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IZA DP No. 13329

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ABSTRACT

In Sickness and in Health: Job Displacement and Health Spillovers in Couples*

We study how a negative labor market shock like job loss generates health spillovers in couples. Using administrative data of all workers and firms matched to mortality and patient records, we document that male job displacement increases the mortality risk for both the man and his partner. For every 10,000 displaced men, there are 27 additional deaths over a 5-year period rising to 115 additional deaths over two decades. Of those, 60% accrue to the displaced worker but 40% are due to excess spousal mortality. Deaths from cardiovascular diseases jump up and hospitalization records show more treatments for alcohol-related disorders and mental health issues. We also find a stunning gender asymmetry: while male job displacement generates large and persistent health effects, no such dire health consequences are observed after a woman loses her job. We explore three explanations for the observed health spillovers: risk sharing through spousal labor supply; earnings losses and the role of public insurance; and the influence of gender roles and family structure.

JEL Classification: I14, J21, J63, J12, D13

Keywords: job displacement, mortality, spillovers, added worker, public insurance, gender roles

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1 Introduction

Workers who lose their job in a plant closure or mass layoffs experience less stable jobs and lower earnings than non-displaced workers – even decades after the initial displacement (Ruhm, 1991; Jacobson et al., 1993; Eliason and Storrie, 2006; Couch and Placzek, 2010; Huttunen et al., 2011). More recently, the literature has gone beyond the labor market to investigate the health consequences for displaced workers (Black et al., 2015; Browning et al., 2006; Eliason and Storrie, 2009; Sullivan and von Wachter, 2009). Sullivan and von Wachter (2009), for instance, document that displaced men suffer a substantially higher mortality risk, which seems closely related to their sizable earnings losses.[1]

The detriments of job loss might not be confined to the displaced person but could fan out to their partner. Social scientists have long underscored that family interactions shape individual behavior, particularly in the context of labor supply, leisure and consumption (Becker, 1991; Browning et al., 2014; Blundell et al., 2016). Spillover effects might benefit the displaced worker and the partner if they absorb or reduce some of the negative consequences of job displacement. One compensation mechanism, and an important motive for marriage, is risk sharing. If one person suffers an unexpected shock such as an illness or job loss, pooling income in a long-term relationship helps to stabilize financial resources for the family. Moreover, the partners may increase their labor supply to compensate for some of the earnings losses suffered by the partner.

Yet, we can also imagine a scenario where spillovers have potentially adverse effects on the partner. A worker who is unemployed after job displacement might develop or exacerbate harmful behavior like smoking or heavy drinking, which damages both partners. Alternatively, a displaced worker might slide into depression, exhibit aggressive behavior or even domestic violence harming the partner mentally or physically. Until now, we still lack a good understanding of how spillovers manifest in the family after a labor market shock and the channels that foster or mitigate them. Ignoring such potential externalities in the family may severely under- or overestimate the actual costs from job displacement. Moreover, such spillovers have important implications for public policy: whereas positive spillovers like risk sharing, for instance, reduce

[1] Displacement is also associated with higher hospitalization rates among surviving men (Browning and Heinesen, 2012). Whether women also face a higher mortality risk after they lose their job remains debated (Black et al., 2015; Eliason and Storrie, 2009).

the need for government programs, negative spillovers such as domestic violence, in turn, raise the demand for public interventions.

In this paper, we investigate the size and nature of health spillovers in couples. We first estimate the causal effects of job loss on the mortality and health of the displaced person and the partner to quantify the overall health costs of job displacement. In a second step, we explore three mechanisms for explaining health spillovers: spousal labor supply; the role of earnings and public insurance; and the impact of gender roles.

Analyzing health spillovers is often hampered by two key challenges. First, it is difficult to obtain suitable data that allow linking the records of both partners and that contain detailed information on the labor market, health and mortality. Our analysis matches employer-employee data with detailed records on employment, earnings and public transfers for every adult to mortality and patient records over several decades. Most importantly, we can match partners in a couple irrespective of whether they are married or cohabitating, using a unique identifier for the partner in the data.[2]

A second challenge is that a worker's job loss is not a random event and might be correlated with pre-displacement health risks because employers lay off workers with poor health or because declining industries employ less healthy workers, for instance. Our analyses therefore focus on workers laid off in plant closures that occurred during the great recession that hit Finland after the collapse of the Soviet Union. During the recession, GDP fell by 11% and unemployment rates quadrupled over a two-year period (Figure 1). The sheer size of the recession suggests that plant closures during that period can be considered largely exogenous to workers' idiosyncratic circumstances or performance, reducing concerns about reverse causality (see Huttunen and Kellokumpu, 2016). In addition, we control for detailed industry and regional fixed effects to adjust for variation in mortality risk or health services across sectors and space. We also control for pre-displacement education to account for the well-known health gradient in education as well as pre-displacement age to capture the health effects of aging. Our estimates confirm that workers displaced in a plant closure during the deep recession and those not displaced during that period face similar mortality risk and hospitalization prior to the job loss.

We first show that male job loss significantly increases both his own and his partner's risk of dying. For every 10,000 displaced men, there are 27 additional deaths in the first five years after job loss. Sixteen (or 60%) of the additional deaths occur among displaced workers, but

[2]Throughout the article, we will use the terms partner and spouse interchangeably.

a stunning eleven additional deaths (or 40%) occur among partners of displaced men. Twenty years after job displacement, excess mortality is a sizable 115 additional deaths per 10,000 displaced men. Partners of displaced men, therefore, carry a sizable share of the health burden associated with job displacement.

We then document a notable asymmetry in the health effects of job displacement: while there are sizable health spillovers after male job displacement, no such spillovers are found after female job displacement. If a woman loses her job in a plant closure, the mortality risk of the displaced woman and her partner remains unchanged. This gender asymmetry is evident in single as much as in dual earner couples. As such, the asymmetry cannot be explained by differential health status of working and non-working spouses, for instance.

To shed light on the nature of the excess mortality, we turn to hospitalization records and cause-specific mortality data. Displaced men are more likely to die from heart diseases. We also find clear evidence of a substantial psychological component like stigma or loss of self-worth after job displacement. Displaced men, but also their partners, are more likely to suffer from alcohol-related health problems and mental health issues than their non-displaced peers. These findings substantiate the profound societal costs of job loss that go beyond monetary or health damages to the displaced worker.

We use our comprehensive data to investigate several mechanisms for the observed health spillovers in couples. Partners or spouses might respond to their partner's job loss by expanding their own labor supply. An increase in spousal employment would raise spousal earnings and family income, but could also imply additional stress for the partner. Spousal labor supply could explain the health asymmetry if women increase their labor supply after their partner's job loss, but men's labor supply remains unchanged. We find very small spousal labor supply responses both at the extensive and intensive margin – irrespective of whether a man or a woman gets displaced. Ten years after displacement, spousal employment is only 1-2 percentage points or about 2% higher for spouses of displaced workers than for spouses of non-displaced workers. Spousal annual earnings after male displacement rise by only 450-650 euros or about 2% in the long-run.

A second channel for the observed spillovers could be a persistent decline in family resources, which reduces health-promoting activities or goods in the couple.[3] We find some support for

[3]In principle, lower family income could reduce the intake of health-damaging goods like alcohol or smoking as well. The empirical evidence suggests that men smoke more after they lose their job, however (Black et al., 2015). Hence, the inward shift of the budget constraint after a job loss seems to reduce the demand for health, resulting

this explanation: the absolute decline in earnings and total family income is more severe when a man loses his job than when a woman loses her job in a plant closure. In addition, the loss of monetary resources is systematically related to the excess mortality after male job displacement accounting for around one-fourth of excess male mortality.

We provide additional evidence that gender roles in the relationship play a role for the observed health burden. Relationships are more likely to break down after a man loses his job, while they are unaffected after a woman loses her job. Moreover, displaced men in traditional couples with a male breadwinner suffer a lower health burden than men in non-traditional couples. Women, in turn, are less likely to suffer negative health consequences after their partner's job loss when there are children in the household. Neither of these patterns can be explained by differences in income or earnings losses between traditional and modern couples or couples with and without children. The observed patterns point, instead, to gender-specific roles within the family as an important stabilizer of health.

Our paper makes several contributions to the literature. We contribute to the job displacement literature by investigating for the first time health spillovers in couples. We show that the health burden of job displacements is much bigger than the costs for the displaced worker alone. While excess mortality after a man's job displacement is similar in magnitude to estimates in the literature (Sullivan and von Wachter, 2009), accounting for health spillovers raises the excess mortality of job displacement by up to 40%. Moreover, we document an important gender asymmetry where excess mortality in couples is strong and persistent after male job displacement, but absent after female job displacement.[4] Finally, we assess three distinct mechanisms that could aggravate or mitigate the health perils after job displacement: spousal labor supply, loss of economic resources and gender roles in couples.

We also shed new light on family health spillovers. Recent studies report positive spillovers when a person is treated to stop smoking (Fletcher and Marksteiner, 2017) or experiences a negative health shock (Fadlon and Nielsen, 2019). In both cases, spouses improve their own health behavior in response to changes in their partner's health status. Our study differs from the existing studies in two important ways: first, we investigate health spillovers in response to a labor market shock. Second, we document that such shocks can have *negative* spillovers

in fewer health investments and worse health status of the displaced and other family members (Grossman, 1972; Deaton, 2001).

[4]One early study uses survey information on job loss through plant closures to study its correlation with the self-reported mental health in couples (Marcus, 2013). It remains unclear whether self-reports allow a causal interpretation in this context, and what mechanisms explain these correlations.

on partner health.[5] We further provide a detailed investigation which mechanisms help explain why negative health spillovers persist after job displacement.

Our paper also contributes to the literature on spousal labor supply. Early studies focused on whether female labor supply increases in response to a husband's unemployment spell. Most studies either found no or small responses (Lundberg, 1985; Maloney, 1987; Mincer, 1962), though slightly larger responses in the long run (Stephens Jr., 2002). More recent analyses of spousal labor supply after job loss again find small effects (Goux et al., 2014; Halla et al., 2019). One potential explanation is that generous unemployment provisions crowd out spousal labor supply responses (Cullen and Gruber, 2000; Hendren, 2017). Yet, our results, like others, suggest that unemployment insurance provides only partial and temporary insurance against the persistent income losses of displacement (Hendren, 2017).

Finally, we provide a new angle on the importance of gender norms. Recent evidence shows that women suffer less domestic violence, an admittedly extreme health outcome, if their bargaining position improve, through a decline in the gender wage gap (Aizer, 2010) or unilateral divorce laws (Stevenson and Wolfers, 2006), for instance. We show that the health of both partners in a couple may suffer if the labor market position of one partner deteriorates. Women violating traditional gender norms, in turn, seem to adjust their labor market careers and live in less stable relationships than women conforming to their prescribed gender roles (Bertrand et al., 2015; Fortin, 2005).[6] Our study also points to a role for gender norms as the health toll of job displacement is less severe in traditional couples and for women with children – both family constellations conforming to traditional gender norms.

The paper proceeds as follows. The next section discusses our linked data sources and the empirical strategy to assess the effects of job displacement on health. Section 3 documents the direct and spillover effects after male and female job displacement by studying overall mortality, cause-specific mortality and hospitalization. Section 4 explores three potential mechanisms for the health spillovers: the role of spousal labor supply responses, earnings and income losses, as well as family structure and gender roles. Section 5 discusses the implications of our findings and concludes.

[5] Job loss may also affect the children in the household. It is known to reduce fertility (Del Bono et al., 2012; Huttunen and Kellokumpu, 2016), while the consequences for existing children remain disputed (Rege et al., 2011; Hilger, 2016; Mjörk et al., 2018; Page et al., 2019).

[6] Altonji and Blank (1999) and Bertrand (2011) provide comprehensive surveys of the rapidly growing literature on gender in the labor market.

2 Data and Empirical Strategy

2.1 Data Sources

We combine several administrative datasets covering the full population of residents and plants in Finland between 1988 and 2013. Three characteristics make our data uniquely suited for analyzing health spillovers in couples. First, we have data on the full population of plants and their workforce. The data allow identifying plant closures and to distinguish them from breakups or other forms of restructuring (see the next section for details). Second, we can follow an individual's health and labor market career over more than two decades as our data contain the complete work history, mortality and hospitalization records of each adult. Third, and most importantly, our data contain an identification number for spouses or cohabitating partners. By linking the individual records between couples, we can study whether job displacement of one person spills over to spousal health, labor supply and earnings.

We next describe each data source in more detail. Information on individual job histories, worker and plant characteristics come from the Finnish Longitudinal Employer-Employee Data (FLEED). For each individual, we observe employment status, education, occupation, industry and region of employment at the end of each year. We define an indicator for employment if the individual is employed in the current year and zero otherwise. We define five skill groups based on the level of formal education: compulsory education, upper secondary (including vocational training), lowest tertiary (some college), lower tertiary (Bachelor degree) or post-graduate education (Masters or Ph.D.). We further distinguish between fields of education (e.g. natural sciences, social sciences and business, humanities and arts, health and welfare, agriculture and technology).

Based on the spouse IDs, we can identify couples and link their labor market histories and earnings. The data further contain information on the number of dependent children in the household. A couple is separated in our data if a person has no longer the same partner or has a different partner in some year compared to our reference year of job loss.

Earnings are measured as annual taxable labor income in the current year. We also observe annual taxable income, which includes transfers, such as unemployment or sickness benefits, pensions, as well as parental and child benefits.[7] Family income is constructed by adding up the

[7] All individuals who have been employed and paid unemployment insurance for at least ten months over the two years prior to an unemployment spell are eligible for unemployment benefits. Unemployment benefits are on

total taxable income including transfers for both spouses. We use these data below to assess the importance of earnings and income losses for displaced workers, for instance.

To study mortality, we merge cause-of-death statistics from Statistics Finland to the employer-employee data using the unique person and partner IDs. The mortality statistics report all deaths and their detailed causes according to the ICD-10 classification. We define cumulative mortality for each post-displacement year starting from one-year mortality and continue up to twenty-year mortality. The risk of dying twenty years after a displacement, for instance, is an indicator equal to one if an individual dies between the year of job loss t and $t + 20$; and zero otherwise. Mortality risks for other post-displacement years are defined accordingly. For the analysis of cause-specific mortality, we group causes of deaths into five broad classes: cancer, circulatory and heart disease, suicide, accidents (including traffic) and alcohol-related deaths. We define the cumulative twenty-year mortality, for instance, as an indicator equal to one if a person has died from cancer between base year t and $t + 20$; and zero otherwise.

To shed light on the broader health effects of job loss, we use health information from the Finnish Hospital Discharge Register. The hospital discharge register provides complete and high-quality information about all inpatient consultations including the dates of hospital admissions, diagnosed medical conditions and medical operations. We group visits into six broad causes based on the main diagnosis.[8] In addition to the five causes for mortality (cancer, circulatory and heart disease, suicide, accidents and alcohol-related diseases), we also include visits because of mental health issues. Our outcome variables are indicators equal to one if an individual had an inpatient visit, which was diagnosed by a specific cause, over a certain time period; and zero otherwise. We study medium-run (between t and $t+5$ years) and long-run (between t and $t+20$ years) effects on inpatient visits for each of the six specific causes.

2.2 Plant Closures and Sample of Displaced Workers

A key challenge in studying the consequences of job loss is to identify a sample of displaced workers who, in the absence of a job loss, would resemble the mean non-displaced workers with respect to their labor market outcomes and future health risk. To approach such a scenario, our

average 60 percent of the last gross earnings but get exhausted after 23 months (or 500 days). After exhaustion, individuals are eligible for a much lower transfer of around 22 percent of average monthly earnings.

[8] Diagnoses are coded using the ICD-9 classification until 1995 and ICD-10 classification since 1996. The ICD-9 and ICD-10 codes used to construct our cause-specific mortality, and hospitalization variables are available in the appendix (table A6). Validation studies have found the quality and completeness of the Finnish Hospital Discharge Register to be exceptionally high (Sund, 2012).

analysis focuses on the great recession that hit Finland after the collapse of the Soviet Union. After 1990, much of Finland's export sector, specialized in producing for the socialist economies of the Former Soviet Union, collapsed – reducing Finland's GDP by 11 percent between 1990 and 1993 (see figure 1). In the labor market, unemployment quadrupled from 3.5 percent in 1990 to over 16 percent in 1993 (Gorodnichenko et al., 2012). As a result, many workers who look very similar to the average worker lost their job because of plant closures or mass layoffs (Huttunen and Kellokumpu, 2016).[9]

From the perspective of the individual worker, plant closures can be considered an exogenous shock as all employees in a plant are displaced, irrespective of their productivity, job performance or prior health status. Using the data for all plants in the private sector with more than ten employees from 1990 to 1993, we define a plant closure if a plant is observed in the data in year t (say, 1991) but no longer observed in $t+1$ (say, 1992) or thereafter. To ensure that we capture a true plant closure and not merely a change in the plant identifier or a spin-off, we further impose a restriction that less than 70 percent of the individuals leaving a plant are observed in a single other plant in the following year. We then define workers as displaced if they were employed in a plant in t or $t-1$ that closed down between t and $t+1$. Plants might start to shed labor even before the actual plant closure, and some workers might quit and leave before the plant actually closes (see, e.g., Eliason and Storrie, 2006; Pfann and Hamermesh, 2008; Schwerdt, 2011). To capture these early leavers in our analysis, we include workers who left their job between $t-1$ and t in a plant that closed down between t and $t+1$ in our sample of displaced workers.

It is important to point out that a job loss, regardless of whether it was due to a plant closure, mass layoff or separation, does not imply the loss of health insurance for the displaced worker and the immediate family. Finland has publicly provided health care for all residents irrespective of employment. In addition, all employers provide occupational health services to their employees under the Occupational Safety and Health Care Act. If an employee loses her job, she loses access to occupational health services but still has full access to public health services.[10]

[9] Workers who are fired from their job, in contrast, have worse unobservables than workers who remain employed (see, e.g., Gibbons and Katz, 1991). Even workers who get displaced during an economic recovery or boom differ from the average worker among many observable and potentially unobservable characteristics (see, e.g., Davis and von Wachter, 2011).

[10] Quality differences across public and occupational health care services seem to be small. There is some evidence that waiting times for doctor appointments are lower in the occupational health care system (see Karanikolos, 2018 for a comprehensive survey of the Finnish health care system). Complex procedures like major operations are almost always performed within the public health care system for all patients.

We restrict our sample to workers between the ages of 20 and 49 with at least one year of tenure at their employer in the year of displacement (i.e. one of the recession years 1991, 1992 or 1993). We drop public sector employees because there are no plant closures in the public sector. In addition, we restrict our sample to workers in plants with at least 10 and at most 1,000 employees. We further restrict the sample to individuals with a partner or spouse who was at least 18 years old in the base year.

Our analysis traces the mortality risk, hospitalization and labor market performance of workers displaced in a plant closure for up to twenty years after the job loss. Our control group consists of non-displaced workers who satisfy the same sample restrictions with respect to age, tenure, plant size, sector and partners. Thus, the control group consists of individuals who remain with their current employer, but also of workers who are fired, get displaced or separate voluntarily from their employer after the deep recession.

Figure 2 traces annual earnings (in 1,000 euros) and employment of displaced relative to non-displaced workers. The left-hand side compares earnings (panel (a)) and employment (panel (c)) for displaced and non-displaced men, the right-hand side earnings (panel (b)) and employment (panel (d)) for displaced and non-displaced women. The x-axis shows pre-displacement years (negative numbers) and post-displacement years (positive numbers) where year zero refers to the year of the displacement (any of the recession years 1991, 1992 or 1993). The bottom panels suggest that workers who lost their job due to a plant closure are less likely to be employed for up to fifteen years after the displacement. The top panels further reveal that displacement is also associated with sizable and persistent reductions in earnings relative to non-displaced workers.

The panels in figure 2 indicate that employment and earnings of displaced and non-displaced workers evolve very similarly prior to job loss, thus supporting our argument that plant closures during the great recession were unrelated to the performance of the displaced workers prior to displacement. Yet, even if a plant closure is an exogenous event for the individual worker, workers displaced in a plant closure may still systematically differ from workers who do not get displaced in terms of their skill level, age or other characteristics that affect their mortality risk.

To check for such pre-displacement differences, table 1 compares observable characteristics for displaced and non-displaced workers prior to displacement. We find that displaced men have slightly lower, displaced women slightly higher pre-displacement earnings than non-displaced men and women. Displaced workers are slightly younger and work in smaller plants than non-

displaced workers. Hence, if anything, we would expect them to suffer lower earnings losses and mortality after displacement than slightly older non-displaced workers. To adjust for the few observable differences, we include a comprehensive set of pre-displacement worker characteristics and earnings in our estimation (see Section 2.3).

2.3 Empirical Strategy

2.3.1 Effects of Job Loss on Health and Mortality

To track health outcomes for displaced workers relative to non-displaced workers, we estimate variants of the following model:

$$Y_{i,t,\tau} = \gamma_\tau \, JobLoss_{i,t} + X_{i,t-1} \, \beta_\tau + \lambda_r + \theta_t + \epsilon_{i,t,\tau} \tag{1}$$

where $Y_{i,t,\tau}$ represents health outcomes (mortality or hospitalization) τ years after (or before) displacement for individual i who was employed or displaced in base year t. For all-cause or cause-specific mortality, the dependent variable is $Pr(Death_{i,t,\tau} = 1)$, which measures the cumulative mortality between the base year t and post-displacement period τ. To study hospitalization for specific causes, the dependent variable is an indicator $Pr(Visit_{i,t,\tau} = 1)$ equal to one if individual i had at least one hospital visit τ years post-displacement; and zero otherwise.

The main independent variable $JobLoss_{i,t}$ is an indicator equal to one if worker i was displaced in a plant closure between base year t and $t+1$; the variable is equal to zero if she was not displaced in base year t (where $t = 1991, 1992$ or 1993). We include a set of individual and plant-level variables $X_{i,t}$ to control for any observable differences prior to displacement. As individual characteristics, we include a fourth-order polynomial in age in base year t, the level and field of education, labor market experience, firm tenure and earnings in base year t.

We further include plant size in base year t and industry fixed effects at the 2-digit level to account for different labor market prospects and health risks across plants and industries. We account for regional differences in labor market prospects or the quality of health services through region fixed effects (λ_r). Equation (1) further includes base year dummies (θ_t) to ensure that we compare displaced and non-displaced workers in the same base year t. Finally, we control for family structure prior to displacement as this might influence an individual's health and well-being: whether the individual is married and whether the individual has children in base year t. We also control for the following characteristics of the partner in base year t: a fourth-order polynomial in age, the level and field of education and whether the partner was employed.

To allow for flexible health effects of job displacement, we estimate equation (1) using a linear probability model separately for each post-displacement year $0 < \tau \leq 20$. We then plot the γ_τ coefficients for the post-displacement period and the corresponding confidence intervals. Note that we cannot estimate mortality in the pre-displacement period ($\tau < 0$) because an individual has to be alive in the base year to be in the treatment or control group.

Our key identifying assumption in equation (1) is that health outcomes of displaced workers would have evolved similarly to non-displaced workers in the absence of displacement conditional on our control variables. This assumption implies that plant closures are uncorrelated with any unobservables that affect the health of the workforce. Note that any displacement effects on health cannot be explained by a worsening health infrastructure or declining industries as we control for region and detailed (2-digit) industry fixed effects.

To analyze the effect of job loss on spousal health, we estimate variants of the following model:

$$Y^S_{i*,t,\tau} = \gamma^S_\tau \, JobLoss_{i,t} + X_{i,t} \, \beta^S_\tau + \lambda^S_r + \theta^S_t + \epsilon^S_{i*,t,\tau}, \tag{2}$$

where the dependent variables $Y^S_{i*,t,\tau}$ are health outcomes (mortality or hospitalization) of the spouse $i*$ in year τ after i's displacement. As above, $JobLoss_{i,t}$ is an indicator variable equal to one if person i who is married or cohabitates with person $i*$ was displaced from his or her job in base year t (where $t = 1991, 1992$ or 1993); and zero if he or she was not displaced in year t. The set of observable characteristics $X_{i,t}$ is the same as in equation (1) above.[11]

Estimating equation (2) separately for each post-displacement year τ, the coefficients γ^S_τ measure the cumulative effect of i's job displacement on the partner $i*$'s health within τ years of displacement relative to the mortality of spouses of non-displaced workers. The identifying assumption in equation (2) is that the outcomes of spouses of non-displaced workers are a valid counterfactual for the outcomes of spouses of displaced workers after displacement conditional on our control variables. One potential concern could be that the probability of job loss is correlated across spouses because the couple works in the same firm or same industry, for example. We address this issue when we discuss the empirical results below.

[11] In particular, we control for spousal level and field of education, a fourth-order polynomial in age and whether the spouse is employed (all variables measured in base year t). Note that we cannot and should not control for other labor market characteristics (like spousal experience, plant size or industry) because not all spouses are employed in base year t.

2.3.2 Effects of Job Loss on Employment, Earnings and Income

We then explore potential mechanisms for the observed spillovers, in particular income pooling and spousal labor supply. Here, we rely on an event study approach commonly used in the displacement literature (Jacobson et al., 1993; Davis and von Wachter, 2011; Huttunen et al., 2011). Pooling pre- and post-displacement years, we estimate variants of the following model:

$$Y_{i,t,\tau} = \sum_{\tau=-3}^{20} \gamma_\tau JobLoss_{i,t,\tau} + X_{i,t,\tau}\,\beta + \alpha_t + \delta_\tau + \theta_i + \epsilon_{i,t,\tau}, \tag{3}$$

where the dependent variable $Y_{i,t,\tau}$ is employment, annual earnings or annual income of worker i (or partner $i*$) observed in period τ after the base year t. The key independent variables $JobLoss_{i,t,\tau}$ are indicators equal to one for individual i observed in period τ who was displaced in base year t; and zero otherwise.

We include the same comprehensive set of control variables $X_{i,t,\tau}$ for the worker, spouse, region, plant and industry as in equation (1). In addition, we add a fourth-order polynomial in age to control for differential age-earnings profiles. Fixed effects for time since displacement τ (δ_τ) and for each base year (α_t) absorb any potential level differences in employment, wages or income between displaced and non-displaced workers in different recession years t.[12]

Including individual fixed effects θ_i implies that we only require changes in outcomes (and not levels) of non-displaced workers to be a valid counterfactual for the outcomes of displaced workers in the absence of a plant closure. The fixed effects specification further ensures that our results are not driven by compositional changes in the treatment or control group through selective dropout or withdrawal from the workforce. We show below that including fixed effects primarily improves precision, but has little impact on the estimated coefficients. The close correspondence between estimates without and with fixed effects indicates that our displaced sample is not selected on time-invariant unobservables, which provides further support for our identification strategy.

The parameters of interest are γ_τ, which measure the changes in employment, earnings or income for displaced workers (or their spouses) relative to those for non-displaced workers (or their spouses) $-2 \leq \tau \leq 20$ years before or after displacement relative to the pre-displacement year $\tau = -3$. An additional advantage of the event study design for labor market outcomes is

[12] One could even include base year (t) x post-displacement fixed effects (τ) interactions, which allow post-displacement earnings or incomes of individuals displaced early in the recession to evolve differently than the earnings or incomes of workers displaced later on. The estimates from this even more flexible specification are very similar to the ones reported here. As such, it seems that the evolution of earnings and income after displacement do not depend on the timing of displacement during Finland's great recession.

that we can compare displaced and non-displaced workers in pre-displacement years to provide further suggestive evidence for our identifying assumption. The coefficients γ_{-2}, γ_{-1} and γ_0 in equation (3) should be close to zero and statistically insignificant.[13]

3 Empirical Results

3.1 Mortality Effects after Job Displacement

We first examine the direct effect of job displacement on the mortality of displaced workers. Studying the mortality risk for those displaced in a plant closure is interesting in its own right and aids in interpreting spillovers in the couple. If we find no adverse impact on mortality for the displaced worker, we would not expect to see sizable health spillovers on the spouse.

Figure 3 plots the coefficients and 90 percent confidence intervals from equation (1) for cumulative mortality from all causes within τ years after job loss. Displaced men (panel (a)) have a higher mortality risk than non-displaced men. Losing one's job does not only carry negative health consequences shortly after the displacement but reduces the life expectancy of displaced men permanently.

We find a strikingly different pattern for women. Losing the job in a plant closure has no impact on women's mortality risk as shown in panel (b) of figure 3. The estimates are even slightly negative in the first three years after displacement suggesting even short-run health gains for displaced women. These reductions in mortality could be related to reduced stress from work and more time to invest in health-promotion activities relative to non-displaced women. In the medium-run (after six post-displacement years), estimates become positive, but are much smaller than for men and never reach statistical significance in any year.

To assess the size of the mortality effect, we next report estimates for cumulative five-year and twenty-year mortality in table 2. Mortality estimates for male job loss are shown in columns (1)–(2) and estimates for female job loss in columns (3)–(4). As mortality risks are small, the coefficients can be interpreted as percentage point changes in mortality for displaced workers $\tau = 5$ or $\tau = 20$ years after job loss relative to the change in mortality risk of non-displaced workers.

[13] Though this condition is neither sufficient nor necessary, it is commonly used to gauge the absence of differential pre-trends (Kahn-Lang and Lang, 2018). Another concern with event studies emerges when pooling cohorts of individuals treated at different times (Abraham and Sun, 2019). In our case, we only pool three depression years (1991-1993) and control for level differences in outcomes through base year fixed effects (α_t).

In the medium run, men who got displaced in a plant closure face a 0.16 percentage points or 23 percent (compared to a mean of 0.7 percentage points) higher mortality risk than non-displaced men (column (1) in table 2). This indicates that for every 10,000 displaced men there are 16 additional deaths in the medium run, which persists even in the long run (column (2)). Twenty years after displacement, the mortality risk is 0.77 percentage points, indicating 77 excess deaths for every 10,000 displaced men. In percentage terms, the long-term effect (13%) is smaller than the medium-term effect because of catch-up mortality among non-displaced men.[14]

In the first years after job displacement, the excess mortality we find for men is smaller than those reported for the United States (Sullivan and von Wachter, 2009). In the long run, however, excess mortality after job displacement is remarkably similar in both countries.[15] One potential explanation for the smaller short-run mortality effect is that most workers in the United States lose their employer-provided health insurance after displacement. They might also suffer from larger income losses than Finnish men losing their job in a plant closure. We investigate this question in more detail in the next section.

For women, there is no mortality effect whatsoever – neither in the medium nor in the long run (columns (3)–(4) of table 2). The five-year mortality risk is 0.03 percentage points or 8 percent lower, while twenty-year mortality is 0.1 percentage points or 3 percent higher than for non-displaced women. None of the estimates reach statistical significance. Hence, the mortality effect for displaced women is only about one-third the mortality effect of displaced men in the medium run and less than one-fourth in the long run. Earlier work reports similar mortality effects for displaced men and women, but noisier, and hence, less statistically robust estimates for women (see, e.g., Eliason and Storrie, 2009 for Sweden).

Overall, our results indicate that a plant closure has persistent and large negative consequences for the health of displaced workers. Yet, these negative effects mostly affect displaced men, while we do not find any effects for displaced women.

[14] Martikainen et al. (2007) finds that an unemployment spell raises mortality more during economic booms than during recessions in Finland. Should our estimates therefore be interpreted as a lower bound of the true effect? We do not think so. Individuals who get displaced in a period of economic growth are much more negatively selected compared to either the average non-displaced worker or individuals who lose their job in a plant closure during a recession. Hence, the larger estimates for displacements outside of recessions are likely an overestimate as non-displaced workers have better unobserved labor market outcomes or lower unobserved health risks than workers who become unemployed during an economic expansion.

[15] A Swedish study finds no effect on long-run mortality, but larger effects on five-year mortality than our study (Eliason and Storrie, 2009). Yet, the Swedish study covers men between the ages of 25 and 65, while men in our sample are aged between 20 and 49 in the base year. Hence, there is more catch-up mortality of non-displaced workers in the Swedish sample over time (ten or more years after displacement) as male cohorts reach their retirement age.

3.2 Mortality Spillovers of Job Displacement

Spillovers in the Couple

We next investigate whether job displacement has negative consequences for the health of the partner of a displaced person as well. Evidence of such negative spillover effects would imply that the societal costs of job displacement exceed the damage suffered by the displaced worker alone.

Figure 4 plots the coefficients and 90 percent confidence intervals from estimating the model in equation (2) separately for each post-displacement year. The dependent variable is now the mortality risk of the partner after the job displacement of her husband, and vice versa. Panel (a) shows that women face a higher mortality risk after her partner gets displaced. The coefficients are consistently larger than zero and statistically significant eight years after the man's job loss. The elevated mortality risk stabilizes about a decade after displacement. Surprisingly, panel (b) of figure 4 suggests no such dire consequences for the partners of displaced women. Men's mortality hovers close to zero within the first decade after the job loss of their partner and never reaches statistical significance.

To quantify the spillovers and compare them to the mortality effect on the displaced person, table 3 estimates the five- and twenty-year mortality risk of the partner when a man or a woman gets displaced in the base year. Male job loss raises spousal mortality risk by about 0.1 percentage points or 29 percent (compared to a mean of 0.37 percentage points) over the first five years after displacement. Hence, for every 10,000 displaced men, there are 11 additional spousal deaths within the first five years after displacement. Over a twenty-year period, the effect accumulates to 38 additional partner deaths, an increase of 13 percent.

Turning to the consequences of job displacement for the partners of women, we find zero spillover effect on mortality both in the medium and long run (see columns (3)–(4) of table 3). The coefficients for husbands are by a factor of ten smaller than the mean effect for displaced men in table 2, while the standard errors are slightly larger. Spousal mortality after female displacement even declines by about 5 percent (-0.0006/0.0121) in the medium run and is basically zero in the long run.

Two conclusions emerge from our results on excess mortality. First, job displacement creates negative health spillovers in couples. For every 10,000 displaced men there are 27 additional deaths in the first five years after job displacement: 60% of the excess mortality accrues to the

displaced men and a stunning 40% to their partners. In the long run, excess mortality amounts to 115 deaths, of which two-thirds occur among the displaced men and one-third are borne by their partners. Intuitively, the direct effect on the displaced man is larger than the spillover effect on the spouse. In addition, the displaced worker carries a larger share of the excess mortality in the long run than in the medium run. One potential explanation for this pattern is that spouses do have the option to get out of an unhealthy, and literally deadly, situation through divorce or breakup.[16]

The second conclusion is that there is a stunning gender asymmetry in the mortality response after job displacement. Men suffer excess mortality after they lost their job in a plant closure. However, no such dire consequences are observed if their partner gets displaced from their job. The opposite is true for women: they face a higher mortality risk only if their partner gets displaced from his job. There are no such dire consequences, and even some short-run health gains, if women lose their job in a plant closure. For both partners in the couple, it is more deadly if the man loses his job than if the woman loses her job. The health spillovers we document are, in percentage terms, as negative for the partners as for the directly affected worker.[17]

Additional Results

Are the spillover effects of male job displacement confined to dual earner couples? Could the spillover effect in couples arise because their risk of job loss is positively correlated because they both work in firms, occupations or industries that are hit hardest by the great recession? To address these questions, we first re-estimate equations (1) and (2) and restrict the sample to couples where both spouses were employed in the base year. The top panels of appendix figure A1 indicate that the direct effect of male job loss on male mortality in double earner couples is similar to those in the full sample, which includes couples with non-working spouses. The bottom panel in figure A1 also controls for spousal job loss in a plant closure or mass layoff in the base year. Hence, the figure compares mortality of displaced and non-displaced workers conditional on the job loss of their spouse or partner. The higher mortality risk after male job loss conditional on spousal job loss looks very similar to the overall effect in panels (a) of figures

[16]Other explanations, like higher catch-up mortality among non-displaced partners or partners being more resilient to displacement in the long run than in the medium run, appear less plausible.

[17]In absolute terms, the number of additional deaths per 10,000 displaced men is higher than for their partner, as men face a higher mortality rate on average.

3 and 4. Hence, the higher mortality risk for partners of displaced men cannot be explained by the correlated risk of job loss.[18]

Most plant closures and certainly the plant closures we study occur during recessions. Plant closures, or the underlying recessions more broadly, might hit especially workers who are most exposed to stress or most vulnerable in terms of their health. To check this, we study mortality for a sample of workers who lost their job in a mass layoff. Mass layoffs by the employer, just like plant closures, should be largely exogenous to the health problems and career performance of individual workers prior to displacement. Our mass layoff sample consists of all workers who lost their job at a plant that reduced its employment by more than 30 percent between t and $t+1$. One advantage of using workers displaced in mass layoffs is that mass layoffs are more common than plant closures and also occur outside of recessions.[19] Appendix figure A2 indicates that mass layoffs also raise the mortality of displaced men and their partners, though the effects are slightly smaller than in the plant closure sample. Hence, the negative effects of job displacement are not restricted to potentially traumatic plant closures, but also visible during mass layoffs.

3.3 Effects on Health and Mortality by Cause

What are the causes of the excess mortality we documented in the previous section? Can the additional deaths be attributed to suicides or mental health issues? Are displaced men and their partners more likely to die from physical ailments like cardiovascular disease, for instance? We turn to detailed mortality by cause and hospitalization records to shed light on the types of health issues emerging after job displacement. We focus on five broad causes of deaths: cancer, heart disease, accidents, diseases related to alcohol consumption and suicide. As mortality might be a too extreme outcome, we also use patient records to shed light on health behaviors more broadly. We collapse the hospitalization data into six broad causes: the same five cases as for mortality (accidents, alcohol-related diseases, cancer, heart disease and suicides) and mental health issues.

Mortality and hospitalization by causes might be positively or negatively correlated over time – even for the same cause. The two are negatively correlated if a displaced person or spouses are less likely to seek treatment and later die from that specific cause (like cancer, for

[18] The main reason for the similar figures is that there are very few cases where the spouse of a displaced worker also gets displaced.

[19] Earnings losses of workers who get displaced in recessions tend to be more severe than for workers displaced in recoveries (Davis and von Wachter, 2011; Korkeamäki and Kyyrä, 2014).

example). The two would be positively correlated if a job loss leads to illness, for which a person seeks treatment, but still dies from it (like a heart attack, for instance). Finally, specific causes for hospitalization or mortality might also be correlated because of competing risks: a job loss might raise alcohol consumption, which in turn could trigger a heart attack later on.

We re-estimate equation (1) where the dependent variables are now inpatient visits and medical treatment for a specific cause (measured within five or twenty years after displacement) or mortality from a specific cause (measured by an indicator if the person died within five or twenty years after the displacement). We then use the corresponding outcomes for the partners of those men to investigate spillover effects, using equation (2). For the analysis of cause-specific inpatient visits and mortality, we focus on displaced men and their spouses as the evidence on all-case mortality revealed no direct or spillover effects for displaced women.[20]

We find that displaced men are more likely to be treated for alcohol-related disorders and mental health issues than their non-displaced peers (see table 4). Over a five-year period, treatment for alcohol intake increases by 19 percent (0.0014/0.0074) and for mental health issues by 17 percent (0.00213/0.0127).[21] These estimates should not be thought of as the cumulative risk of hospitalization because of competing risks: higher alcohol intake might also raise the occurrence of mental health issues and vice versa. This higher incidence of inpatient visits for alcohol intake and mental health disorders disappears in the long run as non-displaced workers catch up on inpatient visits (see the bottom panel of table 4).

Turning to mortality by major causes reveals that displaced men are more likely to die from cardiovascular diseases both in the medium and long run (see table 5). The risk to die from heart diseases is a stunning 51 percent (0.00081/0.0016) higher in the medium run and still 17 percent (0.0028/0.0165) higher than their non-displaced peers in the long run. Moreover, we observe many more suicides among displaced men over the twenty-year period than among non-displaced men, an increase by 32 percent (see table 5, column (10)).[22]

Do spouses suffer from similar diseases and possibly die from similar causes like men displaced in a plant closure? Table 6 shows that spouses are not immune to the mental strain of male job loss. Spouses are more likely to be treated for alcohol-related diseases (see column (2)), an

[20]The long-run results on cause-specific inpatient visits after women's job loss are contained in appendix tables A1 and A2. There are few discernible effects following women's job displacement.

[21]Studying health care expenditures rather than mortality or inpatient visits finds that health care spending, esp. for anti-depressants, increases for men but not women after a plant closure (Kuhn et al., 2009).

[22]That displaced men are more likely to die from external causes including suicides and accidents has also been found for Denmark and Sweden (Browning and Heinesen, 2012; Eliason and Storrie, 2009).

increase by 43 percent (0.00111/0.0026) in the medium run. Even in the long run, the bottom panel of table 6 shows that spouses of displaced men are still 16% more likely to be treated for alcohol-related diseases than spouses of non-displaced men. With respect to mortality, we find that spouses are more likely to die from accidents, which include accidental suicides or accidents under the influence of alcohol or drugs (see table 7). While the effect is visible in the medium run (column (1)), it amounts to a sizable and statistically significant 44 percent (0.00081/0.00186) excess mortality in the long run compared to the spouses of non-displaced workers.

Overall, the evidence from inpatient visits and mortality by causes confirms that the health burden of job loss are sizable and persistent – both for the displaced man and for his spouse. Moreover, the observed health effects suggest that job displacement imposes a substantial psychological burden on the couple, possible related to a loss of self-worth and feelings of stigma and depression.

4 Explaining the Health Spillovers

Our results so far show that job loss is bad for the long-run health and life expectancy of the displaced worker. Yet, the dire consequences do not stop there. Job loss has persistently negative consequences for the partner of the displaced worker as well. Surprisingly, negative health spillovers only occur after a man's job displacement. We find no evidence of persistent negative health consequences after women lose their job. How can we explain these health spillovers and the observed gender asymmetry? In this section, we explore three potential mechanisms for the observed pattern: spousal labor supply; loss in economic resources and public insurance; and the role of gender roles and family structure. We discuss each of them in turn.

4.1 Spousal Labor Supply

One potential explanation for the observed health spillovers is that spouses increase their own labor supply after the partner's job loss. The literature on added workers and second earners has long stressed that spousal labor supply might be one mechanism to insure the family against unemployment and other negative labor market shocks (Lundberg, 1985; Stephens Jr., 2002; Halla et al., 2019). Spouses who take up a job or work more hours are likely to face more work-related stress and have less time for health-promoting activities, which might be detrimental for spousal health.

Spousal labor supply could explain the observed gender asymmetry in health spillovers if women increase their labor force attachment or earnings after male job loss, whereas men do not adapt their behavior after female job loss. Such differential responses might be expected in an environment where women's labor force attachment has traditionally been lower than men's attachment. To estimate spousal labor supply responses, we use equation (3) but replace the dependent variable with employment or earnings of the spouse ($i*$) of displaced individual i. We include the same set of worker and spousal characteristics as before. In earnings regression we further include worker fixed effects; the coefficients γ_τ in the earnings regressions identify spousal earnings changes in year τ after i's displacement compared to the pre-displacement period ($t-3$) and relative to the partners of non-displaced workers.

Panel (a) of figure 5 plots how female employment responds to their partner's job loss. Panel (b) shows how male employment changes after their partner's job loss. For both men and women, employment declines slightly in the first two years after the job loss of their spouses but then goes up over time. Both short- and long-run employment effects are very modest independently of the gender of the displaced worker, however. The short-run employment decline is between 1.7 percentage points (for female partners) and 2.1 percentage points (for male partners). In the long run, spouses increase their employment rate by at most 1 percentage points in response to job displacement. The extensive margin responses are economically negligible for both men and women, especially if compared to employment rates of 81 percent for women and 91 percent for men prior to displacement. To convert this into a participation elasticity, we follow Halla et al. (2019) and relate the absolute change in employment rates in year 5 after displacement (0.4 percentage points) to the losses in husband's earnings (-17 percent). The resulting (semi-) elasticity of $\eta^P = 0.024$ is similar to the elasticity of women's employment response after their husband's displacement in Halla et al. (2019).

We now turn to annual labor earnings, which capture both responses at the intensive and extensive margin. Interestingly, we find similarly modest changes in spousal earnings after displacement (panels (c) and (d) of figure 5). For women, we find a reduction in earnings for the first eight years after male job loss. The earnings decline may reflect the simultaneous risk of job loss for women during the great recession; it might also reflect that women move to lower paying jobs or work less hours. In the long run (more than 15 years after their partner got displaced), women's annual earnings are about 450-650 euros higher than before the displacement relative to the spouses of non-displaced workers. Yet, the additional earnings make up only $2-3$ percent

of annual earnings among partners of non-displaced workers. There is no discernible increase in male earnings in response to the displacement of their spouse. The earnings changes for men are negative for the first ten years, then turn positive but remain close to zero.[23]

What does the observed labor supply response tell us about spillover effects in couples? The short-run decline in women's employment could be explained by leisure complementarities between partners (Goux et al., 2014). If leisure complementarities are used for health-promoting activities, they could explain why we find a small decline in mortality after female job loss for both displaced women and their spouses shortly after displacement (see panel (b) in figures 3 and 4). Yet, leisure complementarities cannot explain why mortality of men and their partners increase after male job loss (see panel (a) in figures 3 and 4). In order to explain the gender asymmetry in mortality effects, leisure complementarities in the couple would have to be used for health-promoting activities after a woman's job loss, but for health-damaging activities after a man's job loss. Such a pattern does not seem very likely.

The negative short-run effect could also be the result of the severe economic recession we analyze. Partners might have a difficult time finding a job or increasing working hours when employers prefer to downsize rather than hire new employees. Figure A3 indeed suggests that women are more likely to lose their job after male job displacement. Yet, this recession effect is short-lived and vanishes after a couple of years. In the medium and long run, the small spousal labor supply response cannot be attributed to the lack of job opportunities, especially since the evidence in figure 2 showed that employment rates of displaced workers do catch up with their non-displaced peers over time.

In the long run, there is no labor supply response of husbands after female job loss and a very modest labor supply response of wives after male job loss. While the responses show some asymmetry, the extensive and intensive labor supply responses after male job loss are too small to explain the higher mortality of women after male job loss. The absence of a sizable labor supply response in the long run could be the result of the high employment rates of women and men prior to displacement. If most individuals work full-time, there might be little room left for an added worker effect or adjustments in working hours. We think that high employment

[23]Previous evidence suggests that labor supply responses are lower among women with very young children (Blundell et al., 2018; Halla et al., 2019). Unfortunately, we do not observe the exact age structure of the children, but only the total number of dependent children under 18 in the household. We show in Section 4.3 below that spousal employment and earnings responses do not differ much for couples with and without children. Given that our spousal labor supply effects are very small in the full sample (where couples have children of all ages), our results cannot be explained by the presence of small children in the household.

rates are unlikely to be the sole reason for the small response at the extensive and intensive margin. Halla et al. (2019) report similar small effects for Austria, an environment with much lower female employment rates than in Finland. Finally, private insurance through spousal labor supply responses might be crowded out by public insurance (Cullen and Gruber, 2000; Hendren, 2017). We investigate the role of public insurance in the next section.

4.2 Monetary Losses and Public Insurance

Earnings Losses

Negative health spillovers could be the consequence of declining family resources, which reduces the couple's demand for health-promoting goods or activities. Economic deprivation could further explain the gender asymmetry if earnings losses are larger and more persistent after male than after female job loss. To explore the role of family resources, we use our event study design from equation (3) that compares earnings changes for displaced workers in some post-displacement year τ relative to earnings changes for non-displaced individuals.

The top panels of figure 6 show the effect for annual earnings after male job displacement (panel (a)) and after female job displacement (panel (b)). Male job loss causes substantial and persistent earnings losses. The strongest decline is observed in the second year after displacement where male earnings are 10,920 euros or about 31 percent lower than mean earnings of non-displaced workers.[24] Over a five-year period, displaced men lose 30,000 euros or about 17 percent of their total earnings capacity (see column (1) in the top panel of appendix table A3. Male earnings never fully recover to pre-displacement levels even two decades after job loss. Twenty years after displacement, the cumulative earnings loss amounts to 75,000 euros or 10 percent of total earnings capacity (see column (2) in the top panel of appendix table A3). Displaced women also experience the strongest decline in earnings two years after displacement. Yet, the decline is with 6,900 euros much lower than after male job loss. In percentage terms, earnings in year two decline by 31 percent (=6,925/21,700) for both men and women. Cumulative earnings losses amount to 21,800 euros or 20 percent over a five-year and 47,300 euros or 10 percent over a twenty-period (see columns (5)–(6) in the top panel of appendix table A3). Overall then, job displacement is associated with sizable and persistent earnings losses for both men and women.

[24] Appendix figure A4 shows that omitting the individual fixed effects but including our observable control variables yields similar employment and earnings effects supporting our identifying assumption that displaced and non-displaced workers do not differ along time-invariant unobservables.

Income Losses and Public Insurance

Lower earnings need not translate into economic hardship if earnings losses are compensated by private or public insurance. As spousal labor supply responses are small (see Section 4.1), private insurance plays only a limited role in our context. Yet, private insurance could have been crowded out by public insurance like unemployment insurance, for instance. Panels (c) and (d) in figure 6 show the impact of job displacement on personal income, which includes public transfers like unemployment and sickness benefits. Personal income declines by less than personal earnings. Hence, public transfers indeed provide some insurance against job displacement. However, public insurance is partial and temporary only compared to the persistent earnings losses from job displacement. Over a five-year period, public transfer compensate for about one-third of the total earnings losses after male displacement.[25] The insurance provided by public transfers is even more modest in the long-run. The cumulative loss in personal income twenty years after male displacement is about 59,000 euros. Hence, public transfers compensate only 20 percent of the earnings lost over the two decades (see column (6) in the bottom panel of appendix table A3). For women, public transfers compensate almost half (46 percent) of the earnings losses in the medium-run, but only 25 percent in the long-run.[26] Finally, panels (e) and (f) in figure 6 trace the impact of job displacement on family income, which consists of earnings for both spouses and public transfers. The panels show that family income declines by less than earnings losses but exhibits a pattern very similar to personal income. The similar dynamic of personal and family income after displacement underscore the modest added worker effects documented in the previous section.[27]

The following tentative conclusions emerge from our results on earnings and income losses. First, public transfers provide only partial and temporary insurance against the long-lasting earnings losses of job losses. Family income never recovers after male job loss and only recovers after female job loss because women's earnings eventually return to their pre-displacement levels. The second conclusion emerging from our findings is that men experience larger earnings losses

[25]The cumulative earnings loss in the first five years after male displacement is 30,000 euros. The cumulative personal income loss over the same period is 19,000 euros (see column (1) of appendix table A3). Hence, the five-year loss in personal income is 36 percent lower than the earning loss.

[26]The cumulative earnings loss in the first five years after female displacement is 21,830 euros; the cumulative personal income loss over the same period is 11,740 euros (compare columns (5) in the top and bottom panel of appendix table A3. Hence, the five-year loss in personal income is 46 percent lower than the earning loss.

[27]The modest private insurance through spousal earnings is also evident from appendix table A3. Five years after either male or female job loss, spousal earnings (see columns (3) and (7) in the top panel of appendix table A3) or spousal income (see see columns (3) and (7) in the bottom panel of appendix table A3) are never statistically significantly different from zero. Even two decades after job loss, spousal earnings have not increased much (see columns (4) and (8) of the top panel in appendix table A3).

in absolute terms than women after job displacement. We next explore whether this last result helps to explain the observed health spillovers and gender asymmetry.

Monetary Losses and Excess Mortality

Are the differences in earnings losses between men and women large and persistent enough to account for the health spillovers and, in particular, their asymmetry across gender? To answer this question, we need to quantify how earnings or income are related to mortality. While a large literature reports a negative association between various measures of income and mortality, there is much less agreement on the direction of causality and causal pathways linking economic resources and health.[28]

In the absence of a consensus in the literature about the size of the causal relationship, we use estimates of the correlation between pre-displacement earnings (averaged over three years prior to displacement) and mortality following the approach by Sullivan and von Wachter (2009). This correlation should in part reflect the effect of earnings on mortality. If some individuals have worse health, which reduces their labor market earnings prior to displacement, the partial correlation would be larger in absolute terms than the causal effect of earnings on mortality. Hence, if anything, our calculations overestimate the contribution of earnings losses to excess mortality.

The calculations are shown in table 8. The correlation of pre-displacement log earnings on 5-year male mortality is -0.0022. Furthermore, the mortality risk for displaced men increases by 23 percent relative to non-displaced men over the first five years after job loss.[29] Hence, the elasticity of 5-year mortality with respect to earnings for displaced men is -0.32. A reduction in earnings by 10 percent would then raise the 5-year mortality of displaced men by 3.2 percent.

Our results further indicate that displaced men lose 17 percent of their cumulative earnings over a five-year period. Multiplying the earnings losses with the earnings elasticity of mortality, we obtain that earnings losses raise mortality by 5.3 percent. Relative to the total mortality increase of 23 percent, earnings losses may thus account for 23 percent of the increased mortality risk for displaced men (see the bottom row of column (1) in table 8). We obtain a very similar

[28] Smith (1999) and Deaton (2003) provide surveys. Using shocks to income like lottery wins, some studies report negative effects on mortality (Lindahl, 2005), some zero effects (Cesarini et al., 2016) and some even positive effects on mortality (Snyder and Evans, 2006).

[29] The coefficient of job displacement on 5-year mortality is 0.0016, while the baseline 5-year mortality rate is 0.007. Hence, 0.0016/0.0070=0.227.

contribution of 21 percent for 20-year male mortality (see column (2) of table 8).[30] Hence, earnings losses account for one-fourth to one-fifth of the rise in male mortality after male job displacement, which is much lower than the contribution of 50-75 percent reported for the U.S. (Sullivan and von Wachter, 2009). The reason is not that Finnish men have lower earnings losses after displacement than displaced men in the U.S.. Earnings losses are actually quite similar in the two countries. They range from 10 to 17 percent in Finland and from 15 to 20 percent in the U.S.. The two countries mainly differ in the estimated association between pre-displacement earnings and mortality. The elasticities are around -0.3 in Finland but -0.5 in the U.S.. One likely explanation for the lower sensitivity is that workers in Finland, unlike their U.S. peers, do not lose their health insurance after job displacement.[31]

We redo the same calculation for personal income, which reflects more closely the loss of actual economic resources (see columns (3) and (4) of table 8). Personal income can account for only 15 percent of the increase in (5-year or 20-year) mortality for displaced men, which is even lower than the contribution of 20-25 percent for earnings. The difference underscores that public insurance of job-related earnings losses partially shields a family from the negative consequences of job displacement. At the same time, the relatively small contribution of income also indicates that job displacement implies much more than the mere decline in actual economic resources.

Can the loss in economic resources also account for some of the health spillovers we observe in couples? Columns (5)-(8) of table 8 indicate a negative correlation between spousal mortality and male pre-displacement earnings as expected. The elasticity of spousal mortality is around -0.17 both in the medium and in the long run – and thus half the earnings elasticity of mortality for displaced men. Compared to the overall increase in spousal mortality (28.5 percent in the medium run and 12.5 percent in the long run), male earnings losses may therefore account for around 10-14 percent of the health spillovers in couples. The explanatory power of male income losses for spousal mortality is again somewhat lower than for earnings.

What do our findings indicate for the link between economic resources and health? First, monetary losses after male job loss may account for up to 25% of the excess mortality among

[30] Interestingly, the elasticity of mortality with respect to earnings does not change much with time elapsed since displacement (-0.27 for 20-year mortality compared to -0.32 for 5-year mortality). Yet, earnings losses become smaller in percentage terms over time (10 percent over a 20-year period rather than 17 percent over a 5-year period) as long-run earnings recover somewhat relative to their non-displaced peers. At the same time, catch-up mortality among non-displaced men seems to reduce the 20-year mortality differential to 13 percent (rather than 23 percent over a 5-year period).

[31] Another potential explanation is that the correlation between pre-displacement earnings and mortality suffers from reverse causality or omitted variable bias. The empirical correlation would be then higher in the U.S. than in Finland, if poor health reduces earnings more in the U.S. than in Finland, for instance.

men. This result clearly shows that earnings or income losses are important for health. We acknowledge that the correlation of mortality with pre-displacement earnings and income might not fully reflect a causal effect. It may well be that individuals with lower pre-displacement earnings had worse health that prevented them from working. In that case, our calculations provide an upper bound to the contribution of economic resources to health. Second, women's earnings losses are smaller in absolute terms than men's earnings losses and eventually return to their pre-displacement level. These smaller monetary losses could account for some of the observed gender asymmetry if the relationship between earnings and mortality were non-linear. It could be that a couple can compensate moderate earnings losses without negative health consequences. Once earnings losses exceed some threshold, however, as in the case of male job displacement, the compensatory mechanisms break down with negative health consequences for the couple. Finally, the loss in economic resources can explain little of the rise in spousal mortality. Together with the modest contribution to excess mortality for displaced men, these findings suggest that the higher mortality risk after job loss has a strong non-monetary component, possibly related to psychological stress or stigma.

4.3 Family Structure and Gender Roles

We now turn to explore the role of family structure and gender roles in accounting for the observed health spillovers and gender asymmetry. The loss of a well-paid job followed by a period of un- or non-employment is likely to strain the couple's relationship. Destructive or aggressive coping strategies of the displaced, through depression or alcohol-related issues, for example, could reduce the actual and possibly future gains from marriage. As a result, the relationship might break down – with negative health consequences for both partners (Charles and Stephens, 2004; Mjörk et al., 2018; Rege et al., 2011). A strained or broken relationship could explain the gender asymmetry in health spillovers if the relationship is more adversely affected when a man loses his job than when a woman loses her job, for example, because a man's role is to provide economically for the family.

To investigate the effects of job displacement on breakups and separations, we use the empirical model in equation (1) where the dependent variable is now equal to one if a couple separates either by getting divorced or by no longer cohabitating τ years after the displacement; and zero otherwise. The dynamics of the cumulative probability of breakup of couples with a displaced partner relative to couples without a displacement is shown in figure 7 for male job loss (panel

(a)) and female job loss (panel (b)). More couples divorce or separate in year two and three after male job loss. Over a twenty-year period, the risk of separation has increased by 0.8 percentage points or about 12 percent. Four years after displacement, the estimates hover close to zero. Following female job loss, the estimates are slightly larger than following male job loss, but never significantly different from zero. These results help to explain the gender asymmetry in health spillovers to the extent that a divorce or break-up affects a couple's health.

Even if a relationship does not break down, a person's job loss might shake some couples to the core, while others are able to absorb the negative shock. We thus turn to explore the role of family structure for the link between mortality and job displacement. In particular, we study two family constellations: traditional and non-traditional couples as well as couples with and without dependent children. We define a traditional couple as one where the husband has more formal education than his spouse or partner. We define a non-traditional couple as one where women have at least as much formal education as her husband.

Economically, a traditional couple with a main breadwinner might be more or less vulnerable to male job displacement than a non-traditional couple. We might expect that a couple with a male breadwinner has larger earnings losses after male job displacement than a couple where both partners have similar labor market skills.[32] Yet, partners in traditional couples might have more room to expand their labor supply to compensate the earnings losses of the displaced. Beyond monetary concerns, traditional and non-traditional couples might be differently affected because of actual or perceived gender roles. Following a long line of research in social psychology and sociology, Akerlof and Kranton (2000) introduced the idea that social categories, like husband and wife in a couple, come with a prescribed role or set of expected behavior. A person who identifies with the prescribed role could then incur large psychic costs if he or she cannot fulfill the expected norms or behavior. On the one hand, men who identify with the role of a traditional breadwinner might be more negatively affected when they lose their job in a plant closure than men in non-traditional earning couples. On the other hand, non-traditional couples seem to have less stable relationships, which might reduce the couple's ability to absorb a negative shock such as a job loss (Bertrand et al., 2015). To compare the health burden of job displacement

[32]Earnings losses might be even higher in the case of the male breadwinner if specialization in the couple allows the husband to accept attractive job opportunities or invest more in job-specific skills, for instance, than husbands in non-traditional couples.

for traditional and non-traditional couples, we rerun our mortality regressions using equation 1 separately for traditional and non-traditional couples.[33]

Surprisingly, figure 8 suggests that both partners in non-traditional couples suffer a higher mortality risk after male job loss. Traditional couples, in turn, do not experience excess mortality after male job loss.[34] Could this pattern be explained by the loss in economic resources? Table A4 shows that non-traditional couples actually suffer smaller losses in family income than traditional couples because of income pooling. Hence, the bigger mortality effect for non-traditional couples cannot be explained by a sharper decline in economic resources. Interestingly, there is no clear labor supply response of spouses in non-traditional couples either. If anything, women in non-traditional couples contribute more to family income, but earn less after male displacement, possibly because they are themselves negatively affected by the great recession. The evidence on mortality and family resources together suggests that the higher mortality in more equal relationships has a strong psychological component, possibly because the man feels threatened in his perceived role or both partners are stressed by the violation of gender norms.[35] This pattern suggests that job loss provides a severe blow to men in more equal partnerships with negative consequences for the couple as a whole.

Further support for the influence of gender roles comes from comparing the mortality of couples with and without children living in the household. Couples with dependent children need to worry more about the economic or social deprivation following a job displacement than couples without children. There is also potentially less room for spousal labor supply response in couples with dependent children as one or both spouses are engaged in home production and childcare (Halla et al., 2019). Figure 9 shows how overall mortality evolves after a male job loss for the displaced (top panels) and his spouse (bottom panels). Displaced men face an elevated mortality risk irrespective of whether they have dependent children or not (compare panels (a)

[33] An alternative approach to defining traditional and non-traditional couples would be to take the pre-displacement earnings share of husbands and wives as in Bertrand et al. (2015). We find very similar results if we use that split instead.

[34] Male job loss should improve the relative bargaining position of the wife and hence, the resources available to her. Changes in relative bargaining positions does not explain why the mortality of both spouses goes up in non-traditional couples, but not in traditional couples, however.

[35] Defining a traditional couple as one where the man contributes more than 50% to family resources (the median is 64%), we again find that men have higher mortality in non-traditional couples than in traditional couples after male job loss. Again, the differential mortality cannot be attributed to the loss of economic resources or spousal labor supply responses.

and (b)). However, women suffer higher mortality risk after male job loss only if they do not have children.[36]

The smaller spousal mortality in couples with children cannot be accounted for by lower earnings losses of the displaced or a stronger labor supply response of couples without children (see appendix table A5). If anything, couples with children have larger earnings and income losses than couples without children. Furthermore, we see little differences in spousal labor supply after male job loss; in both cases, spousal labor supply responds little at either the extensive or intensive margin. These results indicate that the presence of children acts as an insurance device for women against the detrimental health effects of male displacement – but it does not help the displaced man himself. Such an asymmetry could emerge if women derives higher utility from children than displaced men; or there is some other factor that shields women with children from the negative health consequences of male job loss.

Overall, the evidence clearly indicates that relationships are under additional strain when the man loses his job. The evidence that the mortality risk differs by family structure in non-trivial ways highlights that monetary losses alone cannot explain the health spillovers in couples. There seems to be a substantial social and psychological component, which varies systematically with family structure and gender roles. Our evidence suggests that the presence of children insures a woman's health against her partner's job loss. Yet, a man's health is better protected in traditional couples with well-defined gender roles irrespective of whether there are children in the household.

5 Discussion and Conclusion

A long line of research has shown that individuals who lose their job for exogenous reasons suffer severe earnings losses and negative health consequences. Our analysis shows that the dire health effects are not confined to the displaced worker. Using administrative data over more than two decades, we show that man's job loss during an economic downturn significantly increases his own mortality, but also his partner's risk of dying. For every 10,000 displaced men there are 27 additional deaths within five years and even 115 extra deaths over two decades. Up to 40 percent of this excess mortality fall upon the partners of displaced men.

[36] We find a very similar pattern if we split the sample by the median number of dependent children in the household instead.

Our study also reveals a stunning gender asymmetry: when a man loses his job in a plant closure, both he and his spouse suffer negative health consequences. When a woman loses her job, in contrast, we find no such dire health consequences. We investigate three channels for the observed health spillovers and gender asymmetry. First, spousal labor supply response may insure the couple against negative shocks like job loss. Private insurance could reduce the health burden on the displaced worker, but may inflict additional stress on the partner or spouse. We find that spousal labor supply responses are very small and do not vary much between men and women. As such, they cannot explain neither the health spillovers nor the gender asymmetry.

We then investigate the role of declining economic resources and public insurance for our findings. We find some support for this second channel. Earnings losses may account for around one-quarter of the direct effect of male job displacement on male mortality. Public transfers provide only partial and temporary insurance against the negative shock of displacement on earnings. Hence, financial hardship helps to explain why the health burden for the couple is worse after male job displacement; yet, the monetary channel seems less successful in accounting for health spillovers in couples.

Finally, we explore whether some couples are better able to absorb the negative consequences of job displacement than others. Relationships are substantially more likely to break down after male job displacement than after female job displacement. To the extent that a breakup or divorce takes a toll on health, this pattern can help to explain both health spillovers and the gender asymmetry. We also find systematic differences how couples are able to absorb the negative shock from job displacement. Women suffer less after their partner's job loss when they have dependent children living in the household. Men's health, in contrast, suffers less within a traditional couple where the man is more educated or earns more than his partner or wife. These findings, which cannot be explained by differential spousal labor supply responses or income losses, point to a strong psychological component related to perceived gender roles in the couple.

Our study highlights that the societal burden of job displacement is much higher than the economic and health consequences for the displaced workers alone. A second novel result is that the health burden for families with a displaced worker goes well beyond economic deprivation. From this perspective, periods of economic recession or even depression imply a persistent toll on human lives and the long-run health of the population. The presence of such health spillovers

has important policy implications and needs to be taken into account when designing public policies to mitigate or insure workers against negative labor market shocks.

By highlighting the health costs of great recessions, our results do provide important insights into the current debate on the pandemia response. In particular, our results show that there is no simple trade-off between economic and health costs as economic recessions also carry a substantial health burden among displaced workers and their families.

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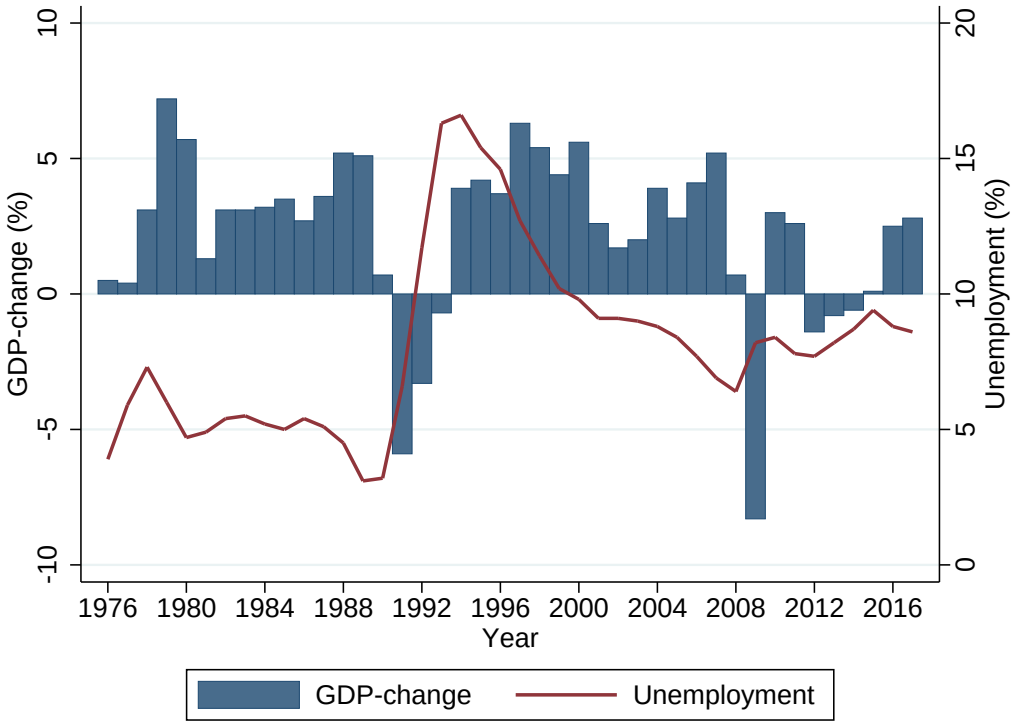
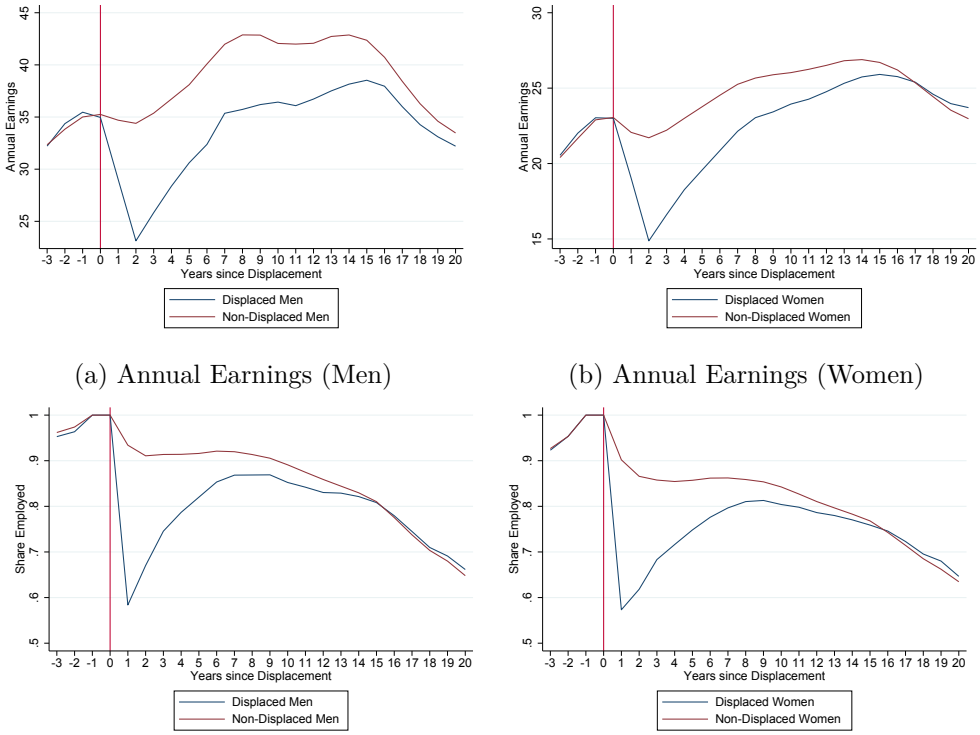


Figure 1: Unemployment and GDP during Finland's Great Recession



(a) Annual Earnings (Men)

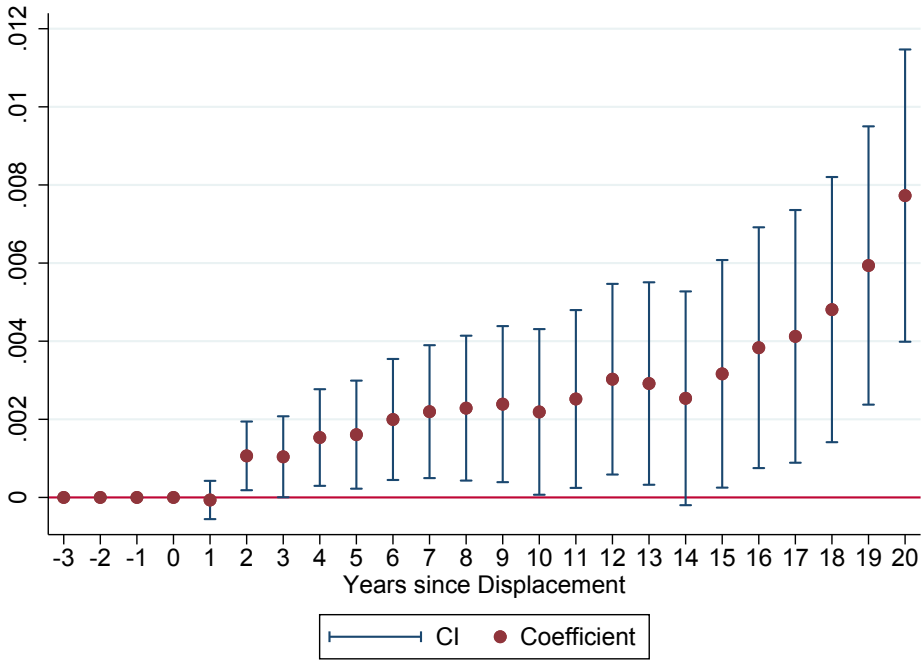
(b) Annual Earnings (Women)

(c) Share Employed (Men)

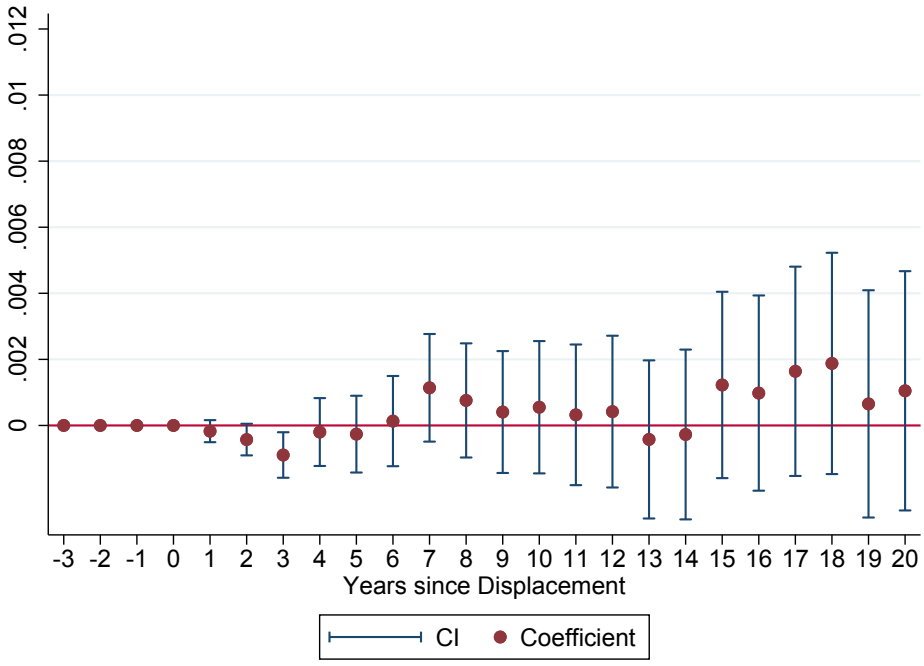
(d) Share Employed (Women)

Figure 2: Earnings and Employment after Male and Female Job Displacement

Notes: The figure plots the mean annual earnings and employment status of male (left-hand side) and female (right-hand side) workers working in plants with between 10 and 1000 workers in base years 1991-1993. Displaced workers refer to group that lost their job in plant closure between year 0 and 1 where year 0 denotes one of the base years.



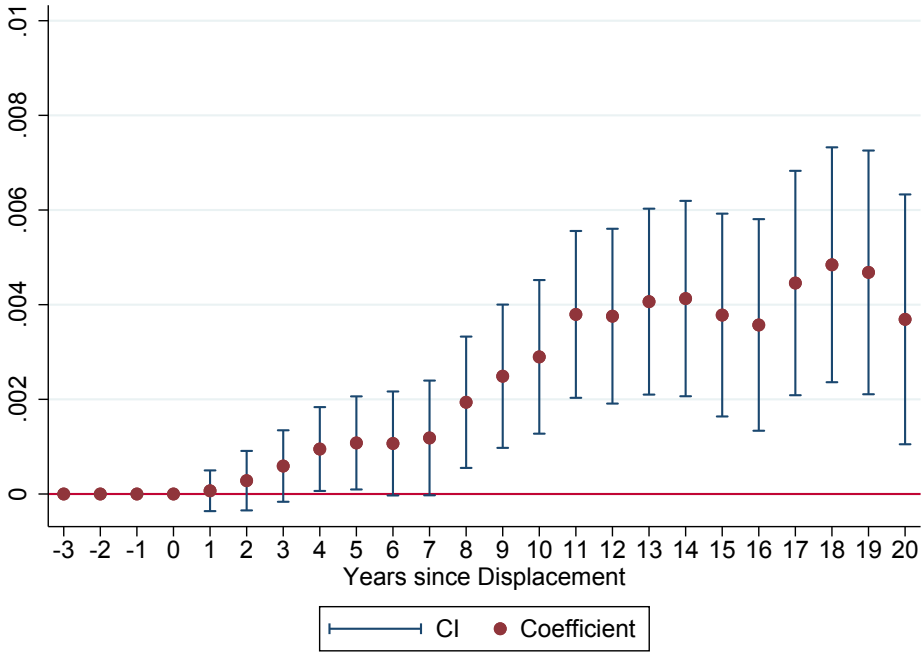
(a) Male Job Displacement and Male Mortality



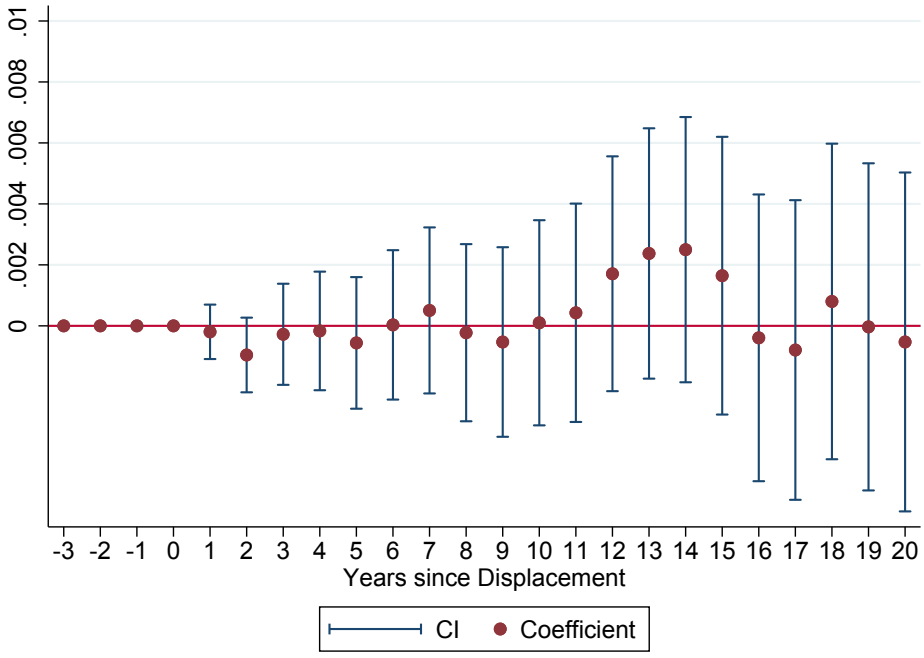
(b) Female Job Displacement and Female Mortality

Figure 3: Direct Mortality Effect of Job Displacement

Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (1), which estimates the effect of displacement on the probability that a worker dies by the year denoted on the x-axis.



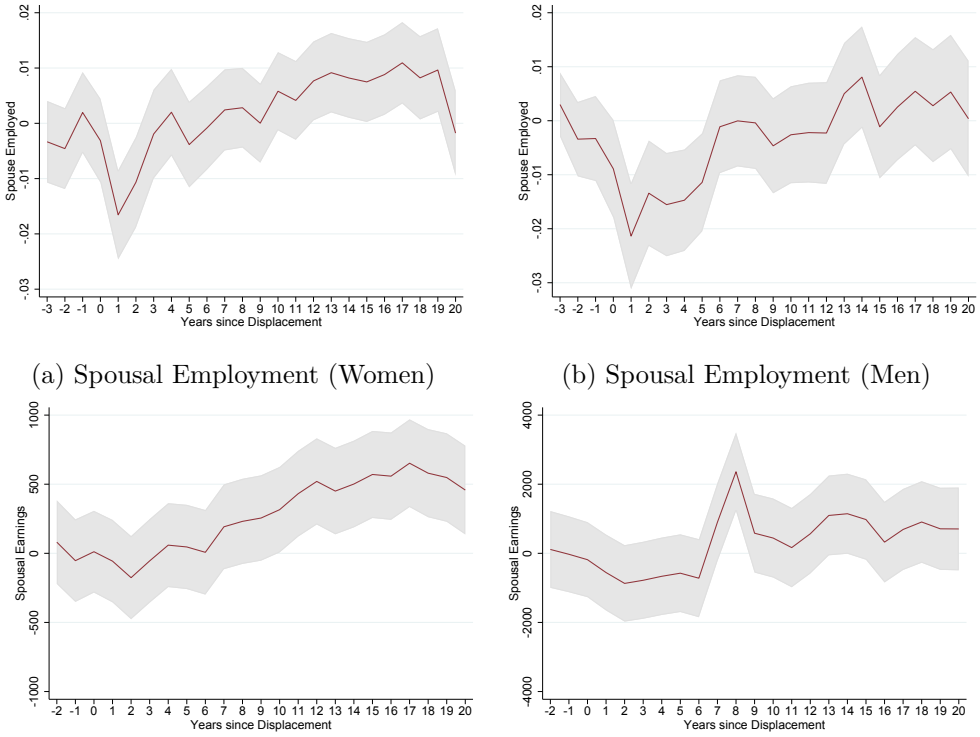
(a) Male Job Displacement and Spousal Mortality



(b) Female Job Displacement and Spousal Mortality

Figure 4: Spousal Mortality Effect of Job Displacement

Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (2), which estimates the effect of displacement on probability that worker's spouse dies by the year denoted on the x-axis.



(a) Spousal Employment (Women)

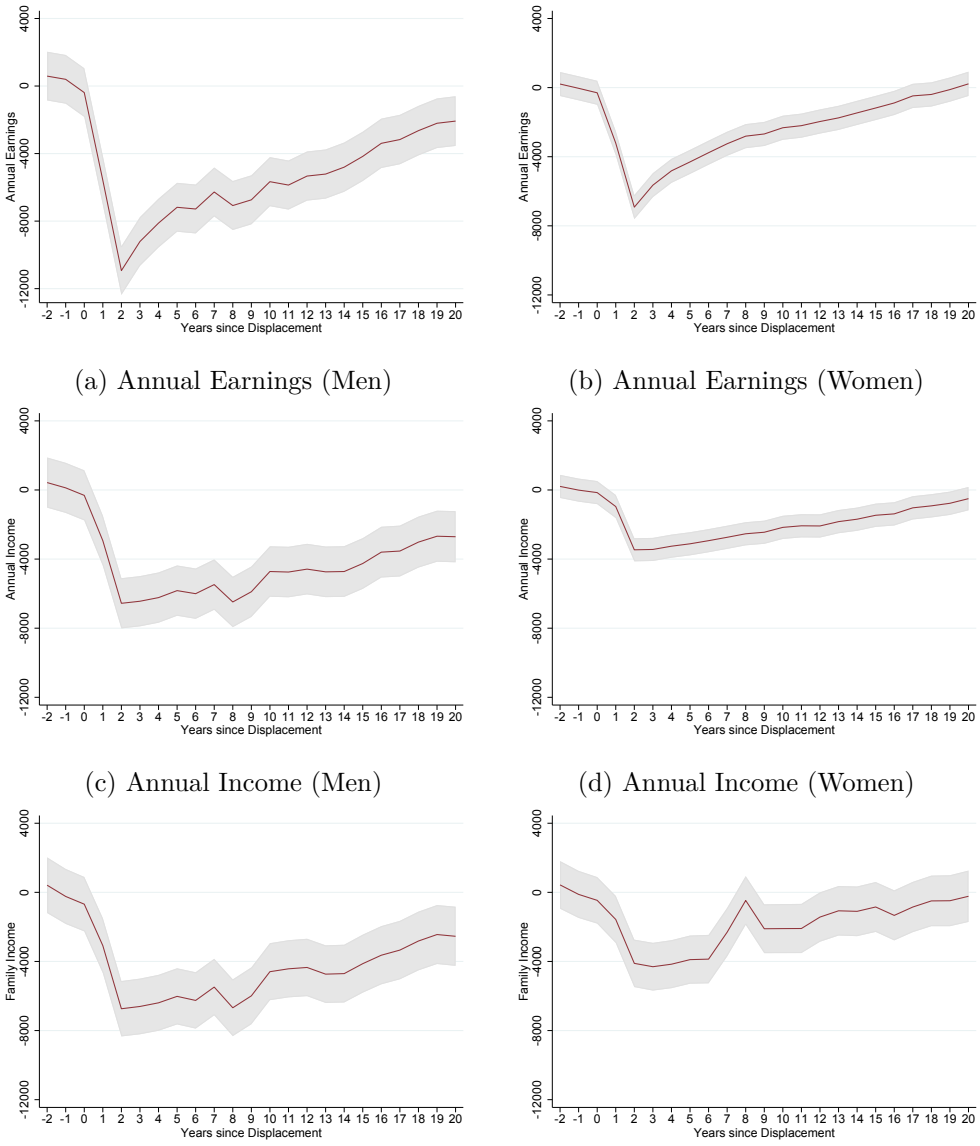
(b) Spousal Employment (Men)

(c) Spousal Earnings (Women)

(d) Spousal Earnings (Men)

Figure 5: Effect of Job Displacement on Spousal Earnings and Employment

Notes: The figure displays coefficients and confidence intervals from regression equation (3), which estimates the effect of displacement on spousal employment (upper panel) and spousal earnings (lower panel) in the years before and after male (left hand side) and female (right hand side) job displacement. The earnings regression includes individual fixed effects, and drops the displacement indicator for year -3 from the regression.



(a) Annual Earnings (Men)

(b) Annual Earnings (Women)

(c) Annual Income (Men)

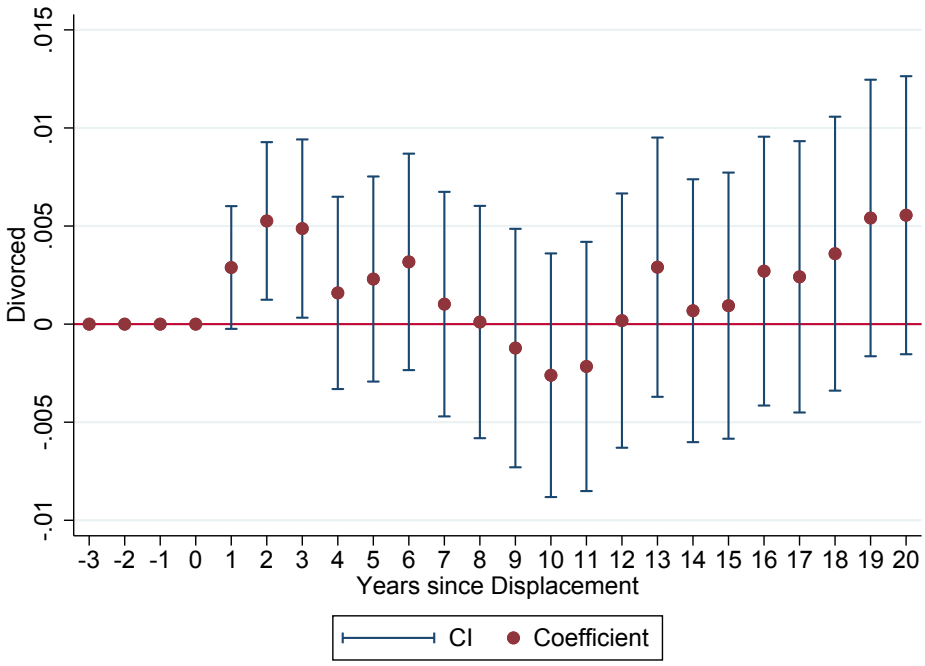
(d) Annual Income (Women)

(e) Family Income (Men)

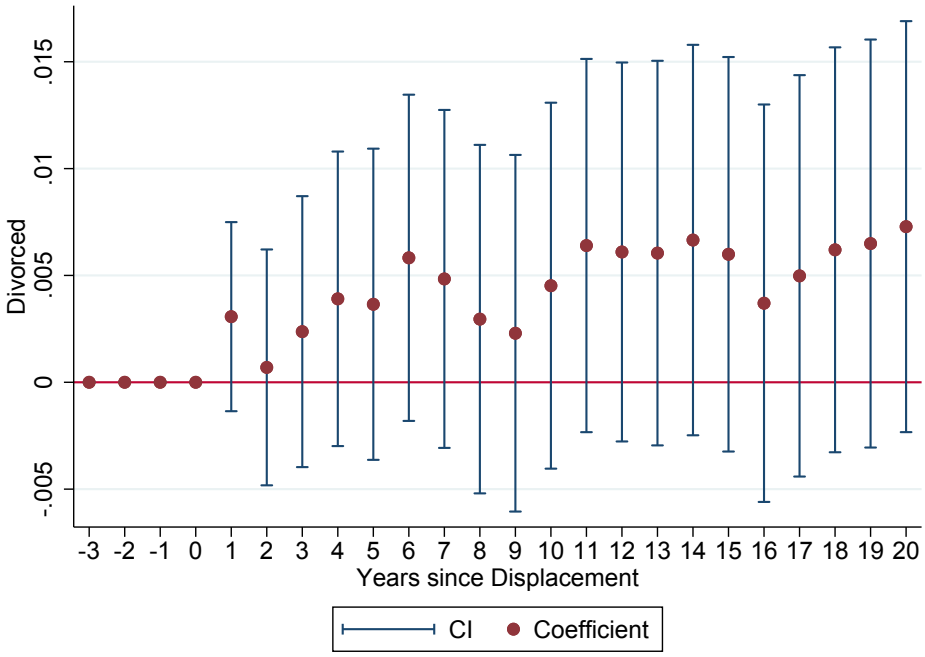
(f) Family Income (Women)

Figure 6: Effect of Job Displacement on Earnings and Income

Notes: The figure displays coefficients and confidence intervals from regression equation (3), which estimates the effect of displacement on worker's earnings and employment in the years before and after male (left-hand side) and female (right-hand side) job displacement



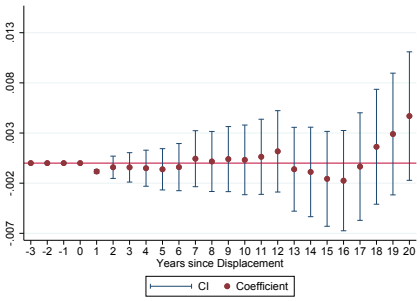
(a) Male Job Displacement



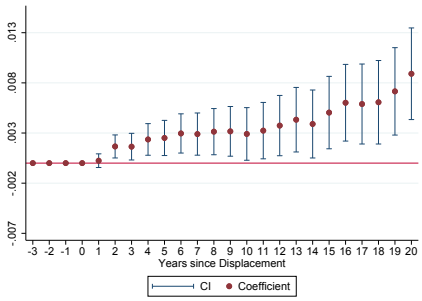
(b) Female Job Displacement

Figure 7: Effect of Job Displacement on Separation

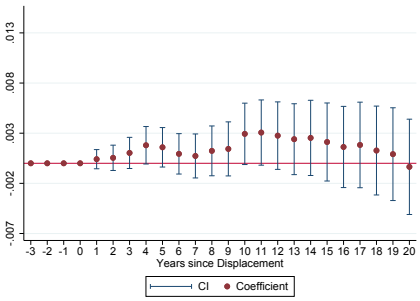
Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (2), which estimates the effect of displacement on probability that a person separates from his or her base year partner by the year denoted on the x-axis.



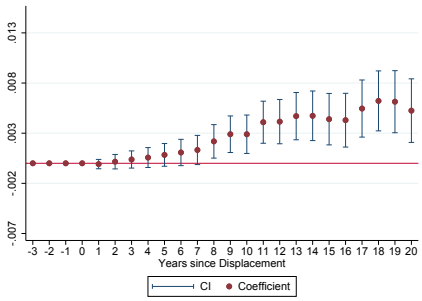
(a) Male Mortality (Traditional)



(b) Male Mortality (Non-Traditional)



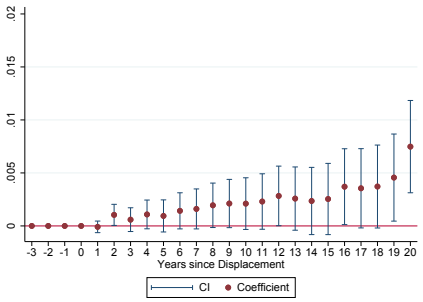
(c) Spousal Mortality (Traditional)



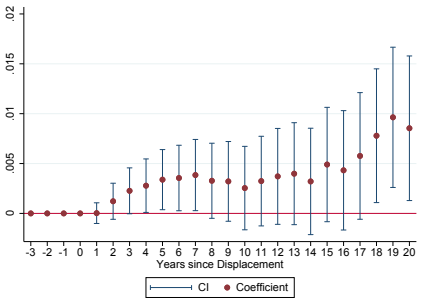
(d) Spousal Mortality (Non-Traditional)

Figure 8: Effects of Male Job Displacement on Mortality by Family Structure

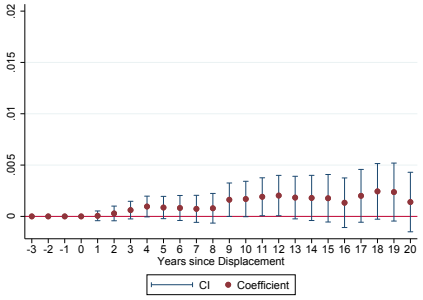
Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (2), which estimates the effect of male job displacement on probability that a person dies by the year denoted on the x-axis. Traditional couples are those where the woman has lower educational attainment than her partner or husband. Non-traditional couples are those where the woman has a higher (or equal) level of education than her partner or husband.



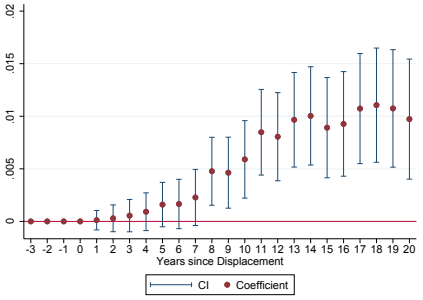
(a) Male Mortality (with Children)



(b) Male Mortality (without Children)



(c) Spousal Mortality (with Children)



(d) Spousal Mortality (without Children)

Figure 9: Effect of Male Job Displacement on Direct and Spillover Mortality for Couples with and without Children

Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (2), which estimates the effect of displacement on the probability that a worker dies by the year denoted on the x-axis separately for two groups: couples with dependent children in base year 0, and couples without children in base year 0.

Table 1: Characteristics of Displaced and Non-Displaced Workers

	Men			Women		
	Displaced Workers	Non-Displaced Workers	p-value	Displaced Workers	Non-Displaced Workers	p-value
	(1)	(2)	(3)	(4)	(5)	(6)
Age	36.19	36.50	0.00	35.87	36.07	0.03
Low-skilled	0.31	0.31	0.86	0.38	0.38	0.43
Medium-skilled	0.37	0.37	0.72	0.32	0.34	0.00
High-skilled	0.32	0.32	0.59	0.30	0.29	0.01
Labor Market Experience	15.32	15.73	0.00	15.82	15.90	0.49
Tenure	2.53	2.93	0.00	2.52	2.84	0.00
Plant Size	75	182	0.00	71	155	0.00
Annual Earnings	34,699	34,294	0.01	22,360	22,033	0.01
Annual Earnings (3 yrs. before job loss)	32,213	32,336	0.47	20,541	20,397	0.29
Earnings growth (2-3 yrs. before job loss)	0.26	0.52	0.00	0.55	0.66	0.47
Employment (2 yrs. before job loss)	0.96	0.97	0.00	0.95	0.95	0.99
Annual Personal Income	36,569	36,463	0.61	25,095	24,884	0.08
Married	0.75	0.77	0.00	0.74	0.74	0.47
Number of Children	1.31	1.32	0.24	1.05	1.06	0.24
Dead in year t+5	0.0085	0.0070	0.08	0.0030	0.0034	0.62
Dead in year t+20	0.0666	0.0583	0.00	0.0329	0.0321	0.72

Notes: All variables are measured in the pre-displacement year, i.e. 1991, 1992 or 1993 unless stated otherwise. Low-skilled means the person has finished compulsory education; medium-skilled means the person has finished upper secondary education; and high-skilled implies a university or college degree. Earnings and income are deflated to 2009 euros. The last two rows of the table report the cumulative mortality of the displaced by $t+5$ or $t+20$.

Table 2: Direct Effect of Job Displacement on Mortality

	Male Job Loss		Female Job Loss	
	5-Year	20-Year	5-Year	20-Year
	(1)	(2)	(3)	(4)
Job Displacement	0.00160*	0.00765***	-0.00026	0.00104
	[0.00084]	[0.00226]	[0.00070]	[0.00219]
Individual Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes
Plant Size (Pre-Job Loss)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes
Year of Displacement Fixed Effects	Yes	Yes	Yes	Yes
Spousal Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes
Observations	475,674	475,674	349,455	349,455
Mean of Dependent Variable	0.007	0.059	0.003	0.032
R^2	0.005	0.030	0.003	0.018

Notes: The table reports the effect of male and female job displacement in t on cumulative mortality by $t+5$ or $t+20$ where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of dying by year $t+5$ or $t+20$. All specifications include pre-displacement characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

Table 3: Spillover Effect of Job Displacement on Spousal Mortality

	Male Job Loss		Female Job Loss	
	5-Year	20-Year	5-Year	20-Year
	(1)	(2)	(3)	(4)
Job Displacement	0.00105*	0.00380**	-0.00060	-0.00054
	[0.00060]	[0.00160]	[0.00131]	[0.00336]
Individual Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes
Plant Size (Pre-Job Loss)	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes
Year of Displacement Fixed Effects	Yes	Yes	Yes	Yes
Spousal Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes
Observations	475,674	475,674	349,455	349,455
Mean of Dependent Variable	0.004	0.030	0.012	0.089
R^2	0.004	0.025	0.013	0.069

Notes: The table reports the effect of male and female job displacement in t on cumulative mortality of the spouse by $t+5$ and $t+20$ where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of the spouse dying by year $t+5$ or $t+20$. All specifications include pre-job loss characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

Table 4: Direct Effect of Male Job Displacement on Hospitalization

	5-Year Hospitalization					
	Accidents	Alcohol	Cancer	Heart	Mental Illness	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
Job Displacement	-0.00026	0.00140*	0.00008	-0.00225	0.00213*	0.00018
	[0.00182]	[0.00084]	[0.00070]	[0.00147]	[0.00110]	[0.00038]
Observations	475,674	475,674	475,674	475,674	475,674	475,674
Mean of Dependent Variable	0.042	0.007	0.005	0.031	0.013	0.002
R^2	0.006	0.004	0.003	0.014	0.004	0.001
	20-Year Hospitalization					
Job Displacement	-0.00165	-0.00015	0.00056	-0.00163	-0.00062	0.00035
	[0.00356]	[0.00172]	[0.00192]	[0.00311]	[0.00196]	[0.00075]
Observations	475,674	475,674	475,674	475,674	475,674	475,674
Mean of Dependent Variable	0.184	0.035	0.047	0.144	0.048	0.006
R^2	0.010	0.008	0.029	0.043	0.008	0.003

Notes: The table reports the effect of male job displacement in t on hospitalization by $t+5$ (top panel) and $t+20$ (bottom panel) where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of being hospitalized by year $t+5$ or $t+20$ due to a specific cause. All specifications include pre-job loss characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * p < 0.10, ** p < 0.05, *** p < 0.001.

Table 5: Direct Effect of Male Job Displacement on Cause-Specific Mortality

	5-Year Mortality					20-Year Mortality				
	Accidents (1)	Alcohol (2)	Cancer (3)	Heart (4)	Suicides (5)	Accidents (6)	Alcohol (7)	Cancer (8)	Heart (9)	Suicides (10)
Job Displacement	0.000056	-0.00006	0.00032	0.00081*	0.00014	0.00032	0.00142	0.00121	0.00282**	0.00181**
	[0.00031]	[0.00024]	[0.00040]	[0.00045]	[0.00034]	[0.00076]	[0.00089]	[0.00122]	[0.00124]	[0.00077]
Individual Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant Size (Pre-Job Loss)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Displacement Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spousal Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	475,674	475,674	475,674	475,674	475,674	475,674	475,674	475,674	475,674	475,674
Mean of Dependent Variable	0.001	0.001	0.002	0.002	0.001	0.006	0.008	0.017	0.017	0.006
R^2	0.001	0.001	0.003	0.003	0.001	0.002	0.003	0.016	0.014	0.002

Notes: The table reports the effect of male job displacement in t on cumulative mortality by $t+5$ and $t+20$ where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of dying by year $t+5$ or $t+20$. All specifications include pre-job loss characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

Table 6: Spillover Effect of Male Job Displacement on Hospitalization

	5-Year Hospitalization					
	Accidents	Alcohol	Cancer	Heart	Mental Illness	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
Job Displacement	0.00189	0.00111**	0.00084	-0.00254	0.00103	0.00004
	[0.00142]	[0.00055]	[0.00092]	[0.00172]	[0.00106]	[0.00047]
Observations	475,674	475,674	475,674	475,674	475,674	475,674
Mean of Dependent Variable	0.023	0.003	0.010	0.041	0.013	0.003
R^2	0.004	0.003	0.007	0.011	0.006	0.002
	20-Year Hospitalization					
Job Displacement	-0.00036	0.00211*	-0.00093	-0.00375	0.00147	0.00085
	[0.00306]	[0.00109]	[0.00220]	[0.00299]	[0.00191]	[0.00095]
Observations	475,674	475,674	475,674	475,674	475,674	475,674
Mean of Dependent Variable	0.128	0.013	0.064	0.131	0.045	0.010
R^2	0.009	0.006	0.023	0.024	0.010	0.005

Notes: The table reports the effect of male job displacement in t on the hospitalization of the spouse by $t+5$ (top panel) and $t+20$ (bottom panel) where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of the spouse being hospitalized by year $t+5$ or $t+20$ due to a specific cause. All specifications include the following pre-displacement characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

Table 7: Spillover Effect of Male Job Displacement on Cause-Specific Mortality

	5-Year Mortality					20-Year Mortality				
	Accidents	Alcohol	Cancer	Heart	Suicides	Accidents	Alcohol	Cancer	Heart	Suicides
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Job Displacement	0.00027	-0.00005	0.00056	-0.00011	0.00006	0.00081*	0.00088	0.00103	0.00073	-0.00042
	[0.00021]	[0.00012]	[0.00042]	[0.00017]	[0.00019]	[0.00045]	[0.00056]	[0.00110]	[0.00062]	[0.00037]
Individual Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant Size (Pre-Job Loss)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Displacement Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spousal Characteristics (Pre-Job Loss)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	475,674	475,674	475,674	475,674	475,674	475,674	475,674	475,674	475,674	475,674
Mean of Dependent Variable	0.00029	0.00018	0.00172	0.00053	0.00050	0.00186	0.00279	0.01480	0.00456	0.00195
R^2	0.001	0.001	0.003	0.002	0.001	0.001	0.003	0.012	0.012	0.002

Notes: The table reports the effect of male job displacement in t on cumulative mortality of the spouse by $t+5$ or $t+20$ where the worker is displaced (in either t or$t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of the spouse dying by year $t+5$ or $t+20$ due to a specific cause. All specifications include the following pre-displacement characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

Table 8: Contribution of Earnings/Personal Income to Male and Spousal Mortality

	Male Mortality				Spousal Mortality			
	Male Earnings		Male Personal Income		Male Earnings		Male Personal Income	
	5-year	20-year	5-year	20-year	5-year	20-year	5-year	20-year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male Displacement	0.00160*	0.00765**	0.00160*	0.00765**	0.00105*	0.00380**	0.00105*	0.00380**
	[0.00838]	[0.00226]	[0.00838]	[0.00226]	[0.00060]	[0.00016]	[0.00060]	[0.00016]
Men's Log Earnings/Income (Pre-Displacement)	-0.00222***	-0.01590***	-0.00233***	-0.01530***	-0.00063**	-0.00534***	-0.00066*	-0.00626***
	[0.00053]	[0.00147]	[0.00059]	[0.00159]	[0.00031]	[0.00102]	[0.00034]	[0.00110]
Earnings/Income Elasticity of Mortality	-0.315	-0.271	-0.331	-0.261	-0.170	-0.176	-0.180	-0.207
Male Earnings/Income Loss (%)	-0.169	-0.099	-0.102	-0.069	-0.004	0.006	0.006	0.010
Mortality Increase through Earnings/Income Loss	0.053	0.027	0.034	0.018	0.029	0.017	0.018	0.014
Total Mortality Effect (%)	0.227	0.131	0.227	0.131	0.285	0.125	0.285	0.125
Contribution of Economic Channel	23.5%	20.5%	14.8%	13.9%	10.1%	13.9%	6.4%	11.4%

Notes: The table calculates the contribution of earnings and income drops on the mortality effect of job loss for the displaced and their spouse in $t+5$ and $t+20$. The earnings/income elasticity of mortality is calculated as the pre-displacement log earnings/income effect on mortality relative to baseline mortality. We use average log earnings/income on the 3-year pre-displacement period for the interaction of pre-displacement and mortality effect of job loss. Each regression includes our full set of control variables. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

SUPPORTING INFORMATION

In Sickness and in Health: Job Displacement and Health Spillovers in Couples

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Kristiina Huttunen, Aalto University School of Economics, VATT and IZA
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June 2, 2020

1 Supporting Figures

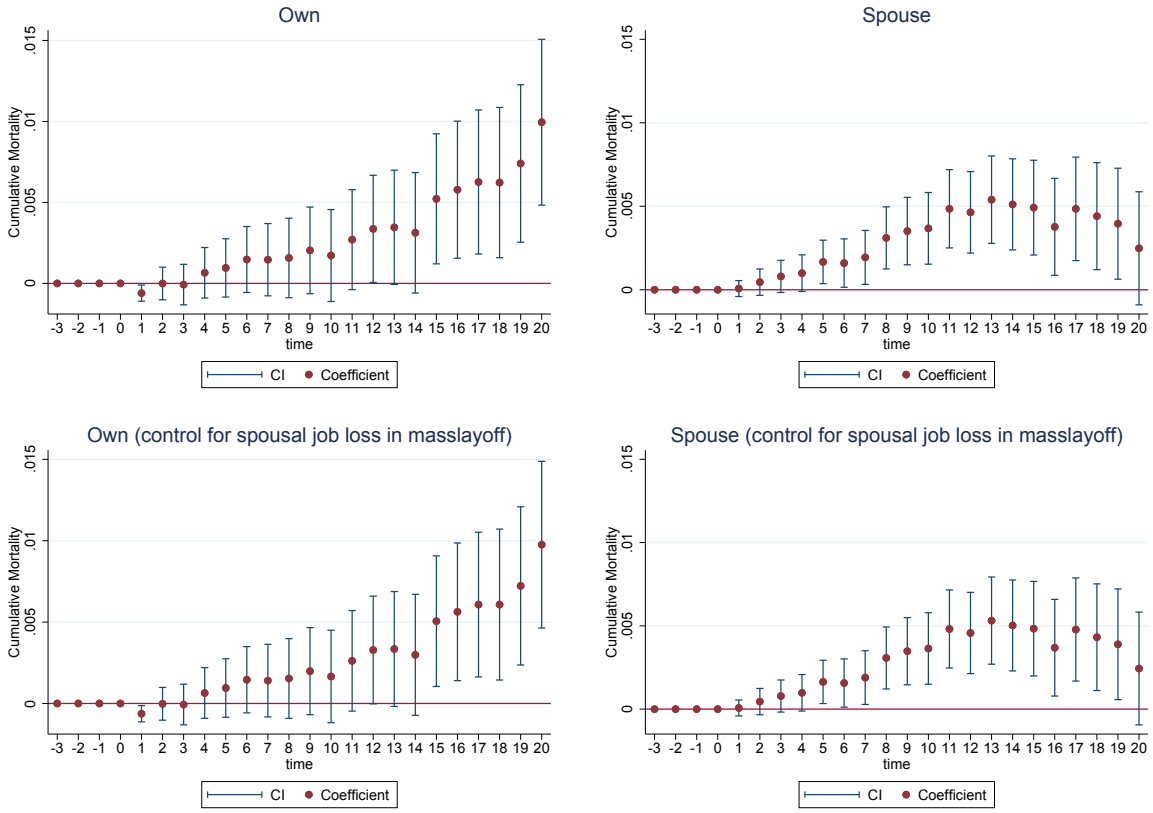
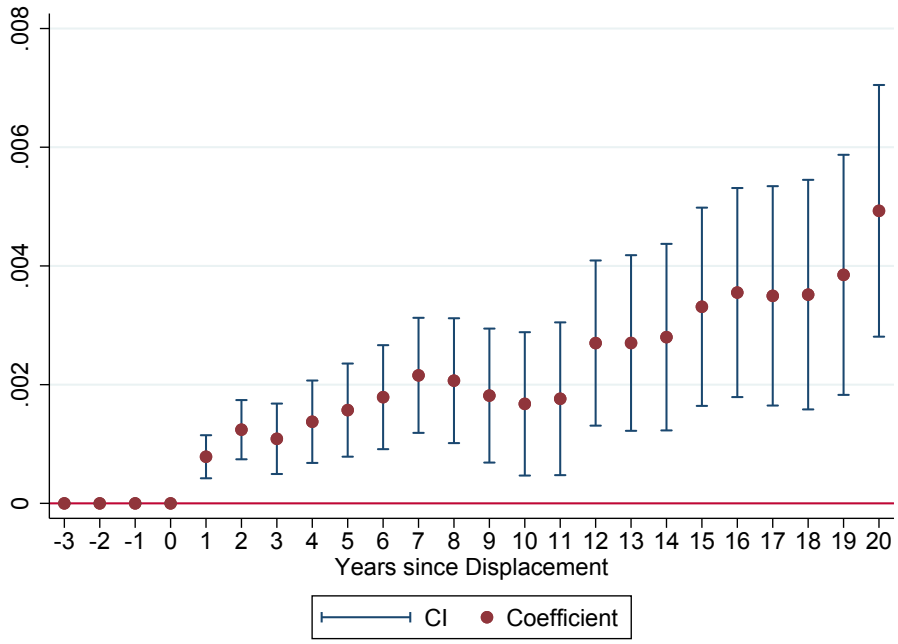
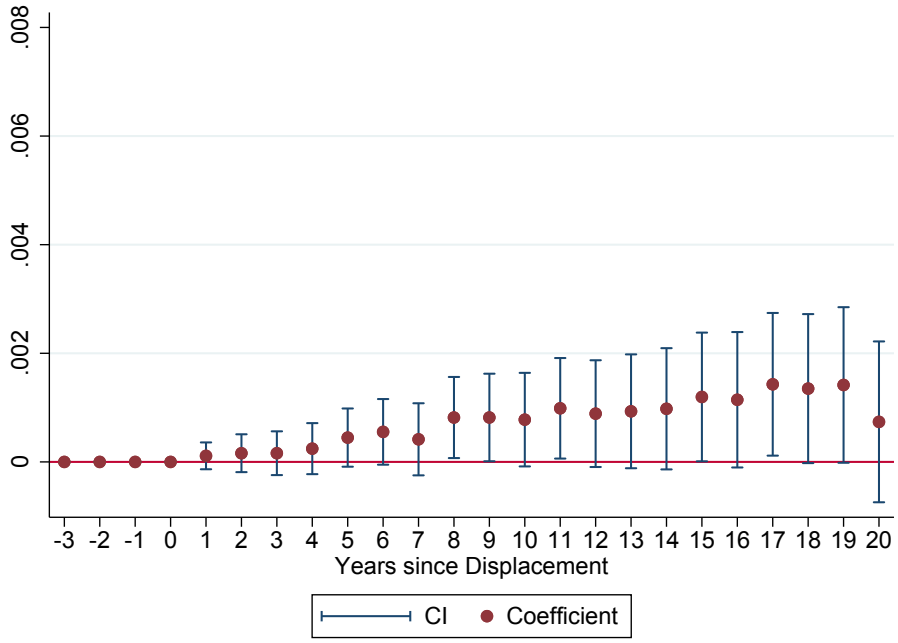


Figure A1: Male Job Displacement and Mortality (Both Spouses Employed)

Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (2) estimating the effect of job displacement on the probability that a worker dies by the year denoted on the x-axis. The sample consists of couples where both man and women were employed in the base year (denoted as 0). The lower panels controls for whether a partner or spouse lost their job in a plant closure or mass layoff.



(a) Direct Effect of Male Job Displacement



(b) Spillover Effect of Male Job Displacement

Figure A2: Direct And Spousal Mortality after Male Displacement in Mass Layoff Sample

Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (2) estimating the effect of job displacement due to either plant closure or downsizing on the probability that a worker dies by the year denoted on the x-axis.

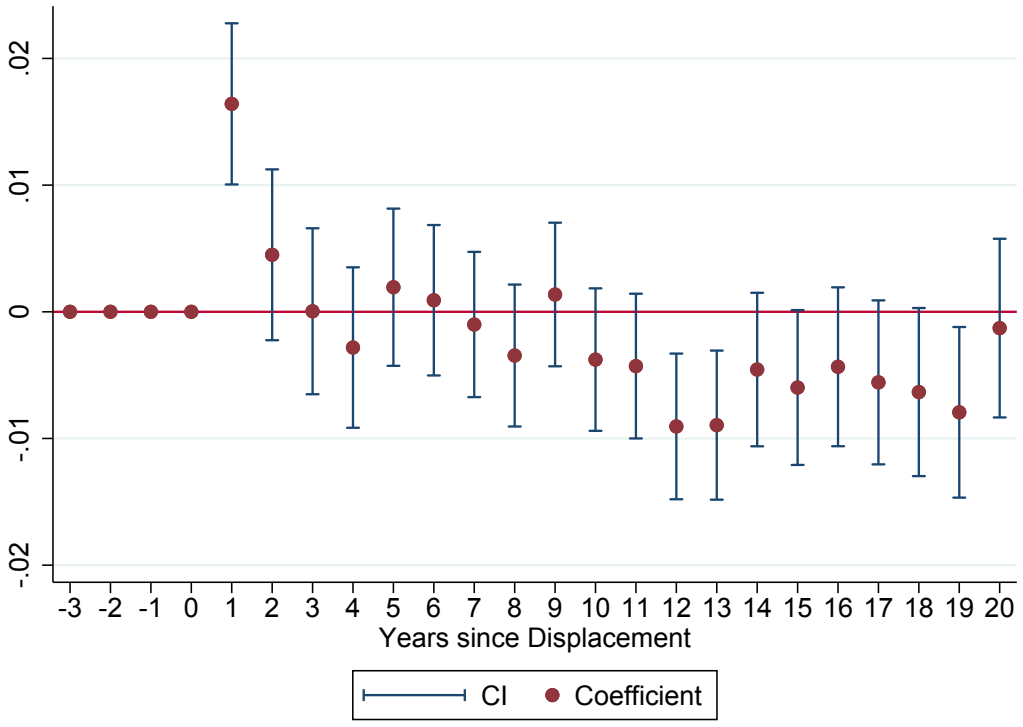
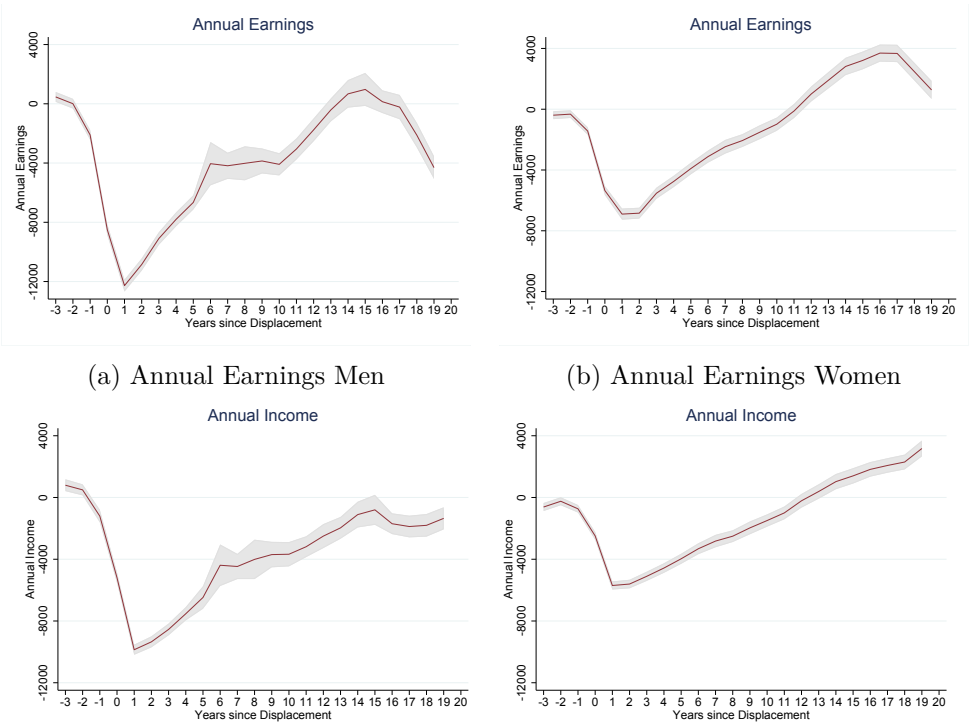


Figure A3: Spousal Job Separation after Male Displacement

Notes: The figure displays coefficients and confidence intervals from separate regressions of equation (2) estimating the effect of job displacement on the probability that a worker's spouse separates from his employer.



(a) Annual Earnings Men

(b) Annual Earnings Women

(c) Annual Income Men

(d) Annual Income Women

Figure A4: Employment and Earnings Effect after Male and Female Job Displacement (OLS)

Notes: The figure displays coefficients and confidence intervals from an OLS regression (without worker fixed effects) estimating the effect of job displacement on worker's earnings and employment in the years before and after job displacement.

2 Supporting Tables

Table A1: Direct Effect of Female Job Displacement on Hospitalization

	Accidents	Alcohol	Cancer	Heart	Mental Illness	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
	5-Year Hospitalization					
Job Displacement	-0.00250	0.00034	0.00135	-0.00162	-0.00067	-0.00031
	[0.00172]	[0.00062]	[0.00137]	[0.00223]	[0.00115]	[0.00049]
Observations	349,455	349,455	349,455	349,455	349,455	349,455
Mean of Dependent Variable	0.023	0.002	0.011	0.041	0.010	0.002
R^2	0.004	0.003	0.008	0.013	0.003	0.002
	20-Year Hospitalization					
Job Displacement	-0.00213	-0.00014	0.00065	0.00337	0.00269	0.00054
	[0.00404]	[0.00136]	[0.00315]	[0.00401]	[0.00238]	[0.00110]
Observations	349,455	349,455	349,455	349,455	349,455	349,455
Mean of Dependent Variable	0.128	0.013	0.071	0.130	0.038	0.008
R^2	0.010	0.005	0.023	0.028	0.006	0.004

Notes: The table reports the effect of female job displacement in t on hospitalization by $t+5$ (top panel) and $t+20$ (bottom panel) where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of being hospitalized by year $t+5$ or $t+20$ due to a specific cause. All specifications include pre-job loss characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include the following characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * p < 0.10, ** p < 0.05, *** p < 0.001.

Table A2: Spillover Effect of Female Job Displacement on Hospitalization

	5-year Hospitalization					
	Accidents	Alcohol	Cancer	Heart	Mental Illness	Suicide
	(1)	(2)	(3)	(4)	(5)	(6)
Job Displacement	-0.00156	-0.00012	-0.00162*	0.00253	0.00311*	0.00114
	[0.00248]	[0.00137]	[0.00093]	[0.00237]	[0.00180]	[0.00074]
Observations	349,455	349,455	349,455	349,455	349,455	349,455
Mean of Dependent Variable	0.045	0.013	0.008	0.039	0.019	0.002
R^2	0.005	0.011	0.008	0.026	0.010	0.003
	20-year Hospitalization					
Job Displacement	-0.00630	0.00280	0.00264	0.00160	0.00434	0.00137
	[0.00480]	[0.00267]	[0.00291]	[0.00444]	[0.00303]	[0.00119]
Observations	349,455	349,455	349,455	349,455	349,455	349,455
Mean of Dependent Variable	0.196	0.047	0.062	0.171	0.062	0.008
R^2	0.007	0.017	0.044	0.067	0.015	0.005

Notes: The table reports the effect of female job displacement in t on the hospitalization of the spouse by $t+5$ (top panel) and $t+20$ (bottom panel) where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. The dependent variable is the probability of the spouse being hospitalized by year $t+5$ or $t+20$ due to a specific cause. All specifications include pre-job loss characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include the following characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

Table A3: Cumulative Earnings and Income Losses of the Displaced and Their Spouse

	Male Job Loss				Female Job Loss			
	Earnings		Spousal Earnings		Earnings		Spousal Earnings	
	5-year	20-year	5-year	20-year	5-year	20-year	5-year	20-year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job Displacement	-29,956.9***	-75,051.6***	-344.7	2,164.5	-21,831.2***	-47,355.3***	-1,644.5	931.1
	[753.7]	[4,928.7]	[438.3]	[2,170.0]	[640.4]	[3,039.2]	[1,077.1]	[6,951.4]
Observations	475,823	475,823	475,823	475,823	349,536	349,536	349,536	349,536
Mean of Dependent Variable	176,940.9	759,542.1	80,936.0	371,103.2	111,849.2	486,455.4	126,172.4	511,527.3
R^2	0.393	0.200	0.379	0.287	0.358	0.312	0.343	0.269

	Male Job Loss				Female Job Loss			
	Income		Spousal Income		Income		Spousal Income	
	5-year	20-year	5-year	20-year	5-year	20-year	5-year	20-year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job Displacement	-18,901.7***	-58,927.2***	576.9	4,357.9**	-11,739.1***	-35,533.2***	-1,492.4	-578.8
	[675.0]	[5,144.4]	[397.6]	[2,162.1]	[519.4]	[2896.9]	[1009.0]	[7070.2]
Observations	475,823	475,823	475,823	475,823	349,536	349,536	349,536	349,536
Mean of Dependent Variable	186,418.3	848,227.3	97,761.5	434,552.4	124,741.6	564,862.7	146,623.3	622,390.6
R^2	0.383	0.191	0.368	0.287	0.386	0.304	0.320	0.244

Notes: The table reports the effect of male (left) and female (right) job displacement in t on worker's and their spouse's cumulative earnings (top panel) and income (bottom panel) by $t+5$ and $t+20$ where the worker is displaced (in either t or $t-1$) from a plant that shuts down between year t and $t+1$. All specifications include pre-job loss characteristics: a quartic in age, annual earnings, labor market experience, level and field of education, whether the person is married or has children in the baseline. Other characteristics include controls for base plant size, 2-digit industry, region and base year dummies. We also include the following characteristics of the spouse: a quartic in age, the level and field of education and whether the spouse is employed. Standard errors are reported in square brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

Table A4: Monetary Losses and Spousal Labor Supply by Family Structure

	Male Earnings				Male Personal Income			
	5-year		20-year		5-year		20-year	
	Traditional	Non-Traditional	Traditional	Non-Traditional	Traditional	Non-Traditional	Traditional	Non-Traditional
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job Displacement	-32,755.1***	-28,944.7***	-95,725.3***	-66,292.0***	-22,381.3***	-17,637.4***	-76,372.9***	-51,723.9***
	[1,715.5]	[798.3]	[11,326.4]	[5,122.9]	[1,570.9]	[701.5]	[12,126.4]	[5,236.0]
Observations	133,327	342,496	133,327	342,496	133,327	342,496	133,327	342,496
Mean of Dependent Variable	215,108.3	162,083.1	968,838.1	678,067.2	223,964.8	171,802.2	1,063,207.9	764,539.5
R^2	0.396	0.344	0.214	0.164	0.396	0.327	0.217	0.148

	Spousal Employment				Spousal Earnings			
	5-year		20-year		5-year		20-year	
	Traditional	Non-Traditional	Traditional	Non-Traditional	Traditional	Non-Traditional	Traditional	Non-Traditional
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job Displacement	0.00097	-0.00052	0.00220	-0.00075	-920.9	-50.96	-2,377.2	4,200.4
	[0.00580]	[0.00338]	[0.00378]	[0.00224]	[885.1]	[564.3]	[3,941.4]	[2,692.3]
Observations	133,327	342,496	133,327	342,496	133,327	342,496	133,327	342,496
Mean of Dependent Variable	0.860	0.888	0.942	0.953	75,316.6	83,123.6	345,492.1	381,073.2
R^2	0.055	0.050	0.042	0.054	0.211	0.280	0.157	0.271

Notes: The top panel of the table reports the effect of male job displacement on male annual earnings and male personal income in $t+5$ and $t+20$ years for couples where the woman has a lower level of formal education than her husband or partner (traditional family structure); and couples where the woman has a higher or equal level of education than her husband or partner (non-traditional family structure). The bottom panel of the table reports the effect of male job displacement on spousal earnings and spousal employment in $t+5$ and $t+20$ years for non-traditional and traditional couples respectively. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Monetary Losses and Spousal Labor Supply for Couples with and without Children

	Male Earnings				Male Personal Income			
	5-year		20-year		5-year		20-year	
	Children	No Children	Children	No Children	Children	No Children	Children	No Children
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job Displacement	-31,163.4***	-27,258.6***	-83,675.9***	-54,602.8***	-19,724.7***	-17,206.8***	-66,512.2***	-41,520.9***
	[924.2]	[1,269.7]	[6,034.3]	[8,649.4]	[831.3]	[1,124.5]	[6,217.8]	[9,395.4]
Observations	337,477	138,346	337,477	138,346	337,477	138,346	337,477	138,346
Mean of Dependent Variable	183,498.4	160,944.8	791,719.9	681,048.6	192,996.1	170,372.7	878,456.3	774,487.5
R^2	0.402	0.349	0.178	0.335	0.387	0.352	0.173	0.311

	Spousal Employment				Spousal Earnings			
	5-year		20-year		5-year		20-year	
	Children	No Children	Children	No Children	Children	No Children	Children	No Children
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Job Displacement	0.00159	-0.00247	0.00087	-0.00206	-32.41	-642.7	3,050.4	632.7
	[0.00343]	[0.00560]	[0.00216]	[0.00407]	[569.0]	[870.1]	[2,689.0]	[3,990.4]
Observations	337,477	138,346	337,477	138,346	337,477	138,346	337,477	138,346
Mean of Dependent Variable	0.884	0.871	0.957	0.932	82,078.8	78,148.5	384,948.4	337,329.8
R^2	0.050	0.058	0.023	0.090	0.270	0.232	0.239	0.246

Notes: The top panel of the table reports the effect of male job displacement on male annual earnings and male personal income in $t+5$ and $t+20$ years for individuals with and without dependent children under age 18 in the household. The bottom panel of the table reports the effect of male job displacement on spousal earnings and spousal employment in $t+5$ and $t+20$ years for individuals with and without dependent children under age 18 in the household. * p $<$ 0.10, ** p $<$ 0.05, *** p $<$ 0.01.

Table A6: ICD-10 and ICD-9 codes for disease groups

	Death certificate	Hospitalization (patient records)	
Disease group	Statistics Finland Classification (corresponding ICD-10 codes)	ICD-10 (1996-2013)	ICD-9 (1988-1995)
Accidents	V01-X44, X46-Y89	V01-X44, X46-Y89	E800-E840, E860-E990, 850
Alcohol	F10, G312, G4051, G621, G721, I426, K292, K70, K852, K860, 0354, P043, Q860, X45	F10, G312, G4051, G621, G721,I426, K292, K70, K852, K860, X45	291, 303, 3050, 3575, 4255, 5353, 5713, 5770D-F, 5771C-D 7607A, 7795A, E851
Cancer	C00-D48	C00-C97	140-208
Heart	I00-I425, I427-I99	I00-I59, I70-I99	390-429, 440-459
Mental illness	-	F00-F99	290-319
Suicide	X60-X84, Y870	X60-X84	E950-E959