Intergenerational effects of parental unemployment on infant health: evidence from Swedish register data

Björn Högberg, Anna Baranowska-Rataj and Jonas Voßemer

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Björn Högberg
Department of Social Work, Umeå University, and Centre for Demographic and Ageing Research, Umeå University, Sweden

Anna Baranowska-Rataj
Department of Sociology, Centre for Demographic and Ageing Research, Umeå University, Sweden

Jonas Voßemer
Mannheim Centre for European Social Research (MZES) and University of Frankfurt, Germany

Abstract

Parental unemployment can have detrimental effects on life chances of the children, and thus reinforce inequalities across generations. Despite a substantial literature documenting that the health of infants at birth can have large and long-lasting consequences, research on intergenerational unemployment effects on infant health is scant. This study fills the gap using high-quality register data from Sweden, including 1.5 million siblings born between 1996 and 2017. To account for selection into unemployment, we employ sibling comparison designs that exploit variation in siblings' exposure to parental unemployment, thereby accounting for stable but unmeasured confounding at the level of families. We find small, although statistically significant effects of maternal unemployment and no effects of paternal unemployment. Our results also suggest that pre-existing social disadvantages – low education, migration background, and dual parental unemployment – are not associated with more adverse intergenerational unemployment effects. The discussion of our findings situates these results in the context of a relatively generous and egalitarian welfare state.

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Abstract:

Parental unemployment can have detrimental effects on life chances of the children, and thus reinforce inequalities across generations. Despite a substantial literature documenting that the health of infants at birth can have large and long-lasting consequences, research on intergenerational unemployment effects on infant health is scant. This study fills the gap using high-quality register data from Sweden, including 1.5 million siblings born between 1996 and 2017. To account for selection into unemployment, we employ sibling comparison designs that exploit variation in siblings' exposure to parental unemployment, thereby accounting for stable but unmeasured confounding at the level of families.

We find small, although statistically significant effects of maternal unemployment and no effects of paternal unemployment. Our results also suggest that pre-existing social disadvantages – low education, migration background, and dual parental unemployment – are not associated with more adverse intergenerational unemployment effects. The discussion of our findings situates these results in the context of a relatively generous and egalitarian welfare state.

Introduction

The employment status of parents is an important determinant of children's life chances, and parental unemployment can have detrimental effects on the education, employment prospects and health of the children (Brand, 2015; Lindemann & Gangl, 2019). The degree to which parental unemployment harms children's health may depend on a family's pre-existing resources, leading to reinforcement of inequalities across families and generations. Research on intergenerational unemployment effects on infants is scant, however, despite a substantial literature documenting that the health of infants at birth can have long-lasting consequences and constitute a link in processes of intergenerational transmission of socio-economic disadvantage (Almond et al., 2018; Conley & Bennett, 2000; Currie, 2011; Palloni, 2006). Existing research has, with few exceptions (Scharber, 2014), either been cross-sectional (Raatikainen et al., 2006), or relied on self-reported birth data, relatively small samples, or both (Dooley & Prause, 2005; Lindo, 2011). Against this background, we ask if parental unemployment preceding or during pregnancy impacts the health of infants at birth, if these effects depend on parental gender, education, migration background and dual parental unemployment.

We use intergenerationally linked and high-quality register data from Sweden, including 1.5 million siblings born between 1996 and 2017. To account for parental selection into unemployment, we employ sibling comparison designs that exploit variation in siblings' exposure to parental unemployment, thereby accounting for stable but unmeasured confounding at the level of families. The study complements the literature on intergenerational effects of unemployment in three ways. First, we study infant health at birth, which has only received scant attention in the literature on intergenerational unemployment effects, despite demonstrated long-term effects on adult outcomes (Almond et al., 2018; Currie, 2011). Second, drawing on theories of compensatory advantages and relative deprivation (Bernardi, 2014; Brand, 2015; Smith et al., 2012), we ask if intergenerational effects of unemployment are heterogeneous across other dimensions of social stratification, and thus if unemployment is likely to reinforce or weaken pre-existing inequalities across families. Specifically, we investigate heterogeneity in effects depending on parental education and migration background; two of the most salient dimensions of stratification in contemporary European labour markets. In addition, we also consider the joint

contribution of both parents unemployment (dual parental unemployment), as the compensatory resources available to these families may be particularly limited (Mooi-Reci et al., 2020).

Third, previous research on intergenerational unemployment effects on infant health has used data from an American context, and solely studied maternal (Dooley & Prause, 2005; Scharber, 2014) or paternal (Lindo, 2011) unemployment. However, unemployment may be a qualitatively different experience in the US, with weak social safety nets and where health insurance is tied to employment, compared to in Europe where the welfare state can compensate for much of the financial costs of unemployment (Gangl, 2006; Nallo & Oesch, 2020). Also, maternal and paternal resources can play different roles in processes of intergenerational transmission (Mooi-Reci et al., 2019), not least in in Nordic contexts with high social acceptance and institutional support for maternal employment (Erola & Jalovaara, 2017). Sweden thus provides a theoretically appealing case to study from this perspective. The universal and comparatively generous welfare state may dampen adverse effects of unemployment, especially for disadvantaged groups with few compensatory resources, while the high female employment rates allow us to compare effects of maternal and paternal unemployment in a comparatively egalitarian dual-earner context.

Background and previous research

Parental unemployment and infant health

Only three studies focusing on parental unemployment and infant health have used methods for causal inference dealing with selection of parents to unemployment. Using American survey data on around 1,000 births Dooley & Prause (2005) find that transitions from employment to unemployment reduce average self-reported birth weight, and increase the risk of low birth weight. Using US survey data on around 2,800 births Lindo (2011) finds that paternal job loss reduces self-reported birth weights and increases the risk of low birth weight. He also finds that effects are somewhat stronger if the mother has higher education. Scharber (2014) uses American administrative records on around 1.3 million births, and finds that maternal unemployment reduces average birthweight and increases the risk of low birth weight. She finds no differences in effects depending on maternal education, but effects are smaller for Hispanic compared to white or black mothers.

Mechanisms linking parental unemployment to infant health

The effects of parental unemployment may be understood from the centrality of employment for life chances in market economies. Unemployment reduces household incomes, which may generate financial strain and stress and constrain access to tangible and intangible goods such as nutritious foods, good housing conditions and safe neighbourhoods, and also increase exposure to harmful environmental circumstances (Brand, 2015; Catalano et al., 2011; Krug & Eberl, 2018). Such exposures may in turn be harmful during pregnancy, by inhibiting the fetal growth and shorten the gestational length (Almond et al., 2018; Currie, 2011; Strully et al., 2010). In addition, unemployment and financial strain increases the risk of relationship strain (Anderson et al., 2021; Blom & Perelli-Harris, 2020), generating stress and possibly further reducing household resources if the parents separate. Unemployment may furthermore be stigmatizing and reduce opportunities for social interaction, thus limiting social support and resilience to stress (Brand, 2015; Krug & Eberl, 2018). Stress during pregnancy and a lack of social support in this crucial stage can in turn be consequential for birth outcomes. Also, behaviors that are known to be harmful during pregnancy, such as smoking and alcohol consumption, can be understood as responses to the stress generated by unemployment (Everding & Marcus, 2020).

Even though the proximate causes of infant health at birth operate through processes in the mother, the father's unemployment may indirectly affect infant health through its effects on the mother. For instance, paternal smoking may hurt the infant by exposing the mother to toxins, and research shows that unemployment can have spillover effects within couples, such that the stress levels, health and health behaviors of one partner are adversely affected by the unemployment of another (Baranowska-Rataj & Strandh, 2021; Blom & Perelli-Harris, 2020; Everding & Marcus, 2020; Inanc, 2018). This leads to our first hypothesis:

H1: Both maternal and paternal unemployment will increase the risk of adverse birth outcomes.

Effect heterogeneity: parental gender and social stratification

There are reasons to except that intergenerational unemployment effects will differ depending on parental gender as well as parental education, migration background and the employment status of the partner (dual unemployment).

As regards parental gender, the traditional role of fathers as family breadwinners, and the on average higher earnings of fathers, means that paternal employment is typically more consequential for household resources and status, and that paternal unemployment therefore may be more detrimental for the family (Mooi-Reci et al., 2020). The psychological consequences of unemployment may be also stronger for fathers, as men are known to externalize stress and are more likely to display anger than women (Simon, 2014). Accordingly, men`s behavioral and emotional reactions may place greater demands on their partners (Blom & Perelli-Harris, 2020). While these arguments point to a stronger role of father's unemployment, infant health is specific in that the proximate causes must pass through the mother, and any effect of paternal unemployment must therefore be indirect. In addition, in many countries, including in Sweden, dual-earner families now constitute the norm, and mothers' employment contribute to a large share of household income. Moreover, while studies show that women are affected more by a male partners unemployment than vice versa, the effects for the directly affected partner tend to dominate the effects of the indirectly affected ones (Everding & Marcus, 2020; Inanc, 2018; Mervin & Frijters, 2014), especially in more gender egalitarian countries (Baranowska-Rataj & Strandh, 2021) such as in Sweden. Hence our second hypothesis:

H2: Maternal unemployment will have a stronger negative impact on infant health compared with paternal unemployment.

Besides gender, education and migration background are two of the most salient dimensions of stratification in contemporary European societies. Across Europe, including in Sweden, migrants and workers with less education are at substantially higher risk of unemployment and insecure employment, have lower incomes and fewer resources, and their children face higher risks of various adverse outcomes later in life (Arránz Becker & Loter, 2020; Erola & Jalovaara, 2017; Gregg et al., 2017). In addition to these two, we look at dual parental unemployment, which has become an increasingly important dimension of stratification as the share of dual earner households has grown (Macmillan et al., 2018; Mooi-Reci et al., 2020).

Different theories imply competing predictions as to whether the consequences of unemployment – once experienced – are more severe for already disadvantaged groups. Compensatory advantage theory (Bernardi, 2014; Erola & Kilpi-Jakonen, 2017) states that the negative effect of an adverse state, such as unemployment, will be stronger for social groups with less resources

that otherwise can compensate for the adversity. This is related to broader theories of cumulative advantage (DiPrete & Eirich, 2006), which state that experiencing an adverse state will increase the risk of experiencing further adverse states. From these perspectives, unemployment can be seen as part of a larger process of mutually reinforcing cumulative disadvantage that disproportionally hits groups with few compensatory resources. Thus, compensatory advantage theory predicts that pre-existing social disadvantage will amplify adverse intergenerational unemployment effects. Specifically, in the context of this study, less educated, migrant and dual unemployed parents tend to have lower pre-unemployment incomes and receive lower unemployment benefits, and may therefore be less capable to uphold their standard of living in times of unemployment (Macmillan et al., 2018; Nallo & Oesch, 2020). Moreover, since these groups have less human and social capital – education, work experience and valuable networks (Griga & Hadjar, 2013; McPherson et al., 2001; Oesch & von Ow, 2017; Verhaeghe et al., 2012) – their re-employment prospects may be poorer, which can aggravate the stress of the unemployment situation. This lack of resources and heightened stress may in turn be harmful for the infant.

Alternatively, theories focusing on relative deprivation state that the negative effects of an adverse state is contingent on what this state is compared to. Relative deprivation here concerns both temporal comparisons – comparing current and past situations – and contextual comparisons – comparing oneself to relevant reference groups (Smith et al., 2012). From this perspective, disadvantaged groups have less to loose from unemployment, since the fall from the lower rungs of the social hierarchy is shorter (Brand & Thomas, 2014; Gangl, 2006; Nallo & Oesch, 2020). For instance, due to lower pre-unemployment incomes, the loss in both relative and absolute income following unemployment will likely be smaller for less educated, migrant and dual unemployed parents. This is especially so in welfare state contexts such as Sweden where unemployment and family support sets an income floor under which no family with children needs to fall, while simultaneously setting a ceiling above which earnings are no longer insured. Low pre-unemployment incomes are closer to minimum levels of unemployment and family benefits, and less likely to be above the benefit ceiling, implying a potentially smaller income loss.

Non-economic and psychological costs of unemployment may also be relatively smaller for these groups. If less educated, migrant and dual unemployed parents face higher risks of becoming unemployed, unemployment may be a less exceptional and shocking experience for them. Also, since social networks tend to be homogenous in terms of education and ethnicity (McPherson et al., 2001), these parents may be more likely to interact and compare themselves with other unemployed people. Unemployment may then be less stigmatizing, imply a smaller relative loss of social status, and hence be experienced as less stressful (Brand, 2015; Brand & Thomas, 2014; Smith et al., 2012). Lower psychological costs of unemployment would imply less stress for the mother and hence relatively less negative effects on the health of the infant.

Due to the opposing theoretical predictions, we formulate two competing hypotheses:

H3a: On the basis of compensatory advantage theory, we expect that the negative effects of parental unemployment on infant health will be stronger for less educated, migrant and dual unemployed parents.

H3b: On the basis of theories of relative deprivation, we expect that the negative effects of parental unemployment on infant health will be weaker for less educated, migrant and dual unemployed parents.

If the absolute level of resources, especially income but also human and social capital, is the most important mechanism linking unemployment to poor infant health, hypothesis 3a is more likely to hold, as less educated, migrant and dual unemployed parents will possess fewer resources that can be used to compensate for adverse unemployment consequences. Conversely, if the relative loss of resources, including relative status loss and other psychological costs, is more important hypothesis 3b is more likely to hold.

Data and methods

Data

This study draws on Swedish register data combining information from several administrative registers (Lindgren et al., 2016), including the Medical Birth Register, which contains data on births in Sweden since 1973, and the Longitudinal Integrated Database for Health Insurance and Labour Market Studies (LISA), comprising educational and labour market data. We selected data for all children born between 1996 and 2017, the maximum number of years with available data

on covariates. For the estimation of family fixed-effects models, we only include children with at least one sibling born to the same mother and father during the study period. We exclude same-sex parents because they are too few to allow for separate analysis. Mothers and fathers are analyzed separately, and in cases where the mother is single, i.e., not married, in partnership or cohabiting, the father is coded as missing, meaning that the sample is slightly reduced in analyses of father's unemployment. For the analyses of maternal and paternal unemployment, the total sample sizes with complete covariate data are 1,501,765 sibling births to 779,267 families and 1,418,382 sibling births to 765,426 families, respectively. Supplementary material S1 provides more details on the construction of the samples.

The use of register data has key advantages for the purpose of this study. First, the large sample size allow the analysis of relatively rare outcomes, such as low birth weight. The high-quality data on birth outcomes based on reports from professional obstetricians and midwives (Källén & Källén, 2003), are also an improvement compared to previous research based on self-reported birth outcomes . Second, unlike surveys, sample attrition and non-response bias are not problems. Third, since nearly all children can be linked to a mother and a father through unique identifiers, it is possible to compare the effects of maternal and paternal unemployment, and to examine effect heterogeneity due to parental education, migration background, and partner's employment status.

Birth outcomes

The Medical Birth Register contains several relevant indicators of infant health measured at birth. The most commonly used measure in the literature is birth weight (Currie 2011), which can be recoded into an indicator of low birth weight (< 2500 grams). Using gestational length data, we create a binary indicator for preterm birth (< 37 weeks). We also examine if the infant is small for gestational age (SGA), using a binary indicator for birth weight that is less than two standard deviations of what would be expected given gestational age. SGA is a proxy for fetal growth restriction.

Parental unemployment

The key treatment variables are maternal or paternal unemployment, defined as being registered as unemployed with the public employment service, and/or receiving benefits for participation in

activation measures. Employment is defined as not being unemployed and not receiving social assistance and, following previous studies (Mörk et al., 2014), also requires an annual wage income above the income base amount (around 5,000 $ in 2017), which the Swedish government sets every year to calculate various benefits. Employment data are only available on an annual basis, meaning we can see whether the parent was unemployed in the year of birth (t) or before birth (t-1). However, we cannot accurately determine the extent to which an unemployment spell coincided or overlapped with pregnancy. We measure parental unemployment in the year before birth (t-1), to avoid problems with reverse causality, i.e., that the birth of a child with health problems would change parental employment status.

Sibling comparison design

We aim to estimate the causal effect of parental unemployment on infant health. Following Lundberg et al. (2021), we first clarify our theoretical estimand by (1) defining a unit-specific quantity of interest before (2) stating a target population over which the former is aggregated. Using the notation of potential outcomes (Gangl, 2010), (1) can be described as $\delta_{if} = Y_{if}(1) - Y_{if}(0)$, which corresponds to the difference in birth outcome Y_{if} of a child i in family f would their parent be unemployed ($D_{if} = 1$) instead of employed ($D_{if} = 0$) in the year before birth (t-1). Averaging this individual-level causal effect over our (2) target population of all children i born in Sweden during the observation period (1996-2017), yields the theoretical estimand $\tau_1 = E(Y_{if}(1) - Y_{if}(0))$. The simplest way to estimate this average treatment effect (ATE) is to calculate the difference in means of the observed birth outcomes of children born to an unemployed and those born to an employed parent, i.e., $\theta_1 = E(Y_{if} \vee D = 1) - E(Y_{if} \vee D = 0)$. However, for θ_1 to be a valid empirical estimand of τ_1, the potential outcomes $Y_{if}(D_{if})$ must be independent of the treatment D_{if}. This would be highly implausible in our study, because characteristics that shape parental labor market outcomes, such as education, health, and genes, are also likely to affect the potential birth outcomes. Such confounding is difficult to address by adjusting for all common causes, as some of the latter will remain unobserved to the researcher.

After estimating pooled OLS models as a benchmark, we therefore use a sibling comparison design as our main identification strategy. Unlike the pooled OLS model, which compares the birth outcomes of all children born to unemployed and employed parents in the year before birth,

it relies only on within-family variation in treatment and outcomes. This accounts for all confounding factors that are shared by siblings, such as parental genes or stable characteristics of the family environment, and that have a constant effect on birth outcomes. However, our reliance on a sibling comparison design also leads to a redefinition of the theoretical estimand we are able to examine empirically. First, only children $i$of families f with within-family variation in treatment D_{if}contribute to our estimate of the effect of parental unemployment. Second, this implies that our target population only includes families with at least two children. This can be captured by an indicator variable $C_f = 1[0 < \sum_{i}^{N_f} D_{if} < N_f]$where $N_f$refers to the total number of children in family f, i.e., children born to the same mother and father. Given this, the theoretical estimand we address is $\tau_2 = E\left(Y_{if}(1) - Y_{if}(0) \middle| C_f = 1\right)$. In addition to only applying to families with at least two children and variation in parental employment status, it differs from τ_1 in so far as only siblings who have the same mother and father can contribute to the estimates. Since it is difficult to assess to what extent empirical estimands for $\tau_2$also hold forτ_1, we restrict our focus to τ_2, acknowledging that it is a conditional average treatment (CATE) effect for a subset of the population. We use the following linear probability model to estimate the CATE:

$Y_{if} = \alpha_f + \lambda X_{if} + \beta D_{if} + \varepsilon_{if}$ (model 1)

Y_{if} is the health at birth of child i born in family f and α_f and ε_{if} denote family fixed effects and a child-specific error term, respectively. λ is a coefficient vector for non-shared covariates X_{if} and D_{if} is an indicator variable, coded 0 if the parent is employed and 1 if unemployed. For fathers, the latter is coded as missing if they do not live with or are in partnership with the mother. β is our empirical estimand of the CATE and for it to identify τ_2, the family fixed effects model makes some key assumptions.

First, relating to the stable treatment unit value assumption (SUTVA) for potential outcomes, it is assumed that (a) there are no carryover effects across siblings (Sjölander et al., 2016). This assumes that the parent's employment status at the birth of one sibling does not affect their employment status at the birth of other siblings or the birth outcomes of the other siblings, and that health at birth of one sibling does not affect parental employment status or health at the birth of another sibling. This assumption would be problematic, for example, if the consequences of

unemployment at the birth of the first child still had a negative impact at the birth of later children, due to a lasting impact of unemployment (Lindo, 2011). When the carryover effects run from the treatment of one sibling to the outcome of another child, the estimated effect is attenuated and, thus, conservative (Sjölander et al., 2016).

Second, and most importantly, we assume (b) that there is no unmeasured non-shared confounding due to characteristics that differ between siblings and affect both parental unemployment and infant health. To support the plausibility of the assumption, we control for a range of covariates X_{if} to capture factors that vary between siblings and are thought to be common causes of birth outcomes and parental unemployment. These include fixed effects for birth order, birth year, and parental age, as well as the health of both parents and the employment status of the other parent measured two years before birth. In addition, we control for parental education and region of residence in the year before birth, the latter indicated by functional labor market regions. Supplementary materials S2 and S3 provide details about the measurement and justify the choice of the covariates as confounders.

To address hypothesis 2 and examine heterogeneity in the effects, we estimate model 1 twice, with D_{if} referring once to paternal and once to maternal unemployment. When addressing hypothesis 3 about effect heterogeneity by parental education, migration background, or partner's employment status M_f, the theoretical estimand is $\tau_3 = E\left(Y_{if}(1) - Y_{if}(0) \middle| C_f = 1, M_f = m_f ¿\right.$. Note that we focus on how the effects differ between subgroups of families, defined by the values of M_f, rather than on the treatment effect of a joint intervention on D_{if} and M_f. This means that any moderation by M_f could be due to a causal interaction or other non-causal relationships and our subgroup analyses do not distinguish between these (Lundberg et al., 2021). For example, if children of more educated mothers are found to be less affected by unemployment than those of less educated mothers, this may be because maternal education itself has a causal effect on birth outcomes, but also because more and less educated mothers differ in other characteristics such as health.

The models are estimated as linear probability models (LPM) with family fixed-effects, and standard errors are clustered by family. We focus on linear models, because for non-linear family fixed-effects models, the regression coefficients cannot be easily interpreted on the probability

scale (Mood, 2010). More importantly, they also cannot be interpreted as typical causal effects, but only as interventions on both siblings and their outcomes (Petersen and Lange, 2020). Finally, estimates from non-linear models cannot be readily compared across samples, limiting the ability to investigate heterogeneity in effects (Mood, 2010). Linear models can impose an unrealistic functional form on probabilities, but we address this by entering all of the independent variables as sets of dummy variables allowing for a fairly flexible relation between the outcome and the independent variables.

Results

Descriptive statistics in Table 1 show that, on average, children born to unemployed parents have poorer birth outcomes compared to children born to employed parents. Specifically, parental unemployment is associated with an increase in the risk of LBW by 0.44-0.52 percentage points, which in relative terms means a 12-14 % increase from the baseline risk. Likewise, parental unemployment is related to a 0.40-0.51 percentage points (or 7-9 %) increase in the risk of preterm birth, and a 0.43-0.46 percentage points (or 28-30 %) increase in the risk of SGA. These associations between parental unemployment and birth outcomes may be driven by other factors that are related to both unemployment and birth outcomes. Parents who become unemployed tend to be younger, more likely to have migrant background, have lower educational attainment and higher sickness absence. Thus, a simple comparison of average birth outcomes depending on parental employment status would probably be biased due to the selection of parents into unemployment.

Table 1 – Sample characteristics, only children with at least one sibling during the observation period.

	Mothers		**Fathers**	
	Employed	**Unemployed**	**Employed**	**Unemployed**
Characteristics of children (averages)				
Low birth weight, %	3.80	4.24	3.72	4.24
Pre-term birth, %	5.60	6.11	5.57	5.97
Small for gestational age, %	1.54	1.97	1.54	2.00
Parity	1.92	1.97	1.92	2.00
Birth year (median)	2007	2005	2007	2005
N	1,152,494	349,271	1,188,213	230,169
N total births with complete data	1,501,765		1,418,382	
	Employed	**Unemployed**	**Employed**	**Unemployed**
Demographic characteristics of parents (averages)				
Age at birth	31.36	29.33	33.64	32.44
Swedish-born, %	89.18	77.10	89.66	68.37
Lower secondary education, %	6.26	22.16	8.33	23.65
Upper secondary education, %	40.63	52.74	49.54	50.82
Tertiary education, %	53.09	25.10	42.13	23.53
≥ 14 sickness days, %	9.23	9.73	3.19	7.08

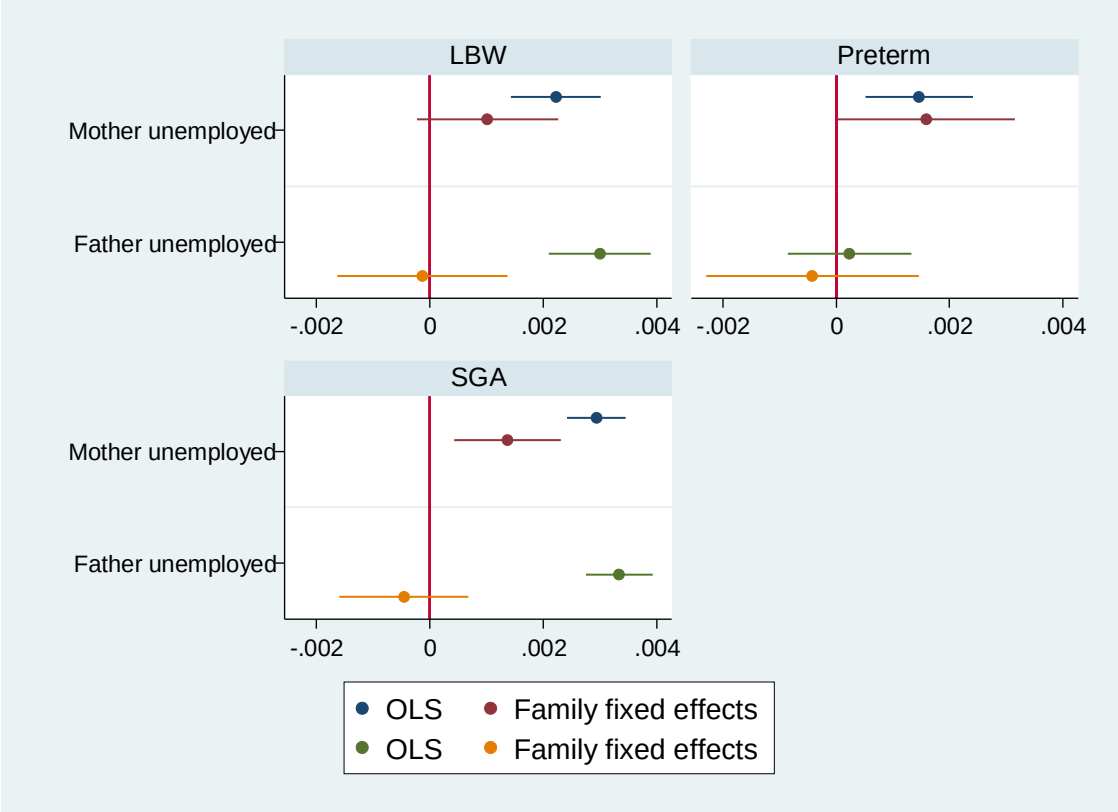
In the next step, we present the results from the regression analyses in Figure 1 (exact coefficients are reported in supplementary material S4). The results from pooled OLS models, which utilize both between and within-sibling variation and adjust for the previously mentioned covariates, show that maternal unemployment is associated with an 0.22 percentage point increase in the risk of LBW, 0.12 percentage point increase in preterm birth, and 0.29 percentage point increase in SGA. The corresponding estimates for paternal unemployment are 0.30 (LBW), 0.02 (preterm birth), and 0.33 (SGA). OLS estimates are in general larger than comparable estimates using family fixed effects. This probably reflects selection bias, but it may also reflect amplified measurement error when only within-sibling variation is used. After controlling for shared family characteristics in sibling comparisons, the estimated effects of maternal unemployment are 0.10 (LBW), 0.16 (preterm birth), and 0.14 (SGA) percentage points, respectively. With preterm birth

and SGA as the outcomes, the coefficients are statistically significant at the 5 % level. With LWB as the outcome, the estimated p-value for a two-sided hypothesis test is 0.109. When viewed in relation to the baseline risks of the outcomes, the estimates for maternal unemployment correspond to 2.6, 2.9 and 9.1 % higher risks of LBW, preterm births and SGA, respectively. Thus, whether viewed in absolute or in relative terms, the effects of maternal unemployment are relatively modest.

Estimated effects of paternal unemployment are all close to 0 and not statistically significant. Thus, overall, our results only partially support hypothesis 1. In line with hypothesis 2, however, we see that the effects of maternal unemployment are clearly larger than the effects of paternal unemployment in the sibling models. A comparison of the results from the sibling models shows that the differences between the coefficients for maternal and paternal unemployment are statistically significant at the 5 % level with preterm birth and SGA as the outcomes (Paternoster et al., 1998). With LBW as the outcome, the difference is in the expected direction but not significant.

Since the results of the main analyses reveal differences between pooled OLS and fixed effects models, which are likely driven by the selection bias, in the further part of our analysis we rely on the latter.

Figure 1 – Average effects of parental unemployment on birth outcomes.



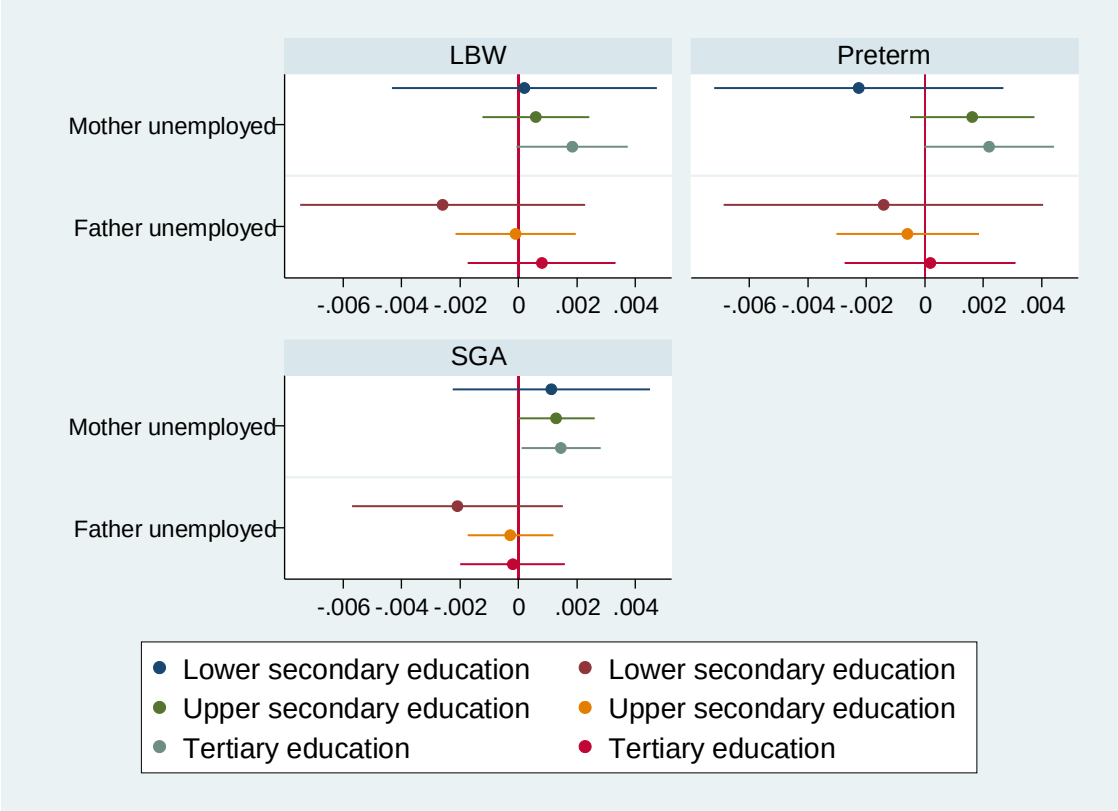
Note: The horizontal x-axes show differences in percentage points compared to employment (the reference category), the dots show point estimates and the lines show 95 % confidence intervals.

Effect heterogeneity

Figures 2-4 address hypothesis 3, by showing differential effects depending on parental education, migration background and single vs. dual unemployment. All models are estimated separately for the focal subgroups, but are otherwise equivalent to the models described by Eq. 1 and the exact coefficients can be found in supplementary materials S5 to S7. Beginning with education, Figure 2 shows results estimated separately for parents with at most lower secondary, upper secondary or tertiary education. For mothers, we see an educational gradient on LBW and preterm births, such that the effects of unemployment are weaker for mothers with lower education. Effects on SGA are for mothers very similar across educational groups. Effects on all three outcomes are also weaker (or more negative) for fathers with lower secondary education. In sum, for five out of six comparisons (mothers vs. fathers on three outcomes) are the effects

smallest for parents with lower secondary education. However, the effects for parents with lower secondary education are imprecisely estimated, and in no case is the difference statistically significant.

Figure 2 – Effects of parental unemployment on birth outcomes. Heterogeneity by parental education.

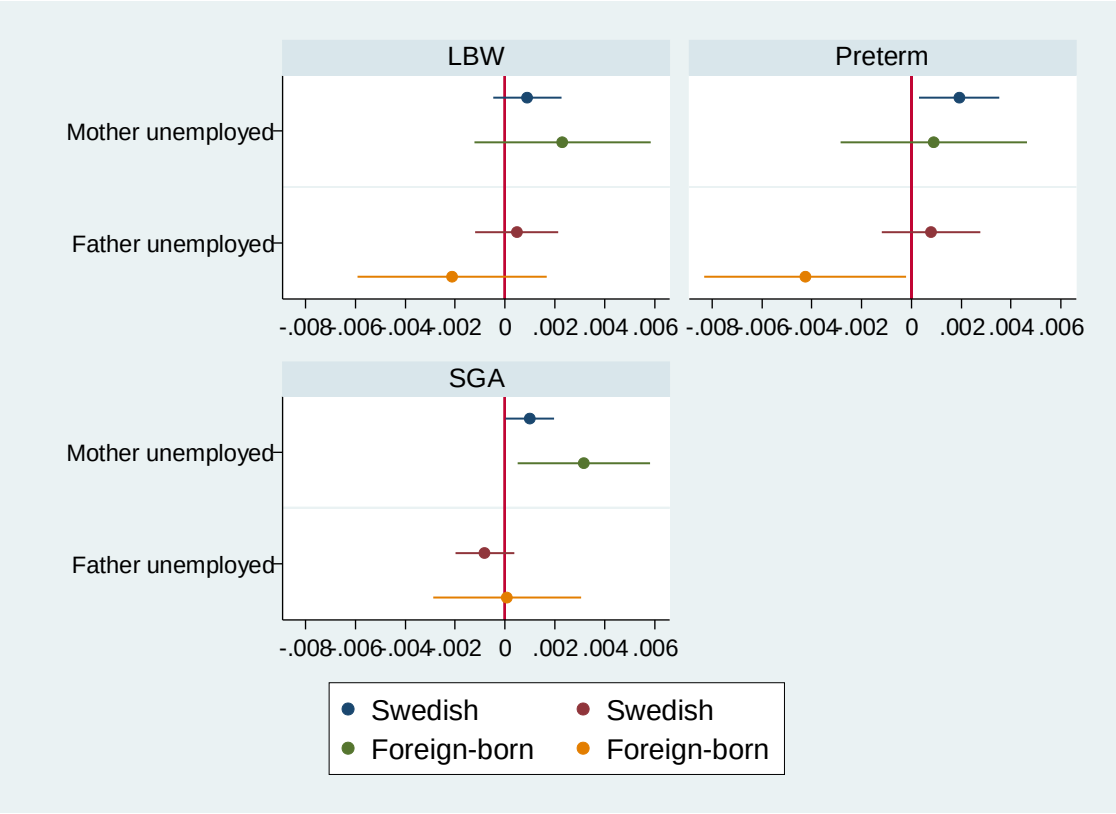


Note: The horizontal x-axes show differences in percentage points compared to employment (the reference category), the dots show point estimates and the lines show 95 % confidence intervals.

Figure 3 shows that there are no consistent differences between parents born in Sweden and foreign-born parents. For mothers, unemployment has somewhat stronger effects on LBW and SGA for migrants, but the opposite is true for preterm births. For fathers, effects on SGA are also slightly stronger for migrants, but effects on LBWare somewhat weaker. Effects on preterm births are clearly weaker for migrant fathers, due to a strong negative effect of unemployment for migrant fathers. In sum, for three out of six comparisons are the effects stronger for migrant parents, while the opposite is true for the other three comparisons. Again, however, we see that

the effects for migrants are imprecisely estimated, and only for fathers and preterm births is the difference statistically significant.

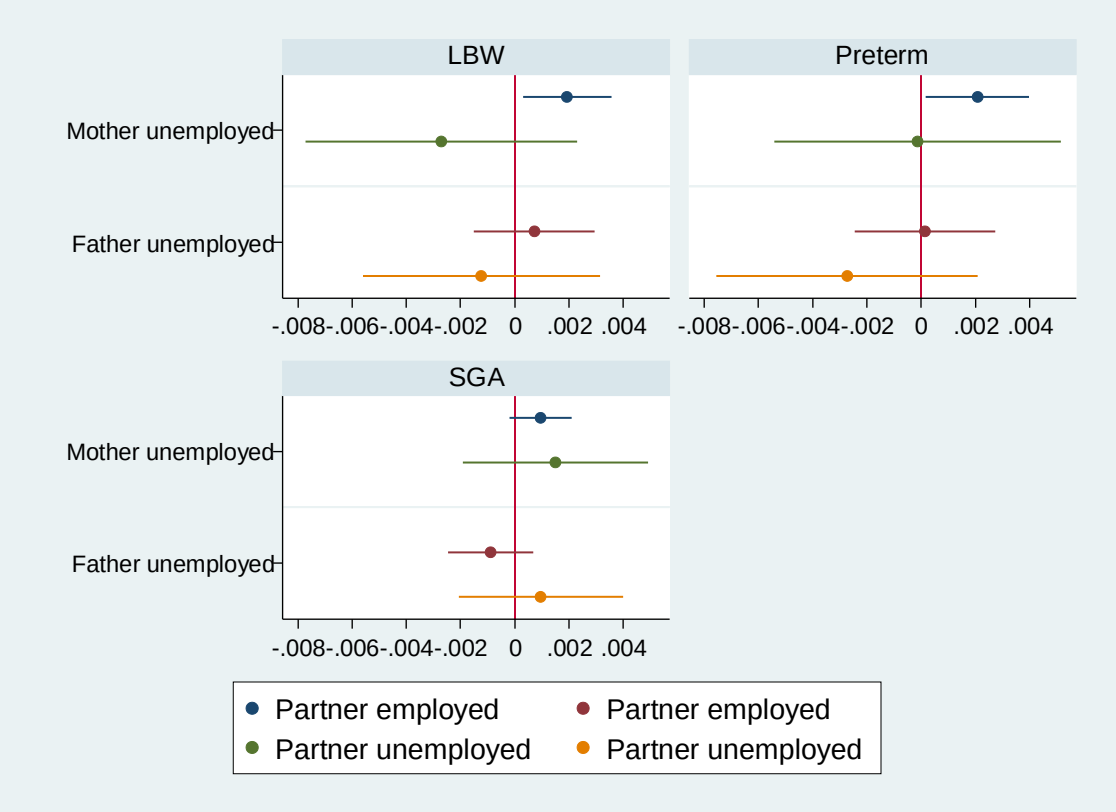
Figure 3 - Heterogeneity by parental country of origin



Note: The horizontal x-axes show differences in percentage points compared to employment (the reference category), the dots show point estimates and the lines show 95 % confidence intervals.

The analyses so far have investigated maternal and paternal unemployment separately. In Figure 4, we investigate the role of dual parental unemployment, by showing effects of maternal (paternal) unemployment depending on the employment status of the father (mother). That is, we investigate if the effects of the unemployment of one parent is different if the other parent is employed compared to unemployed. For mothers, the effects on LBW and preterm birth are weaker if the father is also unemployed (i.e. dual unemployment), with little differences for SGA. For fathers, effects on LBW and preterm birth are somewhat weaker, while effects on SGA are stronger, if the mother is also unemployed. Since dual parental unemployment is quite rare, estimates of its effects are imprecise and in no case is the difference statistically significant.

Figure 4 - Heterogeneity by employment status of the other parent



Note: The horizontal x-axes show differences in percentage points compared to employment (the reference category), the dots show point estimates and the lines show 95 % confidence intervals.

Supplementary analyses

Supplementary material S8 reports on a number of sensitivity analysis, we conducted. First, we re-estimated model 1 (average effects) using a variable in which employment status is defined based on which year the majority of the expected length of a pregnancy (280 days) occurred. For mothers, the estimates with LBW and preterm births as the outcomes are reduced and no longer statistically significant, while the estimate for SGA is only slightly reduced. For fathers, all estimates are small or negative, and all remain statistically insignificant. However, in this case reverse causality, i.e. that infant health affects unemployment risks, is a potential problem.

In our data, few parents (around 3 %) change their highest attained education downwards across births (e.g. from tertiary to upper secondary). The vast majority (> 90 %) of these are foreign-born, indicating that the translation of foreign to Swedish degrees is difficult and subject to

revision over time. The risk of bias due to measurement error can be greater in fixed effects models that only rely on within-unit variation for estimation. We therefore re-estimated model 1 but without parental education as a covariate – treating it essentially as constant across siblings -, with mostly unchanged results. Moreover, our family fixed effects models only rely on variation within families, as defined by children sharing the same mother and father. Due to divorce and re-partnering, some mothers and fathers may be part of more than one family, and the effects of unemployment may differ in families that were formed after re-partnering. In order to test whether this causes any bias, we re-estimated model 1 but excluding re-partnered parents, again with essentially unchanged results.

Discussion

In this study, we used a sibling comparison design and Swedish register data to investigate effects of parental unemployment on infant health at birth. Focusing on a generous welfare state with high female employment rates we shed new light on intergenerational unemployment effects in a comparatively egalitarian welfare state context. We tested four hypotheses. Hypothesis 1 stated that both maternal and paternal unemployment will impact negatively on infant health, while hypothesis 2 stated that maternal unemployment will have a stronger negative impact compared with paternal unemployment.

Hypothesis 1 was only partially supported. Estimates of effects of paternal unemployment were close to zero and not statistically significant, while the corresponding estimates for maternal unemployment were relatively weak. The effects of maternal unemployment ranged from 0.10 (LBW) to 0.16 (preterm births) percentage points, or from 2.6 (LBW) to 9.1 (SGA) percent relative to baseline risks, which is more than an order of magnitude smaller than comparable previous estimates. Lindo (2011) and Scharber (2014), using American data, found that paternal job loss and maternal unemployment increased risks of LBW by between 1.8 and 2.5 percentages points, respectively. Neither of these three studies looked at preterm birth or SGA. The unadjusted (excluding family or mother fixed effects and covariates) difference in average risks of LBW between children born to unemployed and employed mothers was around 6 percentage points in both Scharber and Dooley and Prause (2005), compared to around 0.5 percentage point in this study. Thus, it seems unlikely that the smaller effect sizes found in this study are primarily due to different model specifications. Other points of reference would be well-known risk factors

for adverse birth outcomes such as maternal smoking, which has been estimated to increase the risk of LBW by 6.8 percentage points in the US (Lien & Evans, 2005), or stressful events such as experiencing the death of a relative during pregnancy, which in a Swedish context has been estimated to increase the risks of LBW, preterm birth and SGA by 0.36, 0.52 and 0.02 percentage points, respectively (Persson & Rossin-Slater, 2018).

Nevertheless, our finding that maternal unemployment had consistently stronger effects than paternal unemployment across the three outcomes is in line with hypothesis 2. Relatively stronger effects of maternal unemployment on the health of children have been reported from other Swedish studies on older children (Mörk et al., 2014), and suggest that in more gender-egalitarian countries with high female employment rates, the mother's employment status is as least as important as that of the father's for intergenerational unemployment effects.

Due to conflicting theoretical predictions, and scant guidance from previous findings on intergenerational unemployment effects on infant health, hypothesis 3 was formulated as two sub-hypotheses. On the basis of cumulative and compensatory advantage theory, hypothesis 3a stated that intergenerational unemployment effects will be stronger for less educated, migrant and dual unemployed parents, that is, for groups with pre-existing disadvantage and fewer compensatory resources. On the basis of theories of relative deprivation, hypothesis 3b stated the opposite, that intergenerational unemployment effects will be weaker for less educated, migrant and dual unemployed parents. None of these two hypotheses received consistent support, as the effects for these groups were neither consistently stronger nor weaker compared to higher educated, native and single unemployed parents. While the effects were in general weaker for parents with only lower secondary education, and to some extent when both parents were unemployed (dual parental unemployment), these differences were relatively modest and not statistically significant, suggesting that there is still substantial heterogeneity within these social categories. The differences in the effects according to migration background were inconsistent in terms of direction and, with the exception of paternal unemployment and preterm births, small in terms of magnitude.

Summing up, we find that pre-existing social disadvantage – low education, migration background, dual parental unemployment – was not associated with more adverse intergenerational unemployment effects. Thus, parental unemployment does not seem to amplify

intergenerational disparities in these dimensions of social stratification, at least in the Swedish context. If anything, the evidence suggests that children of parents with low education, and to some extent where both parents are unemployed, may experience relatively less harm from parental unemployment. One interpretation of this is that unemployment is a more common experience for these parents, and that they therefore experience less non-economic and psychological costs such as stigma and relative status loss (Brand, 2015; Brand & Thomas, 2014). Another interpretation is that the relative income loss are smaller, since their pre-unemployment earnings are closer to the floor of the social safety net, and less likely to be above the ceilings on social benefits (Nallo & Oesch, 2020). This second interpretation would indirectly corroborate the previously discussed argument that the, compared to previous American studies, small effect sizes found in this study may partly reflect the buffering role of the welfare state.

Limitations and avenues for future research

Although this study has many strengths, including the use of population register data and sibling comparisons that control for unobserved confounding, it is important to stress its limitations. The results from sibling comparisons may be biased by non-shared unmeasured confounding, and they may only apply to the identifying sample of siblings with variation in treatment status (Frisell et al., 2012; Petersen & Lange, 2020). Also, sibling comparisons are sensitive to measurement error (Bound & Solon, 1999; Frisell et al., 2012), which may be relevant here since with only yearly data on employment status we cannot exactly match the unemployment spell of the parent to the duration of the pregnancy. The most likely scenario is that this leads to random rather than systematic measurement error of the treatment (unemployment), in which case our estimates suffer from attenuation bias. Likewise, the estimated effects may be attenuated due to carryover effects across siblings, such that the unemployment of a parent preceding or during one pregnancy has lasting effects also during subsequent pregnancies (Lindo, 2011; Sjölander et al., 2016).

We also note that while our study focuses on couples with children, our results may suffer from sample selection bias as we do not consider the health of infants who were not born for reasons related to parental unemployment. There are strong theoretical arguments (Mills & Blossfeld, 2013) and empirical evidence that unemployment may lead to postponement of childbearing, also in Sweden (Andersson, 2000). These postponement effects may be stronger among parents who

anticipate that a lack of the job would have strong negative consequences for their family members, including the children. Thus, among infants born to unemployed parents, there may be an overrepresentation of children whose parents decided to have a child because they could anticipate that the health of that child will not be worse off in spite of parental unemployment. If such mechanisms are at work, ignoring the sample selection in our analyses again attenuates the results.

While intergenerational unemployment effects presented in this study may be attenuated due to methodological reasons outlined above, they may also reflect the moderating role of social policies that support families and buffer a large share of the costs of unemployment for affected families. Family and unemployment support can mitigate income loss, active labour market policies can improve re-employment chances, and a tax-funded universal health insurance, including a cost-free provision of antenatal care focused on prevention, can make health behaviors and healthcare consumption less dependent on family resources. Nevertheless, given the scarcity of evidence on intergenerational unemployment effects on infant health, and the salience of health at birth for processes shaping socio-economic disadvantage later in life (Almond et al., 2018; Conley & Bennett, 2000; Currie, 2011; Palloni, 2006), future research could provide a more comprehensive picture and examine context-dependent variation in effects through comparative studies across a broader range of countries.

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The Stata code for replication of the results from this paper is available on OSF platform under this link: https://osf.io/tvnyf/

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Online supplementary materials

S1 – Construction of estimation sample

	N children	**N families**
Full sample 1996-2017	2,330,195	-
+ ID for mother	2,328,706	-
+ ID for mother and father	2,292,807	1,103,061
+ Siblings during study period	1,794,252	863,208
+ Full data on treatment and covariates	1,501,765 (mothers) 1,418,382 (fathers)	779,267 (mothers) 765,426 (fathers)

S2 – Measurement and descriptive statistics for all variables

Variable	**Measurement**	**Range, mean and standard deviation**
Outcome variables		
Low birth weight	Dummy coded. Birth weight < 2,500 grams t-0	Range: 0-1 Mean: 0.039 SD: 0.0197
Preterm birth	Dummy coded. Gestation length < 37 weeks t-0	Range: 0-1 Mean: 0. 057 SD: 0.235
Small for gestational age	Dummy coded. Birth weights lower than 2 standard deviations of what is expected given the gestational age t-0	Range: 0-1 Mean: 0.016 SD: 0.128
Treatment variable		
Employment status: Unemployment	0 = Employed. Wage income > income base amount AND not unemployed AND no social assistance AND (for fathers) not absent. 1 = Unemployed. Registered at unemployment office OR receipt of activation benefits AND (for fathers) not absent. t-1	Range: 0-1 Mothers: Mean: 0.232 SD: 0.419 Fathers: Mean: 0.152 SD: 0.366
Covariates		
Birth year of the child	Dummy coded, one dummy per year. t-0	Range: 1996-2017 Mean: 2006 SD: 5.701
Birth order of the child	Dummy coded: 1, 2, 3, ≥4 t-0	Range: 0-1 Mean: 1.928 SD: 0.848
Parental age	Parental age at the birth of the child. Dummy coded, one dummy per year t-0	Range: 17-77 Mothers Mean: 30.89 SD: 4.652 Fathers Mean: 33.43 SD: 5.593
Parental education	Highest attained education. Dummy coded: 0 = ISCED 0-2; 1 = ISCED-3-4; 2 = ISCED ≥ 5. t-1	Range: 0-2 Mothers Mean: 1.393 SD: 0.633 Fathers Mean: 1.311

		SD: 0.644
Employment status of partner, year before treatment (t-2)	Same as treatment variable, but measured for the partner and the year before treatment. t-2	Range: 0-1 Mothers Mean: 0.167 SD: 0.373 Fathers Mean: 0.237 SD: 0.420
Sickness absence, year before treatment (t-2)	Number of days on sick leave. Dummy coded: 0 = number sickness days < 14; 1 = number sickness days ≥ 14. t-2	Range: 0-1 Mothers Mean: 0.093 SD: 0.291 Fathers Mean: 0.037 SD: 0.197
Functional labor market region	Municipality of residence, grouped into regions based on typical commuting patterns. Dummy coded, one dummy per region. t-1	Range: 0-72 Mothers Mean: - SD: - Fathers Mean: - SD: -
Moderator variables		
Education	Highest level attained over the observation period 1996-2017. Dummy coded: 0 = ISCED 0-2; 1 = ISCED-3-4; 2 = ISCED ≥ 5. Time constant.	Range: 0-2 Mothers Mean: 1.453 SD: 627 Fathers Mean: 1.347 SD: 649
Swedish	Country of birth. Dummy coded: 1 = Born in Sweden; 0 = born outside Sweden. Time constant.	Range: 0-1 Mothers Mean: 0.864 SD: 0.344 Fathers Mean: 0.873 SD: 0.355
Partner's employment status / Dual parent unemployment	Same as treatment variable, but measured for the partner. t-1	Range: 0-1 Mothers: Mean: 0.152 SD: 0.366 Fathers: Mean: 0.232 SD: 0.419

Note: t is defined as the year of birth, t-1 is the year before birth, and t-2 two years before birth.

S3 – Justification of covariates as confounders

An important assumption of family fixed effects models is the absence of unmeasured, non-shared confounding due to characteristics that differ between siblings and are common causes of both parents' unemployment around birth and birth outcomes. To support the plausibility of this assumption, we adjusted for the non-shared covariates listed in Supplementary Material S2. However, caution should be exercised in the selection of covariates because only variables that are hypothesized to affect both treatment and outcome should be adjusted. In contrast, variables that are thought to be endogenous to the treatment should not be adjusted, as this may cause both overcontrol and endogenous selection bias (Elwert & Winship, 2014). Thus, here we briefly justify our choice of covariates as confounders, considering the timing of the covariates, theoretical arguments and previous empirical evidence on their effects on both parental employment status and birth outcomes.

We adjusted for birth year fixed effects (year t) because period effects around birth, such as economic recessions, may not only increase the likelihood of children having unemployed parents (Biegert & Ebbinghaus, 2020) but may also independently affect child health, although it remains unclear whether these effects are pro- or countercyclical (Catalano, 2011; van den Berg et al., 2020). The number of siblings of an unborn child may affect the employment status of parents, particularly mothers (Baranowska-Rataj, & Matysiak, 2016; Matysiak & Vignoli, 2007), and primiparity is thought to increase adverse birth outcomes (Shah, 2010). We included fixed effects for birth order (year t) because there is some evidence for nonlinear relationship between birth order and birth outcomes, with additional negative effects starting at the fourth birth (Valero de Bernabé et al., 2004). Similarly, parental age at year t may affect both parental employment status and birth outcomes. Higher parental age, and particularly advanced maternal age, is thought to be negatively associated with infant health, although it is unclear whether these associations are causal (Goisis et al., 2017; Goisis et al., 2018). Because we focus only on parents of childbearing age in our analysis, parental age is also likely to be positively associated with employment opportunities, as younger workers have yet to establish themselves in the labor market after transitioning from school to work (Blossfeld et al., 2008; Dietrich, 2013). Because there is some evidence that, in addition, young mothers are at higher risk for adverse birth outcomes (Valero de Bernabé et al., 2004), suggesting a nonlinear relationship, we included fixed effects for maternal and paternal age. Similarly, the level of parental education (in year t-1) is likely to influence the labor market careers of mothers and fathers (Gebel & Heineck, 2019), and higher maternal education has been shown to benefit birth outcomes (Valero de Bernabé et al., 2004), which partly captures other aspects of mothers' socioeconomic status, health, and health behaviors. Considering the same mechanisms as described for the effects of own unemployment, the partner's labor market situation may influence birth outcomes. In addition, the partner's employment status may influence or be influenced by the unemployment of the parent who is the focus of the analysis. For example, father's unemployment may increase mother's employment via the added worker effect (Bredtmann et al., 2018) or increase the risk of mother's unemployment, leading to jobless households (de Graaf-Zijl & Nolan, 2011), possibly via a lower social norm of work in households where more people are without a job. If both partners' employment status were measured in the same year t-1, it would be difficult to determine causal direction and therefore difficult to decide whether the partner's employment status is a confounder or endogenous to the treatment (Elwert & Winship, 2014). Therefore, we adjust for partner employment status in year t-2, implying that it cannot be affected by treatment measured in year t-1. In

addition, parental unemployment may be influenced by their own and their partner's health (Kröger et al., 2016), and research suggests that maternal health problems in particular may have a negative impact on birth outcomes (Valero de Bernabé et al., 2004). To avoid controlling for changes in health status due to unemployment, which may partially mediate effects on birth outcomes (e.g., via parental stress), we measured health status of both parents in year t-2, which is indicated by longer absences due to illness. Finally, we included fixed effects for families' place of residence in Sweden in year t-1, measured by functional labor market regions. Less advantaged regions may lack employment opportunities and other community resources, increasing parental unemployment risk (Gassman-Pines & Schenck-Fontaine, 2019; Hane-Weijman et al., 2018), and at the same time, they may negatively affect birth outcomes, for example, through channels related to regional economic conditions (Catalano et al., 2011) but also to an unequal distribution of environmental risk factors across regions (Valero de Bernabé et al., 2004). One issue may be that we measure place of residence in year t-1, the same year as parental unemployment, and there is some evidence that unemployment increases the likelihood of moving to another region (Andersson et al., 2020), although this effect is rather small in absolute terms and likely smaller in our sample because we focus on individuals with children who have a lower propensity to move (Huttunen et al., 2016). We, therefore, think that place of residence in t-1 is more likely to be a confounder than a mediator of the effects of parental unemployment on infant health.

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S4 – Average effects of parental unemployment on birth outcomes.

		Pooled OLS	Family fixed effects	Pooled OLS	Family fixed effects
Low birth weight					
Mother unemployed	B	0.0022	0.0010		
	SE	0.0004	0.0006		
Father unemployed	B			0.0030	-0.0001
	SE			0.0005	0.0008
Cons		0.1135	0.1012	-0.0332	0.0211
N		1,498,303	1,498,303	1,415,179	1,415,179
Preterm birth					
Mother unemployed	B	0.0012	0.0016		
	SE	0.0005	0.0008		
Father unemployed	B			0.0002	-0.0004
	SE			0.0006	0.0010
Constant		0.1244	0.0646	0.1668	0.1584
N		1,501,131	1,501,131	1,417,822	1,417,822
Small for gestational age					
Mother unemployed	B	0.0029	0.0014		
	SE	0.0003	0.0005		
Father unemployed	B			0.0033	-0.0005
	SE			0.0003	0.0006
Constant		0.0470	0.0378	0.0339	-0.0279
N		1,501,765	1,501,765	1,418,382	1,418,382
Family fixed effects			Yes		Yes

Note: Due to missing data, the number of observations is slightly reduced with low birth weight and preterm births as the outcomes. B=slope coefficient; SE=standard error clustered on families.

S5 – Effects of parental unemployment on birth outcomes. Heterogeneity by parental education.

		Mothers			**Fathers**		
		Lower secondary education	Upper secondary education	Tertiary education	Lower secondary education	Upper secondary education	Tertiary education
Low birth weight							
Mother unemployed	B	0.0002	0.0006	0.0018			
	SE	0.0023	0.0009	0.0010			
Father unemployed	B				-0.0026	-0.0001	0.0008
	SE				0.0025	0.0010	0.0013
Constant		0.5289	0.1622	0.3082	0.1811	0.0424	-0.0008
N		108,897	638,530	760,998	128,809	698,385	593,368
Preterm birth							
Mother unemployed	B	-0.0023	0.0016	0.0022			
	SE	0.0025	0.0011	0.0011			
Father unemployed	B				-0.0014	-0.0006	0.0002
	SE				0.0028	0.0012	0.0015
Constant		1.0180	0.0900	-0.1121	0.2446	0.1515	0.1036
N		109,152	639,781	762,347	129,066	699,702	594,452
Small for gestational age							
Mother unemployed	B	0.0011	0.0013	0.0015			
	SE	0.0017	0.0007	0.0007			
Father unemployed	B				-0.0021	-0.0003	-0.0002
	SE				0.0018	0.0008	0.0009
Constant		0.0472	0.0399	0.0001	0.0829	0.0204	-0.0582
N		109,208	640,094	762,618	129,133	699,968	594,685
Family fixed effects		Yes	Yes	Yes	Yes	Yes	Yes

Note: B=slope coefficient; SE=standard error clustered on families.

S6 – Effects of parental unemployment on birth outcomes. Heterogeneity by parental country of origin

		Mothers		**Fathers**	
		Swedish-born	Foreign-born	Swedish-born	Foreign-born
Low birth weight					
Mother unemployed	B	0.0009	0.0023		
	SE	0.0007	0.0018		
Father unemployed	B			0.0005	-0.0021
	SE			0.0009	0.0019
Constant		0.1276	-0.0762	0.0571	-0.0017
N		1,293,997	204,277	1,219,832	195,321
Preterm birth					
Mother unemployed	B	0.0019	0.0009		
	SE	0.0008	0.0019		
Father unemployed	B			0.0008	-0.0043
	SE			0.0010	0.0020
Constant		0.0909	-0.0561	0.2295	-0.9006
N		1,296,491	204,611	1,222,185	195,611
Small for gestational age	B				
Mother unemployed	SE	0.0010	0.0032		
	B	0.0005	0.0014		
Father unemployed	SE			-0.0008	0.0001
				0.0006	0.0015
Constant		0.0387	0.0645	0.0023	-0.0187
N		1,297,041	204,695	1,222,654	195,702
Family fixed effects		Yes	Yes	Yes	Yes

Note: B=slope coefficient; SE=standard error clustered on families.

S7 – Effects of parental unemployment on birth outcomes. Heterogeneity by employment status of the partner.

		Mothers		**Fathers**	
		Partner employed	Partner unemployed	Partner employed	Partner unemployed
Low birth weight					
Mother unemployed	B	0.0019	-0.0027		
	SE	0.0008	0.0026		
Father unemployed	B			0.0007	-0.0012
	SE			0.0012	0.0022
Constant		0.0156	0.1751	0.0525	0.1813
N		1,135,572	204,104	1,047,039	292,637
Preterm birth					
Mother unemployed	B	0.0021	-0.0001		
	SE	0.0010	0.0027		
Father unemployed	B			0.0001	-0.0027
	SE			0.0013	0.0024
Constant		-0.4020	0.1091	0.0296	-0.4156
N		1,137,655	204,511	1,048,916	293,250
Small for gestational age					
Mother unemployed	B	0.0009	0.0015		
	SE	0.0006	0.0018		
Father unemployed	B			-0.0009	0.0010
	SE			0.0008	0.0016
Constant		0.0014	-0.8159	0.0378	-0.2209
N		1,138,080	204,598	1,049,291	293,387
Family fixed effects		Yes	Yes	Yes	Yes

Note: B=slope coefficient; SE=standard error clustered on families.

S8 – Effects of parental unemployment on birth outcomes. Sensitivity analyses.

		Mothers			Fathers		
		Majority of pregnancy	Excluding education	Excluding re-partnered	Majority of pregnancy	Excluding education	Excluding re-partnered
Low birth weight							
Mother unemployed	B	0.0005	0.0010	0.0013			
	SE	0.0006	0.0006	0.0007			
Father unemployed	B				-0.0003	-0.0001	-0.0001
	SE				0.0008	0.0008	0.0008
Constant		0.1237	0.1030	0.0976	0.0218	0.0248	-0.0169
N		1,525,348	1,498,303	1,428,700	1,418,782	1,415,179	1,354,310
Preterm birth							
Mother unemployed	B	0.0005	0.0015	0.0016			
	SE	0.0008	0.0008	0.0008			
Father unemployed	B				-0.0016	-0.0005	-0.0002
	SE				0.0009	0.0010	0.0010
Constant		0.1098	0.0696	0.0626	0.0828	0.1674	0.1606
N		1,528,213	1,501,131	1,431,409	1,421,430	1,417,822	1,356,840
Small for gestational age							
Mother unemployed	B	0.0010	0.0013	0.0014			
	SE	0.0005	0.0005	0.0005			
Father unemployed	B				0.0000	-0.0004	-0.0005
	SE				0.0006	0.0006	0.0006
Constant		0.0271	0.0368	0.0342	0.0174	-0.0320	-0.0688
N		1,528,856	1,501,765	1,431,998	1,421,987	1,418,382	1,357,368
Family fixed effects		Yes	Yes	Yes	Yes	Yes	Yes

Note: B=slope coefficient; SE=standard error clustered on families.
Majority of pregnancy = Employment status based on the year of the majority of the expected length of the pregnancy.
Excluding education = Parental education not included as covariates.
Excluding re-partnered = Re-partnered mothers and fathers excluded from the sample.