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Adverse birth outcomes and parental labor market participation after birth

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Abstract

Numerous articles have looked at the connection between adverse birth outcomes (low birth weight or preterm birth) and an individual's later socioeconomic status. To this day very few studies have been conducted that specifically address how delivery and adverse birth outcomes affect families and the homes where children grow up. In this study, I use data from the German Socioeconomic Panel (SOEP) to research the association between adverse birth outcomes and several parental labor market outcomes following childbirth. The analysis indicates that low birth weight and preterm birth are not associated with most of the considered parental labor market outcomes after birth. Initial disparities prior to childbirth account for a large extent of the negative relationship between adverse birth outcomes and labor market outcomes after birth.

JEL codes: I14, J13, D31

Keywords: Health and Inequality, Children, Labor market outcomes, SOEP

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1 Introduction

Why are some families economically successful whereas others are not? Studying the intra-generational determinants of individual income dynamics across the life course is a central question in both empirical ([Bradbury, 2022](#)) and theoretical research ([Blundell, 2014](#)) in economics. Generally, income trajectories are modelled as a function of family characteristics, education, demographics, macroeconomic conditions, external shocks and crucial life events ([Jäntti and Jenkins, 2015](#); [Angelopoulos et al., 2020](#)).

A large body of literature analyzes the impact of childbirth as one of these factors shaping income dynamics while affecting the labor market outcomes of parents. [Angrist and Evans \(1998\)](#) was one of the earliest articles attempting to quantify the causal impact of childbirth on maternal labor market outcomes with an instrumental variable approach, based on twin births and the gender distribution of earlier births. The results imply that childbirth caused income losses for mothers ranging between 1,300\$ and 2,000\$ per year. Other research that used various instrumental variable based approaches confirmed this finding of a detrimental effect of childbirth on maternal labor market outcomes ([Agüero and Marks, 2008, 2011](#); [Bratti and Cavalli, 2014](#)). Moreover, there is evidence that childbirth is not related to adverse labor market outcomes for fathers, which widens income differences between parents. ([Cools et al., 2017](#); [Kleven et al., 2019](#); [Feldhoff, 2021](#); [Markussen and Strøm, 2022](#))

Even though the relationship between adverse perinatal or early life health and individual long-term outcomes is well established in the literature, very few articles address the resulting economic implications for parents and families. Some research suggests that mothers of children with adverse health and development outcomes after birth are less likely to be employed, and they work and earn less compared to mothers of children without these difficulties ([Frijters et al., 2009](#); [Burton et al., 2017](#); [Laffers and Schmidpeter, 2021](#)). This study aims to fill this gap and address the question of whether adverse birth outcomes have negative implications for the labor market outcomes of both parents and families after birth.

One exception which studies birth outcomes is the article by [Luca and Sevak \(2022\)](#). The authors sum multiple indicators of adverse neonatal outcomes and estimate the effects of this

combined measure on maternal labor supply. They conclude, that the more of these adverse neonatal outcomes children are suffering from the lower is their mother's labor market participation after birth.

Beyond the study of [Luca and Sevak \(2022\)](#), this study is one of the first studying the relationship between adverse birth outcomes and family income as well as labor market participation after birth conditional on various pre-birth characteristics including the pre-birth measures of the outcome variables. In the absence of a meaningful exogenous instrument for adverse birth outcomes, the analysis relies on a linear regression analysis. The article analyzes German panel data, therefore I also present results from Difference-in-Differences models. However, some existing results suggest that low parental socioeconomic status before birth is related to increased risks of adverse birth outcomes ([Lindo, 2011](#); [Güneş, 2015](#)). Hence, the treatment variables, which are adverse birth outcomes, would not be exogenous and Difference-in-Differences results therefore could not be interpreted causally.

The second contribution of this article is methodological. The results from the regression analysis suggest that it is important to control for pre-birth measures of the specific labor market outcome studied. In many of the considered models, it is not sufficient to include general measures of socioeconomic status such as education to account for socioeconomic differences before birth.

2 Data and empirical strategy

Do parents which have babies with adverse birth outcomes experience income losses and do they reduce their working hours after birth? To answer these questions, I perform the following linear regression and estimate the relationship between adverse birth outcomes and different labor market outcomes after birth:

$$Y_{i,t=1} = \beta_1 + B_i\beta_2 + X_{i,t}\beta_3 + Y_{i,t=-1}\beta_4 + \epsilon_{i,t} \quad (1)$$

The variable of interest (B_i) is either an indicator for preterm birth, which denotes a gestational age below 37 weeks, or an indicator for low birth weight, which equals one if the baby weighed less than 2,500g and zero otherwise. Beyond other variables, low birth weight and preterm birth are frequently studied measures of adverse birth outcomes (Conley and Bennett, 2000; Black et al., 2007; Aizer and Currie, 2014; Noelke et al., 2019). The variable $Y_{i,t=1}$ is the outcome, which consists of four measures of average income and average maternal and paternal working hours after childbirth i . The birth year is referred to as $t = 0$.

The control variables included in the model are represented by the matrix $X_{i,t}$. These variables include the age at birth, an indicator for higher education of both parents before birth, the migration background of both parents, an indicator for house ownership before birth, the average household size after birth, an indicator for households located in East Germany, the sex of the child, and the birth rank. The model also includes the respective average pre-birth measure of the outcome variable ($Y_{i,t=-1}$). All control variables could be potentially related to incidences of adverse birth outcomes and labor market outcomes of the parents after birth. In the presented model, the coefficient β_2 represents the marginal effect of the adverse birth outcome (B_i) on the considered economic outcome after birth ($Y_{i,t=1}$), conditional on differences before birth ($Y_{i,t=-1}$) and other included control variables ($X_{i,t}$).

To estimate equation (1), I used data from the German Socio-Economic Panel (SOEP). The SOEP is a representative household panel study that includes roughly 15,000 households with more than 30,000 individuals. It started in 1984 and is still running today (Liebig et al., 2020). More precisely, I use data from the mother-child survey, which started in 2000. This sub-sample includes information on various birth-related variables for 7,657 children born between 2000 and 2019, including the birth weight of newborn children and gestational age, which are the main variables of interest.

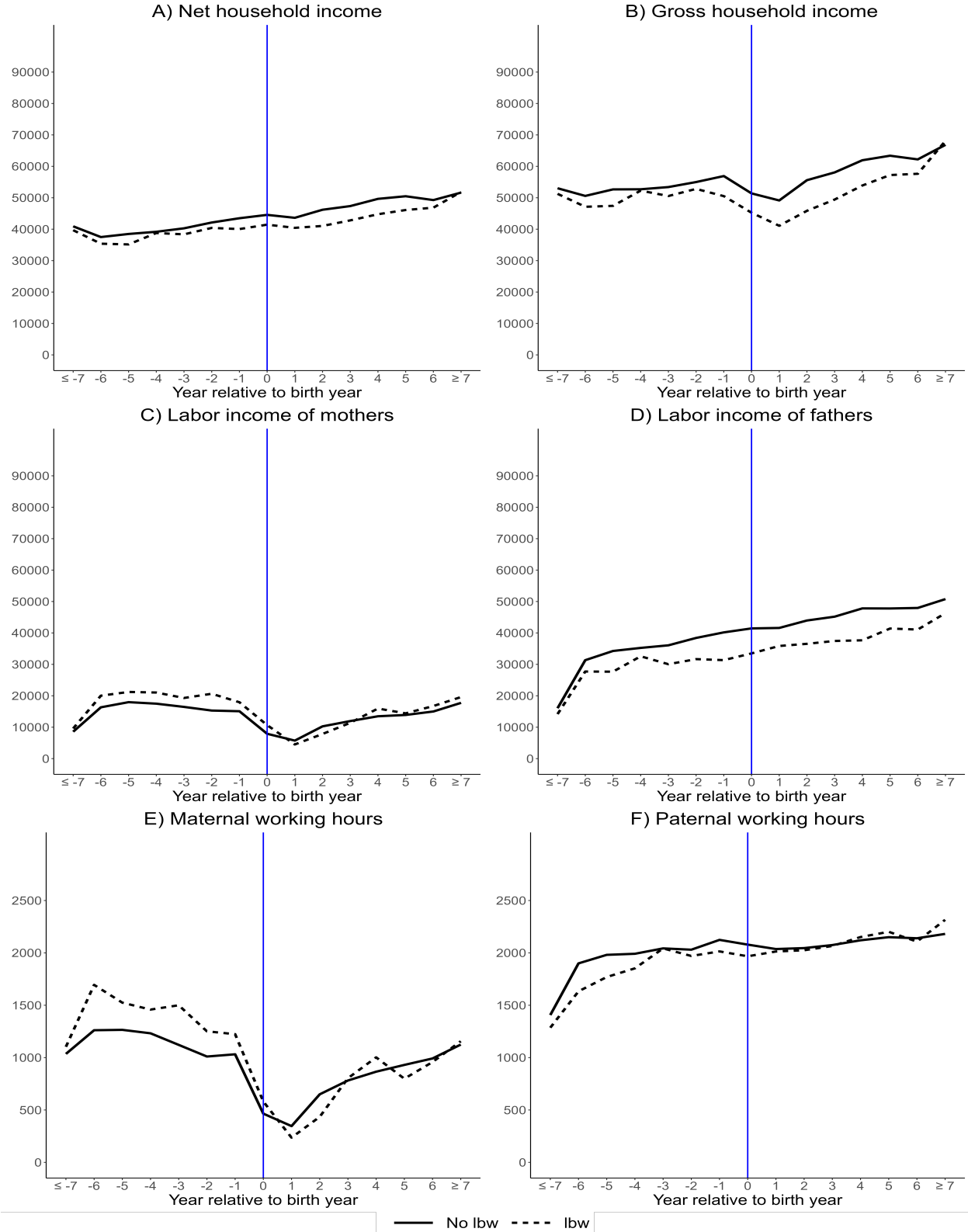
In order to capture differences in permanent income after delivery, log averages of all observations after birth for each child are examined as outcome variables (income and working hours). The same procedure was applied to observations before birth. To account for inflation time trends, all initial income observations are included in real terms of 2007. Moreover,

a large share of parents, especially mothers are likely to participate in paid parental leave during the period around the first year before and after birth. Observations from these years are not included in the analysis, since they are not indicative of parents' long-term labor market performance. Household income variables refer to maternal household income if available and paternal household income otherwise. Excluding all individuals with missing information in any of the explanatory or outcome variables yields the final sample, which consists of 1,718 births from 1,380 biological mothers and 1,379 biological fathers born between 2002 and 2014. All relevant variables for families with and without low birth weight children are summarized in Table [A.1](#).

3 Results

At first, I compare labor market outcomes across families with and without children suffering from adverse birth outcomes. Based on the final sample of 1,718 children, Figure [1](#) visualizes the trajectories of the yearly average of all labor market outcomes used in the analysis and compares families with and without low birth weight children. In the graphs, annual averages are displayed, which is a different measure than the one used in the main analysis. If the results of the main analysis are robust, they should reflect the descriptive evidence presented in these graphs. The graphs show the annual averages for families with low birth weight children and those without, from 7 years before birth to 7 years after birth of the respective child. It is evident that households with a low birth weight child have lower net and gross household incomes in many of the considered periods before and after birth (Panels A and B). Fathers of low birth weight children work and earn less before birth (Panels D and F). After birth, the the income of fathers of low birth weight children remains lower (Panel D). In contrast to that, it seems that mothers of children born with low birth weights are working more and earning a higher income before birth. After birth, these gradients tend to diminish (Panels C and E). The trajectories of parental labor market outcomes are comparable if preterm birth is used as an indicator for adverse birth outcomes (see figure [A.1](#)).

Figure 1: Labor market outcomes of families with and without low birth weight children



The six panels show a time series of the annual average for the six labor market outcomes for parents with and without a low birth weight child based on the final sample of 1,718 births. Observations from more than 7 years before birth are assigned to ≤ -7 years before birth. Observations from more than 7 years after birth are assigned to ≥ 7 years after birth.

Results from the OLS regressions for Model 1 are shown in Table 1 and Table 2, which include the coefficients for the six outcomes under study. These are gross and net household income as well as parental labor income and working hours. In Table 1, low birth weight is used as a dependent variable. Table 2 shows the results for models which replace low birth weight by preterm birth.

Table 1: OLS Results- Low birth weight

A) Household income	Gross household income			Net household income		
Low birth weight	-0.335** (0.159)	-0.354** (0.138)	-0.248** (0.122)	-0.072* (0.038)	-0.068** (0.030)	-0.024 (0.027)
Income before birth			0.531*** (0.084)			0.610*** (0.032)
B) Labor income	Labor income of mothers			Labor income of fathers		
Low birth weight	-0.639* (0.381)	-0.774** (0.330)	-0.640** (0.313)	-0.386** (0.189)	-0.396** (0.169)	-0.269* (0.151)
Labor income before birth			0.320*** (0.032)			0.422*** (0.058)
C) Working hours	Maternal working hours			Paternal working hours		
Low birth weight	-115.276* (61.608)	-147.107*** (55.346)	-155.866*** (55.348)	-20.256 (78.347)	-26.543 (75.006)	5.809 (68.441)
Working hours before birth			0.289*** (0.025)			0.447*** (0.029)
Controls	No	Yes	Yes	No	Yes	Yes
Observations	1718	1718	1718	1718	1718	1718

The table shows the coefficients for OLS regressions using the SOEP data. Control variables include parental age at birth, an indicator for higher education before birth, and migration background of the mothers and fathers, an indicator for house ownership before birth, average household size after birth, an indicator for households located in East Germany, the sex of the child, and the birth rank. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Families with a low birth weight child have a roughly 25% lower average gross household income after birth (Panel A of Table 1). Having a low birth weight child is associated to lower gross average household income, even after the inclusion of the pre-birth average as a control variable. Panel A of Table 1 also shows that net household income is not significantly lower in families with low birth weight children compared to those without, if the pre-birth

income is included in the model. These findings indicate that governmental redistribution of income partly compensates for the negative association between low birth weight and gross household income of the family after birth. The models with all control variables included in Panel B of Table 1 indicate that having a low birth weight child is significantly related to a decline in earnings for mothers (-64%) and fathers (-27%). The coefficient for mothers is more than double the size of the coefficient for fathers.

Table 2: OLS Results - Preterm birth

A) Household income	Gross household income			Net household income		
Preterm birth	-0.294**	-0.217*	-0.162	-0.081**	-0.034	-0.003
	(0.135)	(0.120)	(0.104)	(0.038)	(0.030)	(0.026)
Income before birth			0.534***			0.612***
			(0.084)			(0.032)
B) Labor income	Labor income of mothers			Labor income of fathers		
Preterm birth	-0.401	-0.248	-0.128	-0.374**	-0.284*	-0.224
	(0.310)	(0.278)	(0.264)	(0.177)	(0.163)	(0.139)
Labor income before birth			0.322***			0.423***
			(0.032)			(0.057)
C) Working hours	Maternal working hours			Paternal working hours		
Preterm birth	-148.056***	-125.605***	-117.456***	-52.741	-27.555	-32.697
	(53.499)	(45.649)	(44.478)	(70.848)	(67.737)	(60.996)
Working hours before birth			0.288***			0.447***
			(0.025)			(0.029)
Controls	No	Yes	Yes	No	Yes	Yes
Observations	1718	1718	1718	1718	1718	1718

The table shows the coefficients for OLS regressions using the SOEP data. Control variables include parental age at birth, an indicator for higher education before birth, and migration background of the mothers and fathers, an indicator for house ownership before birth, average household size after birth, an indicator for households located in East Germany, the sex of the child, and the birth rank. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

In all models of Panels A and B, the inclusion of pre-birth income measures reduced the effect size of low birth weight on the considered income variable after birth. This indicates, that is not sufficient to control for general measures of pre-birth parental socioeconomic status, such as education.

Panel C indicates that mothers of low birth weight children work 156 hours (that is about 4 weeks) less annually after birth compared to mothers without a low birth weight child. This is partly driven by the fact that mothers of low birth weight children worked more before birth. Table A.1 shows that mothers of children with low birth weight worked 61 hours more annually before birth even though this difference is not significant. For fathers, the models show no significant reduction in working time after the birth of a child with low birth weight compared to those without. It is important to note, that mothers with low birth weight children work and earn more before birth in the analyzed sample. Even though this might be a surprising finding it is not contrary to all previous evidence [Dehejia and Lleras-Muney \(2004\)](#).

Considering preterm birth as an indicator for an adverse birth outcome, the general picture is comparable to the results from the models including low birth weight instead of preterm birth (see Table 2). Panel A of Table 2 shows that preterm birth is not related to either gross or net household income after birth if the respective pre-birth outcome is included in the model. The same is the case for parental labor income (Panel B of Table 2). In contrast to that, models in Panel C of Table 2 indicate a significant negative relationship between preterm birth and maternal working hours after birth. Fathers of preterm born children do not work significantly less after birth compared to those of term born children (see panel C of table 2).

To summarize, OLS models suggest that low birth weight is related to lower gross household income, which is partly due to lower parental labor income after birth. The coefficient sizes are larger for mothers than for fathers. In addition, mothers are working significantly less after having a low birth weight child compared to those without a low birth weight child. Low birth weight does not, however, negatively correlate with postpartum net household income, highlighting the relevance of governmental redistribution in this context. The association between low birth weight and family resources after birth is not that pronounced, especially if pre-birth resources are included as a control variable. If preterm birth is used as an indicator for adverse birth outcomes, the results are fairly similar. However, OLS models

suggest no significant relationship between preterm birth and gross household income as well as maternal labor income. The results in Table 2 with preterm birth as variable of interest support the previous findings from Table 1 using low birth weight as an independent variable. The analysis also shows, that the pre-birth measures of the outcome variables are important control variables and removing them from the model could lead to a omitted variable bias.

4 Robustness

The main analysis does not take full advantage of the panel structure of the SOEP. As a robustness test I estimate the models presented before without averaging the outcome variables after birth. The models still control for the average pre-birth measure. In these models, different measurements of the dependent variables are used to estimate the OLS coefficients. If the results of these models contradict the findings from the main analysis, it could be attributed to measurement bias. Table A.2 displays the coefficients for low birth weight and Table A.3 for preterm birth. Overall, the results support the findings from the main analysis.

As already mentioned in the introduction, it is possible to use the panel structure of the SOEP to estimate Difference-in-Difference (DiD) models. These models use the full panel structure of the data to estimate the association between adverse birth and labor market outcomes. Moreover, these estimates could be causally interpreted if the required assumptions (especially common trends) are not violated. The DiD models are defined as the following:

$$Y_{i,t} = \beta_1 + B_i\beta_2 + T_i\beta_3 + (B_i * T_i)\beta_4 + X_{i,t}\beta_5 + \gamma_{i,t} \quad (2)$$

In this model, β_2 measures the average difference of the considered socioeconomic outcome between families with and without children with adverse birth outcomes. The coefficient β_3 refers to the average change of the outcome variables from the years before to those after birth. The coefficient of interest is β_4 . It represents differences in the change of the considered labor market outcome across families with and without adverse birth outcomes from periods

before birth to those after birth.

The coefficients from these models could only be interpreted under some crucial assumptions. One is the exogeneity of the treatments, which are adverse birth outcomes. As already stated, some literature suggests a relationship between parental socioeconomic status and adverse birth outcomes ([Lindo, 2011](#); [Güneş, 2015](#)). On the other hand, other articles, mostly from highly developed countries like Germany, find no impact ([Lindeboom et al., 2009](#); [Arendt et al., 2021](#)). Beyond exogenous treatment, the existence of parallel pre-treatment trends is an important assumption. Figure 1 illustrates that most outcome variables seem to meet that assumption, namely are gross and net household income, as well as paternal working hours and income. An exception here is maternal working hours and income because the pre-birth time trends across both groups are not comparable.

Tables A.4 and A.5 summarize the results of these DiD models, which indicate that adverse birth outcomes have no impact on household income and do not negatively affect the income or labor market participation of fathers after birth. For mothers, the models suggest that coefficients are negative which arguably stems from the fact, that the parallel trend assumption is violated. In general, the evidence from the DiD models supports the findings from the main analysis. Adverse birth outcomes can not be consistently related to negative labor market outcomes.

5 Conclusion

The main finding of this article is that labor market outcomes for families of children with adverse birth outcomes are not drastically worsened after birth. Preterm birth and low birth weight are not negatively correlated with fathers' income or labor market outcomes. For mothers, there is some evidence for a negative relationship between adverse birth outcomes and labor market outcomes after birth. However, it seems that these associations do not translate into losses in household income. The analysis also shows that it is important to control for pre-birth measures of the socioeconomic outcomes considered beyond other variables, which also try to capture the influence of socioeconomic status before birth.

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Compliance with Ethical Standards

The author declares no conflict of interest.

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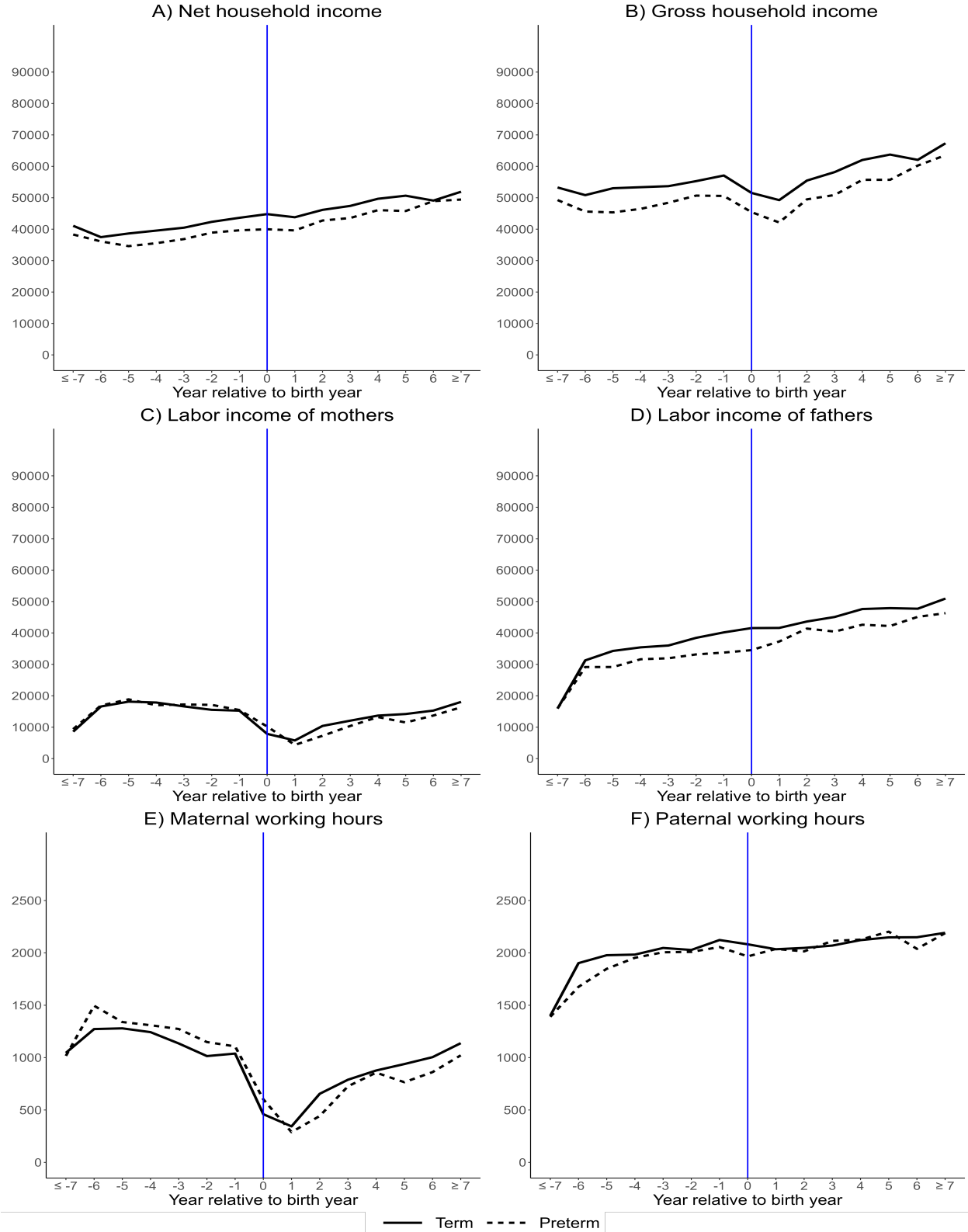
Appendix

Table A.1: Mean differences

Variables	No low birth weight	low birth weight	p-value
Gross household income (after birth)	60303	52225	0.01
Gross household income (before birth)	53294	47097	0.01
Net household income (after birth)	48568	44365	0.02
Net household income (before birth)	41380	37927	<0.01
Maternal labor income (after birth)	13239	12221	0.41
Maternal labor income (before birth)	13947	13482	0.69
Paternal labor income (after birth)	46146	38232	<0.01
Paternal labor income (before birth)	33625	28356	0.01
Maternal working hours (after birth)	835	720	0.06
Maternal working hours (before birth)	1036	1121	0.24
Paternal working hours (after birth)	2054	2033	0.80
Paternal working hours (before birth)	1875	1802	0.34
Maternal higher education	0.47	0.41	0.19
Paternal higher education	0.47	0.48	0.86
Maternal age at birth	30.84	31.18	0.43
Paternal age at birth	33.89	33.88	0.98
Number of household members	3.32	3.28	0.77
East Germany	0.22	0.25	0.37
Paternal migration background	0.24	0.22	0.63
Maternal migration background	0.25	0.22	0.41
House ownership	0.37	0.36	0.86
Child sex	0.51	0.48	0.56
Child number	2.15	2.03	0.29

The table shows mean differences between families of low birth weight with children and those without using the SOEP data. P-values refer to a t-test on mean differences with unequal variances. N = 1,718.

Figure A.1: Labor market outcomes of families with and without preterm born children



The six panels show time series of the annual average for the six labor market outcomes for parents with and without a preterm born child based on the final sample of 1,718 births. Observation from more than 7 years before birth are assigned to 7 years before birth. Observation from more than 7 years after birth are assigned to 7 years after birth.

Table A.2: OLS Results - Low birth weight (no average)

A) Household income	Gross household income			Net household income		
Low birth weight	-0.100*	-0.177***	-0.071	-0.042**	-0.049***	-0.010
	(0.058)	(0.053)	(0.047)	(0.017)	(0.015)	(0.014)
Income before birth			0.679***			0.467***
			(0.047)			(0.015)
B) Labor income	Labor income of mothers			Labor income of fathers		
Low birth weight	-0.122	-0.456***	-0.408**	-0.010	-0.062	0.009
	(0.185)	(0.175)	(0.171)	(0.069)	(0.065)	(0.061)
Labor income before birth			0.349***			0.461***
			(0.018)			(0.033)
C) Working hours	Maternal working hours			Paternal working hours		
Low birth weight	-9.734	-70.682**	-90.958***	75.578**	44.140	56.708*
	(34.007)	(32.149)	(32.385)	(34.967)	(35.352)	(33.714)
Working hours before birth			0.242***			0.416***
			(0.013)			(0.015)
Controls	No	Yes	Yes	No	Yes	Yes
Observations	8247	8247	8247	8247	8247	8247

The table shows the coefficients for OLS regressions using the SOEP data. Control variables include parental age at birth, an indicator for higher education before birth and migration background of the mothers and fathers, an indicator for house ownership before birth, average household size after birth, an indicator for households located in East Germany, the sex of the child, and the birth rank. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A.3: OLS Results - Preterm birth (no average)

A) Household income	Gross household income			Net household income		
Preterm Birth	-0.142*** (0.055)	-0.122** (0.052)	-0.085* (0.048)	-0.047*** (0.017)	-0.023* (0.014)	0.006 (0.013)
Income before birth			0.680*** (0.047)			0.468*** (0.015)
B) Labor income	Labor income of mothers			Labor income of fathers		
Preterm birth	-0.501*** (0.160)	-0.395*** (0.149)	-0.239 (0.145)	-0.085 (0.073)	-0.055 (0.071)	-0.074 (0.067)
Labor income before birth			0.348*** (0.018)			0.461*** (0.033)
C) Working hours	Maternal working hours			Paternal working hours		
Preterm birth	-107.106*** (29.007)	-83.722*** (26.258)	-78.521*** (25.926)	54.808* (31.485)	51.158 (31.225)	17.525 (29.191)
Working hours before birth			0.241*** (0.013)			0.415*** (0.015)
Controls	No	Yes	Yes	No	Yes	Yes
Observations	8247	8247	8247	8247	8247	8247

The table shows the coefficients for OLS regressions using the SOEP data. Control variables include parental age at birth, an indicator for higher education before birth and migration background of the mothers and fathers, an indicator for house ownership before birth, average household size after birth, an indicator for households located in East Germany, the sex of the child, and the birth rank. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A.4: DiD Results - Low birth weight

	Household income		Labor income		Working hours	
	Net	Gross	mothers	fathers	mothers	fathers
After birth	-0.242*** (0.037)	-0.141*** (0.012)	0.387*** (0.122)	0.022 (0.065)	-126.830*** (26.561)	-66.787*** (24.487)
Lbw	-0.199*** (0.059)	-0.060*** (0.018)	0.190 (0.193)	-0.248** (0.102)	195.269*** (42.150)	-123.200*** (38.858)
Lbw * After birth	0.046 (0.078)	-0.001 (0.024)	-0.707*** (0.254)	0.207 (0.134)	-302.288*** (55.274)	188.456*** (50.957)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12834	12834	12834	12834	12834	12834

The table shows the coefficients for DiD regressions using the SOEP data. Control variables include parental age at birth, an indicator for higher education and migration background of the mothers and fathers, an indicator for house ownership, household size, an indicator for households located in East Germany, the sex of the child, and the birth rank. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A.5: DiD Results - Preterm birth

	Household income		Labor income		Working hours	
	Net	Gross	mothers	fathers	mothers	fathers
After birth	-0.247*** (0.038)	-0.141*** (0.012)	0.394*** (0.123)	0.023 (0.065)	-124.894*** (26.755)	-69.122*** (24.658)
Preterm	-0.156*** (0.055)	-0.029* (0.017)	0.127 (0.178)	-0.130 (0.094)	137.819*** (38.732)	-77.472** (35.696)
After birth * Preterm	0.074 (0.070)	0.005 (0.022)	-0.624*** (0.227)	0.147 (0.120)	-240.633*** (49.601)	169.660*** (45.713)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12834	12834	12834	12834	12834	12834

The table shows the coefficients for DiD regressions using the SOEP data. Control variables include parental age at birth, an indicator for higher education and migration background of the mothers and fathers, an indicator for house ownership, household size, an indicator for households located in East Germany, the sex of the child, and the birth rank. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.