

Parental job loss and child human capital in the short and long run ¹

by

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Abstract

Past evidence has shown that displaced workers have lower future earnings, are more likely to experience periods of unemployment, have poor health and higher risk of divorce. We show that there are negative consequences also for the children in the families experiencing job-loss. Using propensity score techniques to establish causal effects we find that parental job loss due to workplaces closing down leads to an increased mortality risk among children with displaced mothers, likely caused by higher risk of death due to self-harm and accidents. While there is no evidence of increased risk for hospitalization there are negative consequences on compulsory school grades at age 16 and also a somewhat higher risk of living on social assistance at age 20–23. In examining parental income and health outcomes, we find that job displacement leads to lower future earnings and lower household income, especially when the father is displaced. We find less severe health effects on displaced fathers compared to previous studies, but for displaced mothers, we find indications of worse mental health.

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1 Introduction

In a globalized, competitive world, startups and plant closures are an integral part of the process of growth and restructuring of the economy, generating overall gains accruing to some and losses for others as their jobs disappear (Autor, 2015). Experiencing a job loss has been shown to have negative long run consequences for affected workers' future employment, earnings, as well as their health and marriage stability, and it is clear that some individuals are on the losing end in this restructuring process.³ Parental job loss and unemployment is an experience shared by many children.⁴ Given that financial resources as well as the quantity and quality of parental care are important inputs in shaping the human capital of children, some of the burden of this restructuring process is likely to be transmitted also to the children of affected workers. The purpose of this paper is to examine how much and in what way. Developing a better understanding of how negative labor market shocks are transmitted is necessary if we are to develop policies that adequately support the human capital development of children in the families with weak labor market attachment.

A growing literature suggests that the negative consequences for workers may indeed spill over and have causal detrimental effects on the workers' children.⁵ In the US and Canada, children from a disadvantaged background whose fathers experienced job loss and unemployment have lower earnings and higher unemployment as young adults (Oreopoulos et al., 2008; Page et al., 2007, Hilger, 2016). Job loss of fathers is also found to have immediate negative effects on children's' educational outcomes in the US and Norway (Coelli, 2010; Stevens and Schaller, 2010; Rege et al., 2011), on birth weight of children and of height and weight for age ratios in the US and China (Lindo, 2011; Hong Liu and Zhong Zhao, 2014) and short run effects on survey measures of health in the US (Schaller and Zerpa, 2015). Studies of maternal job loss are less frequent, but often show effects in a different direction (Schaller and Zerpa, 2015, Rege

³ See for example, Jacobsen et al. 1993; Stevens 1997; Eliason and Storrie, 2009; Sullivan and von Wachter, 2009; Eliason, 2011.

⁴ Hilger (2015) reports that 15–20 percent of U.S non-farm private sector jobs ended in a lay-off or a discharge in 2001–15. Mörk et al. (2014) show that as much as a third of all Swedish children age 3–18 experienced parental unemployment at some point over the period 1992–2007. Actual plant closures are rare; Eliason (2011) shows that 1–2 percent of Swedish workers lost their jobs due to plant closures in any given year during the 1990s.

⁵ These studies differ in what type of job loss they study. Some study all types of involuntary job losses, whereas others focus on job loss due to (self-reported) business failures, or use matched employer-employee data to define if workplace closes down.

et al., 2011), suggesting that the mechanisms through which children are affected may run through both financial resources and parental time use.

The aim of this paper is to study the short and long run consequences of mothers' and fathers' job loss on both children and their parents in order to provide a better understanding of the mechanisms through which child human capital development is affected by job loss. Making use of population wide register data on mortality, hospitalization, educational and labor market performance we are able to study several dimensions of child human capital both prior to, during, and up to 14 years after the job-loss. Similarly, we are able to study effects on health, earnings and unemployment of the parents as well as household disposable income and family stability. We are hence able to present a more complete picture of what happens in the family and assess the consequences of parental job loss for the human capital accumulation of children.

The richness of the register data allows us to overcome some important challenges in estimating a causal relationship between parental exposure to job loss and child outcomes. First, we do not need to rely on self reports on reasons for job loss, but can instead use workplace closures as defined in firm registers. Second, we are able to handle the challenge of omitted variable bias which is likely to arise if workplace closures and parents' job loss are not random but correlated with factors that also affect child outcomes, such as parents' health or productivity. Following earlier Nordic studies analyzing effects of plant closures (see, e.g., Browning et al., 2006; Eliason and Storrie, 2009) we address this problem using a propensity score matching strategy to account for non-random matching of workers to workplaces by conditioning on a wide set of conditioning variables, including previous health outcomes.⁶

This study contributes to the literature on workplace closures and job loss in several ways: First, when measuring effects on child health, we have access to register data over outcomes which have not been studied in the context of parental job loss: i.e. mortality and hospitalization. An important strength is that these measures are in some sense objective and unlikely to suffer from self serving biases present if parents are to report the health conditions of their children. However, it needs to be kept in mind that these measures only capture severe health effects. Second, due to the long panel, we are able to study educational and early adult outcomes, such as high school completion,

⁶ More recently, Hilger (2016) shows that failing to account for this type of sorting may lead to an overestimation of the negative consequences of job loss also in a US context.

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dependence on social assistance and labor market outcomes in young adulthood. Hence, we are able to provide a better understanding of the intergenerational consequences of job loss as well as of the consequences of being at the losing end in the ongoing process of globalization and restructuring of the economy. Third, we also study the impact on the parents' health and labor market outcomes and on family disposable income and stability which will help us understand the pathways through which children are affected. Providing estimates for consequences of both maternal and paternal job loss further contributes to a recent discussion of mechanisms running through reductions in family income and financial stress or through reallocation of parental time use (Schaller and Zerpa, 2015, Page, Schaller and Simon, 2016, Lindo, Schaller and Hansen 2013). A fourth important contribution of this paper is to add evidence from a Scandinavian context where the financial consequences of job loss are likely to be less severe due to a generous unemployment insurance and free health care and education. On the other hand, the strong dual earner norm together with individual taxation and high marginal tax rates, may put a larger stress on displaced mothers to find new employment.

Our overall results suggest negative consequences of parents' job loss on child human capital and health. However, in contrast to the findings in previous papers, the negative effects of job loss are present, in particular, when mothers lose their jobs.⁷ Most startlingly we find higher mortality risk for children with displaced parents. Although deaths in childhood are very rare, children with displaced parents are more likely to die from self-harm or accidents, in particular if the mother is displaced. However, we find no effect on child health measured as admittance to hospital. In line with Rege et al. (2011) and Coelli (2010) we find evidence of adverse effects on school performance measured as grades in the final year of compulsory schooling at age 16 for those whose fathers lost their jobs in the pre- and early teen period. Unlike Rege et al., however, we find negative effects on GPA also for mothers' job-loss. Among children with a displaced parent we also find an increased risk of 5 percent of receiving social assistance as young adults.

The parents themselves are affected by workplace closures in several ways. First, they are 50–75% more likely to be unemployed one year after the displacement. The effect diminishes over time but there is still substantial increased risk of unemployment

⁷ This is consistent the findings when studying the consequences of parental unemployment in Mörk et al (2014).

10–14 years after the job loss, i.e. a long lasting scarring effect. The magnitude of the effects is in line with what has been documented in other studies using data from Scandinavian countries, but smaller than the effects found in US studies. Job displacement of the father leads to a reduction of 7 percent in household disposable income two years after the plant closure. The effect persists and implies a 6 percent reduction after 13 years, which can be compared to a 9.4 percent decline in family income found for the US (Hilger, 2015). Maternal job loss, however, does not significantly reduce household disposable income although maternal earnings and unemployment are affected to the same extent as fathers. In contrast to previous Swedish studies of job loss, we find negative effects on women's health but no strong effects on men's health from being displaced. There are no short run effects on hospitalizations, but mothers' hospitalizations due to poor mental health increase 10-15 years after displacement.

The combined pattern of child and parental effects suggests that a possible pathway through which Swedish children are affected by parental job loss is the psychological stress that mothers suffer when losing a job. This appears more important for child outcomes than the financial stress caused by reduced household income as fathers lose their jobs. First, the relative resilience to paternal job loss, suggests that loss of financial resources is not directly hurting child human capital in the same way as in the US context. Second, negative, rather than positive, effects on children of maternal job loss, suggests that adjustment mechanisms in Swedish families in terms of time use and parenting, may differ from the adjustment mechanisms in the US.

The rest of the paper is organized in the following way: First we discuss channels through which parental job loss may affect child well-being and human capital accumulation and review the literature on job loss and child outcomes. Second, we give a short description of the Swedish institutional setting. Thereafter we present the data and empirical strategy before turning to the results in section 5. Finally, we summarize and discuss our findings.

2 Parental job loss and child human capital: theory and previous findings

In this paper we are interested in how parental exposure to job loss affects child human capital, and health in particular. A simple production function for child human capital may help us in understanding the potential mechanisms at work.⁸ The main elements of this production function are family consumption of market goods and services and parenting and parental care which can all be seen as investments in child human capital. Parental care, or the quality of parental care, is in turn a function of parental time and parental human capital. Further elements are publicly provided goods and care, such as schooling and preventive health care programs and other forms of publicly provided human capital investments in school or otherwise, the child's previous human capital which is a function on both previous health condition, genetic disposition and other cognitive and non-cognitive skills that may influence human health and education outcomes. There is of course also an element of luck, or bad luck in the case of bad health shocks:

$$\begin{aligned} & \textit{child human capital}_t \\ & = H(\textit{market goods}_t, \textit{parenting and care}_t, \textit{publicly provided goods}_t, \\ & \quad \textit{publicly provided education and care}_t, \textit{child human capital}_{t-1}, \\ & \quad \textit{human captial shock}_t) \end{aligned}$$

When a parent loses his/her job, it affects the inputs in the production function in a number of ways. The first and perhaps most immediate effect is lost earnings which in turn is likely to directly affect the families' consumption of market goods and services. Eliason and Storrie (2006) follow Swedish workers of closed plants over a 12-year period after the job displacement and find lasting negative effects on earnings (8– 9 percent) and unemployment (3 percentage points). Also, they find that even if earnings recover a couple of years after the job displacement, workers who have experiences job loss are more likely to be hurt in the next recession. Also for Norway, Bratberg et al. (2008) find evidence of increased unemployment and decreased earnings several years after job displacement. Similar evidence is found in studies analyzing the U.S. and

⁸ Inspiration for the proposed production function comes from Gronau (1974) and Rosenzweig and Schultz (1983).

Canada, see, e.g., Jacobsen et al. (1993) and Stevens (1997), as well as Sullivan and von Wachter (2009), but the adverse effects on worker employment and earnings are generally of larger magnitude. However, in a recent paper Hilger (2016) finds magnitudes more in line with the Scandinavian evidence, when accounting for sorting of workers to firms. Moreover, the unemployment insurance and other income support programs may be more extensive in Sweden compared to U.S and Canada which may offset some of the adverse effects on the household's disposable income.

The second channel through which job loss might affect child human capital development is through the quantity and quality of parental care and parenting. On the one hand, a parent who loses his/her job may initially have more time to spend with the child. On the other hand, stress and poor health caused by job loss, financial strain and unemployment may however impact negatively on home environment and parenting and reduce the quality of the time spent with children.

Job loss may be beneficial for child development if the parent has more time to help out with homework, engage in preventive health care etc. Evidence that the effect of maternal job-loss is less detrimental for educational outcomes and even positive for some health outcomes has been given the interpretation that increased maternal time may compensate for possible negative effects of the foregone earnings (Page, Schaller, Simon, 2016, Stevens and Schaller, 2010; and Rege et al., 2011).⁹ Mörk et al. (2014) instead find that maternal unemployment seems to have more adverse consequences than paternal unemployment, which is instead consistent with the interpretation that either Swedish mothers do not reallocate time towards children, or that the quality of this increased time deteriorates due to poorer parental health and stress.

There is a large literature arguing that financial distress caused by lost earnings and labor market attachment may also cause stress and poor health, with negative consequences for the family (Conger and Conger, 2007). There is indeed evidence that workplace closures hurt displaced workers' health in ways that could affect their ability to parent and care for their children. For example, using Swedish data, Eliason and Storrie (2009) find an increase in hospitalization due to alcohol-related conditions for both men and women and an increase in hospitalization due to traffic accidents and self-

⁹ There is evidence that mothers are more likely than fathers to substitute time in the labor market for time spent with the children (see, e.g. Page, Schaller, Simon, 2016, Aguiar, Hurst, and Karabarbounis et al, 2013; Lindo, Schaller, Hansen, 2013).

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harm among men. The negative health effects for men are particularly strong for married men, suggesting that having a spouse does not seem to work as a protective device. Also Browning and Heinesen (2012) find that hospitalizations due to alcohol related diseases and mental disorder increase as a result of job loss due to plant closures.¹⁰ The evidence from other European countries is mixed. Whereas Kuhn et al. (2007) do find that job loss significantly increases expenditures for antidepressants and related drugs, as well as for hospitalizations due to mental health problems for men in Austria (although the effects are rather small), Schmitz (2011), analyzing German data, does not find any effects on health looking at both hospitalizations and health satisfaction.¹¹

In addition, job loss has also been shown to affect adult mortality. Eliason and Storrie (2009) find that male mortality the first four years after displacement was 44 % higher, especially external causes, alcohol-related and suicides. For women, the point estimates are similar but not statistically significant. Having a family does not seem to diminish the increased risk of dying for men; again the estimated effects are in fact larger for married men than for unmarried men. Eliason (2014) investigates this association closer. He finds an excess risk of both alcohol-related hospitalization and mortality for both men and women. However, whereas men to a larger extent suffer from poisoning, alcohol-induced liver diseases and pancreatitis, women's alcohol-related problems were limited to alcohol dependence. Browning and Heinesen (2012) find mortality to be 79 % higher in the base year, 35 % higher year 1–4, 17 % higher year 1–10, 11 % higher year 1–20. They especially find increased mortality due to circulatory diseases, external causes as well as in the first year for suicide, alcohol related diseases and mental illness. However, this finding is not supported by evidence from Finland; see Martikainen, Maki and Jäntti (2007). Note that the Finnish study uses a somewhat different empirical strategy and does not study different causes of death.¹²

In addition to adverse effects on family income and parental health, parental job displacement may adversely affect children by causing family dissolution. Both Eliason (2011) on Swedish data, and Huttunen and Kellokumpu (2016) on Finnish data find that

¹⁰ However, Eliason and Storrie do not find any increase in cardiovascular diseases (Swedish data), and Browning, Dano and Heinsen (2006) (Danish data) do not find any increase in hospitalization for diagnoses related to stress-related diseases for the circulatory system and diseases of the digestive system.

¹¹ There is also several studies on U.S. and Canadian data, see, e.g., Schaller and Stevens (2012) and Strully (2009).

¹² See also Sullivan and von Wachter (2009) for a study on Pennsylvania workers.

the risk of divorce increases when one of the parents loses his/her job. The evidence suggests that the risk is especially pronounced when it the husband who loses his job. However Eliason (2011) shows that for fathers with children there is no increased risk of divorce following job loss.

Hence, there are both theoretical arguments and empirical evidence that parental job loss may affect children's outcomes. There are a few studies that investigate the long run effects on children. Oreopoulos et al., (2008) investigate future earnings of Canadian boys that were 11-14 years old when their fathers involuntarily lost their job. They find that these boys' earnings as adults were reduced by 9 percent as a result of paternal job loss. The effects are concentrated in the bottom of income distribution. However, using Norwegian data, Bratberg et al. (2008) do not find any long run effects on children's earnings from paternal job loss due to plant closures. Given that the intergenerational correlations in earnings are stronger for the U.S. and Canada than for the Nordic countries (see, e.g., Black and Devereux, 2010) these contradictory results may not come as a surprise. However, in a recent study of US layoffs, Hilger (2015) presents evidence that some of the large negative effects on children's long term outcomes could in fact be due to failure in previous papers to account for the fact that plant closures do not hit a random selection of workers. When he addresses these methodological problems, the negative effects of paternal job loss on college attendance is limited to small adjustments in attendance (less than one percentage point decline), college quality and distance from home, and there are hardly any effects on earnings in early adulthood. The effects are accounted for by children from middle income families who are the children whose families are most likely to be credit constrained since they finance college out of pocket.

There are also a number of studies of short term consequences of parental job loss on child outcomes. Lindo (2011) finds that birth weight was 4–5 percent lower for children born to US women whose partner experienced job displacement during the pregnancy. Investigating urban China, Hong Liu and Zhong Zhao (2014) find that children whose fathers lost their jobs as a result of closure or downsizing of State owned enterprises experienced a reduction in by around 1/3 of a standard deviation in weight and height gain. Schaller and Zerpa (2015) use a child fixed effects approach and study involuntary job loss in the US. They find that parents report a higher incidence of mental health

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problems of children whose fathers lost their jobs, but that children are less likely to suffer acute infections if the mother loses her job. This contrasts with Mörk et al. (2014) where both paternal and maternal unemployment spells are associated with small increases in the risk of being hospitalized in child fixed effects estimations, and where effects are in fact stronger for mothers.

Coelli (2011) finds that the probability of post-secondary enrollment decreased by 0.105 for Canadian children in families where the main income earner was displaced when the children were 16–18 years old. Stevens and Schaller (2011) follow children that were 5–19 years of age when their fathers lost their job involuntarily. They find that paternal job loss increases probability of grade retention by 0.8 percentage points (15%). The only similar evidence from the Nordic countries, is, as far as we are aware of, Rege et al. (2011) who analyze grade point average among tenth graders whose parents were affected by plant closure. They find negative effect of paternal job loss (6 percent of a standard deviation) and an insignificant, but positive effect of maternal job loss. Their attempt to investigate the mechanisms behind their results is less successful; the drop in school results cannot be explained by drops in fathers' income or employment, decreases in maternal labor supply, family separations or residential locations.

3 The Swedish setting

The way in which financial and psychological strain caused by parental job loss is passed on to children is likely to depend on the institutional factors such as presence of unemployment insurance, active labor market programs, childcare arrangements as well as the organization of schools and health care. This section will therefore present some institutional details about the Swedish system that are likely to influence how children are affected by parental job loss.

First of all, it is worth noting that the dual income earner norm is strong in Sweden. Individual taxation, high marginal tax rates and labor income related benefits for sick leave, parental leave and pensions provide strong economic incentives for both spouses to contribute to family income. Labor force participation is high both among men and women, including parents. Lundin et al. (2008) show that even among mothers with the youngest child aged 0–6; 75–80 percent are employed. Yet, far from all mothers work

full time. Although there is strong emphasis on gender equality, Swedish women carry a greater responsibility for parenting and households work. According to the Swedish time use survey in 1990, mothers of small children in two parent households did over seven hours of household work per day while fathers did less than four hours. Out of this time, mothers spent 2h 45m caring for and parenting children and fathers 1h 10m. Since then, 20 minutes of parenting time have shifted from mothers to fathers.¹³

In order to enable such high labor force participation, subsidized, high quality, child care is provided by the local governments. In the middle of the 1990's, the time when the job losses that we study in this paper took place, approximately 50 percent of 1–2 year olds and 70 % of 3–6 year olds attended publicly provided child care (Lundin et al., 2008). However, childcare and after school care slots were in a majority of municipalities reserved for children whose parents were working, and it was up to the municipality to determine whether children were allowed to keep their child care slot if parents became unemployed.¹⁴ Losing access to high quality childcare was thus also a likely consequence of parental job loss in the Swedish mid-1990's.

Health care in Sweden is free of charge for children and heavily subsidized for adults. Therefore, lack of financial resources ought not affect whether you can afford going to the doctor or staying at the hospital. Moreover, unemployed workers are typically covered by unemployment insurance benefits. During the studied period, the replacement rate was 80 percent of lost earnings up to a ceiling. These quite generous replacement rates are combined with an active labor market policy, requiring recipients of unemployment benefits to take part in labor market programs. Unemployed individuals with very unemployment benefits or individuals who are not entitled to unemployment benefits, either because of too little previous labor market experience or having opted out of the unemployment insurance have to turn to the municipalities and apply for social assistance if they need financial support. Social assistance is means tested at the household level and in order to receive assistance, the household cannot

¹³ The most recent survey for 2010 shows a change towards more gender equality in household and parenting. Mothers have reduced their total household work to 5h37m and fathers increased theirs to 4h20m. Time spent caring for and parenting children is now 2,26 per day for mothers and 1h31 for fathers. SCB (2012). Gurian et al (2008) report that US mothers of young children in 2004 spent on average 21 h per week on child related activities, while fathers spent 9h40m.

¹⁴ See Vikman (2010) for a description of access to childcare in the end of the 1990's. Vikman shows that granting access to child care for the children of the unemployed improved unemployed mothers' chances of finding employment.

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have any other means of supporting themselves. In addition, the municipalities typically require recipients to take part in activation programs in order to receive assistance.

There are reasons to believe that the presence of generous unemployment insurance and free access to health care and education limit the financial stress Swedish families are likely to suffer if a parent loses a job. However, a strong dual worker norm may imply that both mothers and fathers are likely to experience the stress imposed on parents who lose their roles as providers and identity as workers. In addition, since unemployment insurance and social assistance are conditional on actively seeking employment or participation in other activation programs, the scope for reallocating time toward household work or parenting may be limited. Because mothers still take greater responsibility for household work and children, the stress of losing a job may thus fall heavier on women, in particular if the children lose the right to childcare.

4 Data and empirical strategy

Our empirical analysis relies on a data base which combines individual level register data from the in-patient- and causes of death registers provided by the NHS, the population register, education register, tax registers and workplace register provided by Statistics Sweden, and the unemployment registers provided by the Public Employment Services. The variables in the data include: individual demographic information (sex, age, family indicator, children); socio-economic information (education level, earnings from work, total income and income from social assistance); health (information from the in-patient register including diagnoses codes, mortality) and workplace information (firm size, industry, county). The data base includes information on individuals aged 0–18 during the years 1987–2010 as well as information on their (biological) parents.

Important for our purpose is that the data base also contains information which makes it possible to match employer and employees. We can hence observe whether the workplaces that parents work at are later closed down. In the registers a workplace may disappear for several reasons. It could be because the workplace is closed down, but also because the firm merges with another firm, is split up or changes identification number for tax or administrative reasons. In order to follow firms and workplaces, Statistics Sweden has constructed a data base on firm dynamics by following the

employees called ‘The database on dynamics of enterprises and establishments’. This data base will be used when identifying closing work places.

4.1 Structure of sample

The study sample consists of children with parents who were employed at workplaces at risk of closing down in 1995–96. We chose these years to allow a long follow up period both regarding effects on children and parents, while also allowing us to study pre closure outcomes. We define t as the base year when a workplace is potentially closed down. The children included in the samples are at least two years and at most 18 years old when the parents potentially experience a workplace closure. We restrict our sample to children whose parents worked at a workplace with at least ten employees in both period $t-2$ and $t-3$. We do not condition on working at the workplace at $t-1$, the year directly before the potential close down. The reason is that we want to keep the children whose parents are potential ‘early leavers’ in the sample. These are potentially a selected group; early leavers may on the one hand be workers with many options on the labor market who are therefore able to find other employment in anticipation of the closing down of the workplace. On the other hand, these workers may have unobserved characteristics making them the first to be let go if the firm down sized prior to closing down.

A workplace is defined as closing in year t if it is categorized as closed down between year t and $t+1$.¹⁵ Children whose parents worked at workplaces that are closed down in our base years 1995 and 1996 are considered as treated. This leaves us with 20,618 children with displaced mothers and 26,982 children with displaced fathers, corresponding to 1.54 percent in the mother-sample and 1.74 percent in the father-sample. For the children whose parents’ workplace is not closed down, we draw a random sample of 25 percent of the population that will make up the base from which we draw our comparison sample. The children and their parents are followed three years before the possible job displacement and up to 14 years after.

¹⁵ More specifically, workplaces are categorized as closed down if i) the number of common workers in year 1 and 2/number of employees year 2 < 0.5 and ii) the number of common worker in year 1 and 2/number of employees year 1 < 0.5.

4.2 Outcome variables

Our objective is to study how job displacement due to workplaces closure affects human capital development, and more specifically, child health and school outcomes. In order to capture health, we will rely on two different measures. First, we study to what extent children of displaced parents die prematurely (*mortality*). Death is arguable an extreme measure of health, but nevertheless a very objective one. Fortunately, very few young people die, which also makes it less likely that we will be able to capture negative health effects. Therefore, we also turn to the in-patient register provided by the Swedish NHS and study hospitalizations. First, we investigate whether a child has been in in-patient care for *any* diagnose during the year (*sick*).¹⁶ Second, we focus on particular health problems which could be a result of parental neglect or a stressful family environment. We here investigate two aggregate measures. The first measure we focus on is diagnoses related to conditions where hospitalization is avoidable if a child is given sufficient preventable care (*avoidable*).¹⁷ Second, we investigate whether the child has been hospitalized with a diagnose related to mental health problems, self-destructive or self-injurious behavior or abuse (*misery*). See Table A.1 for a detailed description of the diagnoses including ICD-codes used to construct the health measures.

A concern is whether our hospitalization measures really capture poor health, or whether they rather capture demand and availability of health care. Health care is universal and free of charge in Sweden. Earlier studies (see, e.g., Mörk et al., 2014) have shown that these measures are strongly negatively correlated with family income. Hence, it is not the case that children with wealthy parents in general consume more health care, yet there is evidence that unemployed adults are less likely to seek care for specific conditions (Burström, 2002; Åhs and Westerling, 2006). We may thus be concerned that the hospitalization measures capture the combined effect of poor health

¹⁶ When measuring health, we do not, so far, condition on the individual remaining in the country. Hence, we run the risk of denoting an individual as healthy although he or she might be hospitalized in another country than Sweden.

¹⁷ Avoidable conditions, sometimes referred to as ambulatory care-sensitive conditions, are conditions which should not be cause for hospitalization if properly cared for at an early stage. It can be divided into three categories: conditions that can be prevented through vaccination; selected chronic conditions that can be managed by pharmaceuticals, patient education and lifestyle; acute conditions for which hospitalization are commonly avoidable with antibiotics or other medical intervention. The frequency of avoidable conditions has been used as a measure of quality of primary care as well as in research. Billings et al. (1993) for example study the association between socioeconomic status and hospitalization rates due to avoidable conditions among communities in the US. We use the definition of avoidable conditions for children suggested by the Public Health Information Development Unit in Australia (Page et al., 2007).

and care seeking behavior. Moreover, these measures also capture the likelihood of being admitted, given a specific health condition. This may also vary with social status.

Next, we study educational outcomes for children of compulsory and high school leaving age. To measure performance in compulsory school we use the grade point rank in the national distribution in the final year (*GPA*). We also investigate whether the child has completed at least three years of high school at age 23 (*High school*). Finally, we look at outcomes as young adults, more specifically, whether they, at ages 20–23, experience any unemployment (*unemployed*) or live in a household which received social assistance (*SA*). An individual is defined as unemployed if he/she is registered as openly unemployed or participates in a labor market program at any occasion during the year.

In order to explore possible pathways and mechanisms, but also to verify if the effects of job displacement on our sample of parents compare to what other studies have found, we present estimates of how job displacement affects unemployment (*unemployed*), parental health (*mortality*, if in in-patient care (*sick*), for diagnoses connected to excess alcohol consumption (*alcohol*) or mental health problems (*mental*)) as well as family disposable income (*disposable income*), earnings from employment or self-employment (*earnings*), whether the family receives social assistance (*SA*) and whether the biological parents live together or if they live in separate households (*separated*). Parental health is measured with information from the patient register. Disposable income is calculated by Statistics Sweden and includes all types of income for all adults in the household.

Table 1 shows summary statistics for children and their parents in the two samples (those with mothers at a closing workplace and those with fathers at a closing workplace). The children in the father-sample are somewhat older and to a larger extent hospitalized than the children in the mother-sample. Displaced fathers have higher pre-closure earnings and are to a less extent hospitalized than displaced mothers.

Table 1 Summary statistics

	Mothers at closing workplace		Fathers at closing workplace	
	Mean	St dev	Mean	St dev
			Children	
Share boys	0.50	0.50	0.48	0.50
Age	8.35	4.76	7.49	4.90

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Hospitalization	52.93	223.9	57.12	232.1
”Avoidable”	8.31	90.79	10.21	100.55
“Misery”	2.09	45.67	1.67	40.85

			Parents	
Age	37.17	6.46	38.78	6.93
Less than 10 years of education	0.16	0.37	0.21	0.41
Years of education 10–12	0.53	0.50	0.46	0.50
More than 12 years of education	0.31	0.46	0.33	0.47
Swedish born	0.88	0.32	0.89	0.31
Years in Sweden	19.31	9.01	18.61	9.95
Separated	0.21	0.41	0.16	0.37
Tenure	4.53	2.14	4.90	2.20
Share unemployed	0.081	0.27	0.093	0.29
Earnings	168,234	76,888	285,290	151,586
Household disposable income	361,577	228,177	372,173	236,872
Share receiving social assistance	0.052	0.223	0.043	0.202
Hospitalization	145.6	352.7	47.81	213.4
Alcohol-related problems	1.46	38.12	2.18	46.71
Mental health problems	3.40	58.17	2.66	51.59

No of obs.	20,618	26,982
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Notes: All variables measured in $t-2$. Hospitalization, “avoidable”, “misery”, mental health problems, alcohol-related problems are measured in persons per 1,000. Tenure is censored at 8 years, Years in Sweden only for those both outside Sweden, Unemployment is measured as being registered at the PES as openly unemployed or in an ALMP

4.3 Empirical strategy

In this paper we study the effect of parents’ job separation due to workplace closure on child health and family outcomes. By focusing only on job separations due to plant closure we reduce the selection problem i.e. that the job separation is due to worker characteristics which also may be correlated with their children’s outcomes. The argument is that a plant closure is close to a natural experiment as all workers are separated from their job irrespective of personal characteristics. However, there may be important differences between workers (and their children) who work at workplaces that later close down and those whose workplaces survive. A possible reason for this difference is that plant closures are concentrated in certain regions or industries. If children of workers in these regions or industries have worse health, then the estimate of the effect of parental exposure to plant closure will be biased in a direction that exaggerates the impact of plant closures. Looking at the data, we note that there are indeed some important differences between parents that work at plants that do close down and those working at surviving plants. For example, the first group have shorter tenure, are more likely to be registered at the employment agency at some point in $t-2$,

work at smaller firms and are more likely to not live with the biological parent of the child. Displaced mothers are also somewhat younger and more likely to have been hospitalized.

In order to create a control group that is as similar as possible to the treatment group we will use propensity score matching (see, e.g., Rosenbaum and Rubin, 1983). The matching is conducted in two steps. First we estimate the probability that a parent's work place will closed down using a logit model conditioning on a set of pre-period characteristics and calculate individual propensity scores. Second, we match treated children to controls based on these scores. The effect of workplace closure is estimated by comparing mean outcomes of the treated and the control group. This estimated effect corresponds to the average treatment on the treated (ATT).

When estimating the propensity score it is important to include all covariates which are likely to affect both the probability to be exposed of a plant closure and the outcome variables. We choose the conditioning variables measured two years, for some variables three years, before the plant closure and include worker characteristics as well as characteristics of the plant. Since we have access to a panel of data we estimate the propensity score including the outcomes of interest before plant closure as covariates, such as different income measures, health of worker and child and whether the biological parents live together before the plant closure. We also include covariates describing the workers' partners and children since they may be correlated with relevant unobservable characteristics of the worker. All variables refer to two years before plant closure ($t-2$) except when explicitly stated otherwise. A detailed list of the variables and definitions can be found in Appendix Table A2.¹⁸

There are different matching methods available. Asymptotically all propensity score matching methods should give the same result but in smaller samples the matching method may matter. Different methods basically involve a trade-off between bias and efficiency; using more matches increases efficiency but at a cost of increasing the bias. Here we match on the nearest neighbors with replacement. We also show some results using five nearest neighbors as controls.

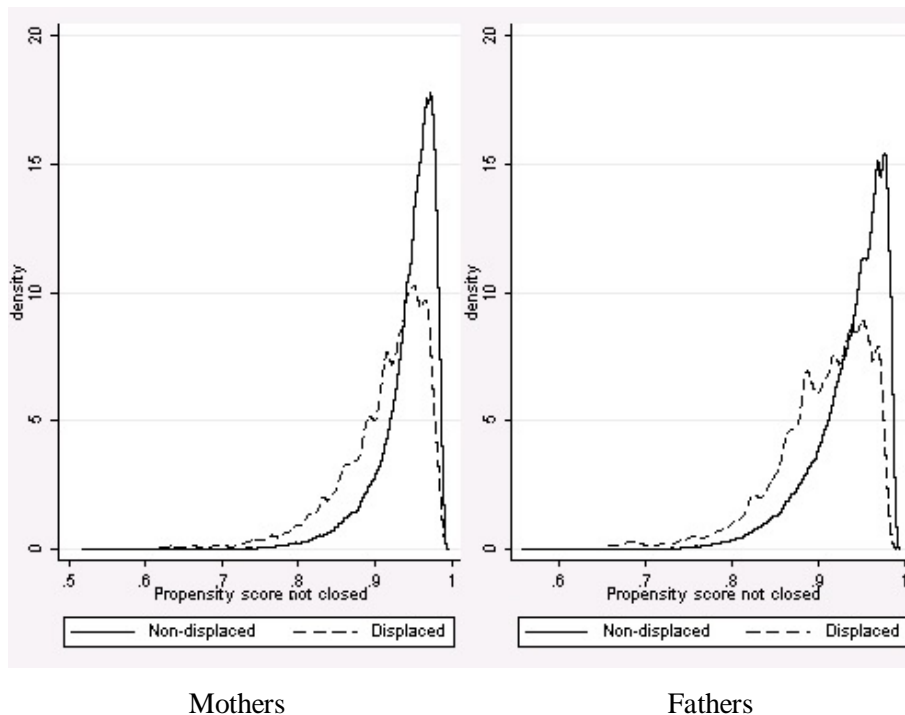
¹⁸ For some outcomes such as grades for a particular cohort the sample is very small and some covariates do not vary across the treated and untreated group and are therefore dropped. Thus, the covariates used to estimate the propensity score differs somewhat in estimations with small samples.

Important requirements for propensity score matching to produce unbiased estimates of the ATT are i) selection on observables, ii) common support, i.e. that for any values of the propensity score a unit can potentially be observed both as treated and not treated, iii) balancing of covariates in the control and treatment group. Whereas the first requirement is impossible to test, the second two are. Below we show evidence that the matching successfully produces a suitable control group in our two samples.

4.4 Evaluation of the matching

In order to test the common-support assumption, Figure 1 plots the distribution of propensity scores (the propensity of working in a workplace that will not be closed in t) for displaced and non-displaced mothers (left panel) and fathers (right panel) . The figure shows that there is considerable overlap across the two groups. The common support assumption is thus fulfilled for all displaced workers.¹⁹

Figure 1. Distribution of propensity score for displaced and non-displaced workers

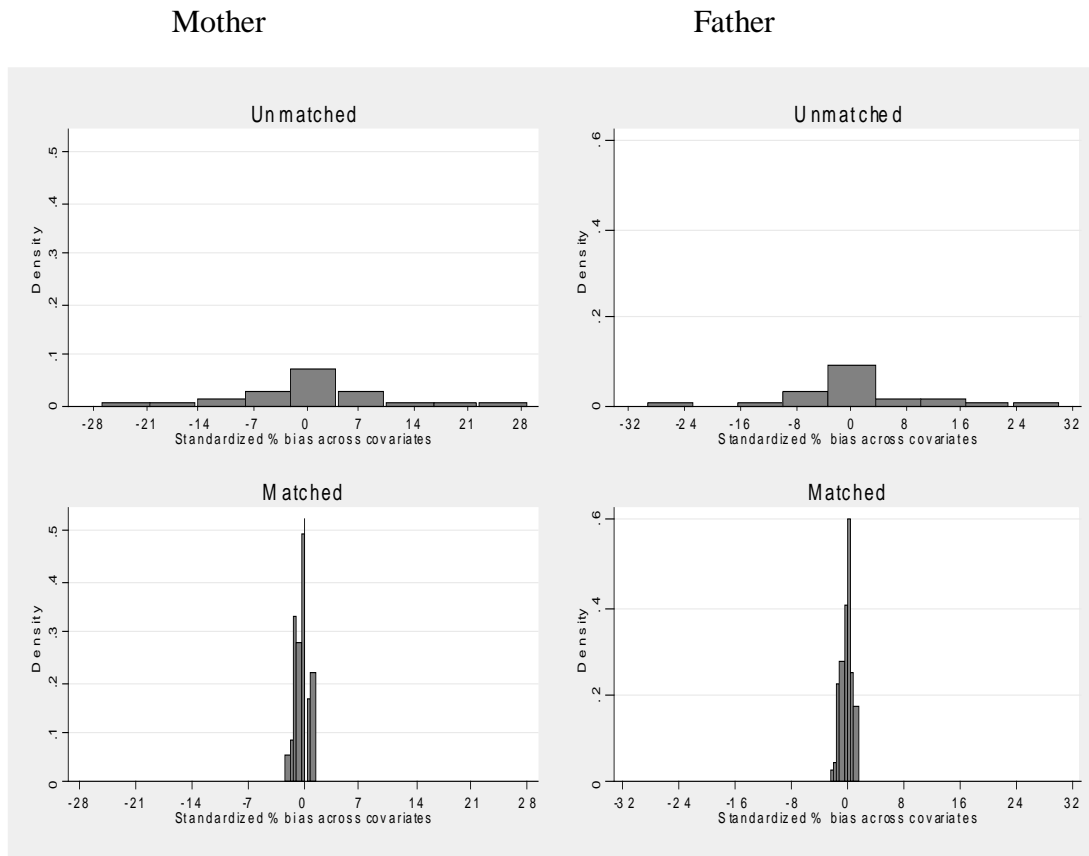


Next we check the matching quality by evaluating the balance of the covariates between the displaced workers sample and the non-displaced workers sample. Figure 2 shows

¹⁹ The estimated propensity scores range between 0.00866-0.473 in the sample of displaced mothers and 0.00616-0.479 for non-displaced mothers. For fathers the propensity scores are 0.0126-0.398 in the sample with displaced workers and 0.00710-0.438 for non-displaced workers.

the standardized biases an indicator suggested by Rosenbaum and Rubin (1985), both before and after the matching. As is evident from the figure, the biases in the covariates are considerably reduced in the weighted samples. In the weighted samples the average bias is 0.7 percent in both samples. There is no clear rule for when the covariates are considered balanced but 10 percent is considered a rather strict cut-off (Harder et al, 2010). Moreover, the analysis in Section 5 will show that there are no pre-trend in important variables suggesting that the treated and control workers are similar before the plant closure.

Figure 2 Balancing of covariates



5 Results

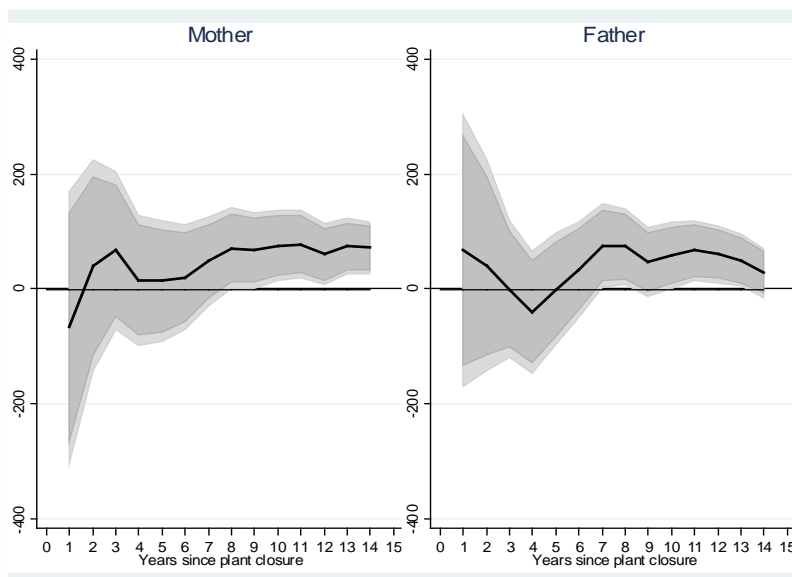
We start by investigating the effects of exposure to parental job loss on child health outcomes in the short and long run, followed by estimations of the effects on school

performance and outcomes in early adulthood. Then we turn to an analysis of the effects on parents to explore possible pathways for how parental outcomes affect the children.

5.1 The effects of parental job loss on child health

First we study to what extent experiencing parental job loss affects child mortality. Figure 3 plots the estimated coefficient of the effect of job loss due to workplace closure on the cumulative probability of death, for each year up to 14 years after plant closure. The graph to the left show effects of maternal job loss and the graph to the right show effects of paternal job loss. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval. Since very few children die each year, the confidence intervals for the first years are very wide and the point estimates unstable. However, seven, eight years after the plant closure, the estimated coefficients turn positive and statistically significant both for children of displaced mothers and fathers. 11 years are the plant closure the mortality rate among children with a displaced father is 75 percent higher, but decreased at the end of the studied period. For children with displaced the risk of mortality is 67 percent higher at the end of the period. Note that 14 years after the plant closure children who were exposed to the plants closing down are now 16–32 years old and many of them are hence no longer children.

Figure 3 Effect of exposure to parental job loss on probability (percent) of child death at the year of and up to 14 years after the closure



Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Table 2 shows the corresponding point estimates, measured as number of deaths per 1,000 individuals 14 years after exposure to plant closure (columns 2 and 3). In addition, we also test how sensitive the results are to the chosen matching algorithm by also matching on the five nearest neighbors (columns 3 and 5). The results using the alternative matching strategy show a similar result as our main method. Mortality is higher among children with displaced mothers 8 years after job loss and every year the whole studied period. Children with displaced fathers show a higher mortality risk 7 to 13 years after parental job loss.²⁰

Table 2 Effect of exposure to parental job loss on probability of child death 14 years after exposure to plant closure

	Mother at closing workplace		Father at closing workplace	
Deaths per	1.446***	1.007**	0.491	0.485
1,000 children	(0.469)	(0.408)	(0.376)	(0.307)
Mean	2.020		1.719	
Obs.	340,041	340,041	400,618	400,618
Matching method	Nearest neighbors with replacement	5 nearest neighbors with replacement	Nearest neighbors with replacement	5 nearest neighbors with replacement

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Estimated using propensity score matching. Standard errors take into account that the propensity score is estimated. Means are calculated using the weighted sample.

The estimated effects indicate rather dramatic consequences of maternal job displacement and some words of caution are warranted. Since people only die once, is it impossible to condition on past values of the outcome variable as is often done to account for possible selection on unobservables. There is therefore a risk that the different mortality patterns between the two groups reflect some underlying health differences that the variables that we do match on are unable to capture.

²⁰ Results available upon request.

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In order to examine the credibility of the result and judge if maternal job displacement actually has these dramatic consequences for children we have examined the distribution of causes of death for children in the treatment and control group. It turns out that children with displaced mothers are more likely to die due to accidents, in particular traffic accidents, and intentional self-harm than children with non-displaced mothers. Out of 55 deaths among children with displaced mothers 33, or 60 percent, died due to accidents or intentional self-harm. For the sample of children in the control group 13 deaths out of 26, or 50 percent, were caused by an accident or self-harm. Thus, 'excess' deaths due to accidents or intentional self-harm in the sample of children with displaced mothers can account for 70 percent of the difference in total deaths between the groups. In contrast, there is no increased risk of dying from cancer among children with displaced mothers.²¹

A similar inspection of the death causes in the sample of children in the father's sample does not show as a clear pattern. This result, also was not robust to matching on five rather than the nearest neighbors. The higher probability of dying in the sample of children with a displaced father is mainly due to self-harm, 14 deaths compared to seven in the control group, but also cancer, seven deaths among children with displaced fathers and two in the sample of children with non-displaced fathers.

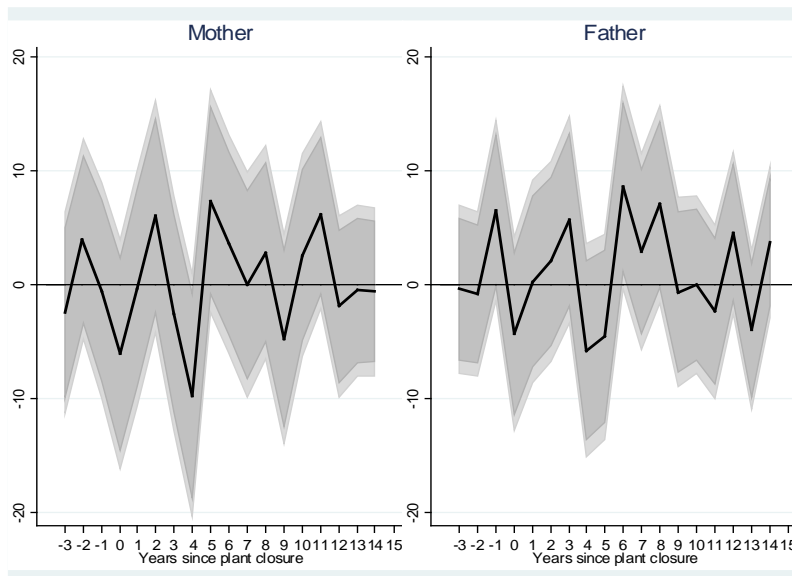
Next, we study whether having a mother or a father who is exposed to workplace closure has an effect on the probability of being admitted to hospital for each year up to 14 years after the plant closure. Being admitted to a hospital is a much less dramatic event than death and considerably more common. Yet, it is still rare. In particular, some of the specific diagnoses that we study are very rare, implying that we might have power problems obtaining precise estimates.

We start by investigating the effects of parental job loss on hospitalization for any cause. The estimated coefficients are plotted in Figure 4. The graph to the left shows effects of maternal job loss and the graph to the right shows effects of paternal job loss. The horizontal lines mark the time period the plant was closed down in the treated group ($t = 0$). First, it is reassuring to note that the share of children admitted to hospital is very similar in the treatment and control group three years before closure

²¹ Mortality is higher among boys in both groups: 78 percent of the deceased are boys in the sample of children with displaced mothers and 72 percent in the control group.

suggesting there are no underlying differences between the groups.²² Second, we can note that there are no indications that parental job loss affects hospitalization either positively or negatively; the point estimates jump around a lot and are sometimes negative and sometimes positive, and are never statistically significant at conventional levels.

Figure 4 Effect of exposure to parental job loss on hospitalization (percent) 4 years before to 14 years after the closure



Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

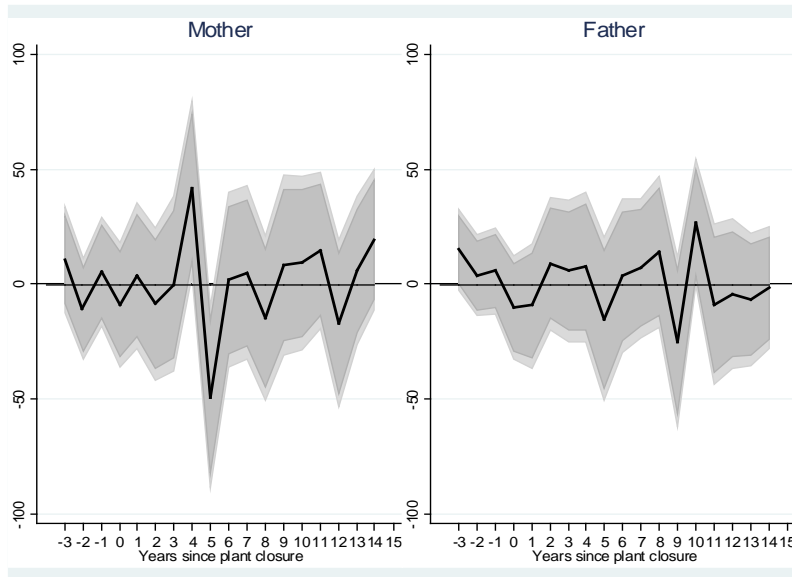
Next, we investigate if displacement of a parent has any adverse effects on specific health conditions, as captured by admissions for certain diagnoses. As discussed in Section 3, we focus on diagnoses related to ‘avoidable’ health problems and to diagnoses related to mental health problems, self-destructive behavior, alcohol-related or abuse, which we have collected under the heading “misery”.

Starting with diagnoses related to “avoidable” health problems (Figure 5), there is a statistically significant positive effect of mothers’ job loss on admissions to hospital due to avoidable diagnoses four years after the plant closure. However, the coefficient is very unstable over time, and is instead negative and statistical significant five years after

²² Past hospitalization is one of the conditional variables in the propensity score estimation, so this result is partly mechanical.

job loss. We are therefore reluctant to draw strong conclusions based on this pattern, but instead conclude that parental job displacement does not seem to systematically affect hospitalization due to “avoidable” health problems.

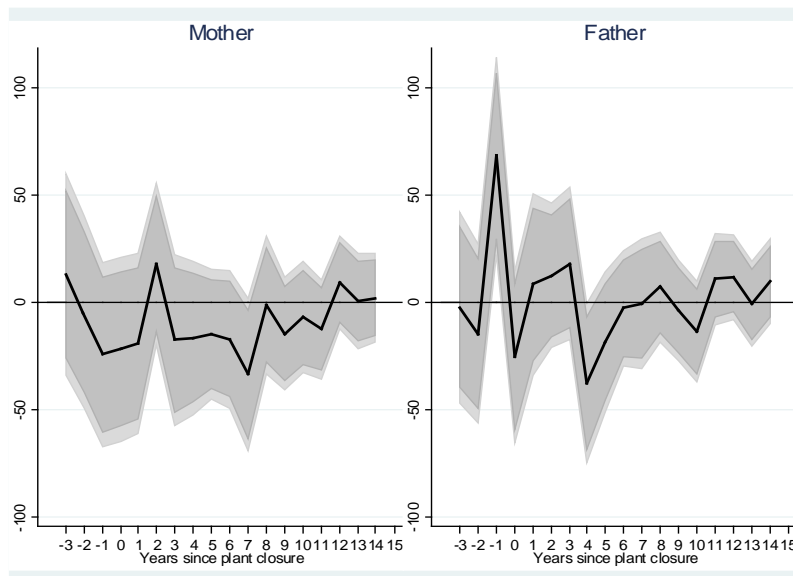
Figure 5 Effect of exposure to parental job loss on hospitalization due to “avoidable” health problems, 4 years before to 14 years after the closure



Note: Estimated using propensity score matching. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval. Matching method used is nearest neighbors with replacement.

Figure 6 instead shows the effects on the diagnoses we have collected under the term “misery”. Once again, it is hard to take away any clear message from the graphs. For maternal job loss, no point estimates are statistically significant at conventional significance level, but if anything they are negative indicating fewer hospitalizations among children with displaced mothers. For paternal job loss, there is an increase in hospitalization the year before the closing of the workplace, a year that we consider as potentially part of the treatment. However, no statistical significant effects are found the following years, making it hard to believe that there is actually an effect in year $t-1$.

Figure 6 Effect of exposure to parental job loss on hospitalization due to diagnoses related to mental health problems, self-destructive behavior, alcohol-related or abuse, 4 years before to 14 years after the closure



Note: Estimated using propensity score matching. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval. Matching method used is nearest neighbors with replacement.

In the figures above, we have estimated the incidence of health problems each year separately. An alternative way is to investigate whether the child has been admitted to hospital in any year following the closing of the plant. Table 3 displays the estimated effects of having a displaced parent on hospitalization (all causes and for different diagnoses) on whether the child has been admitted to hospital (total and different diagnoses) any year between the plant closure and 14 years after. The estimations are shown both for matching on nearest neighbor and the five nearest neighbors. Note that the results may differ from the yearly estimates since aggregating hospitalizations this way does not take into account whether the same person has been hospitalized at more than one occasion.

For fathers, estimations confirm the picture from the graphs; there are no statistically significant effects of parental job loss on child health measured as being admitted to hospital. Having a mother displaced however seems to reduce the probability to be admitted to hospital up to 14 years after the plant closure, but the point estimate is sensitive for the exact matching method and matching on the five nearest neighbors, the

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effect is no longer statistically significant. In addition, the estimated effect is also small in economic sense, corresponding to a decrease in hospitalization with 2.6 percent.

Table 3 Effect of exposure to parental job loss on probability of hospitalization, 14 years after exposure to plant closure

	Mother at closing workplace		Father at closing workplace	
Any diagnose	-10.95** (5.172)	-4.989 (4.016)	-1.190 (4.454)	-1.250 (3.487)
Mean	417.19		406.92	
“Avoidable”	1.197 (2.079)	0.0964 (1.633)	-0.0755 (1.809)	-0.862 (1.416)
Mean	41.40		41.44	
Misery	-2.344 (2.314)	-0.720 (1.785)	1.020 (1.941)	0.203 (1.516)
Mean	52.54		47.61	
Obs.	340,041	340,041	400,618	400,618
Matching method	Nearest neighbors with replacement	5 nearest neighbors with replacement	Nearest neighbors with replacement	5 nearest neighbors with replacement

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Estimated using propensity score matching. Standard errors take into account that the propensity score is estimated. Means are calculated using the weighted sample.

To conclude, the overall picture shows no systematic effects of parental job loss on child health measured as admissions to hospital, but we do find increased mortality of children exposed to maternal job loss. While the causes of the excess deaths lend some credibility to the finding, one should however keep in mind when interpreting results that we are unable to condition on past outcomes.

5.2 The effect of parental job loss on education performance and outcomes as young adults

So far we have focused on how parental job loss affects children’s mortality and health. However, having a parent who loses his/her job may also affect how well the child does in school, and thus the formation of his/her human capital, which in turn may affect how the child fares as a young adult. We therefore turn to educational achievement and other

outcomes as young adults. Educational performance is measured as GPA rank at end of compulsory school in 9th grade (age 16) as well as whether the child has completed three years of high school by age 23. To measure how the child fares as a young adult we study the effect on the probability of being unemployed (measured as being registered at the PES as openly unemployed or in an active labor market program ALMP) or live in a household which receive social assistance any time at ages 20–23.²³

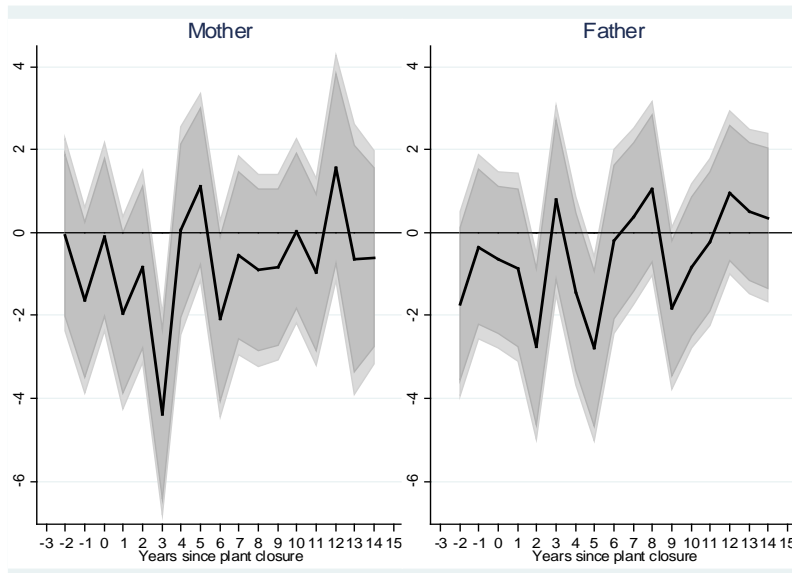
Figure 7 shows the estimated difference in GPA rank between children with a displaced parent and the control group two years before and 14 years after the plant closure. At the time of the plant closure the effect is estimated on the cohorts attending 9th grade that year, the effect on GPA rank one year after the plant closure is estimated on the cohorts who attended 8th grade at the year of the plant closure, two years after is estimated on the cohort who attended 7th grade at the time, and so forth. Since each child only appears once in the sample, the available sample is considerably smaller than the sample that we used when studying effects on health. This implies that there is no variation in some of the conditioning variables between children with displaced and children with non-displaced parents. Therefore we use a smaller set of covariates when estimating the propensity scores.²⁴ Although it is not possible to control for previous outcomes, as when studying hospitalization, we can check whether children in cohorts graduating before the plant closure differ depending on whether their parents are later displaced or not. Reassuringly, there does not seem to be any statistically significant differences between these children with displaced and non-displaced parents. For the years after the plant closure, there are some indications of negative effects on educational achievement for children which experienced parental job loss a few years before graduation. Children whose mothers were displaced when 12 years old, i.e. in 6th grade have 4.2 percentage points lower grade rank and children whose father was displaced when at age 10 (in 4th grade) and at age 13 (in 7th grade) have 2.8 percentage points lower grade rank. The estimates are however rather unstable and somewhat difficult to interpret, but suggest that exposure to parental job loss in pre- or early teens may have adverse consequences for school achievement as measured by compulsory school GPA rank. We thus confirm the Norwegian finding of negative effect of fathers'

²³ PES is the Public Employment Service. Thanks to our long panel, we are able to follow individuals that were 6-9 years old when experiencing parental job loss to the age of 20-23.

²⁴ The conditioning variables are listed in Appendix A3.

job loss, but our finding contradicts the positive effects found for the same country of maternal job loss (Rege et al. 2011)

Figure 7 Effect of exposure to parental job loss on GPA rank two years before and up to 14 years after the closure



Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Table 4 presents the effect of parental job loss on high school completion at age 23, column 1, and on whether the individual lived in a household which received social assistance or is unemployed any time at age 20–23 in columns 2 and 3. Paternal job loss does not seem to affect the probability that the child completed three years of high school, the point estimates are very small and none of the estimated effects are statistically significant. However, being exposed to parental job loss when at age 4–16 seems to increase the likelihood of receiving social assistance as a young adult; an increase with approximately 5 percent. This is true both for maternal and paternal job loss and the effect is statistically significant.²⁵ Turning to unemployment, measured as being registered at the unemployment office either as openly unemployed or as participant in an active labor market program, the conclusion is less clear. The point

²⁵ It is true that the point estimate for maternal job loss is not statistically significant when only matching on nearest neighbor. However, when matching on the five nearest neighbors, which increases precision but might induce bias, the point estimate does not change, whereas the standard errors decrease. We interpret the overall result as an indication of a positive effect on the probability of receiving social assistance.

estimates are all positive, indicating an increased risk of being unemployed for those experience paternal job loss at age 4–16. However, only one point estimate (for maternal job loss and matching on five nearest neighbors) is statistically significant. Taking that point estimate at face value, it implies an increase with 3.5 percent.

Table 4 Effect of exposure to parental job loss on long-term outcomes: High school diploma by age 23, social assistance and unemployment at age 20–23

	Mother at closing workplace		Father at closing workplace	
Three years of high school at age 23	-0.000933	-0.00426	0.00161	-0.00112
Age 7–16 at workplace closure	(0.00452)	(0.00353)	(0.00408)	(0.00318)
Mean	0.849		0.855	
Obs	230,065		249,378	
Social assistance age 20–23	0.00581	0.00581**	0.00640*	0.00573**
Age 4–16 at workplace closure	(0.00366)	(0.00287)	(0.00340)	(0.00267)
Mean	0.110		0.112	
Obs.	274,744		292,424	
Unemployed age 20–23	0.00898	0.0106**	0.00565	0.00473
Age 4–16 at workplace closure	(0.00575)	(0.00449)	(0.00528)	(0.00413)
Mean	0.451		0.446	
Obs.	278,422		296,948	
Matching method	Nearest	5 nearest	Nearest	5 nearest
	neighbors with	neighbors with	neighbors with	neighbors with
	replacement	replacement	replacement	replacement

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Estimated using propensity score matching. Standard errors take into account that the propensity score is estimated. The number of observations differs somewhat for the different outcomes. The reason is twofold. First, for some observations, there are missing information for the variable SA. Second, for the outcomes social assistance and high school, we condition on the individual being a Swedish resident in the end of the year, whereas for the outcome unemployed, it is enough that she/he has been a resident in Sweden sometime during the year.

Summing up the effects of parental job loss on child educational and early adult outcomes we can conclude that exposure to parental job loss when the child is in the pre-or early teens seems to have negative consequences for school grades regardless of which parent loses a job. There do not seem to be long lasting effects on educational outcomes for children who are younger when hit by parental job loss. When studying outcomes in early adulthood, there is a robust increase in the likelihood receiving social assistance between 20 and 23.

5.3 The effects of parental job loss on the family

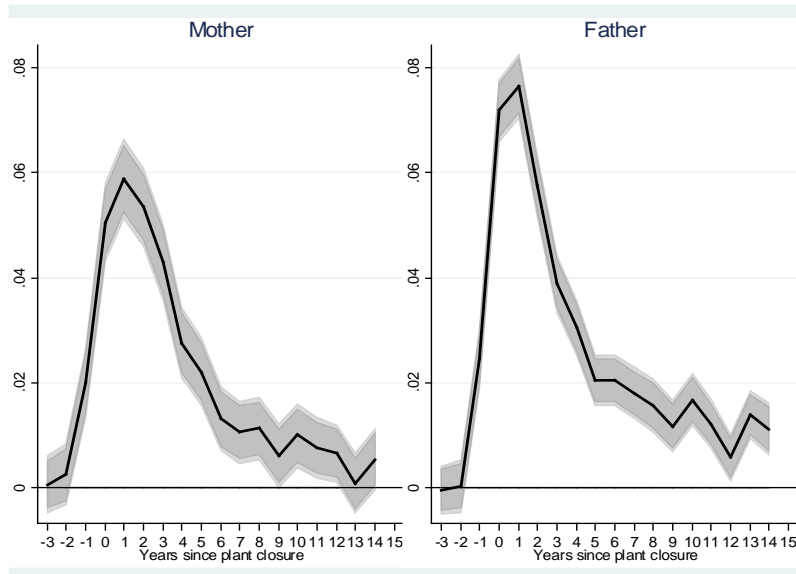
The results above indicate that child human capital is negatively affected by parental job loss although the evidence is not very strong. There are indications of increased mortality risk and negative consequences on school achievement as well as some adverse effects on outcomes in early adulthood of parental job loss. In order to understand these results and also relate them to the earlier evidence on plant-closures we examine the effect on the family as a whole. The outcomes that we focus on are parental unemployment, earnings, disposable family income, whether they receive social assistance, separations, mortality and hospitalization.

Previous research has documented that job loss due to plant closure leads to unemployment and have long-term detrimental effects on workers' income as well as their health. The effects of job loss may well differ across time and space depending on the state of the labor market when a worker experience the job loss, as well as depending on the unemployment insurance and health care systems.²⁶ In addition, the consequences may be different for parents compared to workers without children, since having a children may on the one hand shelter individuals from the most adverse consequences either because it forces parents to keep up routines or because support to families is more generous, or on the other hand put the individual under even more stress if he/she also has a family to support.

We first consider labor market outcomes. Figure 8 shows that unemployment (measured as being registered at the PES as openly unemployed or in an ALMP) increases by 5.9 percentage points for mothers and 7.7 percentage points for fathers in the year after the job loss. This increased risk of unemployment diminishes gradually over time. There is however, still after 14 years, a somewhat higher risk of unemployment among workers who were displaced, the effect is statistically significant for fathers. Comparing this figure with the baseline unemployment level, which is about 10 percent, this corresponds to an increase of as much as 50–75 %, which must be considered to be of economic significance.

²⁶ See Eliason (2011) for an evaluation of how the Swedish welfare state compensates the worker for job loss.

Figure 8 Effect of exposure job loss on parental unemployment (share) two years before and up to 14 years after the closure



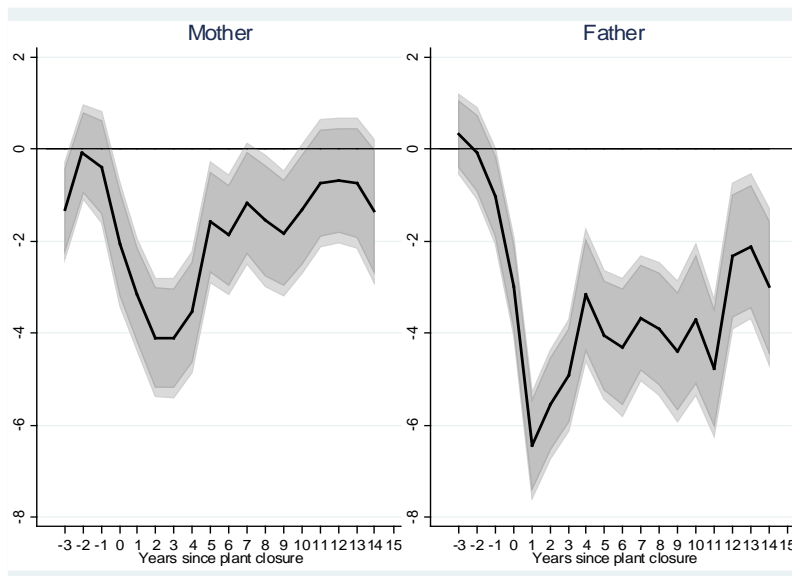
Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Parents who experience job loss hence face long run increases in their unemployment risk, but what happens to their earnings? Figure 9 shows that there are immediate, as well as, long-run effects on labor earnings for both displaced mothers and fathers. Displaced fathers experience an earnings loss the year after the plant closure of 6.4 percent. The earnings loss of mothers two years after the plant closure is 4.1 percent. The magnitudes of these effects are similar to the effects found by Eliason (2011) who uses Swedish data, but for a different time period.²⁷ Looking instead at household disposable income, which includes insurance receipts and social transfers of various forms (Figure 10) it seems like the household is negatively affected only when the father experience job loss. The magnitude of the effect is similar to the effect on fathers' labor earnings. Disposable income remains significantly lower for the entire studied period after paternal job loss. However, the household's disposable income does not seem to suffer much from maternal job loss; the estimated coefficients are all small and

²⁷ Eliason (2011) investigates job losses that take place in 1987, whereas we focus on 1995 and 1996. In 1987, unemployment was low in Sweden (3 %), but in the early 1990s Sweden went into a recession with increasing unemployment rates. In the middle of the 1990s, unemployment rates were around 10 %, but dropped to around 6 percent in the beginning of the 2000s.

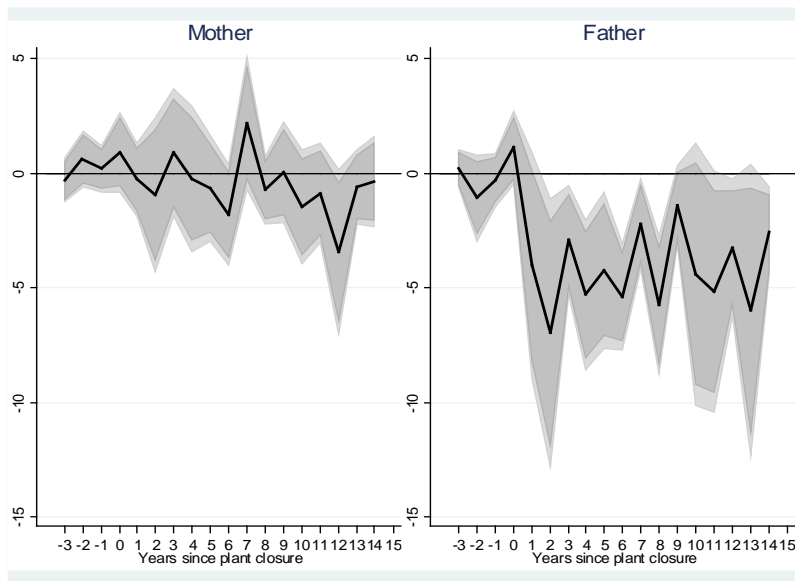
never statistically significant. A reason for this difference in consequences of maternal and paternal job loss may be that female earnings fall short of the ceilings in replacement rates in the unemployment insurance, while men typically have earnings above the threshold where earnings are not replaced. As can be seen in Figure 11, both households with displaced mothers and fathers are more likely to receive social assistance after the plant closure. There are statistically significant positive effects a few years after the plant closure as well as at the end of the studied period.

Figure 9 Effect of exposure to job loss on parental earnings (percent) two years before and up to 14 years after the closure



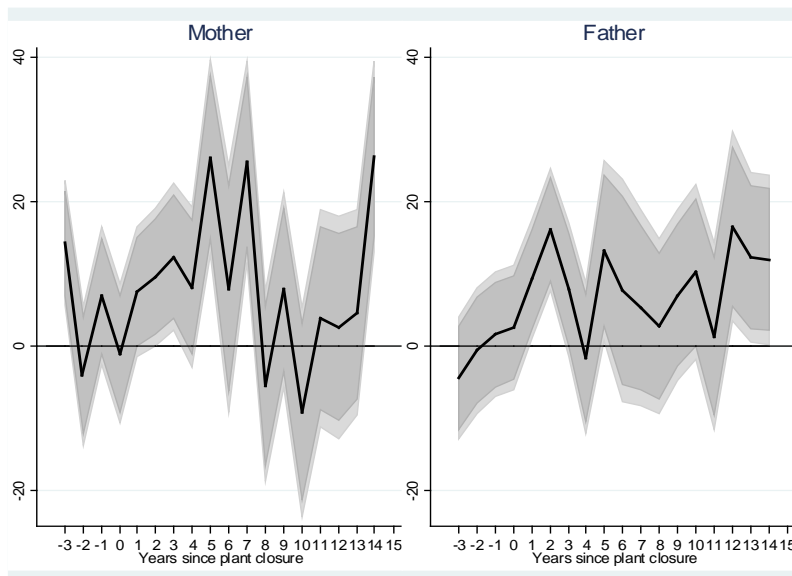
Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Figure 10 Effect of exposure to job loss on household disposable income (percent) two years before and up to 14 years after the closure



Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Figure 11 Effect of exposure to job loss on likelihood of receiving social assistance (share) two years before and up to 14 years after the closure

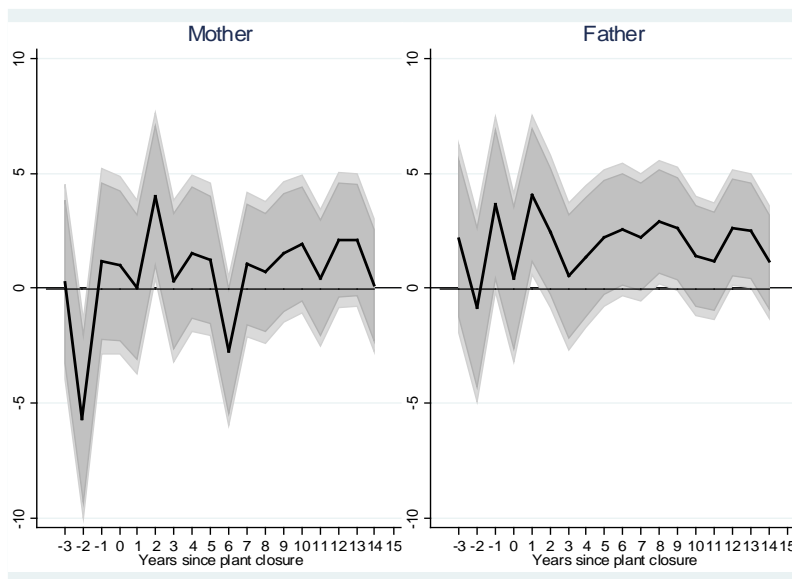


Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Unemployment and lower family income may put stress on the family and lead to divorce. Earlier studies have found that male job loss leads to divorce, although Eliason

(2012) finds no effects for men with children. Figure 12 shows the share of children whose biological parents do not live together three years before and 14 years after the plant closure. The graphs show that displaced fathers are somewhat less likely to live together with the biological mother of the child. The effect is statistically significant, for the year after the plant closure as well as 8 and 12 years after plant closure. The increase is 4 percent for the year after the plant closure and 2.9 and 2.6 percent for the later years. The estimated effect of plant closure on whether mother live with the biological father of the child changes sign over the time period. For most years displaced mothers are more likely to live separated from the father but the effect is only statistically significant two years after plant closure.

Figure 12 Effect of exposure to job loss on likelihood of biological parents being separated (share) two years before and up to 14 years after the closure



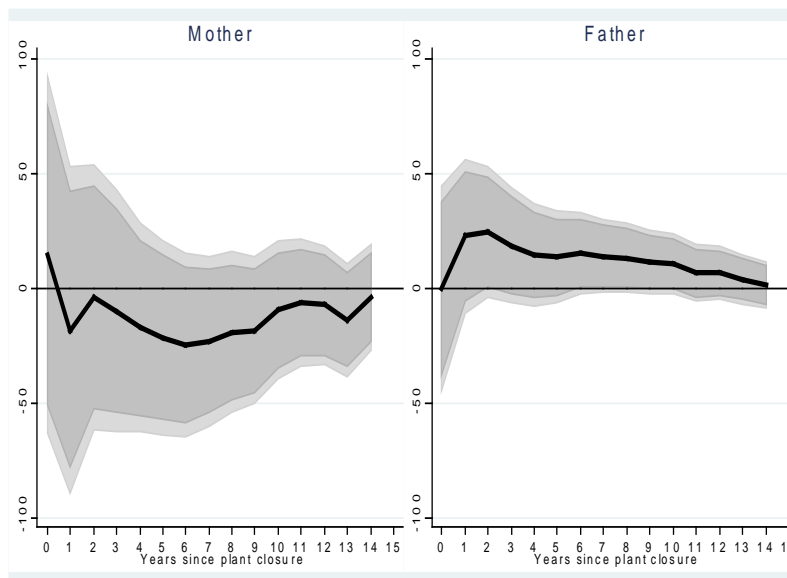
Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Finally, we turn to an analysis of how plant closures affect parental health, starting with mortality and then turning to hospitalization (any diagnose as well as diagnoses related to alcohol and mental health problems).

Figure 13 shows the estimated coefficients on paternal mortality the year of the plant closure and up to 14 years after. Just as with the results for child mortality we are unable to control for past outcomes, which makes the identification somewhat weaker.

For mothers, there is, if anything, a decreased risk of dying when experiencing a plant closure, but the effects is never statistically significant. For fathers, the pattern in the graph indicates increased mortality among displaced fathers, especially during the first ten years. The standard errors are however large and the effect is borderline statistically significant. Table 5 shows the effects, in deaths per 1,000 individuals for two different matching strategies (nearest neighbor and the five nearest neighbors). These effects confirm the results found in Figure 13, but the point estimates are very sensitive to the matching method.

Figure 13 Effect of exposure to job loss on parental mortality (percent) the year of the and up to 14 years after the closure



Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Table 5 Effect of exposure to job loss on probability of parental death 14 years after the closure

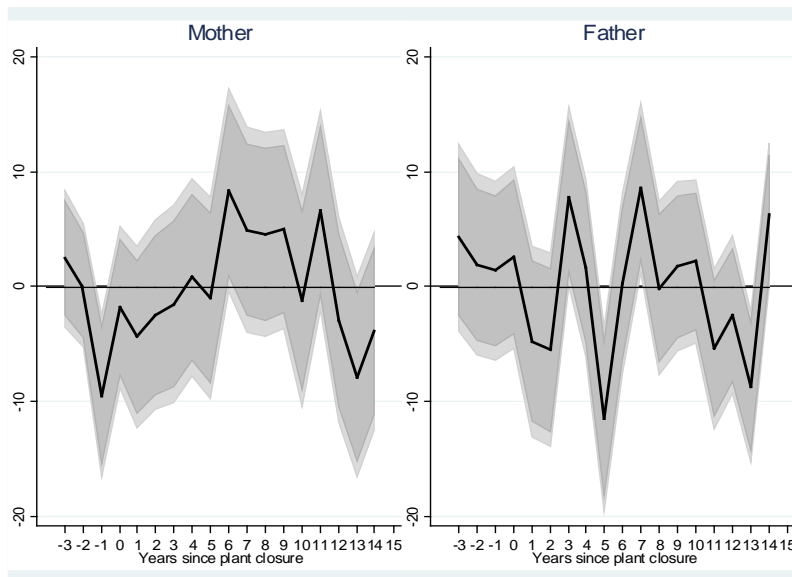
	Mother at closing workplace		Father at closing workplace	
Deaths per	-0.299	0.0998	0.491	0.0995
1,000 individuals	(0.923)	(0.711)	(1.538)	(1.207)
Mean	7.835		28.907	
Obs.	340,041		400,618	
Matching method	Nearest neighbors	5 nearest	Nearest neighbors	5 nearest

with replacement	neighbors with replacement	with replacement	neighbors with replacement
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Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Estimated using propensity score matching. Standard errors take into account that the propensity score is estimated. Means are calculated using the weighted sample.

Turning to the effects on hospitalization, Figure 14 shows hospitalization rates for the displaced and non-displaced parents. There is no convincing evidence of that workers are more likely to be hospitalized due to workplace closures; the coefficients are unstable, sometimes positive, at times negative, and for mothers, they are never statistically different from zero.

Figure 14 Effect of exposure to job loss on parental hospitalization (percent) 4 years before to 14 years after the closure

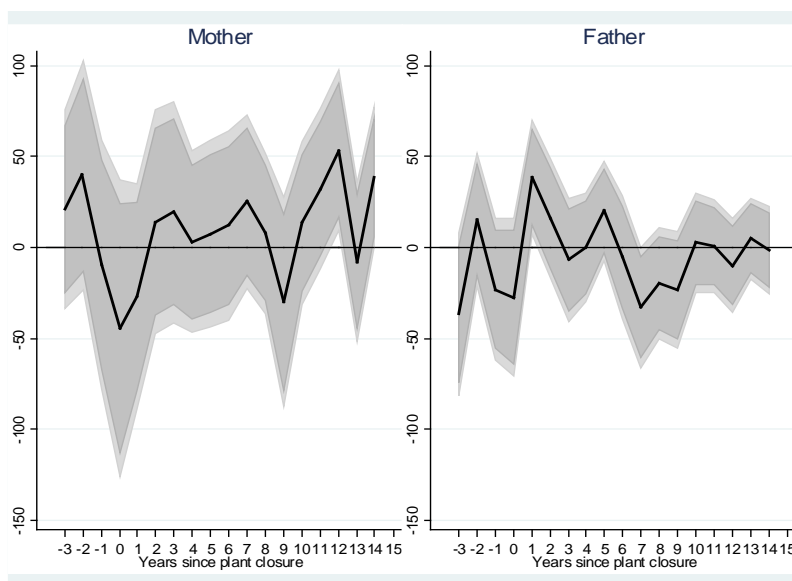


Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Next we turn to hospitalization due to diagnoses related to alcohol use (Figure 15) and mental health problems (Figure 16) that previously have been studied for Swedish worker (Eliason and Storrie, 2009). Since the incidence is small the estimates jump up and down, implying that for some years there are some effects, but that the signs change, making it hard to draw any strong conclusions. There is some indication of a

higher probability of being hospitalized for alcohol related diagnoses immediately after job loss for fathers but in contrast to earlier results from the Nordic countries, we find no long-term effects of fathers' exposure to plant closure on health. For mothers, although noisy, results suggest a pattern of deteriorating mental health and possibly also an increase in alcohol related diagnoses in the long term.

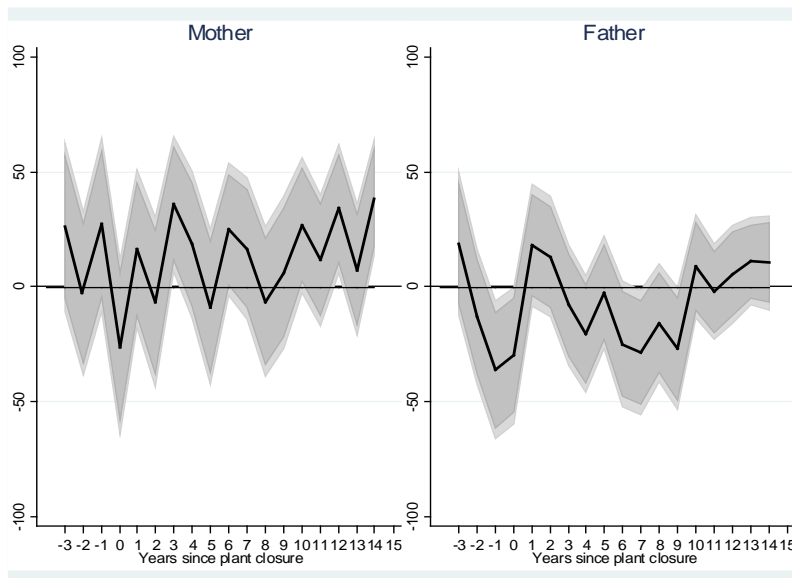
Figure 15 Effect of exposure to job loss on parental hospitalization due to alcohol related diagnoses (percent) 4 years before to 14 years after the closure



Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

Figure 16 Effect of exposure to job loss on parental hospitalization due to mental health problems (percent) 4 years before to 14 years after the closure

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Note: Estimated using propensity score matching. Matching method used is nearest neighbors with replacement. Standard errors take into account that the propensity score is estimated. The dark grey area indicates the 90 % confidence interval, whereas the light grey area indicates the 95 % confidence interval.

In Table 6 we instead estimate the effect of the likelihood of being in hospital any year since the plant closure until 14 years after the closure, using two different matching methods. Again, there is no strong evidence of deteriorating health of parents who experience job loss.

Table 6 Effect of exposure to job loss on probability of hospitalization, 14 years after exposure to workplace closure

	Mother at closing workplace		Father at closing workplace	
Any diagnose	3.793 (5.182)	5.892 (4.038)	-0.983 (4.511)	-0.295 (3.538)
Mean	523.06		436.61	
Alcohol related	-0.948 (1.229)	-0.517 (0.940)	-0.378 (1.813)	-1.393 (1.105)
Mean	14.00		25.50	
Mental	2.096 (2.060)	3.076* (1.613)	-2.231 (1.429)	-0.0819 (1.417)
Mean	40.62		41.71	
Obs.	339,929		400,242	
Matching method	Nearest neighbors with replacement	5 nearest neighbors with	Nearest neighbors with replacement	5 nearest neighbors with

	replacement	replacement
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Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Estimated using propensity score matching. Standard errors take into account that the propensity score is estimated. Means are calculated using the weighted sample.

Summing up the effects of job loss on parents we can confirm that job loss has negative long run effects on the labor market attachment of both men and women, but we do not find the as negative effects on health for parents as has previously been found for Swedish adults. We find that parents who lose their jobs in workplace closures suffer long run earnings losses and increases in risk of unemployment. Interestingly, the effects on household disposable income are substantial when fathers lose jobs, while maternal job loss has no significant effect on household income. Yet, the likelihood of social assistance receipts increase both as mothers and fathers lose their jobs, but for a more extended period for mothers. We also find that paternal job loss, more than maternal, is found to be associated with family instability. When studying effects on health, we find some indications on increased mortality among fathers, but no effects on mothers. Moreover, our hospitalization data show immediate increases in alcohol related hospitalizations for fathers and signs of deteriorating mental health for mothers.

6 Conclusions

We study short-term and long-term consequences of parental job displacement due to the closing of workplaces on child health, educational performance, unemployment and reliance on social assistance as young adults. Previous research and theory suggests several pathways through which children may be affected by parental job loss. Loss of earnings can result in less investments in child human capital, but also financial stress causing worse parental physical and mental health of parents. Job loss can also imply a relocation of parental, in particular mothers', time use towards caring for children and home. However, loss of confidence and identity upon losing a job and the stress of finding a new job may negatively affect the quality of time.

Overall our results show detrimental effects of parental job loss on child outcomes. In particular, we find higher mortality among children who are exposed to maternal job loss. There is, however, no robust sign of increased risk of hospitalizations. Children also have worse school outcomes at age 16 if a parent was displaced a few years prior to graduation. Moreover, there is an increase 5-percent increase in the risk of receiving

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social assistance at age 20–23. An interesting pattern in our results, which contrasts previous findings in Rege et al. (2011), Schaller and Zerpa (2015), and Page et al. (2016), but is consistent with previous Swedish findings in Mörk et al. (2014) is that children suffer as much or more from maternal than from paternal job loss.

The parents themselves and the family environment are affected by workplace closures in several ways. First, parents are 50–75% more likely to be unemployed, have lower earnings and more likely to receive social assistance. However, only paternal job loss is associated with a reduction in household income and there are indications that parents are more likely to separate a few years after the plant closure if the father rather than the mother loses her job. A possible reason for limited effects on disposable income of maternal job loss is that mothers' earnings are sufficiently low not to hit the unemployment insurance's income replacement ceiling. Another reason may be that partners are able to compensate and increase earnings.²⁸

Exposure to workplace closure is also associated with some negative effects on parental health. In the long run, mothers' mental health suffers. However, we find that the negative health effects, in particular for fathers, are milder than have been found in previous studies on Swedish workers and in contrast to earlier studies we find no long run effects on fathers. A possible interpretation of the limited effects on adult health is that the responsibility for children shields parents of the immediate negative health outcomes that other adults, in particular men, suffer. This has the likely beneficial effect that the children are partly also protected. The extent to which parents are able to shield their children of some of the adverse consequences of their own job-loss may depend on how unemployment and health insurance, as well as education and health care are organized, i.e. replacement rates and costs and accessibility of education and health care. It may also be that workers with children are a selected group which is not adversely affected by job loss to the same extent as worker without children.

The fact that maternal job loss seems to hurt children more or in the same way as paternal job loss, in spite of the absence of an effect on household income, suggests that financial stress and lower investments in children are not the mechanisms through which children are affected in a Swedish context. Instead, stress and deteriorating mental health among mothers is a possible channel. While it has been hypothesized that

²⁸ We have explored this, but find no consistent evidence suggesting that the other parents' earnings increase in response to job loss.

mothers' tendency to relocate time towards child care when losing a job is a reason why maternal job loss has been associated with better child outcomes in US studies, there are institutional factors which may explain why Swedish mothers are not able or willing to reallocate time in the same way. First, unemployment benefits are conditional on actively seeking new employment and taking part in active labor market programs. Second, individual taxation, high marginal tax rates and a strong dual earner norm give strong incentives for mothers not to withdraw from the labor force and for feeling the pressure to find a job. In the late 1990's, the period studied here, childcare slots were in many municipalities conditional on parents working. Hence job loss also in many cases implied loss of high quality childcare.

We show that although earnings losses to families exposed to job loss are less pronounced than for instance in a US context, and health effects on parents are not present to the same extent as in studies of Swedish workers in general, some children are severely hurt by parental job loss. Increased mortality, lower GPA-rank and worse outcomes in early adulthood suggest that that child human capital accumulation is not fully protected from the adverse consequences of parental job loss. The overall picture suggests that maternal job loss has more severe consequences. This points to an important conclusion regarding the pathways and suggests that it is not financial stress which is the cause of these negative effects, but rather other forms of stress that potentially hurt the mental health of mothers and has negative consequences for child human capital.

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Appendix

Table A1: ICD-codes for different diagnoses

Variable	Definition based on ICD10 codes
Hospitalization child, mother and father	=1000 if admitted to hospital that year
Alcohol related hospitalization	=1000 if admitted to hospital at any time during the year with main diagnosis or any of the first five sub-diagnoses: alcohol poisoning (T51, X45, X65, Y15), alcohol use disorder (F10), alcoholic liver disease or alcohol-induced pancreatitis (K70,K85, K86.0–1), other alcohol-related diseases or conditions (E24.4, G31.2, G62.1, G72.1, I42.6, K29.2, 035.4)
Hospitalization for self-destructive behavior	=1000 if admitted to hospital with main diagnosis or any of the first five sub-diagnoses Self-destructive behaviour X60-X84, Y10-Y34
Hospitalization for mental health problems	=1000 if admitted to hospital with main diagnosis or any of the first five sub-diagnoses mental health problems F00-F99
Hospitalization for health problems which are avoidable	=1000 if admitted to hospital with diagnose codes Asthma J45, J46 (main or sub diagnoses) Diabetes E101–E108 (main or sub diagnoses) E110–E118, E130-E138, E140-E148 (main or sub diagnoses) Nutrition E40-E43, E550, E643 (main or sub diagnoses) Anaemia D501-509 (main or sub diagnoses) hypertension i110,i119 (main or sub diagnoses) Chronic obstructive lung disease J41, J42, J43, J44, J47 (main diagnoses) ; *J20 (main diagnosis together with) J41, J42, J43, J44, J47 (sub-diagnosis) The following main diagnoses: Diarrhoea E86, K522, K528, K529 Epileptic cramps O15, G40, G41, R56 Infections H66, H67, J02, J03, J06, J312 Vaccine preventable: B16, B26, B05, B06, A15-A19, A37, A36 Influenza and pneumonia j10, J11, J13, J14, j153, j154, j157 j159, j168, j181, j188 Tooth related K02-K06, A690, K08, K098, K099, K12, k13
Hospitalization for injury	=1000 if admitted to hospital with main diagnosis or any of the first five sub-diagnoses Injury, poisoning and certain other

	consequences of external causes S00-T98
Hospitalization for abuse by partner or parent	=1000 if admitted to hospital with main diagnosis or any of the first five sub-diagnoses or e-code: Y070 (partner/spouse), Y071 (parent), Abuse syndromes: T74

Table A2: Overview of covariates used to estimate the propensity score

Variable	Definition
Age (child, other parent)	Years of age
Age ² (child, worker)	Years of age, squared
Female (child)	=1 if girl
Hospitalization t-2 and t-3 (worker), t-2 or t-3 (other parent) and t-2 (child)	=1000 if admitted to hospital that year
Hospitalization for diagnoses indicating mental health problems t-2 or t-3 (worker)	=1000 if admitted to hospital with diagnose code indicating mental health problems according to Table A1
Hospitalization for diagnoses indicating alcohol abuse t-2 or t-3 (worker)	=1000 if admitted to hospital with diagnose code indicating alcohol related disease according to Table A1
Hospitalization for diagnoses indicating alcohol abuse or mental health problems (other parent)	=1000 if admitted to hospital with diagnose code indicating alcohol related disease or mental health problems according to Table A1
Hospitalization for diagnoses indicating mental health problems, self-destructive behavior, alcohol abuse or abuse (child)	=1000 if admitted to hospital with diagnose code indicating mental health problems, self-destructive behavior, alcohol related disease or abuse according to Table A1
Separated (child)	Dummy indicating that the biological parents do not live together
Years in Sweden (worker, other parent)	Dummy indicating time living in Sweden (8) 0: born in Sweden 1: time in Sweden < 6 years 2: 5 < time in Sweden < 11 3: 10 < time in Sweden < 16 4: 15 < time in Sweden < 21 5: 20 < time in Sweden < 31 6: 30 < time in Sweden < 41 7: time in Sweden > 40
Unemployed in t-2 and t-3 (worker) and in t-2 (other parent)	Dummy indicating if the individual is registered at the unemployment agency
Unemployed long (worker, other parent)	Dummy indicating if the individual if registered at the unemployment agency more than 180 days
Income from employment (worker, other parent)	Income from employment or self-employment, deflated with KPI to 2014 year prices

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Household disposable income (worker, other parent)	Log household disposable income in 100s SEK, deflated with KPI to 2014 year prices
Income from social assistance (worker, other parent)	Log social assistance in 100s SEK, deflated with KPI to 2014 year prices in the individual's household
Social assistance in t-3 (worker)	Dummy indicating if the household of the individual receives social assistance.
Swe * social assistance (worker, other parent)	Interaction variable between born in Sweden and income from social assistance in the individual's household
Education (worker, other parent)	Dummy variables for year of years of schooling (3) 1: years of school < 10 2: 9 < years of school < 13 3: years of school > 12
Tenure (worker)	Dummy variables for number of years employed at the current workplace. Categories: 2, 3, 4 and 5 or more years.
Size of workplace (worker)	Number of workers at workplace
Size of workplace ^2 (worker)	Number of workers at workplace, squared
Small workplace (worker)	Dummy variable indicating if the workplace has fewer than 50 workers
Medium sized workplace (worker)	Dummy variable indicating if the workplace has more than 49 but less than 250 workers
Industry sector (worker)	Dummy variables for industry sector, SNI code (9)
County (worker)	Dummy variables for county (25)
Sample year	Dummy for if workplace closed down in 1995 (as opposed to in 1996)

Table A3: Overview of covariates used to estimate the propensity score when studying grades

Variable	Definition
Age (child, other parent)	Years of age
Age ² (child, worker)	Years of age, squared
Female (child)	=1 if girl
Hospitalization t-2 and t-3 (worker), t-2 or t-3 (other parent) and t-2 (child)	=1000 if admitted to hospital that year
Separated (child)	Dummy indicating that the biological parents do not live together
Unemployed in t-2 and t-3 (worker) and in t-2 (other parent)	Dummy indicating if the individual is registered at the unemployment agency
Unemployed long (worker, other parent)	Dummy indicating if the individual if registered at the unemployment agency more than 180 days
Income from employment (worker, other parent)	Income from employment or self-employment, deflated with KPI to 2014 year prices
Household disposable income (worker)	Log household disposable income in 100s SEK, deflated with KPI to 2014 year prices
Swe * social assistance (worker, other parent)	Interaction variable between born in Sweden and income from social assistance in the individual's household
Education (worker, other parent)	Dummy variables for year of years of schooling (3) 1: years of school < 10 2: 9 < years of school < 13 3: years of school > 12
Tenure (worker)	Dummy variables for number of years employed at the current workplace. Categories: 2, 3, 4 and 5 or more years.
Size of workplace (worker)	Number of workers at workplace
Size of workplace ² (worker)	Number of workers at workplace, squared
Small workplace (worker)	Dummy variable indicating if the workplace has fewer than 50 workers
Medium sized workplace (worker)	Dummy variable indicating if the workplace has more than 49 but less than 250 workers
Sample year	Dummy for if workplace closed down in 1995 (as opposed to in 1996)