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## **Parental Job Loss and Children's School Performance**

**Abstract:**

Using Norwegian register data we estimate how children's school performance is affected by their parents' exposure to plant closure. Fathers' exposure leads to a substantial decline in children's graduation-year grade point average, but only in municipalities with mediocre-performing job markets. The negative effect does not appear to be driven by a reduction in father's income and employment, an increase in parental divorce, or the trauma of relocating. In contrast, mothers' exposure leads to improved school performance. Our findings appear to be consistent with sociological "role theories," with parents unable to fully shield their children from the stress caused by threats to the father's traditional role as breadwinner, and mothers responding to job loss by allocating greater attention towards child rearing.

**Keywords:** educational outcomes, downsizing, job loss, layoffs, plant closure

**JEL classification:** I20, J63, J65

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# 1. Introduction

Job loss is an endemic feature of market economies as producers periodically re-optimize in response to changing market conditions. In the USA 8.1 million workers were displaced from jobs during the 2003-2005 period.<sup>1</sup> While such re-optimization can be crucial for long term economic performance, job loss can be detrimental to affected workers. Convincing evidence indicates that job loss increases the likelihood of future unemployment, welfare program participation and divorce, and negatively affects future earnings and health.<sup>2</sup> However, virtually no research has investigated the implications of parental job loss for children.<sup>3</sup>

In this paper we use a unique dataset to estimate the causal effect of parental job loss on children's school performance. Parental job loss could affect a child's school performance through a number of possible mechanisms. To the extent that job loss reduces future family income, the reduction in financial resources could directly affect children's school performance (e.g. Becker and Thomes 1986, Blau 1999, Baum 2003). Job loss likely imposes stress on the affected parent (e.g. McKee-Ryan et al. 2005) from which it could be hard to shield the child (e.g. Ström 2002, Sleskova et al. 2006). Job loss could also trigger other disruptions to the child's environment, such as parental divorce or relocation, which impede a child's educational performance (e.g. Gruber 2004 and Astone and McLanahan 1994). Alternatively, parental job loss could plausibly improve children's school performance if displaced parents allocate greater effort towards child rearing activities.

Estimating a causal relationship between parental job loss and child outcomes faces two challenges: concerns of omitted variable bias and the scarcity of appropriate data (see e.g. Kalil and Ziol-Guest 2006). Omitted variable bias arises if a parent's exposure to job loss is correlated with unobservables that also affect child outcomes, such as the parent's productivity or the experience of an unobserved shock (e.g. sudden decline in parent's health). To circumvent the most obvious forms of omitted variable bias, we focus on job losses that are associated with plant closures.<sup>4</sup>

In addition to omitted variable bias, investigating the relationship between parental job loss and child outcomes is constrained by data availability. The task requires data on parental labor

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<sup>1</sup> Bureau of Labor Statistics of the U.S. Department of Labor, News Release, August 17<sup>th</sup> 2006 (<http://www.bls.gov/news.release/pdf/disp.pdf>).

<sup>2</sup> See for example Jacobson, Lalonde and Sullivan (1993), Stevens (1997), Kletzer (1998), Dragano, Verde and Siegrist (2005), Rege, Telle and Votruba (2005), Huttunen, Møen and Salvanes (2006), Eliason and Storrie (2006) and Rege, Telle and Votruba (2007).

<sup>3</sup> Notable exceptions are Oreopoulos et al. (2006) and Bratberg et al. (2007) studying intergenerational income mobility using job loss associated with plant closure. Moreover, a recent paper by Kalil and Ziol-Guest (2006) documents a significant adverse association between fathers' job losses and children's academic progress using survey data.

<sup>4</sup> Throughout, we use the term "plant" to refer to the establishment at which a worker is employed, which is distinct from the firm of employment (as firms can consist of multiple plants).

force participation, linked to relevant outcomes for the children. Our analysis utilizes a comprehensive, longitudinal register database containing annual records for every person in Norway (FD-trygd), in addition to a database containing the school grades of all graduating secondary students in Norway from 2003 to 2005. Importantly, the two databases contain personal identifiers allowing us to link each child's educational outcomes to the parents' records. This provides us with a unique opportunity to investigate the causal effect of parental job loss on a child's school performance.

Our analysis specifically investigates how children's graduation-year grade point average (GPA) is affected by their parents' exposure to plant closure. Our effect estimate is based on covariate-adjusted comparisons of GPA across children of workers originally employed in plants that either close or remain stable over time. The identifying assumption is that plant closure events are determined by exogenous economic shocks and are independent of unobservable determinants of children's school performance. This assumption may be problematic for several reasons. For example, some industries have more plant closures than other industries. If children of workers in these industries are more likely to perform poorly at school (and this difference is not captured by our observables), then our estimate will exaggerate a detrimental effect of parents' plant closure on children's school performance. Similarly, our estimated effect will be biased if plant closure events are concentrated in municipalities with children of low school performance or with schools of low quality. The richness of our register data allows us to include industry, municipality and school fixed effects to address these sources of bias. We are also able to conduct robustness tests for other types of unobserved differences across workers in closing and stable plants. In particular, we investigate the impact of excluding covariates for father and mother's income and education, which are known to be strong predictors of children's outcomes (e.g. Hill and Duncan 1987, Solon 1992, Haveman and Wolfe 1995).

During our period of study (1999-2005) the Norwegian economy was thriving and several municipalities in particular were "booming" with very low unemployment rates. In these municipalities we expect the effect of plant closure on children's school performance to be smaller since new job opportunities were relatively abundant. Consequently, our empirical analysis distinguishes between plant closures in booming and non-booming municipalities.<sup>5</sup> We find that fathers' plant closure substantially decreases children's school performance, but the effect is limited to non-booming municipalities. In these municipalities, fathers' plant closure is associated with a 0.12 point reduction in graduation-year GPA, a decrease of 16 percent of a standard deviation. In contrast,

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<sup>5</sup> We refer to a municipality with less than three percent unemployment as a "booming municipality". The mean unemployment rate experienced by the subjects in our sample is 3.3 percent (st.dev. 1.0).

mothers' plant closure is associated with a modest (and marginally significant) increase in GPA, though again, only in non-booming municipalities.

Additional analyses fail to support a number of possible mechanisms for the negative effect of fathers' plant closure. Specifically, the GPA effect of fathers' plant closure appears largely unrelated to its effect on father's income and employment, marital dissolution, and residential relocation. Instead, our results appear to be more consistent with the sociological literature on role theories, which emphasize how job loss can affect spousal roles within the household. For the father, displacement can create serious social distress if it threatens his traditional role as breadwinner. For displaced mothers, however, the greater tendency towards experiences out of the labor force (e.g. rearing children) provides her sources of positive identity and more available social networks when out of work, lessening the psychological impact of job loss (e.g. Jahoda 1982, Gershuny 1994). The positive GPA effect of mothers' plant closure could therefore reflect mothers who adapt to job loss by redirecting their energy towards child rearing.

The remainder of the paper is laid out as follows. Section 2 discusses our empirical strategy. Section 3 describes our dataset. Section 4 presents and discusses our empirical results, and Section 5 concludes.

## 2. Empirical Strategy

Our dataset allows us to measure plant downsizing by looking at changes in employment levels by plant and year. We will refer to the *plant downsizing rate* (PDR) as the percentage change in employment from year  $s$  to year  $t$ . More precisely, the plant downsizing rate in worker  $i$ 's plant is given by

$$(1) \quad PDR_{s,t}^i = \frac{FTE_s^i - FTE_t^i}{FTE_s^i},$$

where  $FTE_s^i$  and  $FTE_t^i$  are point-in-time plant employment counts in years  $s$  and  $t$ , denoting number of workers (full-time equivalents) in worker  $i$ 's plant at the end of each year, excluding worker  $i$  himself. In the following, we will refer to a plant reducing employment (from  $s$  to  $t$ ) by more than 90 percent (i.e.  $PDR_{s,t}^i > .90$ ) as a *closing plant*, and a plant with no reduction in employment (i.e.  $PDR_{s,t}^i \leq 0$ ) as a *stable plant*.

Our register data reports employment counts in plants at the end of the year, whereas in Norway the school year starts in August and ends in June. For simplicity, however, we will refer to year  $x$  as the year a student starts the  $x^{\text{th}}$  grade. We restrict our sample to graduating secondary

students, 10<sup>th</sup> graders, whose fathers at the end of year 7 (i.e. middle of 7<sup>th</sup> grade) were employed in a plant that either closed during the next two years or was stable during this period. Our identifying assumption is that plant closure events are determined by exogenous economic shocks and are independent of unobservable determinants of children's school performance. We estimate (via OLS) the following linear regression model for child  $i$ 's grade outcome:

$$(2) \quad G_i = \alpha + \eta W_i^{nb} + \eta^b W_i^b + \beta B_i + \gamma X_i + \delta C_i + u_i$$

where

- $G_i$  ~ Measure of child  $i$ 's 10<sup>th</sup> grade educational outcome (grade point average)
- $W_i^{nb}$  ~ Indicator that the father at the end of year 7 was employed in a plant that closed by end of year 9 and that the municipality of residence was not booming at the end of year 8 (at least three percent unemployment)
- $W_i^b$  ~ Indicator that the father at the end of year 7 was employed in a plant that closed by end of year 9 and that the municipality of residence was booming at the end of year 8 (less than three percent unemployment)
- $B$  ~ Indicator that the municipality of residence was booming at the end of year 8 (less than three percent unemployment)
- $X$  ~ vector of characteristics of  $i$ 's father's plant (at the end of year 7); of  $i$ 's mother and father (at the end of year 7); and of  $i$ 's birth quarter, birth order and number of siblings.
- $C$  ~ vector of cohort dummies
- $u_i$  ~ error term with mean zero

Note from Equation (2) that we distinguish between plant closures in booming and non-booming municipalities. During our period of study the Norwegian economy was thriving and several municipalities were booming with unusually low unemployment rates. In these municipalities we expect the effect of plant closure to be smaller since new job opportunities are abundant. We refer to a municipality with less than three percent unemployment at the end of year 8 as a "booming municipality".<sup>6</sup> In the model given by Equation (2) the parameter of interest is the estimated plant closure coefficient,  $\eta$ , which captures the incremental decrease in school performance from plant closure in a non-booming municipality relative to children whose father is working in a stable plant.

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<sup>6</sup> We choose unemployment rate at the end of year 8 because this is in the middle of the period through which we measure downsizing. About 40 percent of our sample of children lived in a booming municipality (see Table 1).

Estimation of Equation (2) will produce unbiased estimates of  $\eta$  provided that plant closure events are independent of unobserved determinants of children's school performance. This identifying assumption may be difficult to defend for several reasons. For example, plant closures may be associated with particular industries. If children of workers in these industries are more likely to perform poorly at school (and this is not captured by our observables), then our estimate of  $\eta$  will exaggerate a detrimental impact of parent's exposure to plant closure on the child's school performance. Similarly, the estimate of  $\eta$  will also be too large if plant closure events are concentrated in municipalities with children of low school performance or in areas with poor public schools. In our empirical analysis we address these potential sources of bias by including industry, municipality and school fixed effects.

Estimates of  $\eta$  could also be biased if workers with less parenting resources are concentrated in failing plants. In order to check for this potential source of bias we see how our estimate moves if we drop important covariates controlling for father and mother characteristics. It is well documented that parent's income and education are strong predictors of children's outcomes (e.g. Hill and Duncan 1987, Solon 1992, Haveman and Wolfe 1995). If our estimated effect does not increase with the exclusion of these covariates, it suggests that workers with less parenting resources are not concentrated in failing plants.

It should be noted that, absent the sources of omitted variable bias identified above, our results potentially under-estimate the impact of plant closure on children's school performance since our plant closure measure is based on a worker's original plant of employment in year 7. Job mobility across downsizing and non-downsizing plants would therefore tend to attenuate our estimates.

### **3. Dataset Description**

Our empirical analysis utilizes two separate databases provided by Statistics Norway: an educational database and a register database called *FD-trygd*. The educational data includes school identifiers and grade outcomes for graduating secondary students (10<sup>th</sup> graders) in Norway from 2003-2005. The *FD-trygd* data includes a rich longitudinal dataset containing records for every Norwegian from 1992 to 2003. The variables captured in this dataset include individual demographic information (sex, age, marital status, number of children), socio-economic data (years of education, income, wealth), current employment status (full time, part time, minor part time, self-employed), industry of employment (if employed), indicators of participation in any of Norway's welfare programs, and geographic identifiers for municipality of residence. Importantly, the *FD-trygd* data includes personal identifiers for one's parents, allowing us to link 10<sup>th</sup> graders to their parents.

In addition, *FD-trygd* contains records for employment “events” since mid-1995. These events, captured by individual and date, include entry and exits into employment, changes in employment status (full time, part time, minor part time), and changes in plant and firm of employment. These employment events are constructed by data analysts at Statistics Norway from raw employment spell records submitted by employers, and verified against employee wage records (not available to us) to ensure the validity of each spell and to eliminate records pertaining to “secondary” employment spells.<sup>7</sup>

Based on the employment records, we constructed plant-level employment counts at the end of years 7 and 9. The counts were constructed as measures of full-time equivalents (FTEs), with part time and minor part time employment measured as 0.67 and 0.33 FTEs, respectively. Excluded from these counts were any persons identified in *FD-trygd* as self-employed or receiving assistance that should have precluded full time work (those receiving unemployment benefits, a rehabilitation pension or a disability pension). Plant-level FTEs were then used to construct the measure of plant downsizing as defined in equation (1).

Based on the educational records, we constructed a summary measure of each 10<sup>th</sup> grader’s performance in the 11 graduating subjects.<sup>8</sup> Grades in individual subjects are awarded on a scale from 1 to 6, where six indicates excellence and 1 indicates very little competence. It is not obvious how individual marks should be aggregated into one summary measure (Hægeland et al. 2004). For example, a summary measure giving equal weight to mathematics and home economics may not be the most adequate. Consequently, we adopt the summary measure of grade point average (GPA) constructed by Hægeland et al. (2004) that puts weights on the different subjects in accordance with the number of teaching hours.

Our analytic sample consists of all native 10<sup>th</sup> graders graduating during 2003-2005. A number of exclusion criteria were applied to create our final sample of 10<sup>th</sup> graders. First, in Norway it is most common for children to start school the calendar year they turn six and graduate from 10<sup>th</sup> grade the calendar year they turn sixteen. In order to ensure that our estimate is identified from kids of standard school age, we limited our sample to those who graduated within one year of normal graduation age. Second, we excluded all children with unmarried parents at the end of year 7, to ensure that the effect of job loss is identified from families in which the father most likely lives in the same household as the child. Third, and important for our identification strategy, we restrict our sample to 10<sup>th</sup> graders whose father at the end of year 7 (i.e. middle of 7<sup>th</sup> grade) was employed full

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<sup>7</sup> If an individual was employed in multiple plants at a given time, primary employment was determined by employment status and recorded income from each source of employment.

<sup>8</sup> This excludes the subject of *Nynorsk*, which is a more traditional way of reading and writing in Norwegian from which many students are exempt.



time in a plant that either closed during the next two years or was stable. Fourth, we excluded children of fathers with less than one year of tenure in his year 7 plant or where the father received assistance that should have precluded full-time employment. Since the personal income variable in *FD-trygd* includes both earnings and governmental assistance, this restriction ensures that personal income consistently captures annual earnings in year 7, though it potentially includes earnings from more than one employment source. Fifth, to ensure that our estimate is not driven by the closure of plants with persistently unstable employment levels or recent start-ups, we restrict the sample to children where the father was employed in plants that were stable during year 7 with more than five FTEs at the end of year 4. Finally, we exclude all children with fathers working in the educational sector, since plant closure in this sector may affect the children directly. Applying these restrictions provided us with a sample of 10,344 tenth graders.

As described in the empirical strategy, the estimated effect of plant closure on children's school performance is captured through the inclusion of plant closure dummies for closures in booming and non-booming municipalities. The estimated plant closure coefficients capture the incremental decrease in school performance relative to children with fathers in stable or growing plants. Based on characteristics at the end of year 7, a large number of covariates for the child, mother and father were included in all models:

#### *Child Characteristics*

- sex
- number of siblings (0,1,2,3,4, ≥5) and birth order (1,2,3,4,5, ≥6): 21 categories (interacted)
- birth quarter and age at graduation (15,16,17): 12 categories (interacted)
- birth year: 3 categories

#### *Father Characteristics (based on record at the end of year 7)*

- age at birth of child (<20,20-25,25-30,30-35,35-40, 40-45,≥45): 7 categories
- age at birth of his oldest child (<20,20-25,25-30,30-35,35-40, 40-45,≥45): 7 categories
- number of children with other women than the mother of the child (half siblings): linear
- years of education (<9, 9-12, 13-15, ≥16): 4 categories
- years of tenure in plant (1-3,3-5,5-10, ≥10): 4 categories
- plant size (10-25, 25-50, 50-100, 100-500, ≥500) : 5 categories
- personal earnings: linear and quadratic
- household wealth: linear and quadratic
- received sick money during year: indicator
- received social assistance: indicator

*Mother's Characteristics (based on record at the end of year 7)*

- age at birth of child (<20,20-25,25-30,30-35,35-40, 40-45,≥45), 7 categories
- age at birth of her oldest child (<20,20-25,25-30,30-35,35-40, 40-45,≥45), 7 categories
- number of children with other men than the father of the child (half siblings): linear
- years of education (<9, 9-12, 13-15, ≥16): 4 categories
- employment status (not employed, unemployed, self-employed, employed full time, part time or minor part time): 6 categories
- plant downsizing (≤0, 0-30%, 30-60%, 60-90%, >90%): 5 categories
- personal earnings: linear and quadratic
- received sick money during year: indicator
- received social assistance: indicator
- received disability pension: indicator
- received rehabilitation pension: indicator

Summary statistics for some of these variables are presented in Table 1. The first column presents means and standard deviations (in parenthesis) of our main analytic sample. About 5.8 percent of the 10<sup>th</sup> graders had a father residing in a non-booming municipality and working in a plant in year 7 that downsized by more than 90 percent during years 8 and 9. In the next two columns of the table we report the means and standard deviations for the sample of 10<sup>th</sup> graders with fathers being employed in closing and stable plants. The GPA is slightly higher among 10<sup>th</sup> graders with fathers in stable plants (4.15) compared to closing plants (4.11). The means of all the variables are similar across the two sub-samples. In particular, we see that the years of schooling of the fathers and the mothers are very similar in the two sub-samples, indicating that low-educated parents are not over-represented in failing plants. Taken together, children appear very similar on observables across stable and closing plants.

## **4. Empirical Results**

### **4.1. Effect of Plant Closure on Children's School Performance**

Table 2 presents OLS estimates for the effect of plant closure on children's school performance.<sup>9</sup> Standard errors in Table 2 (and subsequent tables) are corrected for heteroskedasticity and non-independence of residuals across children of fathers originally employed in the same plant.<sup>10</sup> Omitting

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<sup>9</sup> Tobit estimation yields similar results (results not reported).

<sup>10</sup> Using the "robust cluster(.)" option in Stata 9.2.

industry, municipality and school fixed effects (see Model 1), we find that fathers' plant closure decreased children's GPA significantly in non-booming municipalities. In booming municipalities, there is no effect of plant closure. As discussed in Section 4, an important concern for our empirical strategy is that plant closures might be concentrated in industries or in geographic areas in which children for some other reason have poor school performance. If so, controlling for industry, geographic area and school fixed effects would be expected to reduce the magnitude of the estimated effect of plant closure. Inclusion of fixed effects for industry (see Model 2) has a modest impact on our estimate, with no significant differences across estimates in the two models. In fact, the magnitude of the estimated effect increases, which is not consistent with omitted variable bias. Similarly, the estimated effect increases when municipality and school fixed effects are included (see Models 3 and 4), not consistent with omitted variable bias.<sup>11</sup>

We view the estimates including both industry and school fixed effects as our preferred estimate (Model 4). These results suggest that the grade point average is about 0.12 points lower among children of fathers originally employed in fully closing plants and residing non-booming municipalities. This represents a 16 percent decline relative to the standard deviation of grade point average in our sample. Given the (approximately) normal distribution of GPAs, a decline of this magnitude for the median student is equivalent to a decline of over six percentage points in class rank. Thus, the average effect of plant closure is considerable in non-booming municipalities.

## 4.2. Robustness Tests

Our estimate is potentially biased if working parents of less academically skilled children or those with less parenting resources are concentrated in failing plants. It is well documented that parental education and household income are strong predictors of children's outcomes (e.g. Hill and Duncan 1987, Solon 1992, Haveman and Wolfe 1995), and we control for these characteristics in the estimates presented above. Nonetheless, our results remain potentially biased to the extent that unobserved variation in academic skill or parenting resources persists conditional on these measured characteristics. To evaluate this potential source of bias, Table 3 presents estimates for the plant closure effect omitting, in Models 2-4, covariates capturing parental education and household income and wealth. For comparison, Model 1 replicates the results of our preferred model from Table 2. Omitting these covariates has only a small effect on our estimate, in a direction that is inconsistent

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<sup>11</sup> Note that grades assigned on relative performance could explain why the estimate grows with inclusion of municipality and school fixed effects. If grades are assigned based on relative performance, the students unaffected by downsizing could see their grades increase if they attend school with students that were affected by downsizing.

with the hypothesis that exposure to plant closure is concentrated among children expected to perform at lower levels.

An alternative source of bias could arise if unobserved shocks affecting children's educational outcomes somehow influence plant closure. For instance, a negative health shock experienced by a key worker in a plant could negatively affect both his children and his plant's performance. Such scenarios would seem more plausible in smaller plants. In Model 5, we therefore restrict our sample to children of workers in larger plants. This restriction actually increases the magnitude of our estimate slightly, suggesting that our original estimate is not biased by unobservable shocks spilling over from workers to their plants.

### **4.3. Mechanisms**

Table 4 explores several mechanisms through which the closure of a father's plant could potentially affect his child's school performance.

Several analysts have documented the negative effect of plant closure on workers' future income (see e.g. Huttunen, Møen and Salvanes 2006, Eliason and Storrie 2006, Rege, Telle and Votruba 2005, Jacobson, Lalonde and Sullivan 1993). Model 1 in Table 4 documents a similar effect in our analytic sample. Fathers exposed to plant closure experience lower income in non-booming municipalities, though no such effect is apparent in booming municipalities. If household income affects a child's educational attainment, as suggested by some studies (e.g. Baum 2003, Blau 1999), this suggests a mechanism through which fathers' plant closure might reduce children's school performance.

We explore the plausibility of this mechanism in Models 5 and 6. In Model 5, we re-estimated our original model including additional covariates for father's income at the end of year 9 (controlled for as a third-order polynomial). If the GPA effect of fathers' plant closure is through its effect on fathers' income, we would expect our estimate to decline under this specification, as some of the effect of plant closure will be captured by the fathers' income covariates. Instead, the estimate produced on Model 5 is very similar to our baseline estimate (Model 4), suggesting that the effect on fathers' income is not an important mechanism for why fathers' plant closure affects children's GPA. Model 6 explores the income mechanism using a different approach, excluding fathers with unusually small income growth over the period (less than 5 percent). Again, if plant closure affects GPA by affecting fathers' income, we should expect the estimate to decline. The estimate does decline but only modestly, possibly the result of selection effects since a greater fraction of fathers in closing plants are

excluded. Together, these results fail to indicate that fathers' income is an important mechanism in the GPA effect.<sup>12</sup>

It has also been documented that workers exposed to plant closure are more likely to be unemployed in the future (see e.g. Eliason and Storrie 2006, Rege, Telle and Votruba 2005), a finding we replicate in two ways in our analytic sample. Model 2 indicates that the probability of drawing unemployment benefits ("day money")<sup>13</sup> at some point between years 7 and 9 is significantly larger for fathers in closing plants, and especially large in non-booming municipalities. Model 3 indicates that the probability of full-time employment at the end of year 9 is lower for fathers in closing plants, though here the effect appears similar across booming and non-booming municipalities. These employment effects represent another plausible mechanism, since spells of unemployment can be associated with stress and depression from which it may be hard to shelter the child.

To test the importance of the employment mechanism, we re-estimated our model restricting the sample (in Model 7) to children of fathers employed full-time in year 9 and (in Model 8) to children of fathers who did not receive day money over the period. Again, a large reduction in the magnitude of the GPA effect estimate would support the importance of the employment mechanism, though modest reductions might be expected due to differential selection effects. We estimate only modest changes in the GPA effect estimate which do not support the importance of the employment mechanism.

Plant closure may also affect married workers likelihood of divorcing (Rege, Telle and Votruba 2007) and their likelihood of relocating to a different municipality. Similar to before, we test the importance of these mechanisms by excluding children of fathers who divorced (Model 9) or relocated (Model 10) over the period. These restrictions barely move our GPA effect estimate, suggesting that marital dissolution and relocation is not an important mechanism through which fathers' plant closure affects children's GPA.

In summary, we find little support that any of the mechanisms we considered are substantively important for explaining the effect of fathers' plant closure on children's school performance. Nonetheless, it is striking that the negative GPA effect of fathers' plant closure is evident only in non-booming municipalities, where the effects on fathers' income and unemployment receipt are also larger. We interpret these findings as suggesting that (1) plant closure imposes stress on a father from which he cannot successfully shield the child and (2) that this stress is greater when the father's re-employment prospects appear bleaker not because poorer employment outcomes

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<sup>12</sup> This is in contrast to the Oreopoulos et al. (2006) finding that fathers' exposure to plant closure leads to a substantial decline in children's future income, and that the effect is driven almost entirely by changes in fathers' income.

<sup>13</sup> All unemployed workers in our sample are entitled to day money following displacement provided they actively search for a new job.

actually occur. As we will argue in the following section, an explanation for this finding possibly lies in sociologists' concept of role theories.

#### **4.4 Effect of Mothers' Plant Closure**

In Table 5 we explore the effect of plant closure experienced by the mothers of school age children. To do so, we constructed a dataset analogous to our main analytic sample except that the conditions applied to fathers (regarding labor market attachment etc., cf. Section 3) were instead applied to mothers (and v.v.). Due to the lower labor force participation of mothers, our sample size is substantially smaller for this dataset. Models 1-4 in Table 4 were then replicated for this sample.

Although mothers' plant closure has qualitatively similar effects to fathers' plant closure in terms of subsequent income and employment (see Models 1-3), some interesting differences emerge. In particular, plant closure in non-booming municipalities has a substantially larger negative effect on a mother's probability of full-time employment in year 9, despite a more modest effect on the receipt of unemployment benefits. Thus, it appears that (in non-booming municipalities) mothers exposed to plant closure are less likely to actively search for a new job. We find no evidence that mothers' plant closure has a negative effect on children's school performance. Instead, the estimated effect of mothers' exposure is positive and marginally significant in non-booming municipalities.

The disparate effects of plant closure across fathers and mothers are consistent with role theories from the field of sociology. According to these theories, social norms and historical employment patterns allow women to develop and appreciate a greater range of non-employment-related roles (Gershuny 1994, Jahoda 1982), such as child rearing. The range of "socially acceptable" roles makes them more adaptable and equipped to handle job loss, thereby reducing the maternal stress associated with job loss. In contrast, men's identity is to a larger degree associated with his job and his fulfillment of the traditional role as breadwinner, and thus the stress associated with job loss is larger. Different perceptions regarding "socially acceptable" roles could explain the larger effect that plant closure has on the employment of mothers relative to fathers. While speculative, these arguments are also consistent with empirical studies documenting that the mental distress experienced by displaced workers is generally more severe for men than women (McKee-Ryan et al. 2005, Grzywacz and Dooley 2003, Waters and Moore 2002).

Evidence from time use surveys could also shed light on these findings. Several studies find that the time devoted by the husband to housework is hardly affected by job displacement, a result often taken to reflect persistence in the roles played by spouses (Gallie et al. 1994). Yeung et al. (2001) finds that the role of providing teaching and homework assistance is predominantly occupied

by the mother. If mothers adapt to job loss by shifting their energy towards this role, this could account for the positive effect of mothers' plant closure on children's GPA.

Overall, this suggests that paternal exposure to plant closure reduces children's school performance as a consequence of the distress experienced by displaced fathers. In contrast, maternal exposure to plant closure tends to increase school performance because job loss imposes less distress on mothers and, as their presence at home increases, enables them to devote more time to homework assistance.

## 5. Conclusion

It is well documented that job loss may be detrimental to affected workers. Job loss has a negative effect on future earnings and health, and increases the likelihood of future unemployment, welfare program participation and divorce.<sup>14</sup> In this paper, we document that children are also affected by their parents' experience of job loss, though only in municipalities with mediocre-performing job markets, and with conflicting implications depending of the sex of the affected spouse. In these "non-booming" municipalities, we find that fathers' plant closure has a negative effect on children's school performance, reducing graduation-year GPA by 16 percent of a standard deviation. This negative effect does not appear to be due to the effects of closure on fathers' income and employment, nor the consequence of parental divorce or family relocation. In contrast, mothers' plant closure has a positive effect on children's school performance, increasing graduation-year GPA by 11 percent of a standard deviation.

The distinct effects we observe for fathers' and mothers' plant closure in non-booming municipalities can best be interpreted in light of spousal role theories from the field of sociology. These theories have emphasized how job displacement can lead to shifts of roles within the household, resulting in different consequences depending on the sex of the affected spouse. For the father, displacement can constitute serious social distress if he fails to fulfill the traditional role as breadwinner. Our results suggest that parents are unable to fully shield their children from the father's distress. For mothers, however, weaker attachment to the labor market and the social acceptability of non-employment-based roles reduces the stress associated with job loss, as they more easily adapt to displacement by shifting greater energy towards their role as care givers. While speculative, this interpretation of our results is consistent with the positive effect of mothers' plant closure on children's school performance despite the larger negative effect on mothers' subsequent employment.

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<sup>14</sup> See for example Jacobson, Lalonde and Sullivan (1993), Stevens (1997), Dragano, Verde and Siegrist (2005), Rege, Telle and Votruba (2005) and Huttunen, Møen and Salvanes (2006).

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Table 1: Summary statistics

Variables	All	Closing plants	Stable plants
<i>dependent variable</i>			
10 <sup>th</sup> grade GPA	4.144 (.762)	4.106 (.757)	4.149 (.762)
<i>treatment variables (father's plant)</i>			
plant closure in non-booming municipality	.0578	.5658	-
plant closure in booming municipality	.0444	.4342	-
non-booming municipality	.5971	.5658	.6006
<i>child characteristics</i>			
female	.5050	.5099	.5045
number of siblings	2.112 (.854)	2.104 (.813)	2.113 (.859)
<i>mother's characteristics</i>			
age (when child was born)	28.21 (4.51)	28.23 (4.495)	28.20 (4.51)
years of schooling (year 7)	13.18 (2.40)	13.17 (2.30)	13.18 (2.41)
income(year 7)	188044 (126629)	187370 (121781)	188121 (127175)
<i>father's characteristics</i>			
age (when child was born)	30.66 (4.92)	30.61 (4.72)	30.67 (4.94)
years of schooling (year 7)	13.44 (2.55)	13.64 (2.48)	13.42 (2.56)
income (year 7)	423694 (310397)	412062 (205272)	425018 (320163)
tenure (year 7)	8.508 (6.412)	7.919 (6.5629)	8.575 (6.392)
# observations	10344	1057	9287

Note: Standard deviations are in parenthesis.

**Table 2: Main results: Effect of Plant Closure in Father's Plant**

	Model 1	Model 2	Model 3	Model 4
dependent variable: 10 <sup>th</sup> grade GPA				
plant closure in non-booming munic	-0.1002** (0.0297)	-0.1070** (0.0284)	-0.1159** (0.0269)	-0.1207** (0.0272)
plant closure in booming munic	-0.0003 (0.0312)	-0.0083 (0.0320)	-0.0017 (0.0318)	0.0051 (0.0330)
<i>Included covars</i>				
industry FEs		X	X	X
Municipality FEs			X	
school FEs				X
Mean	4.1444	4.1444	4.1444	4.1444
st.dev	(0.7619)	(0.7619)	(0.7619)	(0.7619)
R-squared	0.25	0.25	0.30	0.34
N	10344	10344	10344	10344

*Note:* OLS estimates for the effect on 10<sup>th</sup> grade GPA of plant closure in father's plant of employment in year 7. \* and \*\* denote significance at the 5 and 1 percent level. Robust standard errors in parenthesis, corrected for non-independent residuals within plant. All estimates adjust for individual (child, mother and father) and plant characteristics (described in text).

**Table 3: Robustness checks**

	Model 1	Model 2	Model 3	Model 4	Model 5
dependent variable: 10 <sup>th</sup> grade GPA					
plant closure in non-booming munic	-0.1207** (0.0272)	-0.1133** (0.0279)	-0.1097** (0.0290)	-0.1150** (0.0297)	-0.1467** (0.0377)
plant closure in booming munic	0.0051 (0.0330)	0.0208 (0.0331)	0.0201 (0.0340)	0.0072 (0.0346)	-0.0097 (0.0441)
sample redefinition					exclude workers in plants with ≤50FTEs
excluded covariates		father's education	mother and father's education	mother and father's education, income and wealth	
mean	4.1444	4.1444	4.1444	4.1444	4.1816
st. div.	0.7619	0.7619	0.7619	0.7619	0.7646
R-squared	0.34	0.32	0.30	0.28	0.40
N	10344	10344	10344	10344	5245

*Note:* OLS estimates for the effect on 10<sup>th</sup> grade GPA of plant closure in father's plant of employment in year 7. \* and \*\* denote significance at the 5 and 1 percent level. Robust standard errors in parenthesis, corrected for non-independent residuals within plant. All estimates adjust for individual (child, mother and father) and plant characteristics (described in text).

**Table 4: Mechanism investigation: Effect of Plant Closure in Father's Plant**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Dependent variable:	father's (log) income, year 9	Father received DM <sup>a</sup> by year 9	Father full-time empl'd, year 9 <sup>b</sup>	10th grade GPA	10th grade GPA	10th grade GPA	10th grade GPA	10th grade GPA	10th grade GPA	10th grade GPA
plant closure in non-booming munit	-0.0465* (0.0221)	0.0765** (0.0148)	-0.0256* (0.0114)	-0.1207** (0.0272)	-0.1176** (0.0272)	-0.1051** (0.0337)	-0.1234** (0.0293)	-0.1054** (0.0285)	-0.1206** (0.0273)	-0.1235** (0.0281)
plant closure in booming munit	0.0060 (0.0209)	0.0382** (0.0120)	-0.0264* (0.0125)	0.0051 (0.0330)	0.0086 (0.0329)	-0.0002 (0.0386)	0.0044 (0.0341)	0.0196 (0.0339)	0.0016 (0.0325)	0.0011 (0.0334)
Sample restrictions						fathers income increased at least 5 percent by the end of year 9	father full time empl'd at the end of year 9	father rec'd no DM <sup>a</sup> by end of year 9	father and mother still married by the end of year 9	father did not move to new municipality by the end of year 9
Added covariates					father's income at the end of year 9 <sup>c</sup>					
Mean	12.9530	0.0305	0.9468	4.1444	4.1448	4.1611	4.1492	4.1496	4.1452	4.1495
st. div.	0.5346	-	-	0.7619	0.7618	0.7576	0.7622	0.7584	0.7619	0.7594
R-squared	0.52	0.17	0.16	0.34	0.35	0.37	0.35	0.35	0.34	0.34
N	10252	10344	10344	10344	10309	7573	10028	9794	10283	10097

*Note:* OLS estimates for the effect on specified dependent variable of plant closure in father's plant of employment in year 7, +, \* and \*\* denote significance at the 10, 5 and 1 percent level. Robust standard errors in parenthesis, corrected for non-independent residuals within plant. All estimates adjust for individual (child, mother and father) and plant characteristics (described in text).

<sup>a</sup>DM = "day money," referring to the Norwegian unemployment benefit.

<sup>b</sup>Refers to employment status as end of year 9.

<sup>c</sup>Entered as third-order polynomial.

**Table 5: Mechanism investigation: Effect of Plant Closure in Mother's Plant**

	Model 1	Model 2	Model 3	Model 4
Dependent variable:	mother's (log) income in year 9	mother received DM <sup>a</sup> by the end of year 9	mother full-time employed at the end of year 9	10th grade GPA
plant closure in non-booming munic	-0.0873* (0.0356)	0.0519** (0.0176)	-0.0713* (0.0288)	0.0871 <sup>+</sup> (0.0509)
plant closure in booming munic	0.0000 (0.0239)	0.0130 (0.0129)	-0.0247 (0.0315)	0.0079 (0.0581)
Mean	12.5952	0.0251	.8807	4.1977
st. dev.	0.4446	-	-	0.7466
R-squared	0.57	0.37	.028	0.45
N	4426	4460	4460	4460

*Note:* OLS estimates for the effect on specified dependent variable of plant closure in mother's plant of employment in year 7. <sup>+</sup>, \* and \*\* denote significance at the 10, 5 and 1 percent level. Robust standard errors in parenthesis, corrected for non-independent residuals within plant. All estimates adjust for individual (child, mother and father) and plant characteristics (described in text).

<sup>a</sup> DM = "day money," referring to the Norwegian unemployment benefit.