

## Parental job loss and child human capital in the short and long run <sup>1</sup>

by

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### Abstract

Past evidence shows that children of displaced workers have worse health, are less successful in school and earn less as young adults. However, many of these studies suffer from small sample sizes as well as limitations in the extent they are able to control for potential selection into job displacement. In this paper, we use Swedish register data and follow more than 110,000 children whose parents were displaced due to workplace closures. We show that although there are negative consequences for the affected families in the form of lost earnings, lower disposable income, increased unemployment and worse parental health, Swedish children seem to be shielded from these negative effects. Using propensity score techniques, conditioning on a wide set of pretreatment outcomes for both parents and children, we find no effects of parental job loss on childhood health, measured as mortality and hospitalization during a ten-year follow up period. When analyzing educational and labor market outcomes, and it is not possible to match on the child's outcome before parental job loss, our analysis indicates that the estimated effects may be driven by negative selection of affected families.

Keywords: Parental unemployment, workplace closure, child health, human capital formation

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Ändrad fältkod

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## **1 Introduction**

In a globalized, competitive world, firm startups and closures are an integral part of the process of growth and restructuring of the economy, generating overall gains. Nevertheless, some individuals are clearly on the losing side in this restructuring process as their jobs disappear. Earlier empirical work has shown that experiencing a job loss has negative long run consequences for affected workers' future employment, earnings, as well as their health and marriage stability.<sup>3</sup> 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 may be transmitted also to children of affected workers. The purpose of this paper is to examine if this is the case. Developing a better understanding of how negative labor market shocks affect children is necessary if we are to develop policies that adequately support the human capital development of children.

There exists an extensive earlier literature analyzing how parental job loss affects children's health, educational achievement and labor market success, but this literature has produced mixed results. One explanation to these mixed findings could be that there are several methodological challenges that need to be addressed, and earlier work differs in how these challenges are tackled.<sup>4</sup>

Most earlier studies from the US and Canada (see, e.g. Schaller and Zerpa, 2015, Brand and Thomas, 2014, Wigthman, 2012, Lindo, 2011, Coelli, 2011, Stevens and Schaller, 2011 and Page et al., 2009) have relied on survey data. This is also the case in Bubonya et al. (2017) studying Australian data, Peter (2016) using German data, Ruiz-Valenzuela (2015) using Spanish data and Hong Liu and Zhong (2014) using Chinese data. Since surveys by nature are limited to a small number of respondents, these studies have struggled with small sample sizes, which has consequences for how they define treatment. Analyzing causal effects of job loss one would ideally like to observe workers who have experienced job loss as a result of an exogenous shock, but at the same time, one needs a sufficient number of children who have experienced parental job loss. As a compromise between these two goals, many earlier studies have focused on

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

<sup>4</sup> Table A 1 in the Appendix gives a summary of research questions addressed, as well as methodological choices and main findings in a number of earlier studies that have analyzed how parental job loss affects children's short and medium run outcomes.

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cases where a parent has suffered an *involuntary job loss*, resulting from either firm closures or dismissals, where the latter is likely endogenous to factors related to productivity and health. Whereas Schaller and Zerpa (2015) report that their results are robust to focusing only on job loss due to firm closures, Page et al. (2009) find that their results are sensitive to the definition of displacement. Furthermore, even when focusing on both types of involuntary job loss, the limited sample sizes still restrict the ability to obtain precise estimates.

Oreopoulos et al. (2008), Bratberg et al. (2008) and Rege et al. (2011) instead rely on register data from Canada and Norway respectively, which makes it possible to focus solely on job loss due to firm or plant closures and at the same time obtain larger samples. Another advantage with register data is that it avoids problems with recall errors and non-responses. However, even though job loss due to firm closure is arguably more exogenous than dismissal, it may still be the case that firms which close are different with respect to worker characteristics. That this is indeed the case has been shown in earlier Nordic studies analyzing effects of plant closures on displaced workers' outcomes (see, e.g., Browning et al., 2006; Eliason and Storrie, 2009a,b). In order to control for selection, these studies have used propensity score matching, with a battery of covariates, including lagged worker outcomes, to obtain comparative treatment and control groups. Hilger (2016) highlights the difficulties in controlling for selection when analyzing long run outcomes that cannot be observed prior to parental job loss, such as educational achievements and labor market success. Relying on US-register data over federal tax returns and studying effects of paternal job loss on children's educational outcomes and early career earnings, he shows that it is necessary to combine matching with a difference-in-differences approach in order to fully account for that fact that children whose fathers experience job loss differ from other children. Hence, it is uncertain to what extent earlier work on the effects of parental job loss on children has managed to sufficiently control for all relevant differences between children with displaced parents and other children, especially in cases where the analyzed outcome cannot be observed before exposure to parental job loss.<sup>5</sup> A general pattern is that the

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<sup>5</sup> Both the papers utilizing survey data when analyzing effects of involuntary job losses and the papers utilizing register data when analyzing effects of firm closures apply different strategies in order to control for selection, including controlling for family pre-displacement earnings or parental or child fixed effects. In addition, several studies have conducted different types of placebo experiments where the effects of future job loss are analyzed. See column 6 in Table A1 in the Appendix for a detailed description.

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effects on worker and child outcomes are smaller in studies controlling for lagged outcome variables.

A further challenge is how to measure health outcomes. Most previous papers studying health outcomes of children whose parents experience involuntary job loss rely on survey data. Whereas Lindo (2011) and Hong Liu and Zhong Zhao (2014) study outcomes which are easily measured (Lindo: birth weight; Hong Liu and Zhong Zhao: height and weight for age), Bubonya et al., Schaller and Zerpa and Brand and Thomas all focus on health measures that are more subjective, especially when reported by parents (Schaller and Zerpa however also study health insurance coverage and health care utilization). An exception is Mörk et al. (2014) who study effects on registered hospitalizations of parental unemployment rather than of job loss. Relying on health measures reported by parents is problematic if parents' evaluations of their children's health are affected by parental job loss. For example, parents who are themselves experiencing worse health may also believe that children experience similar problems. It could also be the case that spending more time with the child affects parents' attention to different health problems. As a result, it is not clear to what extent differences found in earlier studies reflect genuine differences in child health.

The aim of this paper is to study consequences of parental job loss on health, educational and labor market outcomes for both the children and their parents. Similar to Bratberg et al., Rege et al., Hilger and Oreopoulos et al., we have access to rich administrative register data, in our case from Sweden, allowing us to link parents and children, employees and workplaces, and to identify workplaces that are closed down. We also have access to register data on mortality, hospitalizations, earnings, unemployment spells, social assistance for both children and parents, school outcomes for children, as well as household disposable income and family stability. Not having to rely on survey data has several advantages; we do not have to rely on self-reported reasons for job loss but can identify genuine workplace closures. We can also follow individuals over a long time period, from childhood into young adulthood, and we have access to a relative large population, which is important when analyzing relatively rare events such as workplace closures. Observing all workplace closures in Sweden during the period 1995–2000 gives us a total of 113,332 children experiencing maternal or paternal job loss (44,814 maternal and 68,518 paternal).

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The health outcomes that we study, mortality and hospitalization, have previously not been analyzed for children whose parents experience job loss due to plant/firm closures. An important strength with these register based health measures is that they are in some sense objective and unlikely to suffer from self-serving biases discussed above. When interpreting results, it is however, important to keep in mind that the measures of health used in this study capture relatively severe negative health conditions rather than milder illnesses. While this means we are focusing on conditions which are more likely to have long run consequences for the children, it also means we may miss detecting less severe health effects. In addition, especially mortality is, thankfully, a very rare event among children and young adults, which may lead to problems with statistical power in spite of large samples.

Following earlier Nordic studies analyzing effects of plant closures (e.g., Browning et al., 2006; Eliason and Storrie, 2009a,b) we apply propensity score matching to account for non-random matching of workers to workplaces. We match on a wide set of conditioning variables, including pre-displacement health outcomes of both children and parents. We apply an event-study approach when studying effects on hospitalization, where we compare hospitalization rates of children who experience parental job loss to hospitalization rates for a matched sample of children whose parents work in workplaces that will not be closed, both before and after job displacement, making it possible to validate the identifying assumption of no pre-displacement effects. When analyzing outcomes that are not observable in the pre-displacement period, such as educational and labor market outcomes for children, we conduct placebo analyses comparing outcomes in the years preceding the job loss for children whose parents workplaces later close down with outcomes of children whose parents workplaces do not close down..

We contribute to the existing literature in several ways. In addition to addressing a number methodological challenges, we study several outcomes for both parents and their children. We are thus 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 than what has been possible in earlier studies, which have mostly focused on either adults or children and on either health or educational outcomes. Furthermore, we analyze a Scandinavian context wherecompared to other

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settings (i) the financial consequences of job loss may be less severe due to a generous unemployment insurance and free health care and education, and (ii) 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.

Similar to earlier Swedish studies, we find that job displacement among Swedish parents leads to lower future earnings and lower household income as well as worse parental health, in particular increased mortality for fathers and increased hospitalizations due to alcohol related diagnoses. However, these negative consequences do not seem to spill over to child health. Parental job loss due to workplaces closing down has no statistically significant effects on the likelihood of child hospitalization or mortality over a ten-year follow-up period. The analysis of education and labor market performance, in which it is not possible to match on lagged child outcomes, indicates that the estimated effects may be driven by negative selection of affected families. In particular, performance of children with displaced and non-displaced parents differ both before and after the workplace closure in spite of matching on a wide set of covariates, and the point estimates vary from year to year.

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. Finally, we summarize and discuss our findings.

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

When thinking about how parental exposure to job loss affects child human capital, both in the short and the longer run, it makes sense to take a child human capital production function as a point of departure. The main inputs in such a production function are parenting and parental care, consumption of market goods and services, as well as 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 stock of human capital, i.e. previous health condition, genetic

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disposition and other cognitive and non-cognitive skills, is also an input in the production function (see for example Almond and Currie, 2011).

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. There is also vast empirical evidence that workers of closed plants experience lasting negative effects on earnings and increased unemployment (see, e.g. Eliason and Storrie, 2006; Bratberg et al., 2008; Hilger, 2016).

A second channel through which job loss might affect child human capital development is through the quantity and quality of parental care and parenting. A parent who loses his/her job may initially have more time to spend with the child, and for example, have more time to help out with homework, engage in preventive health care etc. Financial distress caused by lost earnings and labor market attachment may however cause stress and poor health and thereby have a negative impact on home environment and parenting and reduce the quality of the time spent with children (see Conger and Conger, 2007). Depending on the extent to which mothers and fathers differ in how they choose to spend these extra hours with their children, we might expect maternal job loss to have different effects than paternal job loss. Gender norms and gender differences in labor market attachment are likely to influence how displaced mothers and fathers reallocate time.

Earlier empirical evidence shows that plant closures indeed hurt displaced workers' health in ways that could affect their ability to parent and care for their children, i.e. by increasing alcohol related illness and reducing mental health (see, e.g. Eliason and Storrie, 2009b; Browning and Heinesen, 2012; Kuhn et al., 2009)<sup>6</sup>. In addition, there is even evidence of increased mortality among displaced workers (Eliason and Storrie, 2009a; Eliason, 2014; Browning and Heinesen, 2012).<sup>7</sup> Parental job displacement may also adversely affect children by causing family dissolution (see, e.g., Eliason, 2012; Huttunen and Kellokumpu, 2016). Hence, there are theoretical arguments that parental job loss may affect children's outcomes, but it is not clear in which direction.

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<sup>6</sup> There are also several studies on U.S. and Canadian data, see, e.g., Schaller and Stevens (2015) and Strully (2009).

<sup>7</sup> However, the finding of increased mortality among displaced workers is not supported by evidence from Finland; see Martikainen et al. (2007). Note that the Finnish study uses a somewhat different empirical strategy and does not separate between different causes of death.

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As mentioned in the introduction, earlier evidence on child outcomes is mixed, which could reflect different ways of handling methodological challenges. Therefore, some caution is warranted when interpreting the results. Several studies have shown that parental job loss is associated with worse health outcomes. Lindo (2011) finds a 4–5 percent decline in birth weight for U.S. children born to mothers whose partner experienced job loss during pregnancy. Hong Liu and Zhong Zhao (2014), studying Chinese children, find a decline in height- and weight-for-age with 0.3–0.4 standard deviations in case of paternal job loss. The estimates for maternal job loss are smaller and not statistically significant. Using U.S. data, Schaller and Zerpa (2015) instead study parental reported health conditions and find that both paternal and maternal job loss result in reductions in parent ratings of children’s physical and mental health. But whereas paternal job loss increases the incidence of anxiety and depression (for low-SES families also the incidence of injuries), maternal job loss instead reduces the incidence of infectious illness among high-SES families.<sup>8</sup> Mörk et al. (2014) do not study effects of involuntary job loss, but instead focus on effects of parental unemployment, using Swedish register data. Comparing the same child in years when both parents work with years when at least one parent is unemployed, they find that parental unemployment is associated with an immediate increase in hospitalization with 1 percent and a 5 percent increase in the long run. Moreover, maternal job loss seems to be more detrimental to health than paternal job loss.

Analyzing schooling outcomes, Rege et al. (2011) find that Norwegian children suffer from paternal job loss (grade point average is reduced by 6 percent of a standard deviation), but gain from maternal job loss (although the latter positive effect is not statistically significant). Also Stevens and Schaller (2011) find negative effects on schooling outcomes when U.S. fathers (or mothers in case of single-household families) are displaced; the likelihood of grade retention increases with 15 percent as a result of job loss. Finally, Bratberg et al. (2008) and Hilger (2016) find negligible or no effects on future earnings of children of parental job loss when analyzing Norway and the U.S.<sup>9</sup>

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<sup>8</sup> Using U.S. data and a shift-share approach, Page et al. (2018) investigate how gender specific labor demand shocks affect (parental reported) general child health as well as the prevalence of a number of specific conditions such as asthma, ear infections, injuries and emotional difficult. They find that better labor market conditions for women is detrimental for child health, whereas worse labor market conditions for men instead improve child health.

<sup>9</sup> Oreopoulos et al. (2008) find significant negative effects on future earnings of experiencing paternal job loss as a child, but the findings in Hilger (2016) point to that their estimates are likely to be biased by selection. Note that the same problem might be present also in Bratberg et al. (2008).

We will come back to these earlier findings and relate them to our findings later in the paper.

### 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 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, it is worth noting that the dual income earner norm is strong in Sweden. Individual taxation, high marginal tax rates, and earnings' 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 consequently high among both men and women, including parents. Lundin et al. (2008) show that even among mothers of pre-school aged children, 75–80 percent are employed. Yet, far from all mothers work full time.<sup>10</sup>

In order to enable high labor force participation, subsidized, high quality, childcare is provided by the local governments. In the middle of the 1990's, which is the time period when the job losses we study occurred, approximately 50 percent of 1–2 year olds and 70 percent of 3–6 year olds attended publicly provided child care (Lundin et al., 2008). However, in a majority of municipalities, childcare and after school care slots were 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. Losing access to high quality childcare was thus also a likely consequence of parental job loss in the Swedish mid-1990's.

Second, there are no school fees in Sweden and school lunches are provided free of charge in compulsory school (ages 6–16) and high school (ages 17–19). University

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<sup>10</sup> Although there is strong emphasis on gender equality, Swedish women carry a greater responsibility for parenting and household 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. As a comparison, Gurian et al. (2008) report that U.S. mothers of young children in 2004 spent on average 21h per week on child related activities, while fathers spent 9h 40m.

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tuition is free and subsidized student loans are available for all. In addition, health care in Sweden is free of charge for children and heavily subsidized for adults. Therefore, lack of financial resources ought not affect which school children attend or whether you can afford higher education, going to the doctor or staying at the hospital. Moreover, unemployed workers were during the studied period, typically covered by unemployment insurance benefits with a replacement rate of 80 percent of lost earnings up to a ceiling. These quite generous replacement rates were combined with an active labor market policy, requiring recipients of unemployment benefits to take part in labor market programs. Unemployed individuals with very low unemployment benefits or individuals that did not qualify for unemployment benefits, had to turn to the municipalities and apply for social assistance if in need of financial support. Social assistance was means tested at the household level and in order to receive assistance, the household could not have any other means of supporting themselves. In addition, the municipalities typically required 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 suffer when 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, and it is therefore possible that the positive effects of maternal job loss found in e.g. Rege et al (2009) and Schaller and Zerpa (2015), may not be present in the Swedish case.

## 4 Empirical approach

4 We study the effect of parents' job loss on child health and family outcomes. By focusing only on job loss due to workplace closure we reduce the selection problem, i.e., that the job loss is due to worker characteristics which also may be correlated with their children's outcomes. The argument is that the closing down of a workplace is close to a natural experiment as all workers are separated from their job

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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 at workplaces that do not. For example, it may be the case that closing workplaces are concentrated to certain regions or industries or that workplaces with low productivity workers are more likely to close down. If workers and their children in these regions, industries or firms have worse health or will have worse health in the future, then the estimated effects of parental job loss will be biased in a direction that exaggerates the impact of workplace closures.

#### 4.1 Empirical strategy

~~We study the effect of parents' job loss on child health and family outcomes. By focusing only on job loss due to workplace closure we reduce the selection problem, i.e., that the job loss is due to worker characteristics which also may be correlated with their children's outcomes. The argument is that the closing down of a workplace 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 at workplaces that do not. For example, it may be the case that closing workplaces are concentrated to certain regions or industries or that workplaces with low productivity workers are more likely to close down. If workers and their children in these regions, industries or firms have worse health or will have worse health in the future, then the estimated effects of parental job loss will be biased in a direction that exaggerates the impact of workplace closures.~~

Following, e.g., Browning et al. (2006) Eliason and Storrie (2009a,b) we will use propensity score matching in order to create a control group that is as similar as possible to the treatment group. When estimating the propensity score it is important to include all confounders which are likely to affect both the probability to be exposed to a workplace closure and the outcome. Since we have access to rich panel data we estimate the propensity score including pre-closure measures (measured two or three years before the potential job loss) of the outcomes of interest, such as various income measures, health of worker and child, and whether the biological parents lived together before the job loss. We also include covariates describing the other parent and the child

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since they may be correlated with relevant unobservable characteristics of the worker.<sup>11</sup> We estimate Average treatment effect on the treated, using the `teffects psmatch` command in Stata 14. Matching is done on the nearest neighbor with replacement. A complete list of the variables and definitions can be found in Appendix Table A 2 and Table A 3.

We estimate ATET for each year from the workplace closure up to ten years after closure. As a placebo, we also provide estimates for up to eight years before closure. For some outcomes we also aggregate years into pre- and post-treatment periods. For the outcomes that cannot be observed prior to parental job loss, we estimate pre-closure effects using children whose parents will be displaced in the future, as a placebo.

### 4.34.2 Data

The data base that we build the empirical analysis on combines individual level register data from the in-patient hospital discharge and causes of death registers provided by the National Board of Health and Welfare, the population register, education register, tax registers and workplace register<sup>12</sup> provided by Statistics Sweden, and the unemployment registers provided by the Public Employment Service's register of job-seekers. Variables include individual demographic information (sex, age, family indicator); socio-economic information (education level, earnings from work, total income and income from social assistance); health (hospitalization, all causes and special diagnoses, mortality) and workplace information (size, industry, county), as well as information about workplaces which close. Our data includes information on individuals aged 0–18 during the years 1987–2010 as well as information on their (biological) parents.

#### 4.3.14.2.1 Structure of sample

Our sample consists of children whose parents were employed at workplaces at risk of closing in 1995–2000. These years are chosen to allow for a long follow-up period, both regarding effects on children and parents, while also allowing us to study measures of pretreatment outcomes. We define  $t$  as the base year when a workplace is potentially

<sup>11</sup> The conditioning set is very similar to that used in earlier Swedish studies, except that we also condition on child characteristics.

<sup>12</sup> In order to follow firms and workplaces, Statistics Sweden has constructed a data base on firm dynamics called 'The database on dynamics of enterprises and establishments', where they carefully have investigated changes in order to correctly categorize firm and workplace closures and separate true closures from mergers and other organizational changes.

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closed down. For each base year we include children who 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 the same workplace in both period  $t-2$  and  $t-3$  and to workplaces with least ten employees in the year of the potential closure. To retain ‘early leavers’ in the sample, we do not condition on working at the same workplace at  $t-1$ , the year directly before the potential closure. Early leavers are potentially a selected group. They may, on the one hand, have many options on the labor market, thus able to find other employment in anticipation of the closure. On the other hand, they may have unobserved characteristics making them the first to be let go if the workplace downsized prior to closure.

A workplace is defined as closing in year  $t$  if it is categorized as closed down between year  $t$  and  $t+1$ . A child is considered treated if the parent worked at a workplace that was closed. We append the sample for all base years 1995–2000.<sup>13</sup> As discussed above, a requirement to be in the sample is to have worked at the workplace in  $t-2$  and  $t-3$  but we do not put any restrictions on what happens in the following periods. Thus, we compare outcomes for children with displaced parents with the outcomes of children whose parents may or may not lose their job in the future. After restricting the sample to children for whose parents we have information on the covariates used in the matching as well as information on outcome variables, we are left with 44,993 children whose mothers experience job loss and 68,838 children whose fathers experience job loss. For the children whose parents’ workplace is not closed, we draw a random sample of 25 percent of the population on which we conduct the matching procedure to find our comparison group. The children and their parents are followed, for some outcomes, as far back as 8 years before the possible job displacement and up to 10 years after. This implies that the children in the end of the observed period are 12–28 years old.

### **4.3.24.2.2 Outcome variables**

Our main objective is to study how job displacement due to workplace closure affects human capital development, and more specifically, child health, school outcomes and outcomes as young adults. In order to capture health, we rely on two different measures. First, we study to what extent children of displaced parents die prematurely (*mortality*).

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<sup>13</sup> 1.3 percent of the children have a displaced mother and 1.7 percent of the children have a displaced father.

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Death is arguable an extreme measure of health, nevertheless an objective one. Fortunately, very few young people die; however, this also makes it less likely to capture any health effects. Second, we study hospitalizations. We investigate whether a child has been hospitalized for *any* diagnosis (except pregnancy/child birth) during the year (*hospitalization*). We also study particular health problems that could be a result of parental neglect or a stressful family environment, (i) diagnoses related to conditions where hospitalization is avoidable if a child is given sufficient preventable care (*avoidable*),<sup>14</sup> (ii) diagnoses related to mental illness, alcohol-related conditions, self-harm or exposure to abuse (*mental and behavior*).<sup>15</sup> We also construct aggregate indicators of hospitalization for whether a child is hospitalized in any year 2–4 years prior to and during the ten-year period following parental job loss. We do this for both any diagnoses and for the specific diagnoses.

A concern is whether our hospitalization measures really capture poor health, or whether they rather capture demand and availability of health care. There is evidence that unemployed adults are less likely to seek care compared to employed adults, given the same level of self-assessed health or (Burstrom, 2002; Åhs and Westerling, 2006). Also the likelihood of being admitted, given a specific health condition may vary with social status. However, health care for children is heavily subsidized in Sweden. Moreover, earlier studies (see, e.g., Mörk et al., 2014) have shown that our hospitalization measures are strongly negatively correlated with family income. It is thus not the case that children with wealthy parents in general consume more health care.

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*) at age 16. We also investigate whether the child has completed at least three years of high school at age 20 (*high*

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<sup>14</sup> 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 U.S.. We use the definition of avoidable conditions for children suggested by the Public Health Information Development Unit in Australia (Page et al., 2007).

<sup>15</sup> See Table A2 for a detailed description of the diagnoses, including ICD-codes, used to construct the health measures.

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*school*). Finally, we look at outcomes as young adults, more specifically, whether they, at ages 20–23, experience any unemployment (*unemployed*)<sup>16</sup> or live in a household that received social assistance (*SA*).

In order to explore possible pathways and mechanisms, but also to investigate how the effects of job displacement on our sample of parents compare to findings in other studies, we present estimates of effects of job displacement on unemployment (*unemployed*), earnings from employment and self-employment (*earnings*), family disposable income (*disposable income*), whether the family receives social assistance (*SA*) and whether the biological parents cohabit or if they live in separate households (*separated*).<sup>17</sup> We also study effects on parental mortality (*mortality*), and health using a measure of in-patient care (*hospitalization*), and hospitalization for diagnoses connected to excess alcohol consumption (*alcohol*) or mental health problems (*mental*).

### 4.44.3 Descriptive statistics

Table 1 shows summary statistics for children and their parents with mothers at a closing workplace, children with fathers at a closing workplace, as well as for the 25-percent sample of children whose parents are not displaced. Looking at the figures in the table, we note that there are indeed some important differences between parents who work at workplaces which close and those working at surviving workplaces. There is clear evidence of negative selection in terms of both worker characteristics and the human capital of their children. Children with displaced parents are somewhat younger and have lower GPA rank, but there are no health differences between the groups. Displaced mothers are younger, have a lower education level, are less likely to be born in Sweden, have shorter tenure, are less likely to cohabit, and are more likely to be hospitalized compared to non-displaced mothers. Displaced fathers are also younger, have lower education and are more likely to be separated than fathers at non-closing workplaces but the differences are smaller than in the mother sample. Notable is that displaced fathers have higher disposable income before the closure although the earnings from work is lower. Thus, they live in households which have higher income from spouse earnings, or other income sources such as social security. Some workers

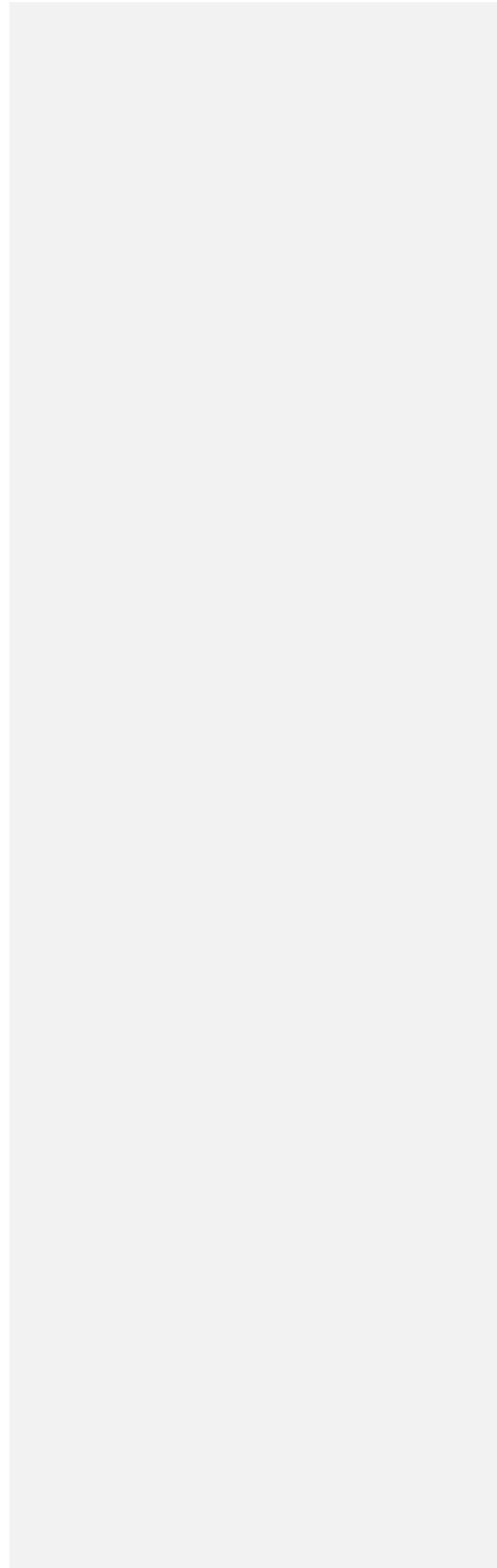
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<sup>16</sup> An individual is defined as unemployed if he/she is registered as unemployed or participates in a labor market program at any occasion during the year.

<sup>17</sup> Disposable income is calculated by Statistics Sweden and includes all types of income for all adults in the household.

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are already registered at the unemployment agency two years before the workplace is closed. Reasons could be that they are part-time unemployed or participating in a labor market program.



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Table 1 Summary statistics

	Workplace not closed	Workplace closed	Difference	(p-value)
<b>Mother sample</b>				
<b>Child characteristics</b>				
Boy	0.51	0.51	-0.00	0.08
Age	8.79	8.56	0.22	0.00
Hospitalization	44.55	44.67	-0.12	0.90
Mental and behavior	1.56	1.85	-0.30	0.12
Avoidable	6.04	6.11	-0.07	0.85
GPA rank	53.18	49.86	3.33	0.00
<b>Mother characteristics</b>				
Age	38.05	37.56	0.49	0.00
Compulsory education	0.12	0.16	-0.04	0.00
Secondary education	0.50	0.53	-0.03	0.00
University education	0.38	0.31	0.07	0.00
Swedish born	0.90	0.88	0.02	0.00
Separated	0.18	0.22	-0.03	0.00
Tenure	5.05	4.60	0.45	0.00
Unemployed	0.05	0.08	-0.02	0.00
Disposable income	367,731	364,998	2,433	0.08
Income	190,003	189,800	203	0.63
Social assistance	0.03	0.04	-0.01	0.00
Hospitalization	49.66	53.09	-3.42	0.00
Alcohol	0.62	1.16	-0.54	0.00
Mental	2.19	3.28	-1.09	0.00
No obs.	805,756	44,814		
<b>Father sample</b>				
<b>Child characteristics</b>				
Boy	0.51	0.51	-0.00	0.08
Age	7.84	7.75	0.09	0.00
Hospitalization	52.81	50.28	1.12	0.20
Mental and behavior	1.53	1.50	0.02	0.89
Avoidable	8.41	7.92	0.49	0.18
GPA rank	52.81	50.35	2.45	0.00
<b>Father characteristics</b>				
Age	39.30	39.14	0.16	0.00
Compulsory education	0.19	0.19	-0.00	0.00
Secondary education	0.48	0.48	-0.00	0.56
University education	0.33	0.32	0.01	0.00
Swedish born	0.90	0.89	0.00	0.00
Separated	0.16	0.17	-0.01	0.00
Tenure	5.32	4.85	0.47	0.00
Unemployed	0.05	0.07	-0.02	0.00
Disposable income	367,954	370,932	-2,978	0.05
Income	311,913	309,359	1,554	0.03
Social assistance	0.03	0.04	-0.00	0.00
Hospitalization	43.88	42.89	0.99	0.22
Alcohol	1.54	1.65	-0.11	0.50
Mental	2.66	2.80	-0.14	0.50
No obs.	956,572	68,518		

Notes: All variables measured in  $t - 2$ . Hospitalization, avoidable, mental and behavior, mental health problems, alcohol-related problems are measured in persons per 1,000. Tenure is censored at 8 years; unemployment is measured as being registered at the Public employment service as unemployed or in an active labor market program. When studying GPA rank the samples only include individuals who are 16 years old. The samples are smaller and include 2,635 children with displaced mothers and 3,329 children with displaced fathers.

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#### 4.54.4 Evaluation of matching

The descriptive statistics presented in Table 1 show that workplace closures do not hit workers randomly. In line with the earlier literature, we use propensity score matching to find a suitable control group, see Table A3 for details of the conditioning set. To the extent possible, we match on pretreatment outcomes of both parents and children. There are a number of requirements which need be fulfilled for propensity score matching to produce unbiased estimates of the treatment effect, i) selection is on observables rather than unobservables, ii) common support, i.e. for any value of the propensity score an individual can potentially be observed both as treated and not treated, iii) there is balancing of covariates in the control and treatment group. Whereas the first requirement is impossible to formally test, the second two are testable. One way to assess the presence of selection on unobservable characteristics is to estimate placebo models. We do this by investigating if treated and untreated children and parents have different outcomes also prior to the workplace closure and present the estimates in the next section. We present evidence ~~in Appendix B~~ in support of ~~our~~ fulfilling ~~these latter~~ requirement (i) and (ii) in Appendix B s.

## 5 Results

We start by investigating how parental job loss affects children's health outcomes in the short and long run. Thereafter we turn to the effects on school performance and outcomes in early adulthood. Then we turn to an analysis of the effects on the parents themselves in order to explore possible pathways for how parents' job loss affect their children. We present coefficient estimates of the difference between treated and untreated children and parents before and after the workplace closure graphically.<sup>18</sup>

### 5.1 The effects of parental job loss on child health

Let us first focus on the most objective and severe measure of health, mortality.<sup>19</sup> Figure 1 plots the estimated coefficient of the effect of parental job loss due to workplace closures on the cumulative difference in deaths per 1 000 children between

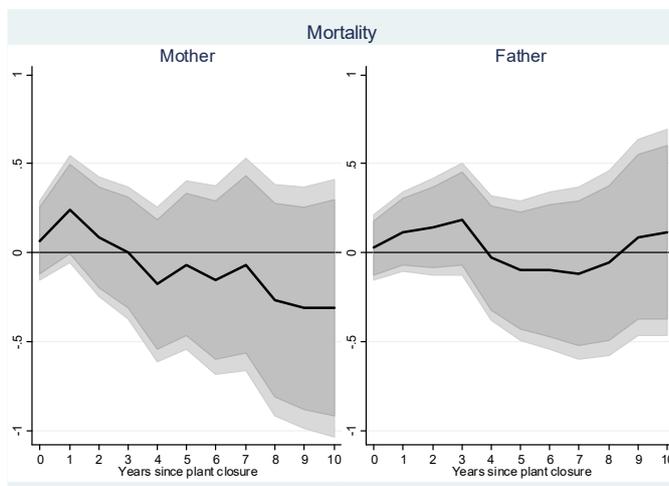
**Kommenterad [AS1]:** Vi kommer garantera få kommentaren att man inte kan se hur stora estimaten faktiskt är. Vet inte hur vi ska göra ngt åt det. Ska detta vara i ett online appendix?

<sup>18</sup> The estimate for each time period is from a separate estimation. Tables with results are not presented for lack of space, but available from the authors.

<sup>19</sup> A methodological weakness is though that we cannot condition on lagged value of the outcome in question (people only die once).

treated and untreated children, for each year up to 10 years after workplace closure. The graph to the left shows effects of maternal job loss and the graph to the right shows effects of paternal job loss. The dark grey area indicates the 90 percent confidence interval, whereas the light grey area indicates the 95 percent confidence interval. Both for maternal and paternal job loss, there is an increase, although not statistically significant, in child deaths just after job loss, but for mothers the effect reverses. The estimates range from -0.30, i.e. a reduction in the number of deaths with 0.3 per 1 000 children, to an increase of 0.25 per 1000 children. None of the estimates is statistically different from zero, hence we cannot reject null-effects. Child mortality is a very rare event, the cumulated mortality in the weighted father sample after 10 years is 2.8 children per thousand. After 10 years, the (insignificant) point estimates suggest a reduction of some 10 percent for maternal job loss and an increase by 10 percent for paternal job loss.

Figure 1 Effect of exposure to parental job loss on the cumulative number of deaths per 1 000 children from the year of closure and up to 10 years after



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.

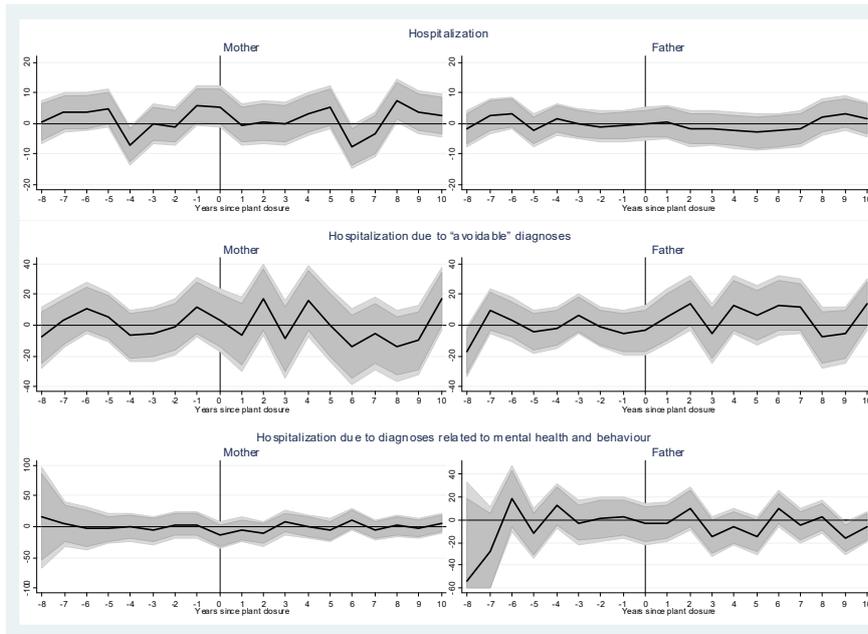
Let us nNext, we turn to a less dramatic and a considerably more common event, namely hospitalization. Still, hospitalization is relatively rare; only 270 out of 1,000

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children are hospitalized during the ten-year period following parental job loss. Figure 2 shows event-type graphs, where we for eight years before and up to ten years after maternal/paternal job loss show the percentage difference in hospitalizations between the treatment and control group for overall hospitalizations (top), hospitalizations due to avoidable diagnoses (middle) and hospitalizations due to diagnoses related to mental illness, alcohol related conditions, self-harm and exposure to abuse (mental and behavior in the bottom graph). Note that since children in our sample are 2–18 years old at  $t = 0$ , the age-composition of children will change as we move away from that year, and we know that hospitalization rates differ with respect to child age. However, the estimates in Figure 2 show the difference in hospitalization rate between treated and non-treated children and since we condition on child age at  $t = 0$  the age compositions in the two groups are the same over the whole period.

Although confidence intervals are rather wide, particularly in the bottom two graphs, we can conclude that there is no sharp increase or decrease in hospitalizations as a parent loses his/her job. Neither is there evidence of a deterioration of or improvement in health over time. To the extent that there are effects significantly different from zero in the posttreatment period, as in the case with hospitalizations due to any cause six years after workplace closure for mothers, one can find estimates of similar magnitude already in the pretreatment period. However, in the case of paternal job loss, there is some evidence of a decline in hospitalizations in diagnoses related to mental illness, alcohol related conditions, self-harm and exposure to abuse (mental and behavior) in the bottom graph.

Figure 2 The effect of exposure to parental job loss on hospitalization (percent) 8 years before to 10 years after closure



Note: Estimated using propensity score matching (nearest neighbor with replacement). Standard errors take into account that the propensity score is estimated. Dark (light) grey area indicates the 90 % (95%) confidence interval.

In Table 2 we formally test if there are any differences between treated and untreated children four to two years before and in the ten-year period after parents' workplaces are closed. Note that the outcome in these estimations is measures as an indicator taking the value zero if the child has not been hospitalized during the whole time period and one if the child has been hospitalized at least once during the period. The results displayed in the figures show the effect for each year after the closure of the workplace. First, we note that we cannot reject that the estimates for the pretreatment-period are zero, suggesting that pretreatment trends are similar in the treatment and control group.<sup>20</sup> Turning to estimates that show the difference in hospitalization between the treated and the untreated children during the first ten years after parental job loss, the

<sup>20</sup> Since the pre-period and the post-period are of different length (in addition, the age composition of the children is different in the pre- and post-period), it is not informative to compare the size of the point estimates.

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estimates are typically economically and statistically insignificant. For example, the estimate for experiencing maternal job loss indicates an increase in hospitalization rate with 4 more children per 1,000, which corresponds to an increase with 1.5 percent compared to the mean of 275. The only statistically significant result is a reduction by 2.5 hospitalized per 1,000 children for diagnoses related to *mental and behavior* in the ten years post paternal job loss, which corresponds to a 7 percent decline, compared to the mean of close to 34 hospitalized per 1,000 children. The same result could be seen in Figure 2 that showed statistically significant negative effects for the periods 3, 5 and 9 years after the paternal job loss.

Table 2 Effect of exposure to parental job loss on probability of hospitalization 0-10 years after closure

	Hospitalization	Avoidable	Mental and behavior
<i>Mother at closing workplace</i>			
<del>Effect</del> Effect 1-10 years after closure	3.948 (3.127)	-0.458 (1.189)	0.915 (1.308)
# observations	828,726	828,726	828,726
# <del>treated children with mother at closing workplace</del>	43,695	43,695	43,695
Mean of outcome variable	275	30	37
Effect 2-4 years before closure	-3.083 (2.300)	0.512 (0.990)	-0.190 (0.454)
# observations	801,988	801,988	801,988
# <del>treated children with mother at closing workplace</del>	41,998	41,998	41,998
<i>Father at closing workplace</i>			
Effect 1-10 years after closure	2.872 (2.540)	1.380 (0.983)	0.330 (1.006)
# observations	998,397	998,397	998,397
# <del>treated children with mother at closing workplace</del>	66,671	66,671	66,671
Mean of outcome variable	273	31	32
Effect 2-4 years before closure	3.351* (1.983)	0.546 (0.899)	0.261 (0.347)
# observations	919,910	919,910	919,910
# <del>treated children with mother at closing workplace</del>	61,333	61,333	61,333

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 matched sample.

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To conclude, the overall picture shows no systematic negative effects of parental job loss on child health measured as admissions to hospital or mortality of children exposed to maternal job loss. There is, however, possibly a small decline in hospitalizations due to mental illness, alcohol related conditions, self-harm or exposure to abuse (mental and behavior) after fathers' displacement.

**Earlier studies have shown that exposure to parental job loss may have larger detrimental effects for children from disadvantage backgrounds (see e.g. Oreopoulos et al., 2008). The job loss may also have heterogeneous effects depending on child characteristics. For example, recent studies have shown that boys may be more sensitive to household circumstances than girls (Autor et al. 2016). We have therefore investigated if effects differ by family income (below or above median) or by sex. We find no signs of heterogeneous effect in these dimensions, see Appendix C**

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Table A 4 Hospitalization – yearly estimates. Corresponds to figure 2 Mother

Period	Estimate	St.d	Estimate2	St.d	Estimate	St.d	# Obs
	Hospitalization		Avoidable		Mental and behavior		
-8	0.266	(2.078)	-0.673	(0.875)	0.0313	(0.0858)	620,538
-7	2.144	(1.906)	0.257	(0.800)	0.0286	(0.114)	676,021
-6	2.081	(1.782)	0.928	(0.737)	-0.0265	(0.180)	726,337
-5	2.630	(1.681)	0.471	(0.714)	-0.0496	(0.181)	772,413
-4	-3.524**	(1.579)	-0.560	(0.705)	-0.0238	(0.224)	801,932
-3	-0.0310	(1.449)	-0.360	(0.599)	-0.151	(0.270)	820,405
-2	-0.489	(1.429)	-0.0556	(0.537)	0.0889	(0.292)	853,448
-1	2.416*	(1.373)	0.601	(0.523)	0.100	(0.325)	851,955
0	2.064	(1.302)	0.134	(0.420)	-0.446	(0.344)	850,570
1	-0.179	(1.274)	-0.201	(0.398)	-0.156	(0.342)	849,319
2	0.0671	(1.270)	0.559	(0.400)	-0.402	(0.381)	848,520
3	-0.0447	(1.260)	-0.268	(0.379)	0.302	(0.411)	847,824
4	1.119	(1.257)	0.515	(0.384)	-0.0224	(0.435)	847,257
5	1.815	(1.281)	-0.0112	(0.373)	-0.314	(0.457)	846,463
6	-2.647**	(1.259)	-0.437	(0.397)	0.606	(0.480)	845,548
7	-1.258	(1.292)	-0.191	(0.407)	-0.292	(0.501)	844,406
8	2.723**	(1.299)	-0.473	(0.404)	0.124	(0.544)	842,994
9	1.364	(1.306)	-0.383	(0.438)	-0.135	(0.588)	841,335
10	0.982	(1.342)	0.711*	(0.427)	0.429	(0.635)	839,418

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Table A 5 for results.

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

We turn next to educational achievement and other outcomes as young adults.<sup>21</sup> Educational performance is measured as GPA percentile rank at end of compulsory school in 9<sup>th</sup> grade (age 16) and by high school completion by age 20. To measure how the child fares as a young adult we study the effect on the probability of being unemployed or live in a household that receives social assistance at least once during ages 20–23.

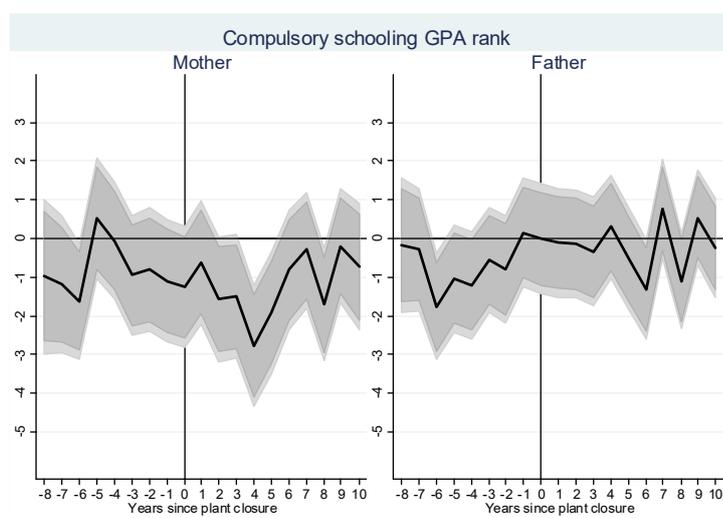
First, consider effects on compulsory school GPA rank, shown in Figure 3. We only observe GPA rank when children leave high school at age 16. Depending on how old children were when their parent experienced a job loss, the period between treatment and the observed outcome will differ. The estimate for  $t = 0$  hence corresponds to the difference in GPA rank between treated and untreated children for those whose parents' workplaces closed when the child was 16, and the estimate for  $t = 1$  corresponds to the effect for those treated one year before graduation, at age 15,  $t = 2$  corresponds to being treated 2 years before graduation, at age 14 etc.. The placebo estimates for the pre-period ( $t = -1, \dots, -8$ ) show the difference in GPA rank between treated and untreated children who had already graduated, i.e. who were 17 to 24 years old, when the parent experienced job loss.

A first observation from the graph is that the estimates change a lot from year to year and that the confidence intervals are wide. Most of the estimates are not statistically different from zero, although for children whose mother's workplace closed three to five years before they graduated from compulsory school, i.e. when they were 11–13 years old, there is a statistically significant negative effect in the order of magnitude of 2–3 percentile ranks, which corresponds to about 7–10 percent of a standard deviation. There are also significant negative point estimates at  $t = 8$  (children who were 8 years old when treated) in the case of maternal job loss and  $t = 6$  (children who were 10 years old when treated) in the case of paternal job loss. However, it is also clear that estimates are fairly unstable and that there are statistically significant estimates also for

<sup>21</sup> As in the case of mortality, we cannot in the propensity score, condition on lagged values of the outcome variable, which is a shortcoming when controlling for potential selection.

the children who had already graduated when their parent was displaced, suggesting that in spite of matching on a rich set of child outcomes we are unable to properly balance pre-displacement characteristics in child school outcomes.

Figure 3 Effect of exposure to parental job loss on GPA rank percentile at age 16 for children graduating  $t$  years after closure



Note: Estimated using propensity score matching (nearest neighbor with replacement). Standard errors take into account that the propensity score is estimated. Dark (light) grey area indicates the 90 % (95%) confidence interval.  $t=0$  is the estimate for children who are 16 at the time of workplace closure.  $t = 1, 2, \dots, 10$  is for children who were 15, 14,  $\dots$ , 6 at time of workplace closure and  $t = -1, -2, \dots, -8$  which implies that the child was 17, 18,  $\dots$ , 24 at closure.

Table 3 present estimates for groups of children who are exposed to parental job loss at different ages. The results confirm the results in Figure 3. There is a negative statistically significant effect for children exposed to maternal job loss at ages 13–16 (top panel, third column) and paternal job loss at ages 7–9 (bottom panel, first column). However, the GPA-rank for children whose parents were exposed to workplace closure after they had graduated is different from the GPA-rank of children whose parents did not experience a job loss (forth column). Hence, the results indicate that we have not been successful in controlling for selection. Another take home message from Figure 3

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and Table 3 is that depending on which cohorts we study and how we aggregate different cohorts, we can reach quite different conclusions.

Table 3 Effect of exposure to parental job loss on GPA rank percentile, exposure at different ages.

	7–9 years old at workplace closure	10–12 years old at workplace closure	13–16 years old at workplace closure	18–20 years old at workplace closure
		<i>Mother at closing workplace</i>		
<u>Workplace closure</u> <u>GPA rank percentile</u>	-0.428	-0.274	-1.226***	-0.838*
	(0.439)	(0.458)	(0.405)	(0.454)
# observations	173,603	170,754	219,492	171,949
		<i>Father at closing workplace</i>		
<u>GPA rank percentile</u> <u>Workplace closure</u>	-0.803**	-0.145	0.124	-0.903**
	(0.370)	(0.383)	(0.358)	(0.410)
# observations	205,327	188,160	224,379	163,816

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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 matched sample.

Next, we turn to high school completion and other outcomes in young adulthood.<sup>22</sup> Results are presented in Table 4. Starting with the main effects, it seems like maternal job loss increases the likelihood of living in a household that receives social assistance (with 6 percent) and increase the likelihood of being unemployed (with 1.5 percent). However, turning to the placebo estimates, which show how young adults whose parents will experience job loss in the future compare to those whose parents will not experience a future job loss, we find that the former group is less likely to have completed high school and more likely to receive social assistance and experience unemployment. Hence, they seem to be negatively selected with respect to educational and labor market outcomes, making it hard to draw firm conclusions from the main

<sup>22</sup> Similar to GPA these outcomes can only be measured once per child, limiting the possibility to control for pretreatment differences between the groups.

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analysis. It is possible that absence of average effects, masks differential treatment effects for different groups.

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

	High school completion at age 20	Social assistance age 20–23	Unemployed age 20–23
<i>Mother at closing workplace</i>			
<del>Parental</del> -workplace closure at age 6–16	-0.000640 (0.00334)	0.00814*** (0.00309)	0.00788* (0.00464)
# observations	493,205	472,495	472,495
# treated children	25,764	24,812	24,812
Mean of outcome variable	0.837	0.128	0.469
<del>Parental</del> -workplace closure at age>23	-0.0147* (0.00763)	0.0141** (0.00646)	0.0185** (0.00761)
# observations	137,210	182,295	182,295
# treated children	6,767	8,438	8,438
<i>Father at closing workplace</i>			
<del>Parental</del> -workplace closure at age 6–16	0.00154 (0.00286)	0.00345 (0.00276)	0.0062* (0.00402)
# observations	534,279	496,151	496,151
# treated children	35,618	33,233	33,233
Mean of outcome variable	0.841	0.135	0.478
<del>Parental</del> -workplace closure at age>23	-0.0118* (0.00673)	-0.00116 (0.00567)	0.010* (0.00676)
# observations	131,925	165,828	165,828
# treated children	8,676	10,779	10,779

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 matched sample.

To conclude, even though we have access to rich register data, including past health outcomes of both parents and children, the results in this section suggest that this is not enough to control for potential selection when it comes to studying educational and labor market outcomes, making it hard to draw firm conclusions regarding effects of parental job loss on child human capital. Our results, however, do not suggest large negative effects on educational and labor market outcomes.

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### **5.3 The effects of parental job loss on the family**

The results above indicate that children's health, measured as hospitalization, was not negatively affected by parental job loss and although it is hard to draw firm conclusions about other effects on human capital there are no indications of large negative effects. There are at least two possible explanations for this. First, it might be the case that the parents and families were actually not affected by the closure of their workplace. Although earlier studies suggest long-lasting negative effects on affected workers' income, unemployment and health, these studies focus on a different period and do not focus specifically on parents. It might be the case that parents for some reason are less hurt by job loss, they are for example typically younger than the average worker is, or that the general situation on the labor market matters. Second, it might be the case that the parents are indeed affected but that this does not spill over to the children, possibly because the Swedish welfare state allows parents to shield their children from the negative effects. To shed light on the potential mechanism behind the results for children we will next investigate the effect of job loss on the parents themselves. The outcomes we investigate are unemployment, earnings, disposable family income, social assistance recipiency, family separations, as well as mortality and hospitalization.

We first consider labor market outcomes. The top panel in Figure 4 shows the difference (in the fraction) in unemployment of mothers (left) and fathers (right) who are exposed to workplace closure compared to parents in the matched control group, seven years prior to the exposure and up to ten years after. As is clear from the figure, there are no differences between treatment and untreated parents two years or more before the workplace closes down.<sup>23</sup> However, once the workplace closes, unemployment increases sharply for both treated mothers and fathers. In the year of closure and the following year, the increase relative to controls is some 7–8 percentage points for mothers and around 9 percentage points for fathers, which implies an increase by 118 percent for fathers and 84 percent for mothers in unemployment risk compared to mean levels for these years for the control group. The differences in unemployment diminish gradually over time. There is, however, still after 10 years, a higher risk of unemployment (1.4 percentage points for mothers and 1.2 percentage point for fathers) among workers who were displaced.

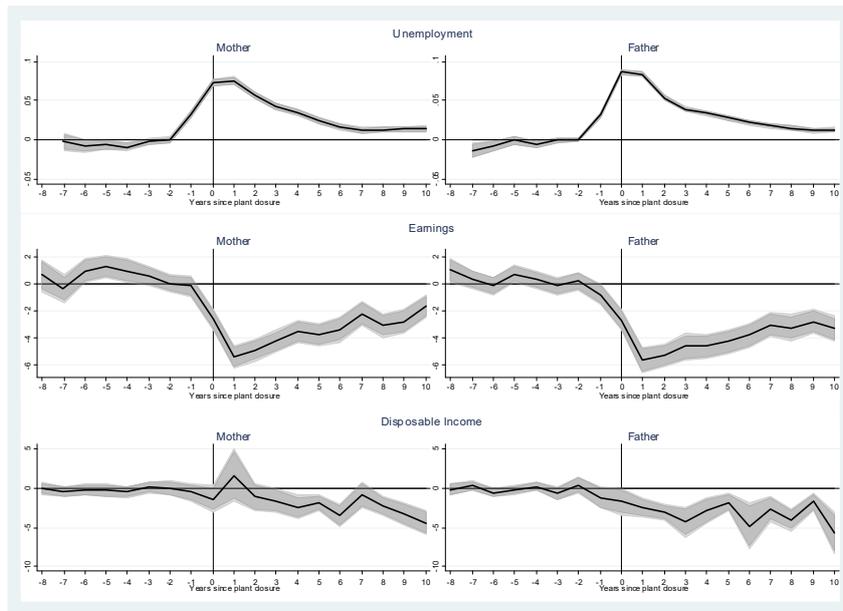
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<sup>23</sup> Since we condition on parents working in the workplace at  $t-2$ , it should come as no surprise that there are no differences in unemployment in this year.

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The middle panel in Figure 4 shows the effect on the labor earnings of the affected parent. At the time of the workplace closure, earnings drop by 5–6 percent for both mothers and fathers, slowly recover, but are still about 3 percent lower for the displaced parents compared to the untreated parents 10 years after the workplace closed. The bottom panel shows the difference in family disposable income in percent between treated and untreated families. Disposable income in treated families shows a persistent decline compared to untreated families of about 2–3 percent as mothers' workplaces close and somewhat larger effects as fathers' workplaces close.

Figure 4 Parental outcomes: Unemployment (fraction), Earnings (percent) and Disposable income (percent) 8(7) years before and up to 10 years after closure



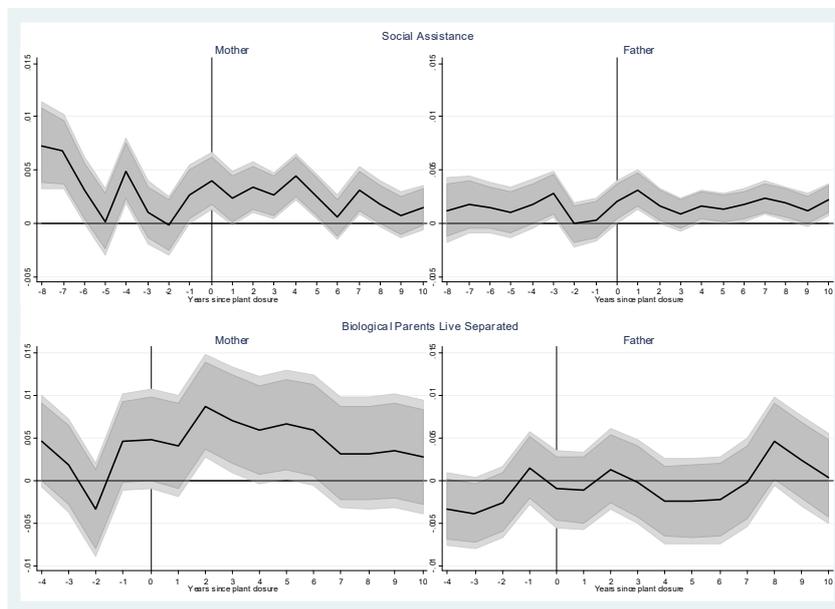
Note: Estimated using propensity score matching (nearest neighbor with replacement). Standard errors take into account that the propensity score is estimated. Dark (light) grey area indicates the 90 % (95%) confidence interval. Unemployment is only observed in the data since 1992, therefore the pre-period is only 7 years instead of 8.

In Figure 5 we consider the effects of job loss on the incidence of receiving social assistance (top panel) and on family separations (bottom panel). As mothers' workplaces close there is some evidence of an increase in the share of families receiving

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social assistance in the order of magnitude of 0.5 percentage points in the years after displacement. The fraction of households receiving social assistance prior to job loss was 0.04 and hence the effect corresponds to 12.5 percent increase. However, although we are able to match treatment and controls on receiving social assistance at  $t - 2$ , there are significant differences between the two groups already in the pretreatment-period, more so when mothers are displaced. This casts doubts on whether treatment effects on social assistance can be interpreted causally. In the bottom panel, the results suggest that family separations increase as mothers' workplaces close. Two and three years after workplace closure, the share of separated families increases by between 0.5 and 1 percentage points compared to the control group. As 27 percent of the children in the sample did not live with both their biological parents two years after the job loss this corresponds to an increase of 2–3 percent.

Figure 5 Effect of exposure to job loss on social assistance (share) and likelihood of biological parents being separated (share) eight years before and up to 10 years after closure



Note: Estimated using propensity score matching (nearest neighbor with replacement). Standard errors take into account that the propensity score is estimated. Dark (light) grey area indicates the 90 % (95%) confidence interval

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Next, we turn to parental health. Figure 6 presents effects of workplace closure on parental mortality (top panel), hospitalizations in general (second panel), hospitalizations related to alcohol (third panel), and hospitalizations related to mental health (bottom panel). Note that the scale on the y-axis differs for mothers and fathers in the two bottom panels. Mortality of mothers and fathers increases relative to the control group as workplaces close. For fathers, the increase of two deaths per thousand fathers 6–7, years and also 10 years after workplace closure, is statistically significant. The long run estimates, 10 years after workplace closure, imply a 12.4 percent increase in deaths for fathers and 9.2 percent for mothers, although the effect for mothers is statistically insignificant.

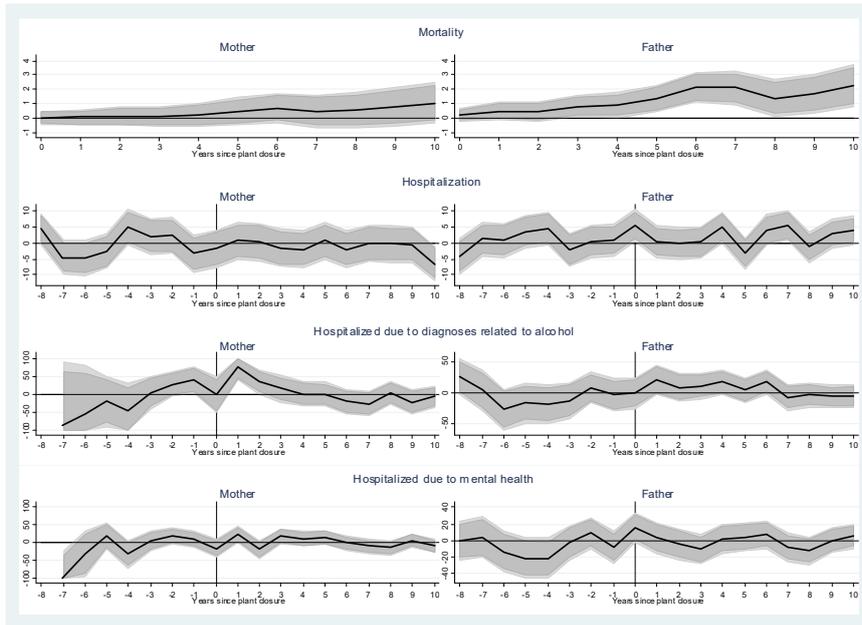
Turning to the effects on hospitalization, for any cause, ~~just as in the~~ similar to the case for children, ~~the~~ confidence intervals are rather wide and ~~it is difficult to~~ we do not detect ~~an obvious~~ pattern ~~of increased~~ where hospitalization rates ~~increase in connection~~ ~~with the~~ after the workplace closure ~~of the workplace~~. For fathers, there is a small increase (around 5 percent) in some of the years in connection and following the job loss. When focusing on specific diagnoses (alcohol related conditions and mental health problems), there seems to be some negative consequences of workplace closures. For mothers, hospitalization due to alcohol related conditions show a large increase (as much as 60 percent increase at  $t = 1$ ) in the years around the closure, and some increase in hospitalization due to mental conditions (significant at  $t = 1$ ). For fathers, there is a smaller (around 25 percent increase) but more persistent (significant at  $t = 1$ , at  $t = 4$ , at  $t = 6$ ) increase in hospitalization due to alcohol related conditions, but no signs of deteriorating mental health.

Next we study whether workers exposed to job loss are more likely to be admitted to hospital at any time up to 10 years after closure of the workplace. The results in Table 5 show a statistically significant effect on hospitalization for conditions related to mental health among mothers but no effects on hospitalization due to alcohol related conditions. As we can see in Figure 6, although mothers exposed to job loss are more likely to be hospitalized for conditions related to alcohol the first years following displacement, they are less likely (although the estimates are not statistically significant) 5 to 10 years after workplace closure. Hence, when we study the probability to admitted

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to hospital in any period 0–10 years after workplace closure these effects cancel out and there is no statistically significant overall effect.

**Figure 6** Effect of exposure to job loss on parental mortality (number of deaths per 1 000 between closure and year t) and hospitalization (percent)



Note: Estimated using propensity score matching (nearest neighbor with replacement). Standard errors take into account that the propensity score is estimated. Dark (light) grey area indicates the 90 % (95%) confidence interval. There is no estimate for the effect on hospitalization due to alcohol or mental health for mothers in period -8 because no one got any of these diagnoses.

(1)	(2)	(3)	(4)	
VARIABLES	sick m8 18	mental m8 18	alcohol m8 18	dead m18
r1vs0.close_m6	-2.684 (3.314)	0.933 (1.166)	1.183* (0.690)	0.849 (0.730)
Observations	835,507	835,507	835,507	848,746

**Table 5** Effect of exposure to job loss on probability of hospitalization 0-10 years after closure

	Hospitalization	Mental health	Alcohol
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<i>Mother at closing workplace</i>			
Effect 1-10 years <i>after</i> closure	-2.684 (3.314)	0.933 (1.166)	1.183* (0.690)
# observations	835,507	835,507	835,507
# <del>treated</del> children <del>with mother at closing workplace</del>	43,957	43,957	43,957
Mean of outcome variable	348	29	10
<hr/>			
Effect 2-8 years <i>before</i> closure	-2.273 (2.297)	0.262 (0.993)	-0.179 (0.595)
# observations	848,488	848,488	848,488
# <del>treated</del> children <del>with mother at closing workplace</del>	44,670	44,670	44,670
<hr/>			
<i>Father at closing workplace</i>			
Effect 1-10 years <i>after</i> closure	2.414 (2.635)	1.425 (0.947)	0.422 (0.744)
# observations	1,028,744	1,028,744	1,028,744
# <del>treated</del> children <del>with father at closing workplace</del>	68,777	68,777	68,777
Mean of outcome variable	330	29	18
<hr/>			
Effect 2-8 years <i>before</i> closure	-1.832 (2.345)	-0.975 (0.605)	-0.207 (0.442)
# observations	1,013,494	1,013,494	1,013,494
# <del>treated</del> children <del>with father at closing workplace</del>	61,412	61,412	61,412

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 matched sample.

In summary, our results show that families are indeed negatively affected by parental job loss in a number of ways. In particular, unemployment risk increases, parental earnings drop and family disposable income is lower for ten years following the closure of a parent's workplace. The evidence on social assistance is less clear, but when mothers suffer job loss the risk of family separation increases. Parental health is also affected. In particular, this is manifested in an increased mortality for fathers and an increase in hospitalizations due to alcohol related conditions for both parents and possibly an immediate increase in hospitalization due to mental health conditions for mothers.

#### 5.4 Discussion of results

Parental job loss does not seem to have large negative consequences for children, although parents are hurt by job loss in a number of ways. First, we do not find evidence

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of increased mortality nor increased hospitalizations of the exposed children. Instead, there is a small decline in hospitalization due to diagnose related to mental illness, alcohol related conditions, self-harm or exposure to abuse (mental and behavior) following paternal job loss. When studying educational and early adulthood outcomes, we similarly do not find convincing evidence of large negative effects. Although we find negative effects on compulsory school GPA and possibly small increases in the fraction receiving social assistance as well as the fraction unemployed, the credibility of these ~~effects-results~~ can be questioned since pretreatment patterns indicate remaining negative selection in the treatment group as compared to the matched control group.

Our results for children's outcomes are somewhat at odds with previous studies. We cannot confirm that parental job loss is associated with worse mental health (Schaller and Zerpa, 2015) and socio-behavioral problems (Peter, 2016), nor worse schooling outcomes (Rege et al., 2011; Stevens and Schaller, 2011; Ruiz-Valenzuela, 2015). Our results are hence more in line with the longer run findings of negligible or no effects on or future earnings in (Bratberg et al., 2008; Hilger, 2016).<sup>24</sup>

Considering the effects on compulsory school GPA ~~of parental job loss for children~~, when focusing on children who were 12–14 years at job loss, our results ~~show some resemblance~~ ~~are similar~~ to the results presented in Rege et al. (2011), i.e. children whose parents suffer job loss a few years before they are about to graduate from compulsory school have about 2–3 percentiles lower GPA rank, which corresponds to about 7–10 percent of a standard deviation. Unlike, Rege et al., who find negative effects of paternal job loss and positive (although statistically insignificant) effects of maternal job loss, we find the negative effects for both paternal and maternal job loss.<sup>25</sup> However, as is clear from Figure 3, for some of the cohorts ~~that graduated-graduating~~ *before* parental job loss there are significant estimates of similar magnitude. Since we, in addition, do not find any evidence that high school completion was affected, our conclusion is that the negative effects found for GPA are likely driven by selection or just spurious correlations. The overall pattern is not convincing enough to conclude that schooling outcomes were indeed negatively affected.

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<sup>24</sup> Since the children we study are at least 2 years of age when hit by parental unemployment, we cannot compare our results to (Lindo, 2011) and (Hong Liu and Zhong Zhao, 2014) who study birth weight, height- and weight-for age.

<sup>25</sup> Mörk et al. (2014) find that maternal unemployment, if anything, is more detrimental for child health than paternal unemployment.

Oreopolous et al. (2008) and Page et al. (2009) find that children from weaker socioeconomic background are more severely hit by parental job loss. We have investigated if results differ for children in families above or below median income. We find no such differences, supporting a conclusion that Swedish children are not negatively affected by parental job loss, at least not when it comes to mortality, hospitalizations or the early adult outcomes measured here.

Our results on the effects of job loss on the labor market outcomes of parents, situation of the family and parental health show effects that are ~~very much~~ in line with what has been found in the earlier literature for the Nordic countries. First, we find that parental unemployment rises sharply by some 7–9 percentage points with job loss. There is also a small increase in the unemployment risk ten years after job loss. This is somewhat smaller than the effect found in Eliason and Storrie (2006), but larger than the effects reported in Rege et al. (2011). The effects on earnings, around a 2–6 percent decline in the years after workplace closure, are similar to the effects found in Eliason (2009, 2011) and Rege et al. (2011), but smaller than those found in Bratberg et al. (2008), ~~as well as those found and in in the~~ U.S. studies using self-reports on involuntary job loss.

Our results on family stability and parental health also point in the same direction as those ~~that has been~~ found for workers in general, see Eliason (2012) and Huttunen and Kellokumpu (2016). ~~In particular. As regards health,~~ Eliason and Storrie (2009) and Eliason (2015) also find evidence of increased alcohol related hospitalization following job loss.

Hence, it is not the case that the absence of effects on children in our study is ~~explained by a result of a similar absence of effects on th at the the~~ Swedish parents who lost their jobs in the late 1990's ~~were shielded from the negative effects of job loss.~~ The ~~consequences of job loss for these parents were as negative as the consequences for~~ ~~did indeed suffer in much the same ways as~~ other workers.

## 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 suggest~~

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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.

Kommenterad [AS2]: Stryk detta?

Overall, our results show very limited effects on child outcomes. We do not find any negative effects of parental job loss on mortality or hospitalization. Effects on other human capital measures are also limited. The lack of effects of children is however not a result of that parents and the family were not affected by workplace closure. Instead, similar to previous literature, we find that parents are more likely to be unemployed and have lower earnings for several years after job loss. In addition, parental health is negatively affected; fathers show increased mortality risk, mothers' display increases in mental health hospitalizations and both parents show increased hospitalization due to alcohol related conditions.

Our result on education cannot confirm previous evidence of negative effects on school performance (Rege et al. 2009). Instead they are more in line with the previous evidence on effects in early adulthood (Bratberg 2008 and Hilger, 2016). Importantly, our results on education and early adult outcomes are in line with those found by earlier studies. However, they also show that selection issues remain, even though we match on a richer set of child and parent characteristics than previous studies. This finding points to the importance of controlling for lagged outcome variables, as emphasized ~~is~~ in Hilger (2016).

How should we understand the absence of negative effects on child health, measured as hospitalizations, given that families seem to be negatively affected by workplace closures, and that the effects are very similar for maternal and paternal job loss? It is possible that the Swedish context, with a welfare state and a dual earner norm can in part explain this result. First, the welfare state institutions of unemployment benefits, subsidized childcare, free tuition and health care insure families and children against the consequences of job loss and financial distress. Second, the dual earner norm may, on one hand, imply that families are more severely hit by maternal job loss in terms of separations and increases reliance on social assistance, but, on the other hand, imply that

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mothers' ability and willingness to relocate time towards parenting is limited by a need to regain employment, hence reducing the scope for positive effects on children's human capital accumulation of maternal job loss.

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## Appendix A

Table A 1 Earlier studies

Study	Data	Outcome	Population	Definition of job loss	Model	Results
<b>Health</b>						
Lindo (2011)	US, survey data: PSID	Birth weight (self-reported)	Children born to mothers whose partner (the father) experienced job loss during pregnancy  No. of treated children: 797	Involuntary job loss due to plant closure, lay-off or due to being fired (self-reported)	Control for mother- fixed effects, mother's age and the year of birth and child's sex and birth order fixed effects Placebo: No effects on children born two years before paternal job loss	Parents: Family income declines by 13 percent.  Children: A decline in birth weight with 4-5 percent. Suggestive evidence that the effects of larger effects at the bottom of weight distribution.
Hong Liu and Zhong Zhao (2014)	China, survey data: China Health and Nutrition Survey	Height-for-age and weight-for-age z-scores (self-reported) z-score =(actual height(weight)-mean height(weight)/st. dev. height(weight)	Children aged 0-18 with parents with working history in the public institutions, state owned enterprises, or collectives.  No. of treated children: 247	Layoffs caused by restructuring of state owned enterprises in connection with the urban labor market reform (self-reported)	Control for child-fixed effects as well as co- variates including lagged health Placebo: No effects of future job loss	Parents: Household income decreases (50% of average household income) with paternal job loss but not with maternal job loss, in which case time spend caring for children increase.  Children: A decline in height- and weight-for-age with 0.33-0.37 standard deviations in case of paternal job loss. Smaller and insignificant effect of maternal job loss. The effect is driven by poor households
Mörk, Svaleryd and Sjögren	Sweden, register data	Hospitalization	Children 3-18 years old, where the biological parent participates in the	Being registered as openly unemployed or	Control for child-fixed effects as well as child age and gender,	Children: Parental unemployment is associated with an

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(2014)			labor force.  No. of treated children: 1,603,459	participating in a labor market program.	parental age, education level and immigrant background, parental health, family disposable income, intact family as and local unemployment	immediate 1 % increase in hospitalization and a 5 % increase in the long run. Stronger effects for maternal unemployment.
Schaller and Zerpa (2015)	US, survey data Medical Expenditure Panel Survey (MEPS)	Parental-reported health and mental health  Health conditions (parental-reported): infectious illnesses, bronchitis, asthma, injuries, ADD, stress- related mental disorder (anxiety and depression)  Health insurance status  Health care and prescription drug utilization expenditures (parental-reported, but with complemented with information collected from a sample of medical providers)	Children 1-16 years old with at least one employed parent at first interview (when looking at mental health outcomes: children 6-16).  No. of treated children: 1,969/1,618 (paternal/maternal job loss)	Involuntary job loss due to the following reasons "job ended", "business dissolved or sold", "laid off" (self- reported) Sensitivity: only job loss due to firm closures	Control for child-fixed effects co-variates and linear time trend Placebo: No effects of future job loss	Children: Both paternal and maternal job loss result in reductions in parent ratings of children's health and mental health: Paternal job loss increases the incidence of anxiety and depression, and among low-SES families increases the incidence of injuries. Maternal job loss reduced the incidence of infectious illness among high-SES families. Paternal job loss implies a reduction in private insurance coverage counteracted by an increase in public health insurance coverage Health care visits: Fathers: increase in mental health visits Mothers: reductions in drug prescriptions
Peter (2016)	Germany, survey data: Socio Economic Panel Study	Non-cognitive skills: 5/6-year olds: socio emotional behavior 17-year olds: Locus of control	Preschool sample: children aged five/six whose mother was 20 or older when giving birth.  Adolescents-sample:	Involuntary job loss due to plant closures or dismissal by employer (self- reported)	Regression-adjusted matching approach	Parents: Decreased life- satisfaction for preschool mothers and decreased household income for mothers with older children.

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			Children aged 17 living with their parents, and whose mother was 20 or older when giving birth Study maternal job loss  No. of treated children: 229/522 (preschool-/adolescent-sample)	Sensitivity: separate between the two reasons for job loss		Children: Increases preschool children's socio-behavioural problems with 51 % of a standard deviation and decrease adolescents' locus of control with 26% of a standard deviation (the latter only for dismissals)
Bubonya, Cobb-Clark and Wooden (2017)	Australia, survey data HILDA	Self-reported mental health: experiencing anxiety and mood disturbances over a four week period	Children aged 15-20 living with at least one parent  No. of treated children: 245/221 (paternal/maternal job loss)	Involuntary job loss due to lay-off, retrenchment, redundancy, dismissal and firm closures (self-reported) Sensitivity: unexpected job loss	Control for individual-specific fixed effects and co-variates	Parents: Mental health of women (but not men) declines following a spouse's job loss, but only if that job loss results in a sustained period of non-employment or if the couple experienced prior financial hardship or relationship strain Children: A negative effect of parental job loss on the mental health of adolescent girls, especially in case of maternal job loss.
<b>Grades</b>						
Rege, Telle and Votruba (2011)	Norway, register data	Grade point average of 10 <sup>th</sup> graders	Tenth graders (typically 16 years old) whose parents were employed in a plant three years before, that closed during the next two years or was stable, and had at least one year of tenure and worked full time.  No. of treated children:	Workers in plants with a plant downsizing rate of 90 % or more	Control for industry-, municipality- and school-fixed effects as well as covariates including past earnings Placebo: No effects of future plant closures	Parents: A decline in fathers'/mothers' earnings with 0.06/0.04 ln-points, and they are 3 % less likely to be employed year after. No immediate effect on divorce () Children: Negative effect of paternal job loss (6 % of a standard dev)

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			1,672 (paternal job loss)			Positive (non-significant) effect of maternal job loss
Stevens and Schaller (2011)	US, survey data Survey of Income and Program Participation (SIPP)	Grade retention the year after parental job loss	Children 5-19 whose fathers (or mothers in single households) experienced job loss  No. of treated children: 2,170	Involuntary job loss: fired or discharged, employer sold or bankrupt, slack work or business conditions (self-reported) Sensitivity: only job loss due to employer sold or bankrupt, slack work or business conditions	Control for child-fixed effects and time-varying and fixed family, school and child factors as well as regional unemployment Placebo: No effects of job loss in the current year	Parents: Family income reduces with 10 % and family earnings with 15 %. An increase in likelihood of divorce/relocation with 3/7.5 % in the short run  Children: Increase in the probability of grade retention by 15 %. Larger effects for in families with high pre-period income
Ruiz-Valenzuela (2015)	Spain: survey data	Average grades during an academic year	Students aged 3-16 in Barcelona, in two-parent households  No. of treated children: 54	Unemployed during the Great recession (self-reported and retrospective)	Control for children-fixed effects as well as year X group effects Placebo: No effect of future unemployment (only cross-section estimates)	Children: Fathers job loss reduces grades with 13% of a standard dev, especially for boys. No effects of maternal unemployment
<b>Long run outcomes including post-secondary schooling</b>						
Oreopoulos, Page and Stevens (2008)	Canada, register data Intergenerational Income Database (IID)	Earnings, unemployment insurance and social assistance at age 25-32.	Boys 10-14 when fathers lost job. Fathers aged 30-50, with at least two year tenure at the firm  No. of treated children: 1,411	Job loss due to firm closures	Controlling for family income in the pre-displacement years, as well as region, industry and firm size fixed effects.	Parents: Fathers earnings are reduced by 30 % in the short run and 18 % after 8 year. Family income is reduced by 10 %.  Children: Earnings reduced by 9 % as adults. Effects concentrated in the bottom of distribution. The likelihood of receiving unemployment insurance/social assistance increases with

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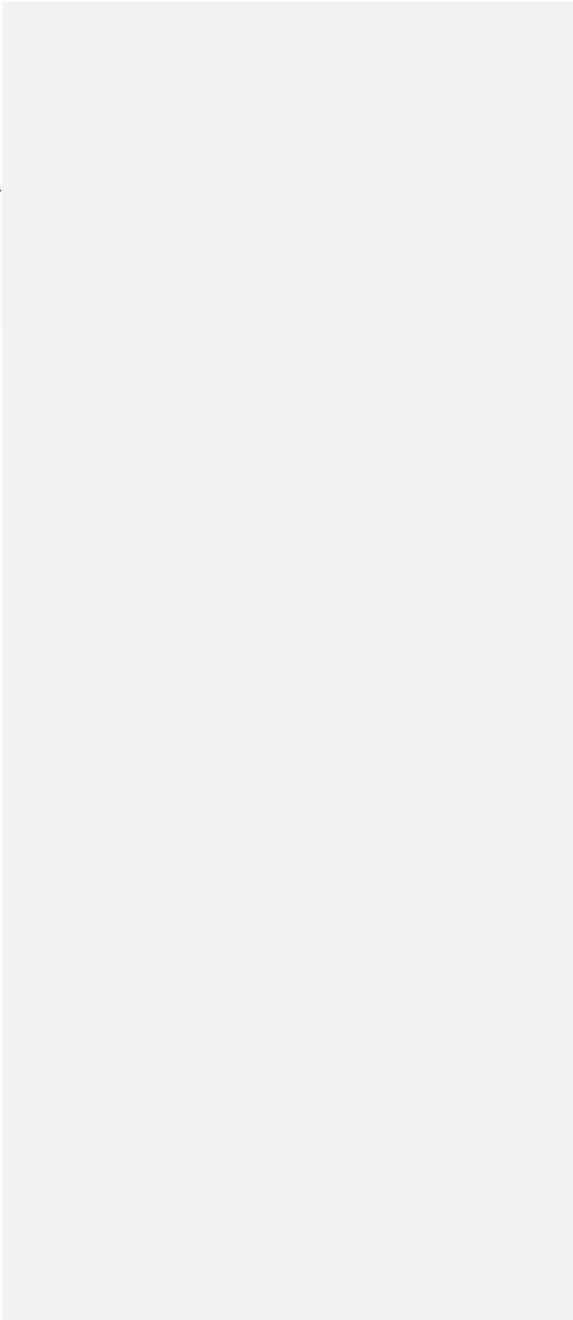
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Bratberg, Nilsen and Vaage (2008)	Norway: Register data	Earnings at age 25-30 (15 years after paternal job loss)	Children 12-15 when their father experienced job loss Fathers with at least four years tenure at the firm.  No. of treated children: 2,486/720 (all displaced/plant closures)	Job loss due to downsizing (at least 30 % of the labor stock) or plant closures	Control for fathers' pre-displacement earnings and industry, as well as gender and cohort of the child	Parents: Fathers' earnings are reduced with 5-10% (10-20 % for those on closing plants) and employment is reduced by 40 pp initially and with 10-13 pp after 7 years.  Children: No effects on earnings, nor in the aggregate or anywhere in the earnings distribution.
Page, Stevens and Lindo (2009)	US, survey data PSID	Education, income, earnings, unemployment, AFDC	Children aged 15 or younger when family head experienced job loss.  No. of treated children: 673/242 (all displaced/only job closures)	Job loss due to layoffs or firm closures (self-reported). Focus on firm closures in most of the paper.	Control for average family income 3-5 years before job loss (control for gender, age, business cycle)	Parents: Earnings and family income are 20-30 % lower up to 6 years after job loss.  Children: When all job losses are included, future earnings drop with 10 % due to job loss, but when only firm closures are considered earnings are not affected. For children from poor families, negative effects on education, unemployment and AFDC. Larger effects for children that were young at parent job loss
Coelli (2011)	Canada, survey data Canadian Survey of Labour and Income Dynamics (SLID)	Post-secondary enrollment at ages 16-19/29	Children whose main income earner experienced job loss when children were 16-18.	Involuntary job loss due to permanent layoff (redundancy) or business failure (self-reported).	Control for after tax parental income at age 16, parental education, gender, distance to closest university as well as city, rural, time and	Parents: Family income drops with 17 %. No evidence of increased stress (self-reported).  Children: Probability of

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			No. of treated children: 174	Sensitivity: separate between layoffs due to redundancy and business closures	province dummies  Placebo: Finds no effects of future job loss	enrollment lowered by 10 percentage points. Larger effect for children whose parents had higher pre-displacement income If anything larger effects for firm closures
Wightman (2012)	US, survey data PSID	Post-secondary educational attainment at 21	Children where the household head experienced job loss.  No. of treated children: 1038/616 (layoffs/firm closures)	Involuntary job loss due to layoffs or plant/firm closures (self-reported). Separate between the two causes for job loss	Control for gender, race, family structure, parental income and education, parental cognitive ability and non-cognitive attitudes parental ability at child birth Sensitivity: use industry specific demand as instrument for job loss	Children: parental job loss due to layoffs/firm closures reduces the probability of obtaining post-secondary education with 15/5 percent.  IV estimates show larger negative effects
Brand and Thomas (2014)	US, survey data The National Longitudinal Survey of Youth (NLSY) and The National Longitudinal Survey's Child-Mother File (NLSCM)	High school completion at age 19, college attendance at age 21, college completion at age 25, depressive symptoms at ages 20-24, depressive symptoms at ages 25-29	Children aged 0-17 to single (when displaced) mothers.  No. of treated children: 5,697	Involuntary job loss due to layoffs or plant closures (self-reported)	Propensity score matching, on maternal cognitive and non-cognitive skill, delinquent activity, race, education, employment and family history (at child's birth/age6/age12)  Also investigates heterogeneous effects with respect to the propensity score	Children: Maternal job loss leads to 4-6 percentage points lower high school/college completion and 2.5 percentage points more depressive symptoms at ages 25-29. The effects larger for mothers less likely to be displaced and in "better" times. The negative effects are driven by children whose mothers were displaced when child was >5
Hilger 2016)	US, register data Federal tax returns	College enrollment, college quality, early career earnings	Children aged 12-18 at paternal job loss  No. of treated children: Not clear from the paper	Uptake of unemployment insurance benefits. In a sensitivity analysis: involuntary job	Difference-in-differences approach: First difference: Children of laid off parents and children whose parents remained at the firm. Second difference:	Parents: Reductions in household income.  Children: College enrollment reduces by less half of one percentage point.

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				loss due to firm closures	Those that reach 19 before layoff and those that reach 19 after layoff	Marginally negative effects on college quality. No effects on early career earnings. Biggest effects for middle-incomes
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Table A 2 ICD-codes for different diagnoses

<b>Variable</b>	<b>Definition based on ICD10 codes</b>
Hospitalization	= 1 000 if admitted to hospital that year
Avoidable	= 1 000 if admitted to hospital with diagnosis codes: Asthma J45, J46 (main or sub diagnosis) Diabetes E101–E108 (main or sub diagnosis)  E110–E118, E130-E138, E140-E148 (main or sub diagnosis) Nutrition E40-E43, E550, E643 (main or sub diagnosis) Anemia D501-509 (main or sub diagnosis) hypertension i110,i119 (main or sub diagnosis) Chronic obstructive lung disease J41, J42, J43, J44, J47 (main diagnosis) ; *J20 (main diagnosis together with) J41, J42, J43, J44, J47 (sub-diagnosis) The following main diagnoses: Diarrhea 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
Mental and behavior	Hospitalization for self-harm Hospitalization for mental health problems Hospitalization for abuse by partner or parent See definitions below
Hospitalization for self-harm	=1000 if admitted to hospital with main diagnosis or any of the first five sub-diagnoses Self-destructive behavior 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 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
Alcohol	=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, O35.4)

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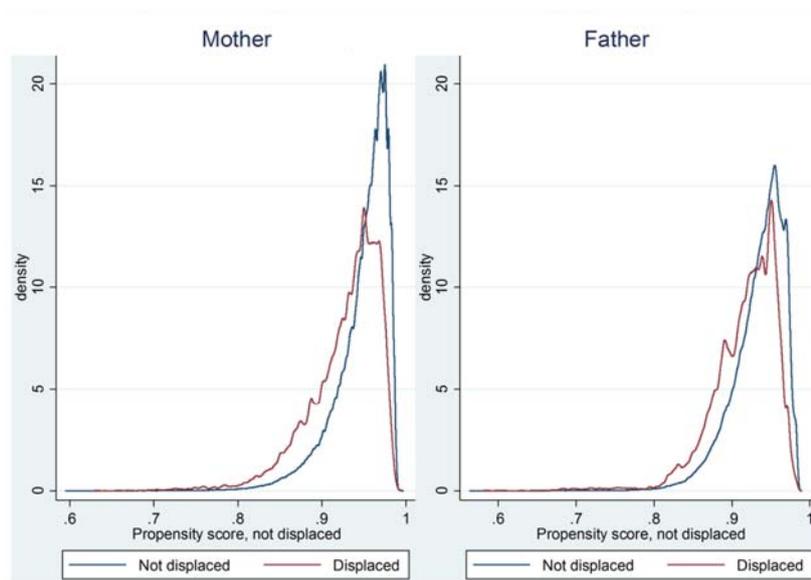
Table A 3 Overview of covariates used to estimate the propensity score

<b>Variable</b>	<b>Definition</b>
Age (child, worker)	Years of age
Age <sup>2</sup> (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 diagnosis code indicating mental health problems according to Table A2
Hospitalization for diagnoses indicating alcohol abuse t-2 or t-3 (worker)	=1000 if admitted to hospital with diagnosis code indicating alcohol related disease according to Table A2
Hospitalization for diagnoses indicating alcohol abuse or mental health problems t-2 or t-3 (other parent)	=1000 if admitted to hospital with diagnosis code indicating alcohol related disease or mental health problems according to Table A2
Mental and behavior (child)	=1000 if admitted to hospital with diagnosis code indicating mental health problems, self-destructive behavior, alcohol related conditions i.e. disease or abuse according to Table A2
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 PES
Unemployed long (worker, other parent)	Dummy indicating if the individual if registered at the PES more than 180 days
Income from employment (worker)	Income from employment or self-employment, deflated with CPI to 2014 year prices
Household disposable income (worker, other parent)	Log household disposable income in 100s SEK, deflated with CPI to 2014 year prices
Income from social assistance (worker, other parent)	Log social assistance in 100s SEK, deflated with CPI to 2014 year prices in the individual's household
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 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 <sup>2</sup> (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 variables for sample year 1995-2000

### Appendix B: Common support and balancing of covariates

In order to assess the common-support assumption, Figure A 1 displays the estimated density of the predicted probabilities that a non-displaced worker is not displaced, and the estimated density of the predicted probabilities that a displaced worker is not 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.

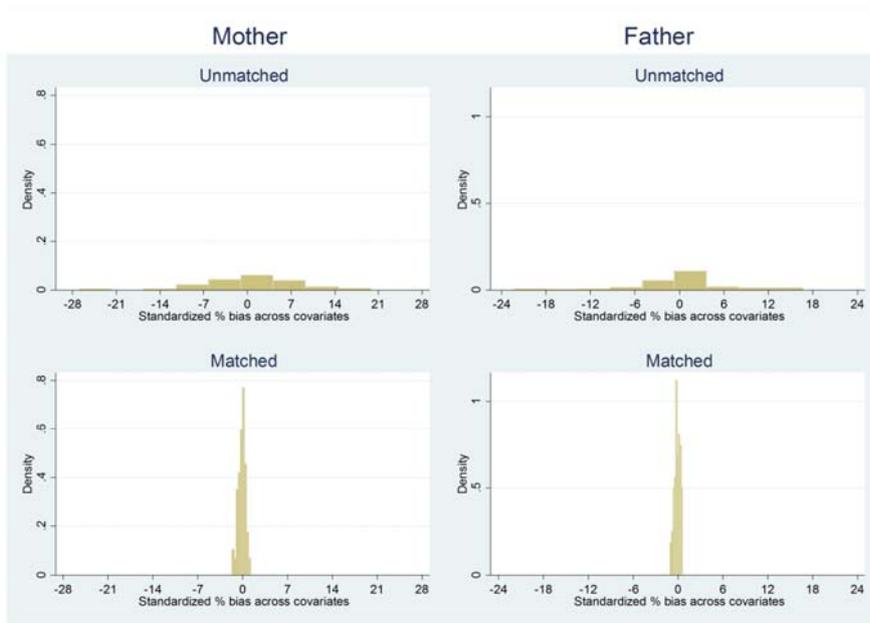
Figure A 1 Distribution of propensity score for displaced and non-displaced workers.



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 A 2 shows the standardized bias in the covariates, 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 matched samples.

Figure A 2 Standardized % bias across covariates, unmatched and matched samples

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Appendix C

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Table A 4 Hospitalization – yearly estimates. Corresponds to figure 2 Mother

Period	Estimate	St.d	Estimate2	St.d	Estimate	St.d	# Obs
	Hospitalization		Avoidable		Mental and behavior		
-8	0.266	(2.078)	-0.673	(0.875)	0.0313	(0.0858)	620,538
-7	2.144	(1.906)	0.257	(0.800)	0.0286	(0.114)	676,021
-6	2.081	(1.782)	0.928	(0.737)	-0.0265	(0.180)	726,337
-5	2.630	(1.681)	0.471	(0.714)	-0.0496	(0.181)	772,413
-4	-3.524**	(1.579)	-0.560	(0.705)	-0.0238	(0.224)	801,932
-3	-0.0310	(1.449)	-0.360	(0.599)	-0.151	(0.270)	820,405
-2	-0.489	(1.429)	-0.0556	(0.537)	0.0889	(0.292)	853,448
-1	2.416*	(1.373)	0.601	(0.523)	0.100	(0.325)	851,955
0	2.064	(1.302)	0.134	(0.420)	-0.446	(0.344)	850,570
1	-0.179	(1.274)	-0.201	(0.398)	-0.156	(0.342)	849,319
2	0.0671	(1.270)	0.559	(0.400)	-0.402	(0.381)	848,520
3	-0.0447	(1.260)	-0.268	(0.379)	0.302	(0.411)	847,824
4	1.119	(1.257)	0.515	(0.384)	-0.0224	(0.435)	847,257
5	1.815	(1.281)	-0.0112	(0.373)	-0.314	(0.457)	846,463
6	-2.647**	(1.259)	-0.437	(0.397)	0.606	(0.480)	845,548
7	-1.258	(1.292)	-0.191	(0.407)	-0.292	(0.501)	844,406
8	2.723**	(1.299)	-0.473	(0.404)	0.124	(0.544)	842,994
9	1.364	(1.306)	-0.383	(0.438)	-0.135	(0.588)	841,335
10	0.982	(1.342)	0.711*	(0.427)	0.429	(0.635)	839,418

Table A 5 Heterogeneous effects: Effect of exposure to parental job loss on probability of hospitalization 0-10 years and mortality 10 years after exposure to workplace closure

	Hospitalization	Avoidable	Mental and behavior	Mortality after 10 years
<i>Mother at closing workplace</i>				
Household income < median t-2	12.14*** (4.435)	3.522** (1.712)	1.464 (2.004)	-0.401 (0.540)
Household income > median t-2	4.649 (4.358)	-1.397 (1.610)	0.550 (1.705)	0.310 (0.483)
Girls	8.412* (4.468)	-1.833 (1.863)	-1.692 (2.069)	0.364 (0.426)
Boys	-1.160 (4.394)	2.208 (1.483)	0.870 (1.689)	-0.652 (0.584)

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	<i>Father at closing workplace</i>			
Household income < median t-2	-2.422 (3.628)	-0.121 (1.450)	-3.452** (1.541)	0.284 (0.420)
Household income > median t-2	-2.660 (3.550)	-0.0594 (1.372)	-0.178 (1.354)	0.364 (0.415)
Girls	-2.070 (3.604)	0.659 (1.519)	-3.067* (1.570)	0.452 (0.354)
Boys	2.172 (3.587)	0.954 (1.276)	-0.998 (1.325)	0.274 (0.469)

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 outcome variables are measured as number of cases per 1000. t = the period the workplace was closed down.

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