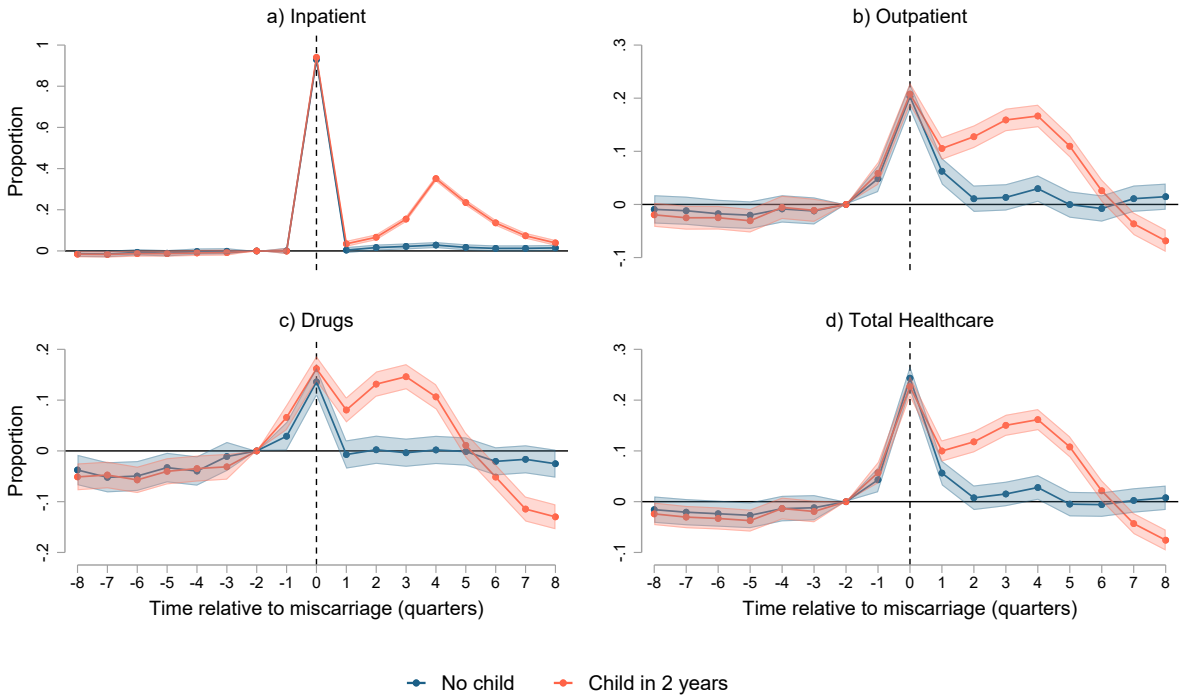
Notes: Each figure displays the estimated effects of miscarriage on utilization of mental healthcare services from Equation (1). Panels a)-c) present disaggregated indicators, and Panel d) presents an aggregate measure of mental healthcare utilization. The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on mental healthcare services is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure A8: Event Study for Mental Health Drugs by Subsequent Fertility



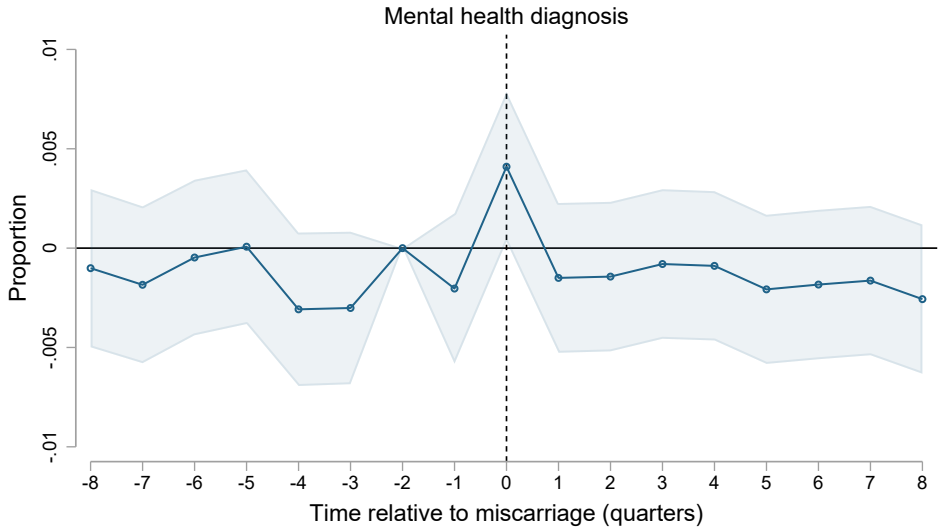
Notes: Each figure displays the estimated effects of miscarriage on prescriptions for mental health drugs from Equation (1). Panels a)-c) present disaggregated indicators, and Panel d) presents an aggregate measure of mental health drugs. The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on drug prescriptions is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure A9: Event Study for Healthcare Utilization by Subsequent Fertility



Notes: Each figure displays the estimated effects of miscarriage on utilization of healthcare services from Equation (1). Panels a)-c) present disaggregated indicators, and Panel d) presents an aggregate measure of healthcare utilization. The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss and those who did not. The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on healthcare services is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Figure A10: Event Study for Spouses' Mental Health Diagnosis



Notes: The figure displays the estimated effects of miscarriage on spouses' mental health diagnosis from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). Shaded areas indicate 95% confidence intervals, calculated using standard errors clustered at the individual level. Data on mental health diagnosis is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

Table A1: Event Study Estimates for Labour Market Outcomes

	Employment	Maternity leave	Unemployment	Sickness absence
	(1)	(2)	(3)	(4)
t=-8	0.0136	-0.0016	0.0142**	0.0013
t=-7	0.0161*	-0.0026	0.0114*	0.0019
t=-6	0.0145*	-0.0022	0.0094*	0.0001
t=-5	0.0105	-0.0024	0.0051	0.0011
t=-4	0.0008	-0.0011	0.0072	0.0003
t=-3	0.0024	-0.0005	0.0028	0.0010
t=-2	0.0000	0.0000	0.0000	0.0000
t=-1	-0.0075	0.0009	0.0006	0.0012
t=0	-0.0268***	0.0066	0.0077	0.0026
t=1	-0.0487***	0.0063	0.0210***	0.0077***
t=2	-0.0557***	0.0143**	0.0202***	0.0046**
t=3	-0.1064***	0.0633***	0.0169***	0.0044**
t=4	-0.2417***	0.2093***	0.0057	0.0009
t=5	-0.3727***	0.3525***	-0.0041	0.0010
t=6	-0.4373***	0.4196***	-0.0092*	0.0000
t=7	-0.4777***	0.4692***	-0.0153***	-0.0013
t=8	-0.4963***	0.4993***	-0.0147***	-0.0021
Observations	353,961	353,961	353,961	353,961
Mean outcome (t=-2)	0.8512	0.0026	0.0640	0.0051
Individual FE	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes

Notes: The table displays the estimated effects of miscarriage on women's labour market outcomes from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). The sample is restricted to women who experienced miscarriage between 1998 and 2018. All outcomes are measured as dummy variables (0/1). Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A2: Event Study Estimates for (Mental) Health Outcomes

	Mental healthcare	Mental health drugs	Total healthcare	Gynaecologist	Vitamins	Risky behaviour	Iron	Progesterone	Change of gynaecologist
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
t=-8	0.0004	-0.0010	-0.0213*	-0.0226*	-0.0003	-0.0017**	-0.0008	-0.0087***	-0.0097
t=-7	0.0013	0.0030	-0.0269**	-0.0377***	0.0012	-0.0004	0.0002	-0.0090***	-0.0141**
t=-6	-0.0009	-0.0010	-0.0297***	-0.0324***	0.0004	-0.0012	-0.0016	-0.0079***	-0.0098*
t=-5	0.0034	0.0012	-0.0334***	-0.0254**	0.0030*	-0.0002	-0.0017	-0.0063**	-0.0089
t=-4	0.0000	0.0014	-0.0144	-0.0131	0.0013	-0.0009	-0.0016	-0.0046*	-0.0028
t=-3	0.0010	0.0001	-0.0168*	-0.0074	0.0009	-0.0009	-0.0017	-0.0027	-0.0008
t=-2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
t=-1	0.0022	-0.0035	0.0513***	0.1350***	0.0005	-0.0012*	0.0148***	0.0120***	0.0298***
t=0	0.0078**	-0.0021	0.2347***	0.5181***	0.0016	-0.0005	0.0486***	0.0347***	0.1294***
t=1	0.0074**	-0.0047	0.0805***	0.2719***	0.0002	-0.0006	0.0198***	0.0191***	0.0370***
t=2	0.0051	-0.0045	0.0682***	0.2211***	0.0011	-0.0008	0.0460***	0.0292***	0.0366***
t=3	0.0039	-0.0050	0.0893***	0.2642***	0.0015	-0.0012*	0.0782***	0.0248***	0.0169***
t=4	0.0050	-0.0060*	0.1013***	0.2864***	0.0022	-0.0015**	0.0795***	0.0209***	0.0081
t=5	0.0014	-0.0093***	0.0578***	0.2165***	0.0014	-0.0007	0.0581***	0.0136***	-0.0020
t=6	-0.0033	-0.0091***	0.0093	0.1108***	-0.0003	-0.0016**	0.0400***	0.0068**	-0.0097*
t=7	0.0007	-0.0067**	-0.0234**	0.0540***	0.0007	-0.0010	0.0271***	0.0004	-0.0206***
t=8	-0.0026	-0.0041	-0.0391***	0.0254**	0.0021	-0.0014*	0.0212***	-0.0013	-0.0256***
Observations	353,961	353,961	353,961	353,961	353,961	353,961	353,961	353,961	353,961
Mean outcome (t=-2)	0.0199	0.0214	0.7193	0.2449	0.0048	0.0008	0.0033	0.0012	0.0319
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table displays the estimated effects of miscarriage on women's (mental) health outcomes from Equation (1). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). The sample is restricted to women who experienced miscarriage between 1998 and 2018. All outcomes are measured as dummy variables (0/1). Data on (mental) health outcomes is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3: Event Study Estimates for Labour Market Outcomes by Subsequent Fertility

	Employment	Maternity leave	Unemployment	Sickness absence
	(1)	(2)	(3)	(4)
Panel A: Women who had a child within two years				
t=0	-0.0232**	0.0046	0.0011	0.0038*
t=1	-0.0443***	0.0071	0.0184***	0.0057**
t=2	-0.0635***	0.0229***	0.0177***	0.0080***
t=3	-0.1548***	0.1116***	0.0119*	0.0081***
t=4	-0.3944***	0.3732***	-0.0002	0.0033
t=5	-0.6234***	0.6237***	-0.0173***	0.0023
t=6	-0.7379***	0.7371***	-0.0240***	0.0012
t=7	-0.8070***	0.8197***	-0.0312***	-0.0014
t=8	-0.8200***	0.8600***	-0.0353***	-0.0017
Observations	198,402	198,402	198,402	198,402
Mean outcome (t=-2)	0.8904	0.0012	0.0509	0.0052
Individual FE	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes
Panel B: Women who did not have a child within two years				
t=0	-0.0270**	0.0047	0.0160*	0.0008
t=1	-0.0499***	0.0011	0.0243**	0.0097**
t=2	-0.0434***	0.0007	0.0233**	0.0002
t=3	-0.0444***	0.0013	0.0231**	-0.0004
t=4	-0.0511***	0.0041	0.0131	-0.0023
t=5	-0.0586***	0.0120***	0.0121	-0.0009
t=6	-0.0588***	0.0193***	0.0093	-0.0016
t=7	-0.0620***	0.0258***	0.0044	-0.0013
t=8	-0.0880***	0.0432***	0.0110	-0.0029
Observations	155,559	155,559	155,559	155,559
Mean outcome (t=-2)	0.7980	0.0045	0.0818	0.0048
Individual FE	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes

Notes: The table displays the estimated effects of miscarriage on women's labour market outcomes from Equation (1). The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss (Panel A) and those who did not (Panel B). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). The sample is restricted to women who experienced miscarriage between 1998 and 2018. All outcomes are measured as dummy variables (0/1). Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4: Event Study Estimates for (Mental) Health Outcomes by Subsequent Fertility

	Mental healthcare	Mental health drugs	Total healthcare	Gynaecologist	Vitamins	Risky behaviour	Iron	Progesterone	Change of gynaecologist
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Women who had a child within two years									
t=0	0.0088**	0.0039	0.2268***	0.5346***	0.0000	-0.0009	0.0551***	0.0344***	0.1359***
t=1	0.0072*	0.0012	0.1000***	0.3279***	0.0022	-0.0009	0.0341***	0.0293***	0.0553***
t=2	0.0088**	-0.0033	0.1178***	0.3649***	0.0022	-0.0013*	0.0805***	0.0444***	0.0596***
t=3	0.0035	-0.0053	0.1503***	0.4582***	0.0022	-0.0011*	0.1362***	0.0392***	0.0316***
t=4	0.0043	-0.0085**	0.1614***	0.4737***	0.0008	-0.0009	0.1408***	0.0283***	0.0089
t=5	-0.0002	-0.0089**	0.1076***	0.3624***	0.0013	-0.0007	0.1035***	0.0175***	-0.0022
t=6	-0.0032	-0.0068*	0.0211*	0.1725***	-0.0003	-0.0013*	0.0694***	0.0008	-0.0218***
t=7	-0.0012	-0.0045	-0.0435***	0.0605***	-0.0012	-0.0013*	0.0388***	-0.0083**	-0.0374***
t=8	-0.0031	-0.0004	-0.0760***	-0.0081	0.0006	-0.0017***	0.0181***	-0.0107***	-0.0404***
Observations	198,402	198,402	198,402	198,402	198,402	198,402	198,402	198,402	198,402
Mean outcome (t=-2)	0.0164	0.0159	0.7209	0.2577	0.0050	0.0005	0.0033	0.0002	0.0328
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Women who did not have a child within two years									
t=0	0.0066	-0.0097*	0.2438***	0.4955***	0.0035	0.0000	0.0401***	0.0350***	0.1216***
t=1	0.0075	-0.0124**	0.0568***	0.2034***	-0.0025	-0.0002	0.0019	0.0072*	0.0153*
t=2	0.0004	-0.0063	0.0082	0.0460***	-0.0003	-0.0002	0.0039	0.0108**	0.0090
t=3	0.0041	-0.0050	0.0155	0.0266*	0.0004	-0.0013	0.0075*	0.0074*	-0.0010
t=4	0.0057	-0.0032	0.0275*	0.0548***	0.0039	-0.0024*	0.0039	0.0118***	0.0075
t=5	0.0033	-0.0101*	-0.0043	0.0339*	0.0014	-0.0007	0.0014	0.0088**	-0.0015
t=6	-0.0037	-0.0123**	-0.0052	0.0337*	-0.0003	-0.0020	0.0033	0.0143***	0.0058
t=7	0.0030	-0.0095*	0.0030	0.0473***	0.0031	-0.0006	0.0126***	0.0115***	0.0013
t=8	-0.0023	-0.0089	0.0086	0.0700***	0.0040	-0.0009	0.0257***	0.0105**	-0.0063
Observations	155,559	155,559	155,559	155,559	155,559	155,559	155,559	155,559	155,559
Mean outcome (t=-2)	0.0246	0.0288	0.7172	0.2275	0.0045	0.0013	0.0032	0.0026	0.0307
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table displays the estimated effects of miscarriage on women's (mental) health outcomes from Equation (1). The effects are estimated separately for women who had a child within eight quarters following the pregnancy loss (Panel A) and those who did not (Panel B). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). The sample is restricted to women who experienced miscarriage between 1998 and 2018. All outcomes are measured as dummy variables (0/1). Data on (mental) health outcomes is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A5: Event Study Estimates for Spouses' Labour Market and (Mental) Health Outcomes

	Employment	Unemployment	Sickness absence	Total healthcare	Mental healthcare	Urologist	Urologist change	Vitamins	Risky behaviour
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
t=-8	0.0074	-0.0069	0.0007	-0.0157	-0.0026	-0.0105	-0.0026	0.0013	-0.0026**
t=-7	0.0123	-0.0092	0.0002	-0.0171	0.0013	0.0048	-0.0027	-0.0006	-0.0030**
t=-6	-0.0046	-0.0030	0.0018	-0.0287	-0.0054	-0.0015	-0.0011	0.0002	-0.0019
t=-5	-0.0007	-0.0086	0.0000	-0.0266	0.0036	-0.0081	-0.0031	-0.0002	-0.0019*
t=-4	-0.0013	-0.0063	0.0025	-0.0173	-0.0033	-0.0057	-0.0034	0.0009	-0.0013
t=-3	0.0110	-0.0086	0.0018	-0.0231	-0.0022	-0.0031	-0.0009	0.0001	-0.0017
t=-2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
t=-1	0.0159	-0.0161	-0.0013	-0.0020	-0.0006	0.0069	-0.0027	-0.0006	-0.0023*
t=0	-0.0019	0.0015	0.0005	-0.0016	-0.0012	-0.0150*	-0.0040	0.0032	-0.0017
t=1	-0.0068	-0.0004	0.0055	-0.0325	0.0011	-0.0144*	-0.0030	0.0022	-0.0021*
t=2	-0.0141	0.0056	0.0044	-0.0257	-0.0046	-0.0136*	-0.0073***	0.0009	-0.0003
t=3	-0.0033	-0.0117	0.0056	-0.0237	-0.0022	-0.0131*	-0.0040	0.0014	-0.0012
t=4	-0.0030	-0.0039	0.0043	-0.0448*	-0.0097*	-0.0204***	-0.0008	0.0012	-0.0011
t=5	0.0045	-0.0055	0.0027	-0.0522**	-0.0018	-0.0226***	-0.0046*	0.0007	-0.0007
t=6	-0.0029	-0.0005	0.0045	-0.0250	-0.0041	-0.0287***	-0.0033	0.0011	-0.0004
t=7	-0.0028	-0.0029	0.0033	-0.0191	-0.0034	-0.0245***	-0.0052*	0.0007	-0.0009
t=8	-0.0058	-0.0004	0.0028	-0.0497**	0.0039	-0.0341***	-0.0069**	0.0005	-0.0012
Observations	91,200	91,200	91,200	91,200	91,200	91,200	91,200	91,200	91,200
Mean outcome (t=-2)	0.8922	0.0544	0.0066	0.5460	0.0178	0.0183	0.0010	0.0041	0.0000
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table displays the estimated effects of miscarriage on spouses' labour market and (mental) health outcomes from equation (2). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). The sample is restricted to men whose spouse experienced miscarriage between 1998 and 2018. All outcomes are measured as dummy variables (0/1). Data on labour market outcomes is from the Austrian Social Security Database and spans from 1998–2018. Data on (mental) health outcomes is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6: Event Study Estimates for Sisters' Fertility and (Mental) Health Outcomes

	Total healthcare	Risky behaviour	Vitamins	Gynaecologist	Change of gynaecologist	Live-birth	Maternity leave	Mental health drugs	Mental healthcare
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
t=-8	0.0188	-0.0005	0.0028*	0.0121	-0.0026	0.0003	0.0013	0.0028	0.0032
t=-7	-0.0031	-0.0016	0.0018	0.0077	-0.0008	0.0004	0.0041	0.0013	0.0016
t=-6	-0.0016	-0.0001	0.0022	0.0037	-0.0007	-0.0004	0.0041	-0.0004	-0.0004
t=-5	0.0022	-0.0010	0.0012	0.0129	-0.0026	0.0018	0.0037	-0.0002	-0.0000
t=-4	-0.0125	-0.0009	0.0023	0.0007	-0.0013	-0.0002	0.0044	-0.0019	0.0001
t=-3	-0.0036	-0.0003	0.0032*	0.0021	-0.0039	-0.0003	0.0031	-0.0015	0.0022
t=-2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
t=-1	-0.0091	-0.0013	0.0013	0.0022	-0.0027	-0.0011	0.0005	-0.0015	0.0001
t=0	0.0244	0.0003	0.0013	0.0166*	-0.0003	0.0017	-0.0002	-0.0032	-0.0009
t=1	0.0069	-0.0003	0.0014	0.0154	0.0057	0.0010	0.0010	0.0004	-0.0017
t=2	0.0038	-0.0004	0.0024	0.0165*	0.0024	0.0011	-0.0014	-0.0001	0.0019
t=3	0.0021	-0.0005	0.0018	0.0144	-0.0007	0.0028	0.0018	0.0006	-0.0012
t=4	0.0180	-0.0005	0.0013	0.0028	0.0000	0.0032	0.0041	-0.0024	0.0024
t=5	0.0116	-0.0016	0.0009	0.0073	-0.0014	0.0013	0.0022	-0.0001	0.0012
t=6	0.0042	-0.0018	0.0029*	0.0015	-0.0004	-0.0023	0.0014	-0.0016	0.0033
t=7	-0.0014	-0.0014	0.0030*	0.0186*	0.0024	0.0032	-0.0033	0.0013	0.0007
t=8	0.0146	-0.0007	0.0007	0.0097	-0.0019	-0.0008	-0.0028	0.0004	-0.0021
Observations	187,147	187,147	187,147	187,147	187,147	187,147	187,147	187,147	187,147
Mean outcome (t=-2)	0.6188	0.0009	0.0038	0.1165	0.0126	0.0084	0.0622	0.0181	0.0135
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age at (placebo) miscarriage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table displays the estimated effects of miscarriage on sisters' fertility and (mental) health outcomes from equation (2). The estimates are measured relative to the baseline two quarters before the event ($k = -2$). The sample is restricted to women whose sister experienced miscarriage between 1998 and 2018. All outcomes are measured as dummy variables (0/1). Data on fertility outcomes is from the Austrian Social Security Database and spans from 1998–2018. Data on (mental) health outcomes is from the Upper Austrian Health Insurance Fund and spans from 1998–2018.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$