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Abstract

Using Danish administrative data linked to two independent, validated postpartum depression screenings, we study how postpartum mental health shocks shape women's labor market trajectories. Event-study estimates show no pre-birth differences in trends between depressed and non-depressed mothers, but persistent employment gaps that widen immediately after birth. Health-care utilization patterns indicate that these differences reflect acute mental health shocks rather than pre-existing trends. The penalties are concentrated among less educated mothers and those in less family-friendly jobs. Our results highlight postpartum depression as a meaningful and unequal contributor to the motherhood penalty.

Keywords: Postpartum depression, motherhood penalty, labor market inequality

JEL Classifications: I12, J13, J16

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1 Introduction

The transition to parenthood is one of the most consequential periods in women’s lives, with lasting implications for both economic trajectories and health. A large and growing literature documents that the arrival of children produces substantial and persistent reductions in women’s employment and earnings, commonly referred to as the motherhood penalty (Kleven et al., 2025; Cortés and Pan, 2023; Kleven et al., 2019). Childbirth also coincides with heightened vulnerability in maternal mental health. Clinical evidence indicates that 10–15 percent of mothers in high-income countries experience mild to moderate postpartum depression (Wang et al., 2021). Despite the prominence of both phenomena, relatively little is known about how postpartum mental health contributes to the motherhood penalty. Answering this question is critical for society and policy; understanding whether the motherhood penalty is exacerbated by a treatable health condition can direct resources toward interventions that narrow gender gaps in the labor market.

In this paper, we provide new evidence on the extent to which postpartum depression contributes to the motherhood penalty. Addressing this question requires the availability of validated measures of postpartum depression and longitudinal labor market outcomes for the same women. Such data are rare. We overcome this limitation by linking population-wide Danish administrative registers to two independent sources that measure postpartum depression using validated psychometric instruments. We use survey data from the Danish National Birth Cohort (DNBC), covering 30% of births in 1998–2002, and screening data from the municipal Nurse Home Visiting (NHV) program for births in 60 (out of 98) municipalities during 2012–2017. Importantly, our measures of postpartum depression capture mild to moderate cases rather than severe clinical illness as they rely on reported symptoms. As a result, the labor market penalties we document arise among mothers at the margin targeted by population-wide screening and early-intervention programs in preventive maternal care.

We link the data containing measures of postpartum mental health to administrative data on earnings, employment, and hours worked, tracing trajectories from four years before to four years after first birth. Using an event-study design in the spirit of Kleven et al. (2019), we estimate dy-

namic responses separately for mothers who do and do not screen positive for postpartum depression symptoms. To improve comparability between these groups, our baseline specifications implement propensity-score reweighting of non-depressed mothers based on pre-birth characteristics, following Kleven et al. (2021). Interpreting the weighted estimates as causal requires that, conditional on observables, mothers' labor-market trajectories would have evolved similarly in the absence of postpartum depression. While we cannot test this assumption directly, we implement several diagnostics test to gauge its plausibility. First, we show that mothers with and without postpartum depression exhibit parallel pre-birth trends in all labor market outcomes and healthcare utilization. Second, even in the absence of pre-trends, our estimates could be biased due to unobserved concurrent shocks (such as giving birth to a child with health complications or lacking a supportive partner) that simultaneously trigger maternal depression and impact labor market outcomes. The richness of the data allows us to construct several proxies for such shocks and we find no significant differences between depressed and non-depressed mothers in terms of infant health or proxies of partner support. Finally, we show that all of our results are robust to unweighted specifications and alternative weighting schemes.

Our results suggest that postpartum depression is associated with an increase in the motherhood penalty on the labor market. In both the DNBC and NHV data, mothers who experience postpartum depression symptoms exhibit larger and more persistent declines in labor market outcomes following childbirth than mothers without such symptoms. While we document losses in earnings, the most robust and precisely estimated effects operate through employment (the extensive margin). Four years after childbirth, the employment penalty among depressed mothers is roughly three percentage points larger than among non-depressed mothers, a magnitude that is strikingly similar across the two samples despite their separation by more than a decade and their use of distinct mental health measures. This difference is economically meaningful and corresponds to approximately one third of the employment penalty among non-depressed mothers.

To confirm that these patterns reflect the consequences of postpartum mental health shocks rather than pre-existing differences in underlying health, we examine health care utilization around

childbirth. In both samples, total general practitioner (GP) fees for depressed and non-depressed mothers follow parallel trajectories up to about one year before birth, when fees begin to rise for both groups. After delivery, GP fees remain elevated for both groups, with a persistent positive differential for mothers who screen positive for postpartum depression. In addition, mental health care use rises sharply at childbirth among mothers who screen positive for postpartum depression, while remaining close to the counterfactual for other mothers. These patterns suggest that postpartum depression (i) is a rapid deterioration in mental health around childbirth and (ii) has long-run consequences for mothers' mental health care use.

We next turn to factors that may mitigate the postpartum depression penalty on the labor market. We hypothesize that its magnitude and persistence depend on mothers' resources and the environments in which they work. More educated mothers may be better positioned to buffer a postpartum mental health shock through greater economic resources and access to market substitutes for household production (Aguiar and Hurst, 2007), and better health literacy and more timely engagement with care (Santos and Pinheiro, 2025; Cutler and Lleras-Muney, 2010; Currie and Moretti, 2003). The postpartum depression penalty may be attenuated among women employed in more family-friendly job environments given existing evidence that occupation characteristics and sector of employment are linked to the size and persistence of the motherhood penalty (Cortés and Pan, 2023; Goldin and Katz, 2016; Bertrand et al., 2010). Consistent with these ideas, we find that the postpartum depression penalty in employment is concentrated among mothers without post-secondary education. The penalty is also driven by less family-friendly pre-birth job environments, proxied by high occupation-level gender wage gaps, low female representation among top earners within the occupation, and employment in the private sector.

Finally, we explore whether maternal postpartum depression generates spillovers within the household by studying fathers' labor market outcomes. We find limited evidence of systematic effects on fathers' employment, but suggestive evidence for reductions in hours worked.

This paper makes two contributions. We provide the first attempt at causally identifying the contribution of postpartum depression to the employment penalty, leveraging the rare availability

of validated measures of depression symptoms linked to population-wide administrative data on labor-market outcomes.¹ Only one recent study adopts a causal design to examine the role of maternal mental health around childbirth. Currie and Zwiers (2025) study the impact of *treatment* for postpartum depression on mothers' employment outcomes in the Netherlands. Without direct measures of depression symptoms, their instrumental-variables strategy uses provider prescribing tendencies to identify effects for women at the margin of treatment. They find limited employment effects for this group. Because this approach jointly tests treatment efficacy and the impact of depression itself, it may understate the labor-market consequences of postpartum depression. Our study complements this work by directly comparing mothers who differ in depression symptoms and shows that postpartum depression *per se* is associated with substantial and persistent reductions in labor market attachment.

We also contribute to the literature on the labor market consequences of motherhood (Kleven et al., 2025; Cortés and Pan, 2023; Kleven et al., 2019). Ahammer et al. (2023) document large and persistent gender gaps in antidepressant use following childbirth in Austria and Denmark using an event-study design that compares mothers and fathers. They interpret these patterns as reflecting the mental load associated with women's greater caregiving responsibilities rather than biological factors or short-lived postnatal conditions.² In this paper, rather than comparing women to men, we focus on mothers and use measures of depression symptoms to directly assess the role of postpartum depression on the employment penalty. By comparing new mothers who screen positive to those who do not, we hold the broader transition to motherhood constant. We find that mothers experiencing postpartum depression exhibit persistently higher mental health care use, but also substantially worse labor market outcomes than otherwise similar mothers without depression symptoms. These findings indicate that postpartum depression represents an important contributor to the motherhood penalty in both mental health and economic outcomes.

¹A number of studies in economics examine associations between postpartum depression and material hardship, including food and housing insecurity (Corman et al., 2016; Noonan et al., 2016), while a large multidisciplinary literature focuses on early parenting practices and maternal well-being (Slomian et al., 2019; Netsi et al., 2018).

²They argue that postpartum depression does not explain their results, and the antidepressant gaps in their study emerge two and four years after birth. Bhalotra et al. (2025) similarly find a deterioration of mental health among mothers who take on more child care and house work.

Our results have important policy implications. We document larger labor market penalties for depressed mothers in Denmark, a setting with universal health care, universal access to treatment for postnatal depression, high labor force participation of women, generous parental leave, strong employment protections for new mothers, and subsidized childcare. Thus our estimates are likely conservative relative to other countries, where protections for new parents are substantially weaker. Moreover, the heterogeneity in our estimates suggests that postpartum depression interacts with economic and institutional buffers that support labor market attachment. Our findings point to potential gains from a greater focus on mental health support and workplace accommodations in reducing persistent gender gaps in the labor market.

2 Institutional Background

We study motherhood penalties in Denmark, a setting with strong institutional support for combining parenthood and employment. Health care is publicly financed and universally accessible, with no user fees for GP visits. Pregnant women receive standardized prenatal and postnatal care through GPs, midwives, and municipal health visitors, who monitor maternal well-being, infant development, and family needs. GPs serve as the main entry point to mental health care and can provide counseling, prescribe medication, or refer patients to specialists. Psychiatric services are free with GP referral, and psychotherapy for postpartum depression is partially subsidized in both periods we study. These features reduce financial and administrative barriers to care, although awareness of postpartum mental health problems likely increased over time.

Denmark also offers generous parental leave, strong job protection for pregnant workers and new parents, and publicly subsidized childcare, with access to a supported childcare placement from around the child's first birthday. Although family policies evolved over the period we study, the core framework remained stable. Dismissal during pregnancy and parental leave was prohibited, and parents retained the right to return to their pre-birth job or an equivalent position. Paid parental leave expanded over time, reaching 46 weeks by 2012, while universal access to subsidized full-day

childcare remained in place across both cohorts.

3 Data

We use survey and register data from Denmark covering the period 1993–2022. These data contain individual-level records with unique personal identifiers that allow us to follow individuals over time and to link family members.

Maternal Depression. We draw on two complementary data sources to measure postpartum depression, described in detail in Appendix A.³ First, we use survey data from the *Danish National Birth Cohort* (DNBC), which covers approximately 30 percent of all births in Denmark between 1998 and 2002. Postpartum depression is measured using survey responses from Interview 3, administered around six months after delivery. The interview includes nine questions: six drawn from the Symptoms Checklist-92 (depression and anxiety) and three from the General Health Questionnaire-60 (stress), each answered on a three-point Likert scale with higher values indicating more frequent or severe symptoms. Following Anderson (2008), we standardize each item, construct a weighted index using the inverse covariance matrix, and re-standardize the resulting index. We classify mothers with index values above the 90th percentile as experiencing postpartum depression, consistent with prevalence estimated in other high-income countries (Wang et al., 2021).

Second, we use administrative data from the municipal *Nurse Home Visiting* (NHV) program, which includes children born between 2012 and 2017. We have obtained screening data from 60 (out of 98) municipalities. Postpartum depression is assessed using the Edinburgh Postnatal Depression Scale (EPDS), typically administered around two months after birth. The EPDS ranges from 0 to 30, with higher scores indicating worse mental health. Following the Danish validation study by Smith-Nielsen et al. (2018), we classify mothers as being at risk of depression if their EPDS score is 11 or higher.

³Due to data access restrictions, the two data sources are merged with other Danish registers under separate project protocols. As a result, some supplemental variables are available in one sample but not the other.

Our measures of postpartum depression are based on screening instruments rather than diagnoses, health-care use, or medication, and thus mainly capture mild to moderate symptoms.⁴ This margin is especially policy-relevant because it aligns with the population targeted by large-scale screening and early intervention in maternal care. Together, the two sources allow us to study maternal depression risk across cohorts and institutional settings: DNBC provides rich survey-based measures in the early 2000s, while NHV offers more recent coverage based on a clinically validated screening instrument. Their combination strengthens the validity and robustness of our analysis by ensuring that the results are not tied to a single period or measure.

Outcomes. We measure parental labor market outcomes using the *Income Statistics Register*. Our main outcomes are annual labor earnings (including zero earnings), an indicator for employment defined as having any positive labor income, and hours worked conditional on employment.⁵ All monetary variables are expressed in 2015 DKK and converted to euros.

Additional Variables. We use several registers to obtain information on parents and their children. Information on year of birth and partnership status come from the *Population Register*. Parental educational attainment is measured using the *Education Register*, from which we construct indicators for having less than a high school degree and for having at least some college education. Health care utilization around first birth is measured using the *National Health Insurance Register*, which records reimbursements to primary care physicians for all services covered by the national health insurance system. We compute total GP fees and indicators for psychological counseling in primary care (DNBC), depression diagnostic tests in primary care (NHV), and for any consultation with

⁴Women with severe depression are less likely to participate in the DNBC survey, and women already diagnosed with depression are not screened in the NHV program.

⁵Danish maternity leave typically lasts close to a year. At the start of the leave, mothers usually receive full wage replacement paid by employers for a period determined by collective bargaining agreements (around 14 weeks in the private sector, typically longer in the public sector). These payments are recorded as labor earnings in the administrative data. The remaining part of the leave is financed by public leave benefits, recorded as government transfers (Adams et al., 2025). Because our employment measure is based on having any labor earnings within the calendar year, and because the transfer-financed portion does not cover a full year, mothers on leave are still classified as employed (i.e., maternity leave itself does not mechanically generate non-employment in our data). Hours worked are measured following Kleven et al. (2019). The measure is derived from mandatory contributions to the labor market pension scheme (ATP), which are based on reported hours worked and recorded in discrete bins.

privately practicing psychologists or psychiatrists.⁶

We use the *Employment Classification Module* and the *Register-Based Labor Force Statistics* to characterize mothers' pre-birth job characteristics, based on their last job in the two to four years before the birth. For the DNBC sample, we use 3-digit ISCO codes to classify mothers' pre-birth occupations. For each occupation with at least 10 employed women and 10 employed men, we compute the difference between men's and women's average wages as a share of men's average wage. We then define an indicator for high gender gap occupations as those where this measure is above the median across occupations. We also calculate, by occupation, the share of women among workers in the top 20 percent of the earnings distribution within the occupation and define an indicator for low female representation among top earners as occupations where this share falls below the median across occupations. For the NHV sample, we create an indicator for public versus private sector employment.

Analysis sample and descriptive statistics. We begin with the universe of first-time mothers who gave birth between 1998–2002 (DNBC) or 2012–2017 (NHV) and who are observed in the medical birth registry. We impose two restrictions. First, we require that mothers are observed in the labor market data each year from four years before to four years after first birth, regardless of their employment status. Second, we restrict the sample to native-born mothers to reduce heterogeneity in attitudes toward mental health. Finally, we limit the sample to mothers who completed the DNBC survey or participated in the NHV postnatal depression screening. The final samples include 30,270 DNBC mothers and 44,112 NHV mothers.

Appendix Table B1 compares our analysis samples to the families who gave birth in the same years but were not included in the DNBC or NHV data. Because sample sizes differ across groups, we assess balance using standardized (normalized) differences rather than t -tests, following best practice to emphasize effect sizes rather than statistical significance when evaluating covariate balance (McKenzie, 2017; Imbens and Rubin, 2015).⁷ Across both periods, observable characteristics are closely

⁶We do not observe prescription drug use in our data.

⁷The standardized difference is defined as $\frac{\bar{X}_A - \bar{X}_B}{\sqrt{\frac{1}{2}(s_A^2 + s_B^2)}}$, where \bar{X}_A, \bar{X}_B are group means and s_A^2, s_B^2 are variances. This

aligned, with most of the standardized differences close to or below the conventional 0.1 threshold for imbalance. The variable with the largest standardized difference in both data sets is maternal years of schooling, indicating modest positive selection on education into the survey and screening samples. Overall, the analysis samples appear broadly representative of their respective birth cohorts. If anything, since higher maternal education is associated with a lower prevalence of postpartum depression (Cena et al., 2021; Matsumura et al., 2019) and smaller child penalties (Bazen et al., 2025; Doren, 2019), this positive selection suggests that our estimates likely represent a lower bound on the true effects in the full population.

Appendix Figure A1 presents the distributions of our two postpartum-depression measures. The gray bars show the standardized DNBC mental health index, while the red line displays the standardized EPDS scores from the NHV screening data. The two distributions are similar: both are smooth and approximately unimodal, with long right tails reflecting a small share of mothers reporting elevated symptom levels. The thresholds (the top 10 percent of the DNBC index and EPDS ≥ 11) capture comparable portions of the upper tail (10 and 8.4 percent, respectively), without any evidence of mass points or discontinuities around the cutoffs. These patterns provide reassurance that the depression indicators are well behaved and that the classification of mothers as “depressed” versus “non-depressed” primarily distinguishes those in the high-symptom range rather than a separate subgroup.

Appendix Table B2 compares pre-birth characteristics of mothers classified as depressed and non-depressed in the DNBC and NHV samples. The table shows that mothers classified as depressed and non-depressed are generally similar in both the DNBC and NHV samples, with small standardized differences. However, a few characteristics do display meaningful imbalance across both datasets. In particular, depressed mothers have lower educational attainment, higher baseline GP fees, and lower labor earnings measured two years prior to birth, indicating differences in both socioeconomic status and pre-birth health-care utilization. To address these imbalances, we implement inverse probability weighted regressions that reweight the comparison group to match depressed

provides a scale-invariant measure of the magnitude of imbalance.

mothers on key pre-birth characteristics. We detail the empirical strategy in the next section.

4 Empirical Strategy

To describe how mothers' labor-market outcomes evolve around the arrival of the first child, we follow Kleven et al. (2019) and estimate event-study specifications separately by postpartum mental health status $d \in \{0,1\}$, where $d = 1$ indicates that the mother is classified to have postpartum depression. We track labor market outcomes for four years before and after childbirth. The baseline specification is:

$$y_{it}^d = \sum_{\substack{j=-4 \\ j \neq -2}}^4 \beta_j^d \mathbf{1}[j = t - b_i] + \theta_t^d + \gamma_{a(it)}^d + \varepsilon_{it}^d, \quad (1)$$

where y_{it}^d denotes the labor market outcome for person i in calendar year t , b_i is the year when i first becomes a parent, θ_t^d are calendar-year fixed effects, and $\gamma_{a(it)}^d$ are age fixed effects. Indicators are included for all $j \in \{-4, \dots, 4\}$ except $j = -2$, which serves as the omitted (baseline) year.

Interpretation and identification. In order to interpret any observed post-birth differences between depressed and non-depressed mothers as causal, two conditions need to be satisfied. First, the evolution of outcomes among non-depressed mothers should be similar to that among depressed mothers in the absence of depression. We observe no differential pre-trends between the depressed or non-depressed mothers (and no pre-trends at all for the employment outcome, our main result).⁸

Second, there should be no concurrent shocks that occur around the birth that jointly determine depression and labor market attachment. For example, mothers of newborns with severe health issues may be both more likely to develop depression and forced to exit the labor market to provide

⁸Our baseline identification strategy follows Kleven et al. (2019), exploiting idiosyncratic variation in the timing of first birth conditional on age and calendar-year fixed effects, which absorb life-cycle and macroeconomic trends. Interpreting β_j^d , $j \geq 0$, as the causal impact of childbirth requires that women do not time childbirth to periods when labor-market attachment is expected to be weaker (Melentyeva and Riedel, 2025; Bensnes et al., 2023). This would require that $\beta_j^d = 0$ for $j < 0$. However, because we are interested in a comparison of depressed and non-depressed women, we only need the weaker assumption that the pre-trends are parallel.

care. Similarly, mothers without a supportive partner may face a dual burden that drives both outcomes. While this is an untestable assumption, we use the administrative data to run balance tests on proxies for child health (birth weight, gestational age, and delivery method) and proxies of partner support (presence of a partner or the relative earnings of the mother and father two years prior to birth). Finally, although observables measured two years prior to first birth are broadly similar between depressed and non-depressed mothers, some minor imbalances remain, motivating the use of propensity-score weighting.

Propensity-score weighting. Following Kleven et al. (2021), we address imbalances between depressed and non-depressed mothers by reweighting the comparison group of non-depressed mothers. Let x denote a vector of pre-birth covariates. We estimate the propensity score $p(x) = \Pr(d = 1 \mid x)$ and assign weight $p(x_i)/(1 - p(x_i))$ to non-depressed mothers, while mothers with postpartum depression receive unit weight. In our main analyses, we construct weights using a parsimonious set of characteristics measured at $b_i - 2$: maternal earnings, maternal GP fees, and an indicator for any maternal contacts with a psychologist or psychiatrist. In robustness checks, we construct weights using a broader set of covariates that additionally includes maternal years of schooling, maternal employment, and maternal mental health-related GP contacts. Table 1 and Appendix Table B3 report summary statistics by depression status in the weighted samples under the baseline and extended weighting schemes. The tables confirm that, after applying weights, depressed and non-depressed mothers are highly comparable in pre-birth characteristics, as virtually all the standardized differences are smaller than 0.1.

Normalization. For presentation, we convert the level coefficients into percentage deviations,

$$P_j^d \equiv \frac{\hat{\beta}_j^d}{\mathbb{E}[\tilde{y}_{it}^d \mid j]}, \quad \tilde{y}_{it}^d = \theta_t^d + \gamma_{a(it)}^d, \quad (2)$$

which expresses the event-time effect as a share of the predicted counterfactual outcome. This normalization highlights the dynamic path of outcomes before and after first birth for each mental

health subgroup without imposing log-linearity and while retaining zeros in the data. We plot P_j^d to illustrate how labor market outcomes evolve around first birth across women with and without postpartum depression.

5 Results

Postpartum Depression and the Motherhood Penalty. Figure 1 plots event-time profiles of mothers' yearly earnings, employment, and working hours (conditional on employment) around first birth, separately for mothers classified as depressed and non-depressed. Appendix Figure B1 and Appendix Figure B2 show that the estimated event-study profiles are very similar in the unweighted sample and under the full weighting specification. Consistent with prior work on the motherhood penalty, maternal labor market outcomes decline sharply at childbirth and recover only partially over the subsequent years.

The first panel presents effects on yearly earnings. In both the DNBC and NHV samples, earnings decline sharply at the time of birth and remain persistently below the pre-birth counterfactual throughout the follow-up period. Pre-birth trajectories are nearly identical for depressed and non-depressed mothers, supporting a clean comparison of post-birth dynamics. Confidence intervals around the earnings estimates of depressed mothers are sizable due to smaller sample size and generally overlap with those of non-depressed mothers, but the point estimates in both datasets consistently suggest larger post-birth earnings losses among mothers classified as depressed. In DNBC, the earnings penalty associated with postpartum depression is relatively stable over the four years following childbirth. Four years after birth, earnings are approximately 16.5% lower for depressed mothers, compared with 14.0% for mothers without postpartum depression. In NHV, the earnings gap appears to widen over time, with earnings declines of 24.8% for depressed mothers and 21.3% for non-depressed mothers by the end of the observation window.

The second panel turns to employment. In both datasets, employment trajectories are virtually identical prior to birth, with no evidence of differential pre-trends. After childbirth, employ-

ment falls sharply for all mothers, but the decline is larger for mothers classified as depressed and the gap persists throughout the follow-up period. The confidence intervals indicate that this post-birth employment gap is estimated with meaningful precision over much of the post-birth horizon. Four years after birth, the employment penalty in DNBC is approximately 7.8% for non-depressed mothers and 10.8% for depressed mothers. The NHV sample shows a comparable pattern, with corresponding declines of around 14.8% and 17.8%.

The last panel examines intensive-margin responses. In DNBC, hours worked conditional on employment decline after birth for both groups, and point estimates suggest somewhat larger post-birth reductions among mothers classified as depressed, although the confidence intervals generally overlap. In NHV, the hours profiles for depressed and non-depressed mothers are very similar and the confidence intervals overlap throughout, indicating no statistically distinguishable differences in hours conditional on employment.

Role of Unobserved Health and Concurrent Shocks. Could underlying health differences explain the post-birth employment gaps between mothers with and without postpartum depression? To shed light on this, we investigate in Figure 2 the evolution of overall and mental health-related health-care utilization around childbirth. In both samples, total GP fees evolve similarly for depressed and non-depressed mothers prior to birth, staying close to the counterfactual. GP fees increase for both groups in the year preceding childbirth, consistent with standard prenatal care. The increase is somewhat larger among mothers who later screen positive for postpartum depression, suggesting some of these women may start experiencing depression during pregnancy. After delivery, overall GP utilization remains elevated for both groups and continues to track broadly in parallel.

In contrast, measures of mental health–related care show a sharp and discrete divergence at childbirth. The probability of receiving depression-related counseling or screening by a GP rises abruptly for depressed mothers in the year of birth by roughly 149.1% in DNBC and 86% in NHV, while remaining close to baseline for non-depressed mothers. Similarly, contacts with psychologists or psychiatrists increase sharply at birth for depressed mothers and persist thereafter, with no corre-

sponding increase among non-depressed mothers. The timing and concentration of these differences strongly support the interpretation that postpartum depression reflects an acute deterioration in mental well-being around childbirth that persists throughout the follow-up period, rather than the continuation of pre-existing differences in health status or care-seeking behavior.

We next consider whether concurrent shocks around birth may jointly influence depression and labor market attachment. Appendix Table B4 examines balance on additional characteristics capturing the most likely sources of confounding around childbirth: markers of infant health at birth (birth weight, low birth weight, preterm birth, and C-section delivery) and proxies for partner support (presence of a partner and relative pre-birth earnings within the couple). Depressed and non-depressed mothers do not differ significantly on any of these dimensions, providing strong reassurance that our weights balance the groups on the most plausible observable confounders around childbirth.

Benchmarking the Employment Effects. How large is the effect of postpartum depression on the motherhood penalty? Mothers with postpartum depression experience an additional 2.9 percentage point reduction in employment in the four years following childbirth, relative to mothers without postpartum depression. This translates to a 3.1% reduction when compared to the counterfactual employment rate of depressed mothers in the absence of the birth. To gauge the magnitude of this effect, we compare it to the employment consequences of other health shocks. Bradley et al. (2002) find that breast cancer reduces women’s employment in the US by 7 percentage points (11%) within 2–3 years, while García-Gómez et al. (2013) show that acute hospitalization in the Netherlands lowers employment by 8.4 percentage points (9.6%) after two years. By contrast, Conti et al. (2025) estimate employment losses from menopause of only 0.3–0.7 percentage points (around 1%) over four years. Our estimates therefore suggest that mild to moderate postpartum depression generates employment losses smaller than those from major health shocks, but substantially larger than those associated with menopause.

The Mitigating Role of Education and Job Characteristics. We next examine whether education and job characteristics mitigate the labor market consequences of postpartum depression.⁹ There are several reasons why the postpartum depression penalty may vary systematically with maternal education. More educated mothers tend to have greater economic resources, which may allow them to purchase market substitutes for household production and allocate less time to non-market tasks (Aguiar and Hurst, 2007), reducing the need to exit employment when coping with mental health challenges. They also tend to have better health literacy and stronger engagement with treatment, which may facilitate earlier recognition of symptoms and more effective care (Santos and Pinheiro, 2025; Cutler and Lleras-Muney, 2010; Currie and Moretti, 2003).¹⁰ Finally, higher education is associated with sorting into occupations and firms that offer greater stability, benefits, and flexibility, and that impose smaller penalties for employment interruptions, which can help mitigate employment and earnings losses following health or family-related shocks (Blau and Kahn, 2017). Taken together, these channels suggest that the employment consequences of postpartum depression may be smaller and less persistent among mothers with higher education.

We assess this hypothesis by estimating event-study profiles separately by pre-birth educational attainment. As shown in Figure 3, employment declines following childbirth are substantially larger for depressed mothers with lower education relative to their non-depressed counterparts.¹¹ By contrast, among mothers with at least some college education, we find little evidence of a differential post-birth employment penalty associated with postpartum depression.

The postpartum depression penalty may also vary systematically with job characteristics. Prior work shows that occupational pay structures and work demands play a central role in gender wage gaps, particularly around childbirth (see Cortés and Pan, 2023, for a recent review). Women fall behind men the most in occupations that reward long and inflexible hours through non-linear pay schedules (Bütikofer et al., 2018; Goldin, 2014; Bertrand et al., 2010). In these occupations women

⁹Appendix Table B5 shows that these characteristics are balanced between depressed and non-depressed mothers.

¹⁰Even in Denmark's universal system, more educated individuals may be better able to navigate care and obtain timely or higher-quality treatment (Packness et al., 2021).

¹¹Appendix Figure B3 and Appendix Figure B4 present the corresponding results for earnings and hours worked, respectively.

are also less likely to reach the top of the earnings distribution (Bertrand et al., 2010) and new mothers are more likely to switch jobs or exit employment (Ishizuka and Musick, 2021). In contrast, gender gaps and motherhood related penalties are smaller in occupations with more flexible hours and more linear pay schedules (Goldin and Katz, 2016). Gender gaps also tend to be smaller in occupations with a larger share of public sector employees, and wage penalties after childbirth are markedly lower in the public sector than in the private sector (Zucco, 2019; Hardoy and Schøne, 2008). Against this backdrop, our hypothesis is that the labor market consequences of postpartum depression may be attenuated in job environments that are more family-friendly.

Figure 4 sheds light on the plausibility of this hypothesis. We assess whether the employment consequences of postpartum depression vary across occupations along the three proxies for family-friendliness defined in Section 3: (i) the occupation-level gender wage gap and (ii) female representation among top earners in the DNBC, and (iii) employment in the public versus private sector in the NHV.¹² For each proxy, we split the sample into settings that are plausibly more supportive of mothers' labor market attachment (lower occupation-level gender wage gaps, higher female representation among top earners, and public-sector employment) versus less supportive settings (higher wage gaps, lower representation, and private-sector employment). Across these measures, the estimates consistently indicate larger and more persistent penalties for depressed mothers in less family-friendly job environments, while in more family-friendly occupations there is no evidence of a differential postpartum depression penalty.

Potential Spillovers to Fathers. Finally, we examine whether maternal postpartum depression is associated with changes in fathers' labor market outcomes. A growing economics literature documents spillovers from health shocks within families (Adhvaryu et al., 2024; Breivik and Costa-Ramón, 2024; Anand et al., 2022; Fadlon and Nielsen, 2021). Fathers may also play an important role in buffering the consequences of maternal postnatal health problems through adjustments in labor supply. Appendix Figure B7 plots fathers' outcomes around first birth by maternal postpar-

¹²Appendix Figure B5 and Appendix Figure B6 present the corresponding results for earnings and hours worked, respectively.

tum depression status. In DNBC, fathers partnered with mothers classified as depressed exhibit larger post-birth earnings declines, driven primarily by responses at the intensive margin. In NHV, the patterns are noisier but point estimates similarly suggest reductions in fathers' hours worked when mothers screen positive for depression. While these estimates are imprecise, the direction of the responses is consistent with some reallocation of fathers' time toward caregiving in response to maternal mental health challenges.

6 Conclusion

This paper examines the contribution of postpartum depression to the motherhood penalty. We show that mothers who experience postpartum depression symptoms suffer larger and more persistent employment losses after childbirth, with effects that remain visible several years later. These penalties are highly unequal. They are concentrated among mothers with lower education and among those employed in less family-friendly jobs prior to birth, while we find little evidence of differential penalties in more supportive work environments.

Our results highlight that even mild to moderate postpartum depression may lead to substantial, persistent and unequal economic consequences. A key implication is that broad access to health care and family policies does not, by itself, eliminate the long-run employment consequences of maternal mental health shocks. This points to a potential role for interventions that link screening and timely treatment to policies that facilitate continued work attachment, such as workplace flexibility and accommodations in the post-birth period.

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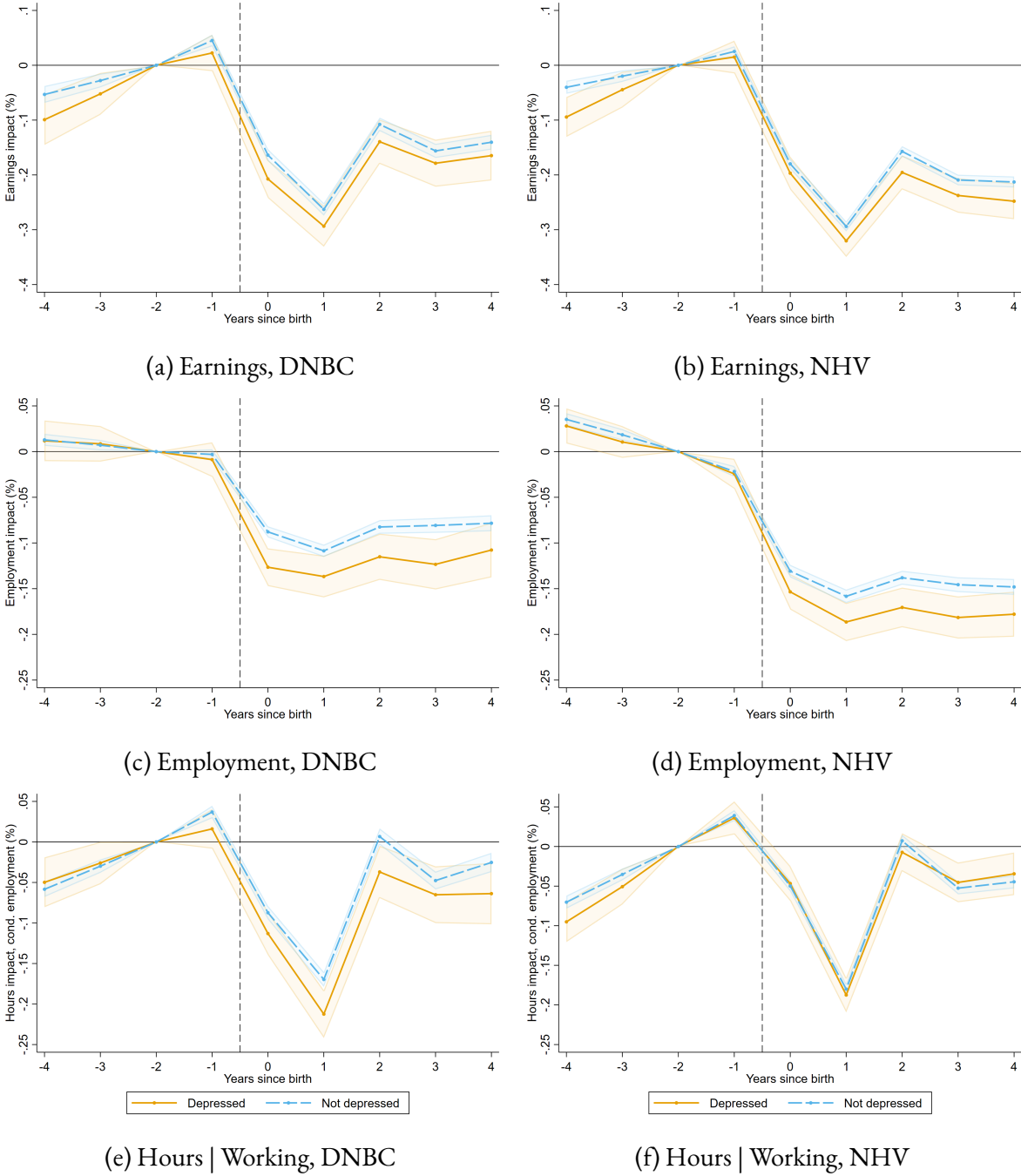
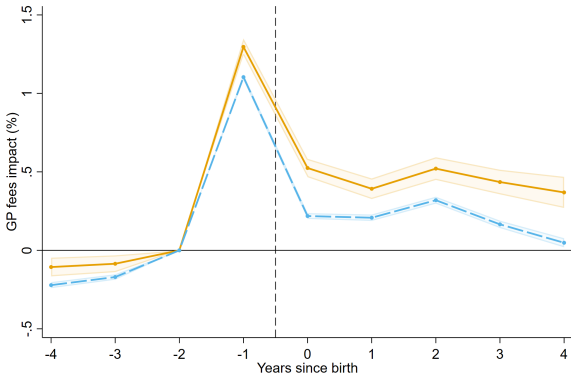
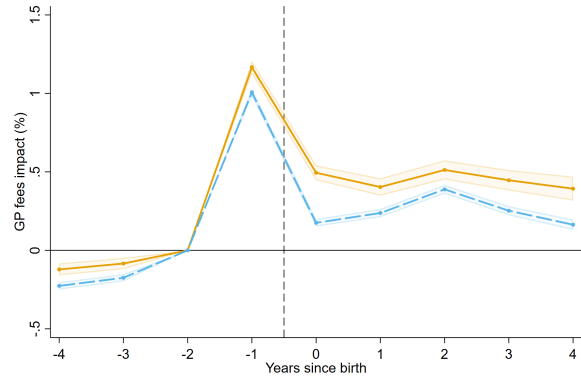


Figure 1: Effects of parenthood on mothers' labor market outcomes by postpartum depression status

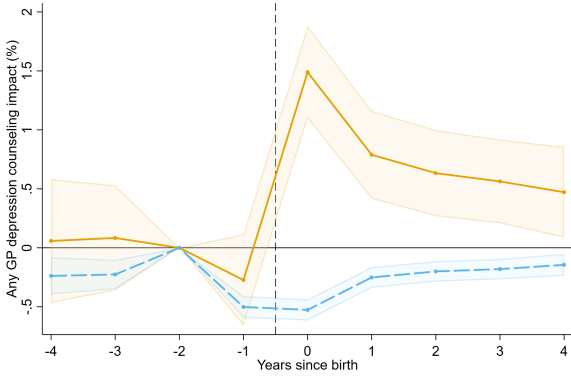
Notes: Samples include first-time native born mothers observed from four years before to four years after first birth. Each panel plots event-time coefficients from Equation (1), shown as percentage deviations P_j^d defined in Equation (2). Outcomes are yearly earnings and employment probability (extensive margin), as well as yearly hours conditional on being employed. Left-hand panel classifies postnatal depression using DNBC self-reported survey responses, while right-hand panel uses the EPDS screening available in the NHV data (see Section 3). Event time is $j = t - b_i$, with b_i the year of first birth, and coefficients are normalized to $j = -2$ following the empirical strategy in Section 4. Orange solid lines plot the outcomes for mothers classified as depressed in the postnatal period, while blue dashed lines plot the outcomes of mothers not classified as depressed. Shaded areas show 95% confidence intervals based on robust standard errors. The sample of non-depressed mothers is weighted using inverse probability weights as described in Section 4.



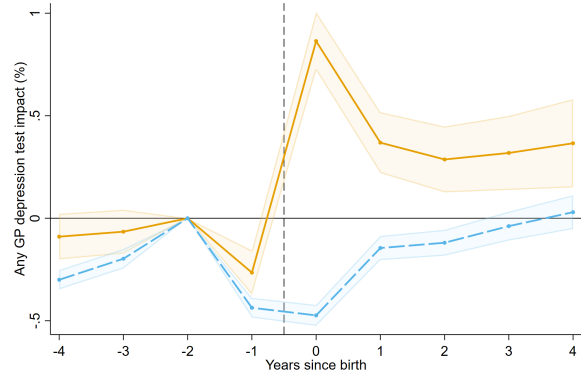
(a) Total GP fees, DNBC



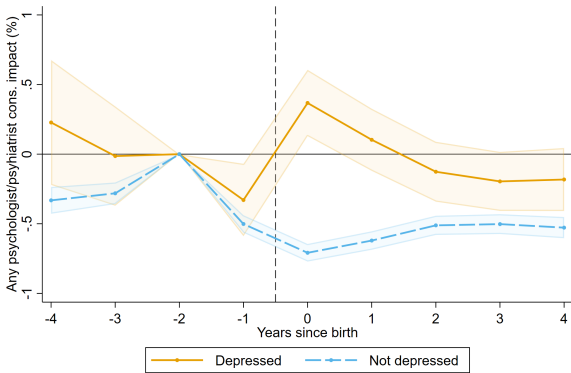
(b) Total GP fees, NHV



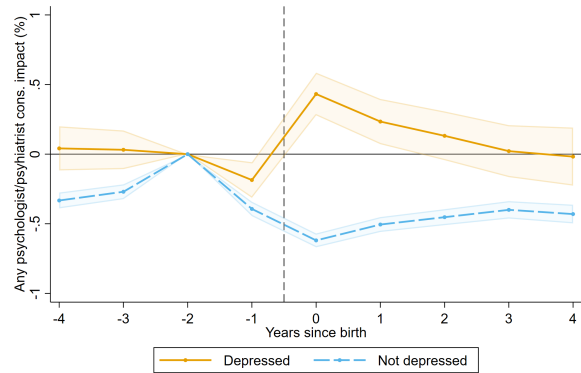
(c) Any GP depression counseling, DNBC



(d) Any GP depression test, NHV



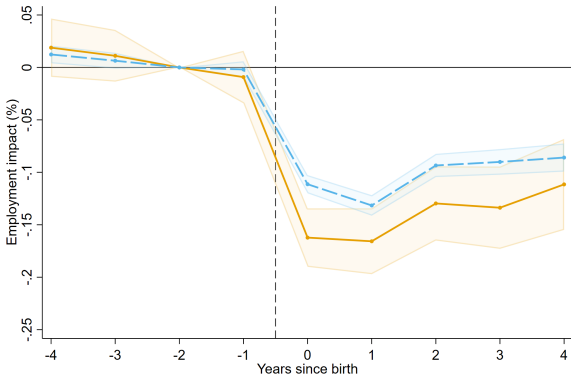
(e) Any psychological contact, DNBC



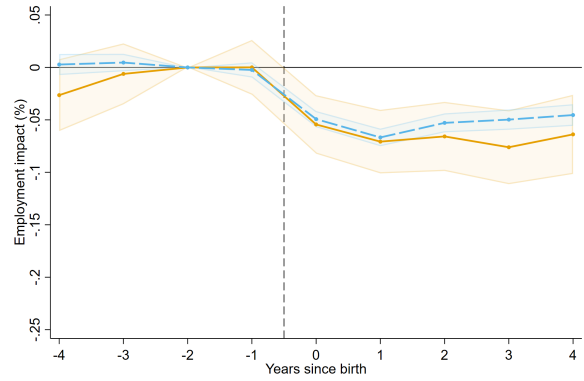
(f) Any psychological contact, NHV

Figure 2: Effects of parenthood on mothers' health care utilization by postpartum depression status

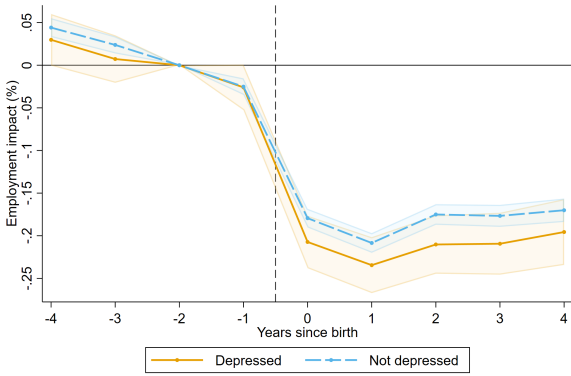
Notes: See notes to Figure 1. Outcomes are: total GP fees, an indicator for receiving psychological counseling (DNBC sample) or being administered a depression test (NHV sample) by a GP, and an indicator for any contact with a psychiatrist or psychologist.



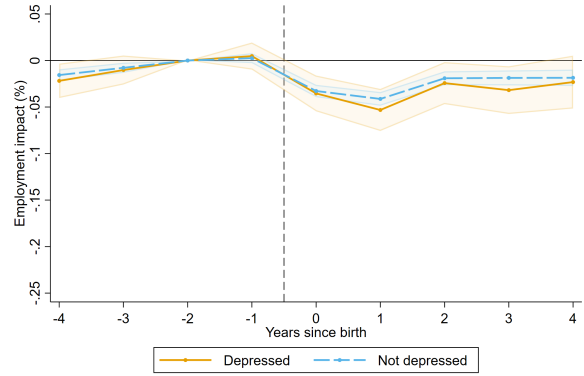
(a) High school or less, DNBC



(b) Some college or more, DNBC



(c) High school or less, NHV



(d) Some college or more, NHV

Figure 3: Effects of parenthood on mothers' employment by education and postpartum depression status

Notes: See notes to Figure 1. Education is defined as the highest degree attained 2 years before birth. Left-hand panel restricts the sample to women with at most a high school degree, right-hand panel to women who obtain post-secondary education.

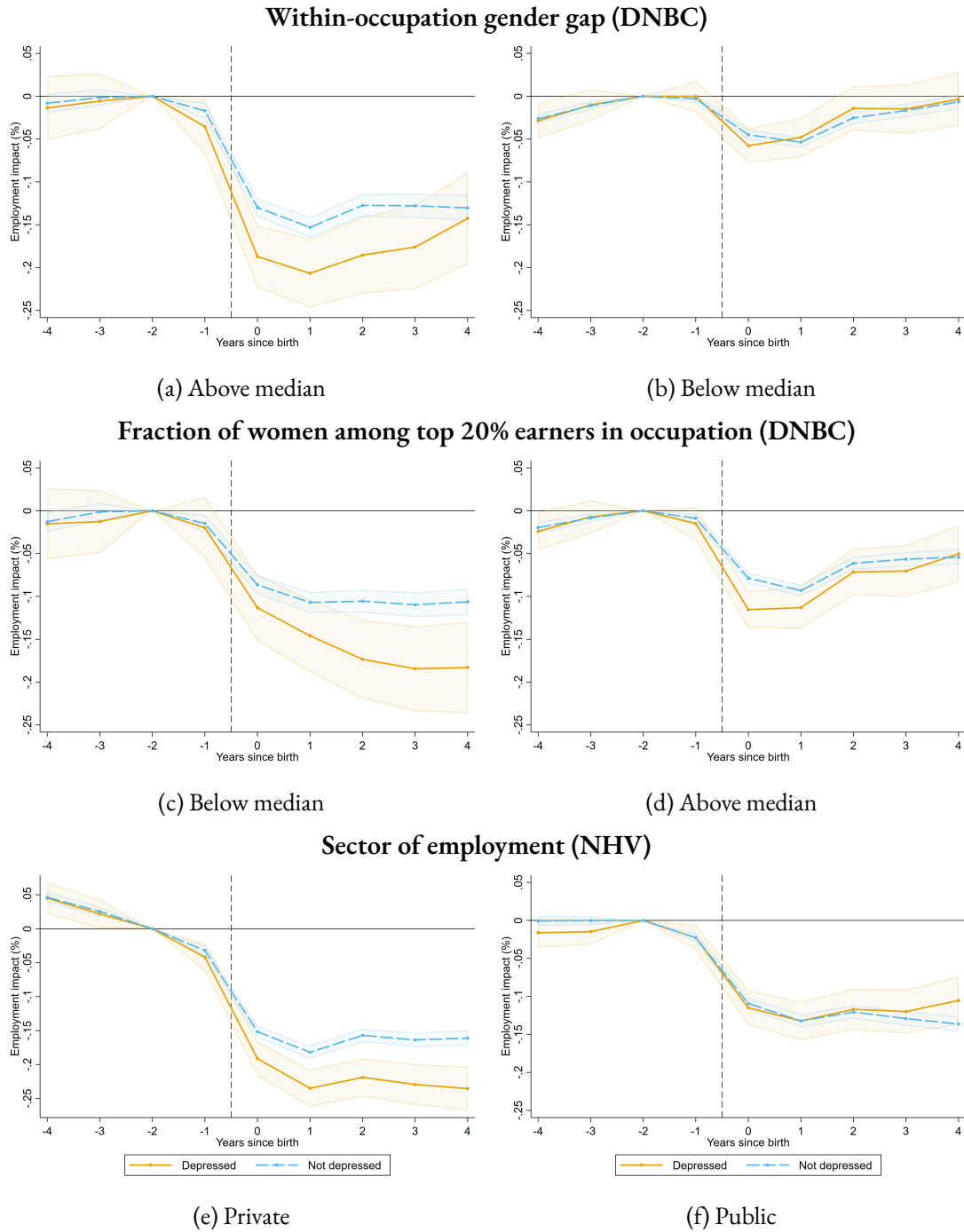


Figure 4: Effects of parenthood on mothers' employment by job characteristics and postpartum depression status

Notes: See notes to Figure 1. Left-hand panel refers to less family-friendly job characteristics, right-hand panel to more family-friendly job characteristics. Top two Figures split the DNBC sample based on whether the gender wage gap within the last occupation held 2–4 years before birth is above (a) or below (b) the median gender wage gap, with the gender gap defined as the ratio of the difference between the average wage of men and of women to the average wage of men. Middle two Figures split the DNBC sample based on whether the fraction of women among the top 20 percent earners in the last occupation held 2–4 years before birth is below (c) or above (d) the median. The bottom two Figures split the NHV sample based on whether the last job held 2–4 years before birth was in the private (e) or public (f) sector.

Table 1: Descriptive statistics of the analysis samples: Mothers with and without postpartum depression (baseline weights)

	DNBC sample (birth cohorts: 1998–2002)			NHV sample (birth cohorts: 2012–2017)		
	Mother not depressed (<i>N</i> = 27,305) (1)	Mother depressed (<i>N</i> = 2,965) (2)	Std. diff. (3)	Mother not depressed (<i>N</i> = 40,408) (4)	Mother depressed (<i>N</i> = 3,704) (5)	Std. diff. (6)
A. Child characteristics						
Female child	0.49	0.49	0.004	0.48	0.48	0.000
B. Mother's characteristics at baseline						
Years of schooling	13.92	13.76	0.077	14.30	14.22	0.030
High education indicator	0.30	0.28	0.041	0.31	0.30	0.022
Age at birth	26.34	26.47	-0.032	28.23	28.65	-0.087
Employed	0.93	0.93	0.032	0.90	0.89	0.032
Labor earnings (1,000EUR)	25.90	25.90	-0.000	26.68	26.72	-0.002
Hours Working	1,351.83	1,346.51	0.008	1,276.08	1,296.07	-0.030
GP fees (1,000EUR)	0.14	0.14	0.016	0.17	0.17	0.000
GP depression counseling (DNBC)/test (NHV)	0.03	0.03	-0.018	0.12	0.15	-0.087
Psychologists/psychiatrists consultation	0.04	0.04	0.002	0.11	0.11	0.000
Employed in:						
Occupation with high-earning women	0.78	0.77	0.013			
Occupation with low gender wage gap	0.37	0.40	-0.049			
Public sector				0.44	0.46	-0.040
C. Father's characteristics at baseline						
Years of schooling	14.07	13.85	0.102	13.98	13.87	0.035
Age at birth	28.92	28.88	0.010	30.58	30.97	-0.069
Employed	0.92	0.93	-0.008	0.90	0.90	0.000
Labor earnings (1,000EUR)	37.45	37.44	0.000	37.59	37.51	0.003
Hours Working	1,553.65	1,544.83	0.015	1,494.79	1,511.39	-0.026
GP fees (1,000EUR)	0.06	0.06	0.002	0.06	0.06	0.000
GP depression counseling (DNBC)/test (NHV)	0.01	0.01	-0.027	0.04	0.04	0.000
Psychologists/psychiatrists consultation	0.01	0.01	0.001	0.02	0.03	-0.062

Notes: Samples include first-time native born mothers observed from four years before to four years after first birth, their first-born children, and the fathers of these children. Columns 1–3 present, for the DNBC sample, means for the sample of mothers classified as not depressed (Column 1) and as depressed (Column 2), as well as the standardized difference between these means. Columns 4–6 present, for the NHV sample, means for the sample of mothers classified as not depressed (Column 4) and as depressed (Column 5), as well as the standardized difference between these means. All parental characteristics are measured 2 years before the birth unless noted otherwise. All monetary variables are expressed in 2015 DKK and converted to euros. The sample of non-depressed mothers is weighted using inverse probability weights as described in Section 4.

Postpartum Depression and the Motherhood Penalty

Online Appendix

Appendix A

Data Sources

A.1 The Danish National Birth Cohort Data

The Danish National Birth Cohort (DNBC) is a nationwide longitudinal study that enrolled more than 90,000 pregnancies between 1996 and 2002, corresponding to roughly 30 percent of all births in Denmark during this period. Women were recruited at their first prenatal visit with a general practitioner and subsequently participated in a series of structured telephone interviews conducted by trained interviewers using a standardized protocol. For our analysis, we focus on first births from the 1998–2002 cohorts, for whom both pregnancy interviews and the postpartum interview were consistently administered.

The DNBC collects detailed information on mothers' health, behaviors, and socioeconomic characteristics during pregnancy. Maternal mental health is assessed through self-reported symptom questions included in the postpartum interview conducted approximately six months after childbirth. These questions cover symptoms of anxiety, depression, and stress and are derived from validated instruments—the Symptoms Checklist-92 (SCL-92) and the General Health Questionnaire (GHQ-60)—adapted to a three-point response scale (“not at all,” “a little,” “a lot”). The postpartum interview includes three items each for anxiety, depression, and stress, as well as a combined summary score ranging from 0 to 18.

Prior studies based on DNBC classify mothers as having elevated postpartum symptoms using the cutoff closest to the 90th percentile of the combined emotional-distress score (Skov et al., 2022). We follow a similar approach where we construct a standardized index for mental health and classify mothers with index values above the 90th percentile as depressed.

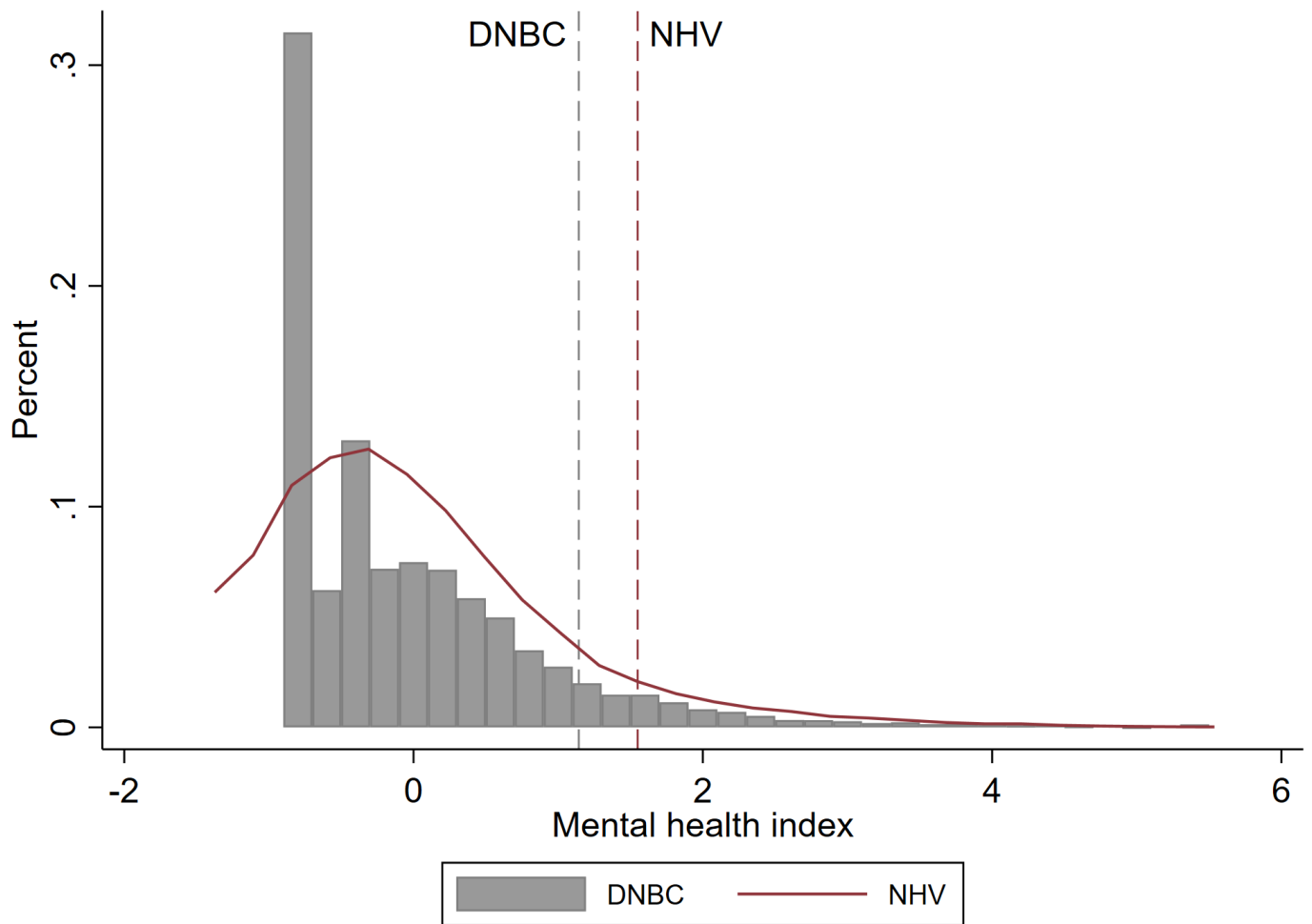
A.2 The Universal Mental Health Screenings

The Danish nurse home visiting program (NHV) provides structured postnatal support to all families with newborns. The program includes up to five universal home visits during the child's first year of life, with additional targeted visits offered at the discretion of the family nurse. Targeted visits may occur during pregnancy, after the first year, or whenever concerns arise, and nurses can refer families to other health professionals when needed. Nurses also organize mother groups for families who consent, providing opportunities for peer support during the first year after birth. The overarching goals of NHV are to monitor family health and well-being, support infant development, and identify families who may benefit from additional services.

In recent years, an increasing share of Danish municipalities has adopted standardized mental health screening within NHV. The most widely used instrument is the Edinburgh Postnatal Depression Scale (EPDS) (Smith-Nielsen et al., 2018; Cox and Holden, 2003), a validated 10-item questionnaire that produces a score from 0 to 30, with higher scores indicating worse underlying mental health. EPDS screenings are conducted by nurses during a routine home visit, typically around two months after birth. Screenings are recorded electronically in the family home alongside other nurse registrations, including the timing of the visit, infant feeding mode, general observations of infant development and well-being, and any referrals to other providers. Based on the EPDS score and their clinical assessment, nurses determine whether follow-up is needed. Follow-up options include additional nurse visits, group-based support within the NHV program, or referrals to general practitioners and mental health specialists. These decisions are guided by municipal procedures and the nurse's professional judgment.

During our study period (2012–2017), municipalities used locally determined EPDS thresholds and guidelines. After 2017, Danish municipalities adopted a national policy recommending further assessment or referral for moth-

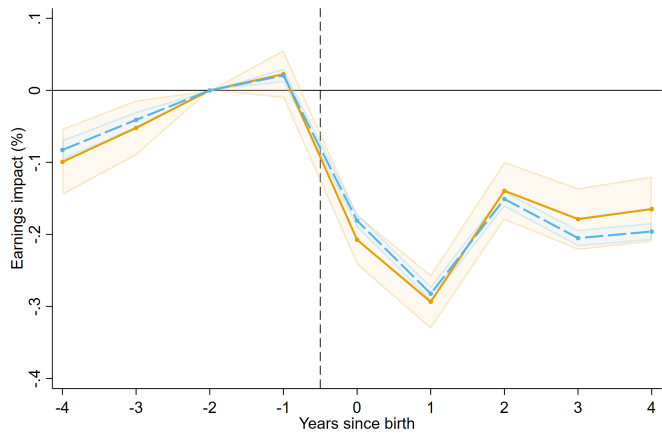
ers scoring 11 or above, based on a Danish validation study of the EPDS instrument (Smith-Nielsen et al., 2018). Consistent with this national guidance, we use an EPDS cutoff of 11 to identify mothers with elevated postpartum depressive symptoms in our analysis.



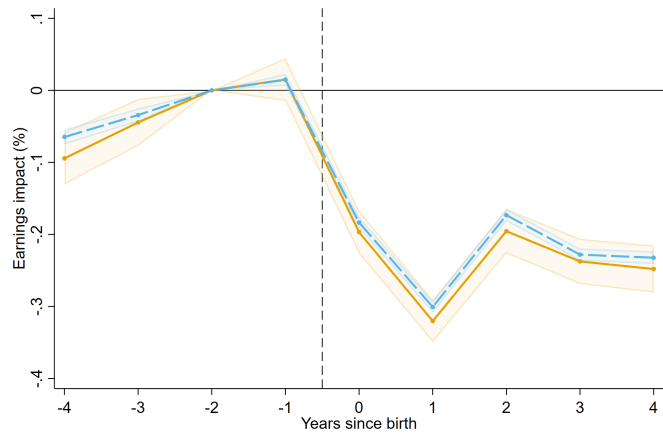
Appendix Figure A1: Histogram of the standardized maternal mental health index (DNBC) and standardized EPDS screening score (NHV)

Notes: Samples include first-time native born mothers observed from four years before to four years after first birth. The gray bars plot the distribution of the standardized mental health index in the DNBC sample, while the red line displays the distribution of the EPDS scores from the NHV sample standardized to have mean zero and variance one. The vertical dashed lines indicate the threshold for classifying women as depressed in the DNBC sample (gray) and in the NHV sample (red).

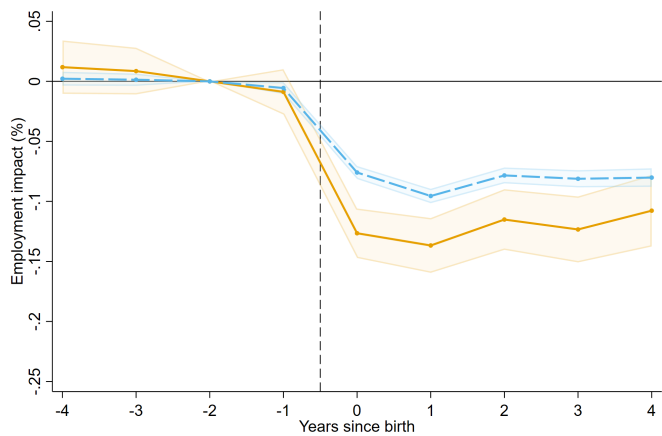
Appendix B
Additional Results



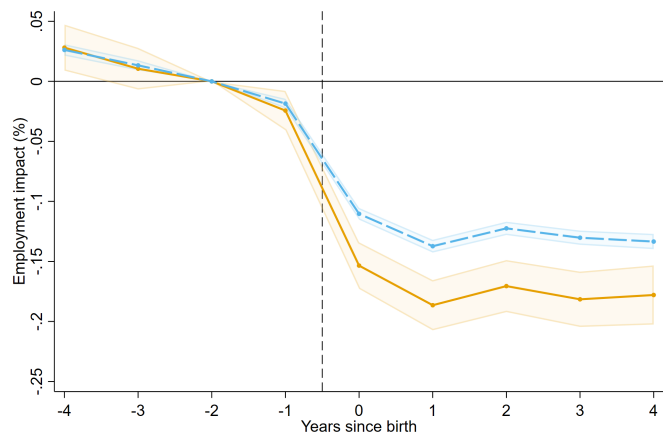
(a) Earnings, DNBC



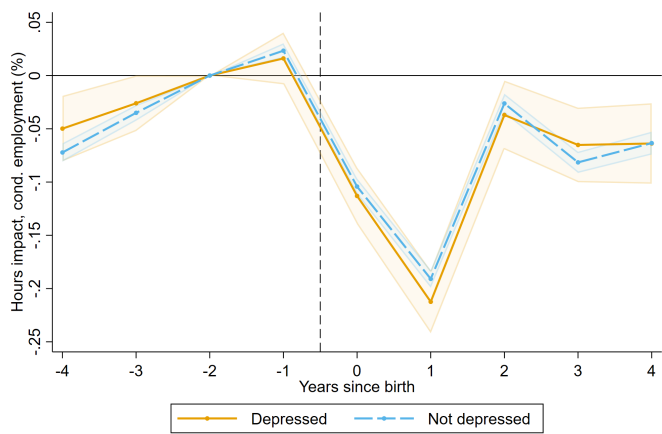
(b) Earnings, NHV



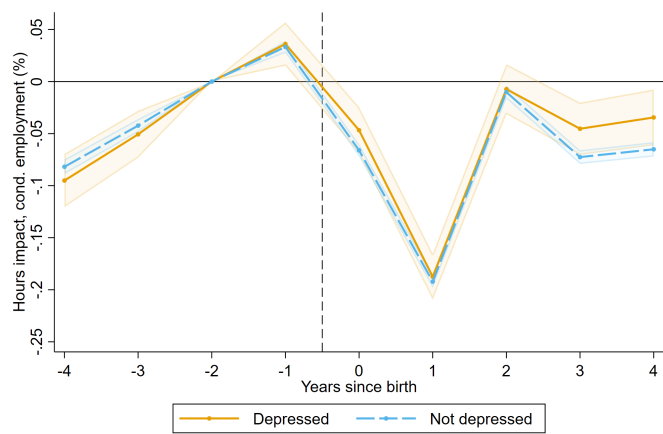
(c) Employment, DNBC



(d) Employment, NHV



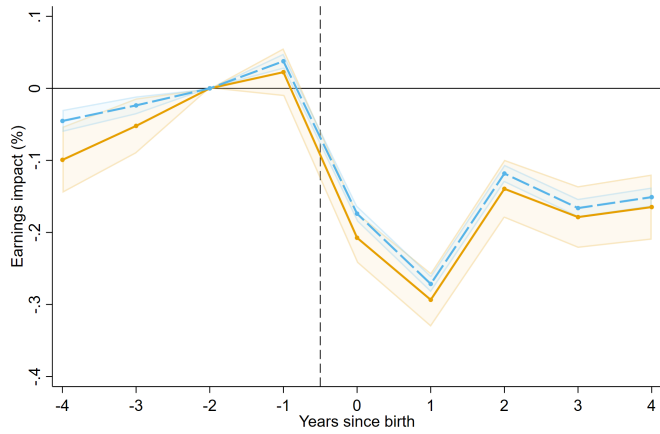
(e) Hours | Working, DNBC



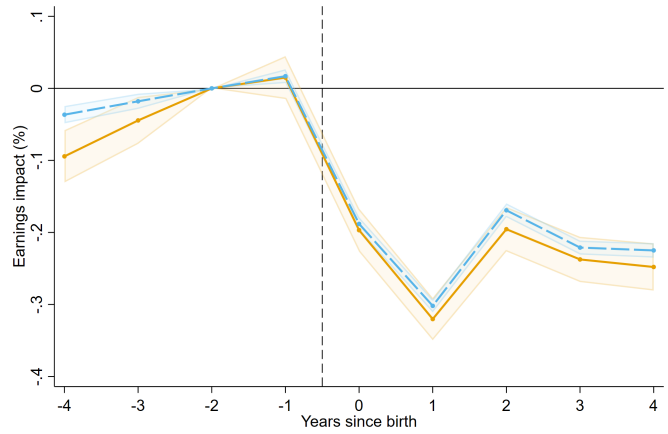
(f) Hours | Working, NHV

Appendix Figure B1: Effects of parenthood on maternal labor market outcomes by postpartum depression status, unweighted results

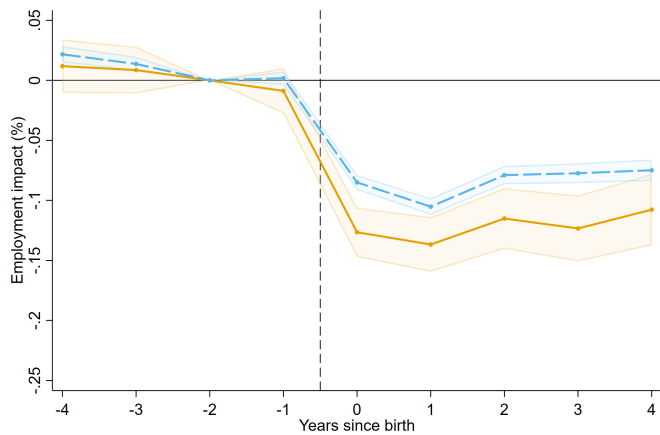
Notes: See notes to Figure 1. The sample of non-depressed mothers is weighted using weights equal to one.



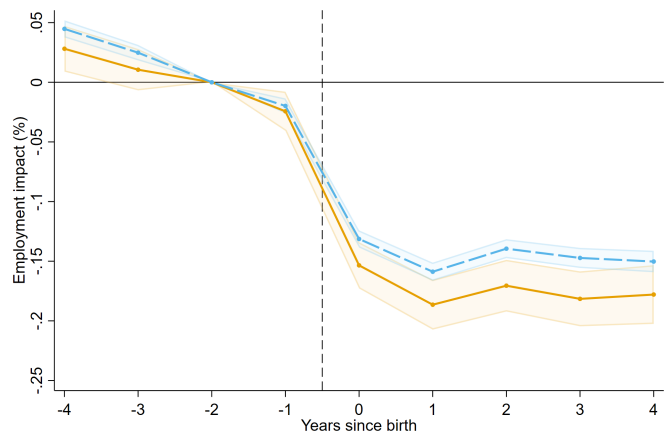
(a) Earnings, DNBC



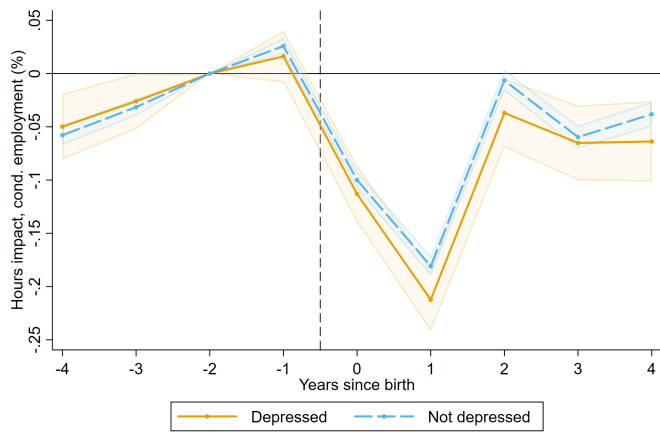
(b) Earnings, NHV



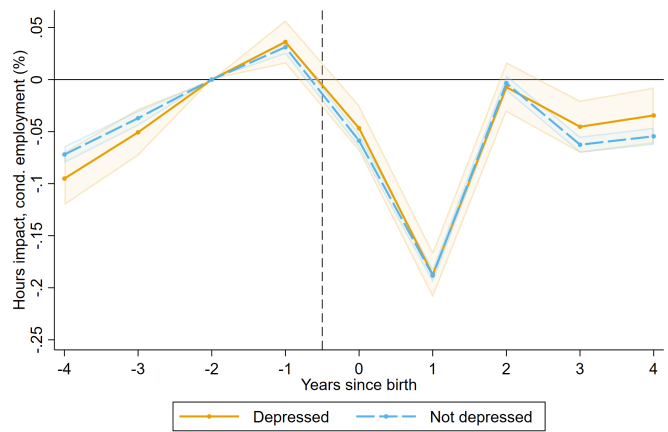
(c) Employment, DNBC



(d) Employment, NHV



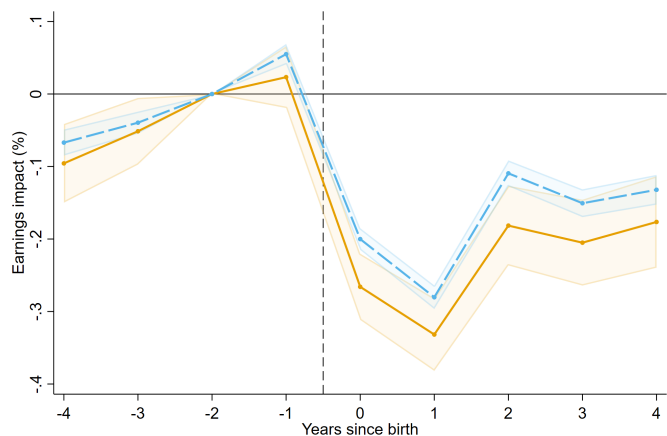
(e) Hours | Working, DNBC



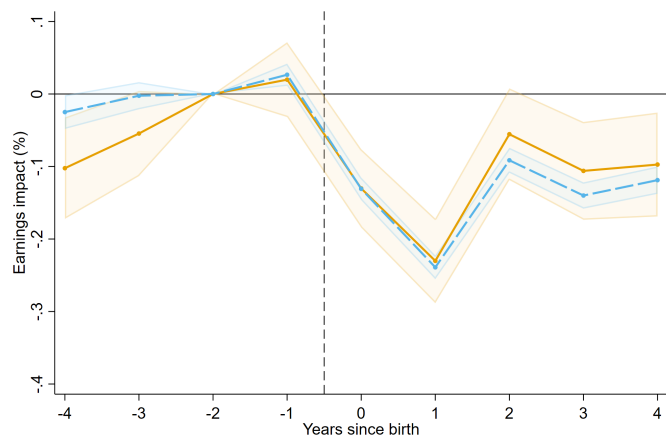
(f) Hours | Working, NHV

Appendix Figure B2: Effects of parenthood on maternal labor market outcomes by postpartum depression status, extended weights

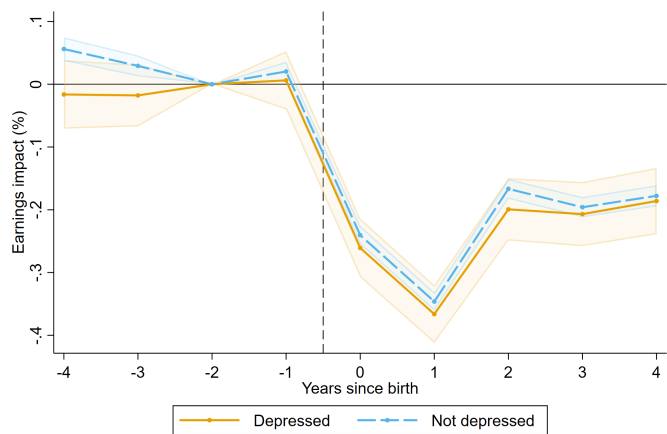
Notes: See notes to Figure 1. The sample of non-depressed mothers is weighted using inverse probability weights as described in Section 4, based on the extended set of mother's characteristics that additionally includes maternal years of schooling, maternal employment, and maternal mental health-related GP contacts.



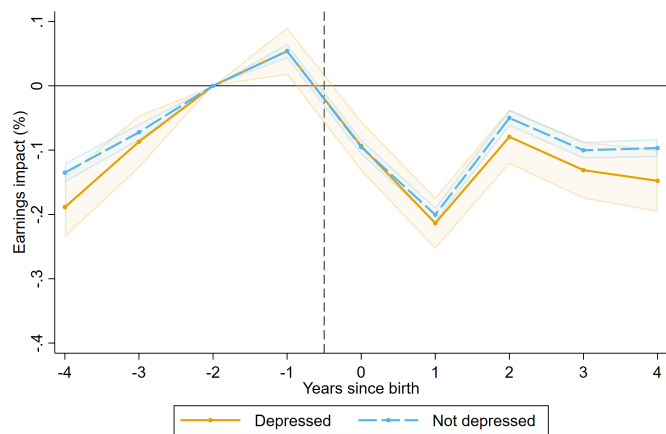
(a) High school or less, DNBC



(b) Some college or more, DNBC



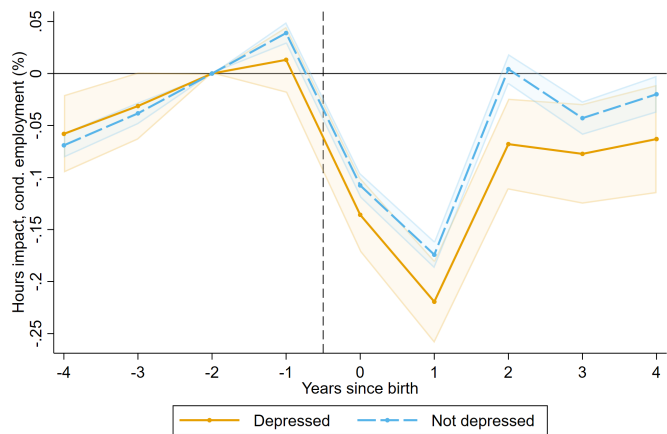
(c) High school or less, NHV



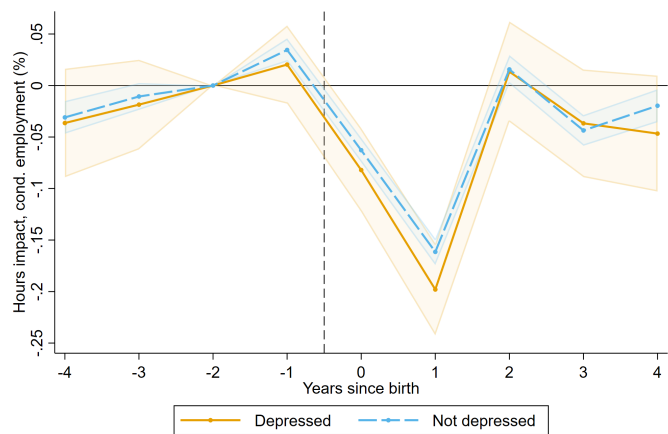
(d) Some college or more, NHV

Appendix Figure B3: Effects of parenthood on mothers' labor income by education and postpartum depression status

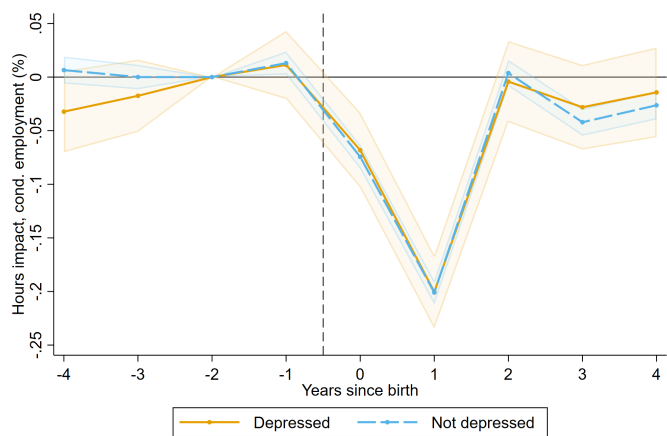
Notes: See notes to Figure 1. Education is defined as the highest degree attained 2 years before birth. Left-hand panel restricts the sample to women with at most a high school degree, right-hand panel to women who obtain post-secondary education.



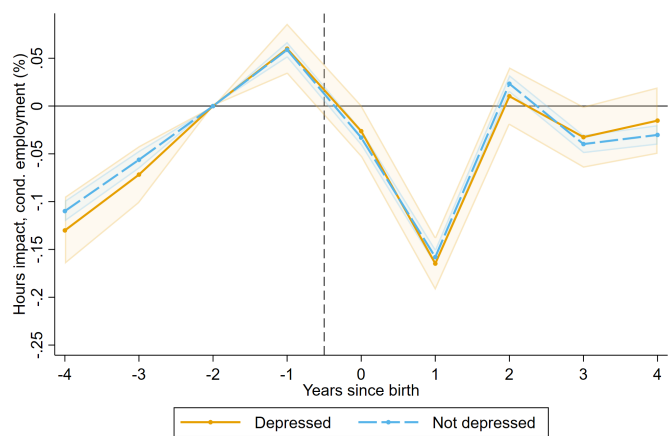
(a) High school or less, DNBC



(b) Some college or more, DNBC



(c) High school or less, NHV

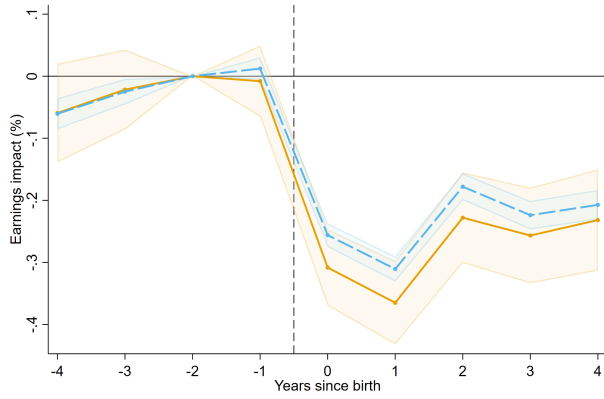


(d) Some college or more, NHV

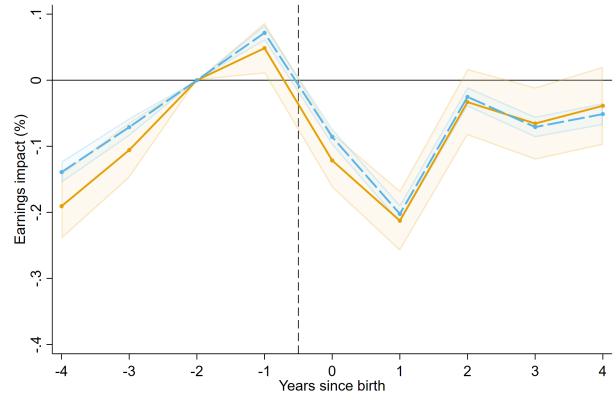
Appendix Figure B4: Effects of parenthood on mothers' working hours by education and postpartum depression status

Notes: See notes to Figure 1. Education is defined as the highest degree attained 2 years before birth. Left-hand panel restricts the sample to women with at most a high school degree, right-hand panel to women who obtain post-secondary education.

Within-occupation gender gap (DNBC)

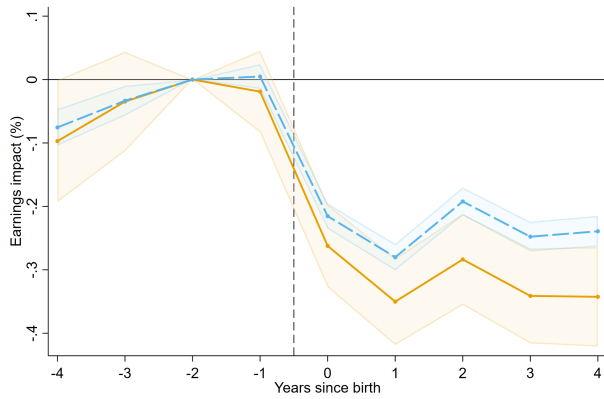


(a) Above median

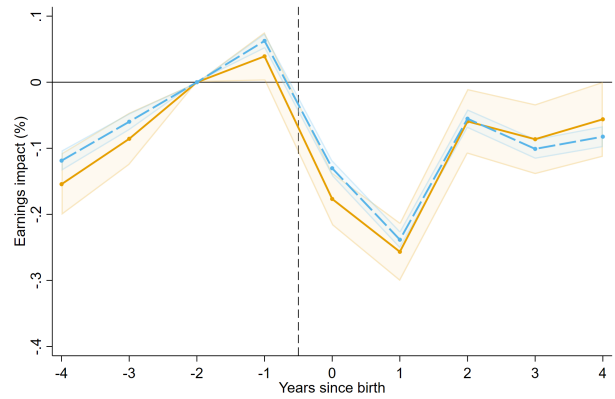


(b) Below median

Fraction of women among top 20% earners in occupation (DNBC)

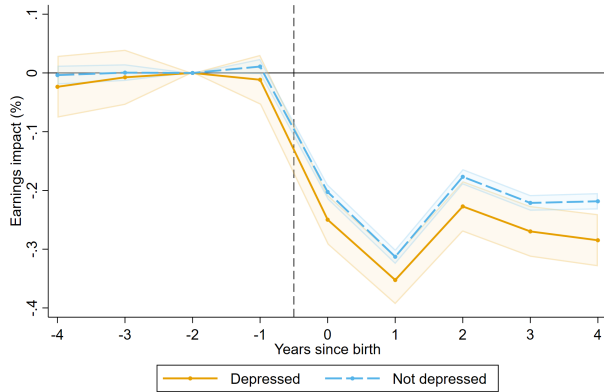


(c) Below median

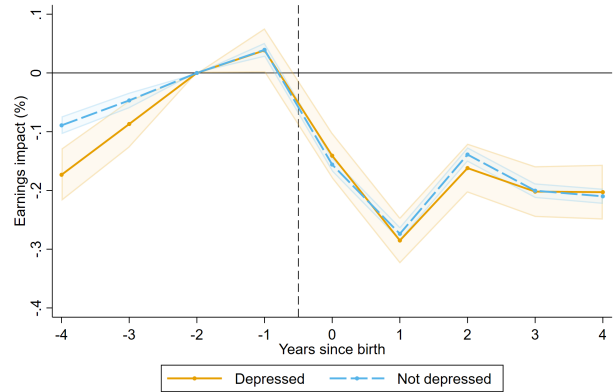


(d) Above median

Sector of employment (NHV)



(e) Private

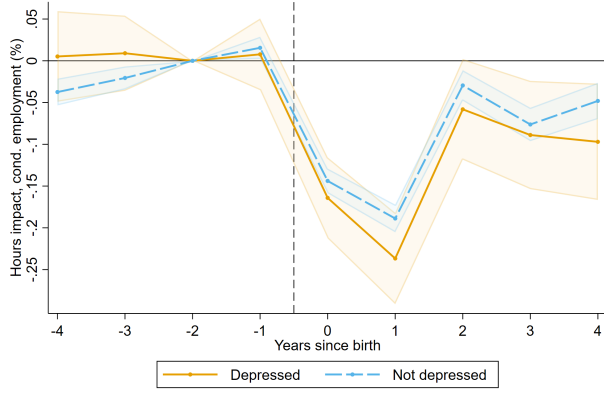


(f) Public

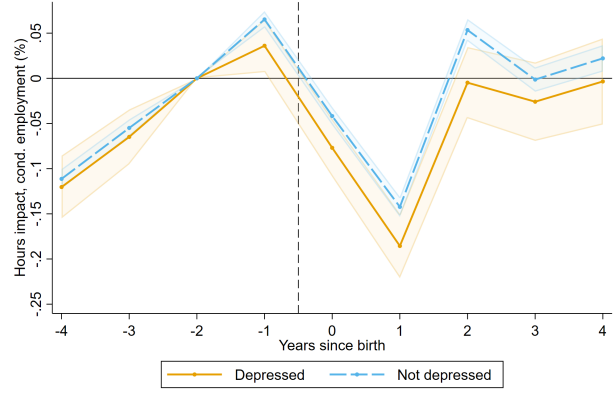
Appendix Figure B5: Effects of parenthood on mothers' labor income by job characteristics and postpartum depression status

Notes: See notes to Figure 1. Left-hand panel refers to less family-friendly job characteristics, right-hand panel to more family-friendly job characteristics. Top two Figures split the DNBC sample based on whether the gender wage gap within the last occupation held 2–4 years before birth is above (a) or below (b) the median gender wage gap, with the gender gap defined as the ratio of the difference between the average wage of men and of women to the average wage of men. Middle two Figures split the DNBC sample based on whether the fraction of women among the top 20 percent earners in the last occupation held 2–4 years before birth is below (c) or above (d) the median. The bottom two Figures split the NHV sample based on whether the last job held 2–4 years before birth was in the private (e) or public (f) sector.

Within-occupation gender gap (DNBC)

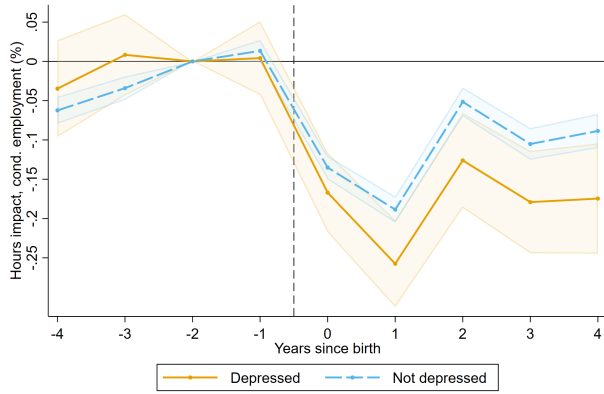


(a) Above median

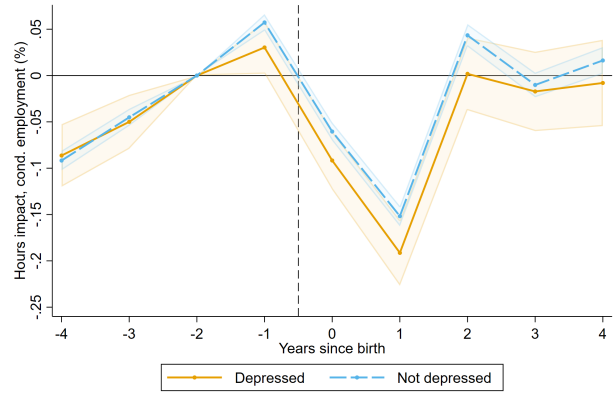


(b) Below median

Fraction of women among top 20% earners in occupation (DNBC)

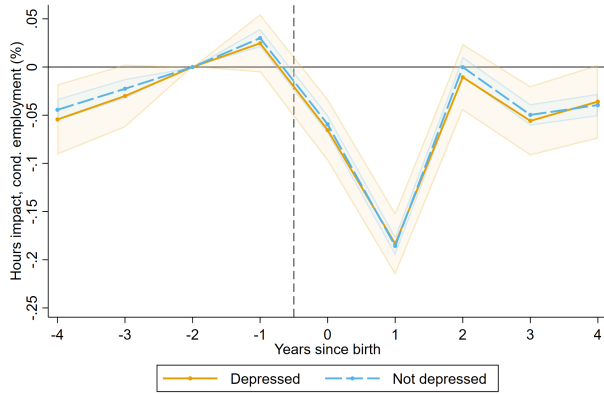


(c) Below median

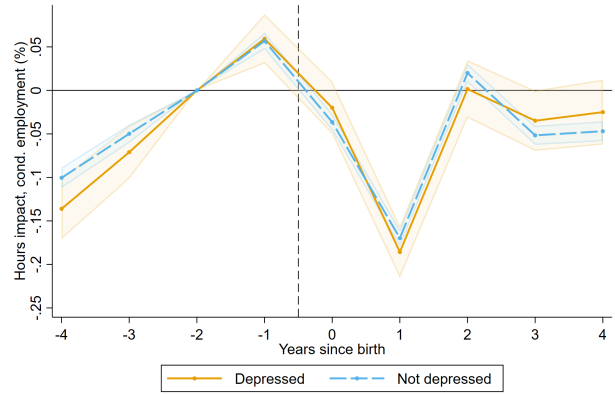


(d) Above median

Sector of employment (NHV)



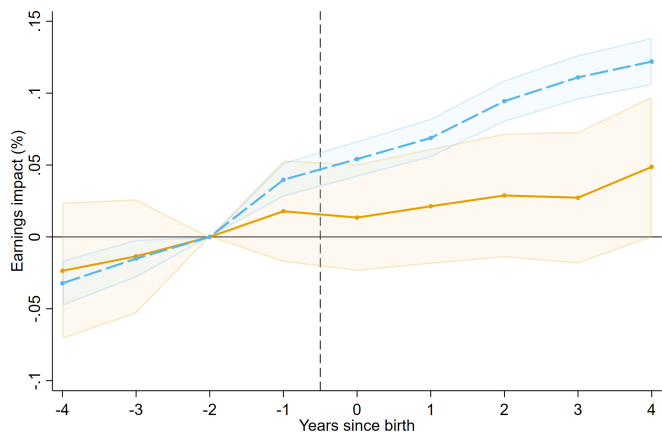
(e) Private



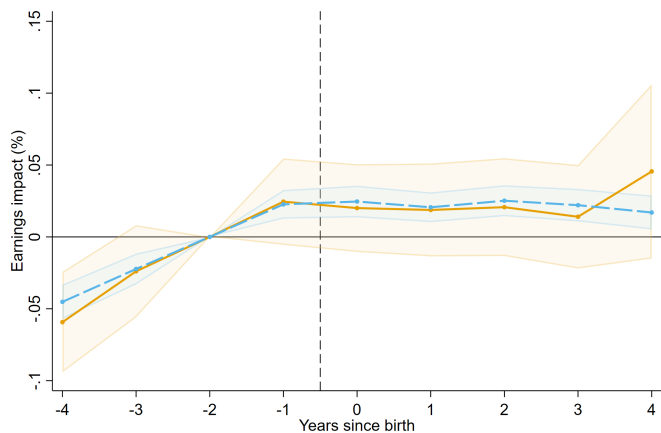
(f) Public

Appendix Figure B6: Effects of parenthood on mothers' hours worked by job characteristics and postpartum depression status

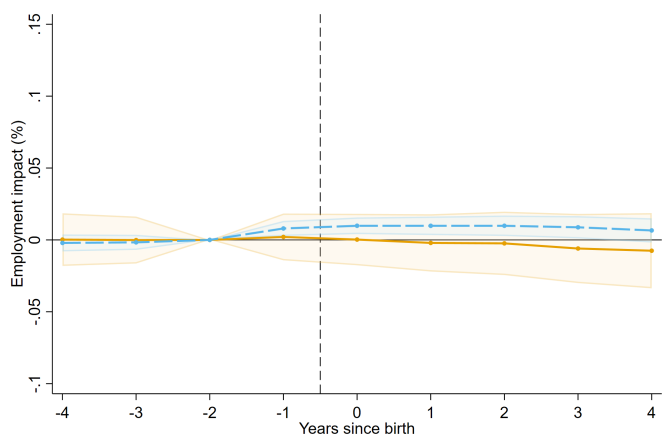
Notes: See notes to Figure 1. Left-hand panel refers to less family-friendly job characteristics, right-hand panel to more family-friendly job characteristics. Top two Figures split the DNBC sample based on whether the gender wage gap within the last occupation held 2–4 years before birth is above (a) or below (b) the median gender wage gap, with the gender gap defined as the ratio of the difference between the average wage of men and of women to the average wage of men. Middle two Figures split the DNBC sample based on whether the fraction of women among the top 20 percent earners in the last occupation held 2–4 years before birth is below (c) or above (d) the median. The bottom two Figures split the NHV sample based on whether the last job held 2–4 years before birth was in the private (e) or public (f) sector.



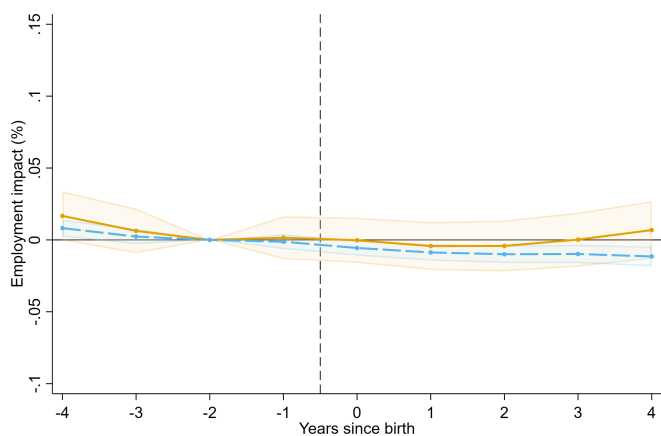
(a) Earnings, DNBC



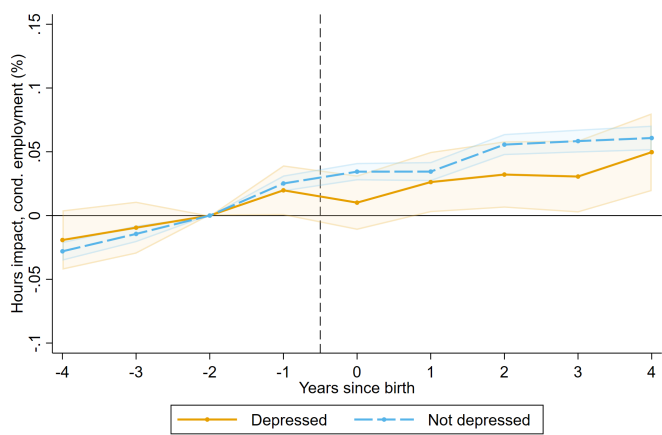
(b) Earnings, NHV



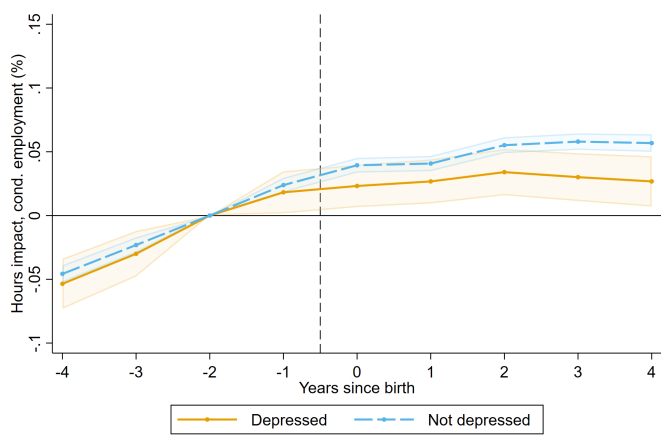
(c) Employment, DNBC



(d) Employment, NHV



(e) Hours | Working, DNBC



(f) Hours | Working, NHV

Appendix Figure B7: Effects of parenthood on fathers' labor income by mothers' postpartum depression status

Notes: See notes to Figure 1. Orange solid lines plot the outcomes for fathers of first-born children born to mothers classified as depressed in the postnatal period, while blue dashed lines plot the outcomes of fathers of first-born children born to mothers not classified as depressed.

Appendix Table B1: Descriptive statistics: Analysis samples versus the full population

	Birth cohorts: 1998–2002			Birth cohorts: 2012–2017		
	Mother not in DNBC (<i>N</i> = 93,431) (1)	Mother in DNBC (<i>N</i> = 30,270) (2)	Std. diff. (3)	Mother not screened (<i>N</i> = 74,778) (4)	Mother Screened (<i>N</i> = 44,112) (5)	Std. diff. (6)
A. Child and birth characteristics						
Female child	0.49	0.49	0.002	0.49	0.49	0.001
B. Mother's characteristics at baseline						
Years of schooling	13.55	14.09	-0.256	14.33	14.55	-0.085
High education indicator	0.25	0.33	-0.177	0.32	0.34	-0.046
Age at birth	26.18	26.69	-0.119	28.48	28.63	-0.032
Employed	0.92	0.95	-0.129	0.90	0.92	-0.054
Labor earnings (1,000EUR)	26.92	29.06	-0.118	29.21	29.99	-0.035
Hours Working	1,403.06	1,434.26	-0.050	1,346.35	1,349.97	-0.005
GP fees (1,000EUR)	0.12	0.11	0.058	0.14	0.13	0.024
GP depression counseling (DNBC)/test (NHV)	0.02	0.02	0.020	0.09	0.08	0.013
Psychologists/psychiatrists consultation	0.02	0.02	0.038	0.06	0.06	-0.003
Employed in:						
Occupation with high-earning women	0.74	0.76	-0.046			
Occupation with low gender wage gap	0.42	0.37	0.088			
Public sector				0.45	0.45	0.009
C. Father's characteristics at baseline						
Years of schooling	13.75	14.14	-0.173	13.94	14.14	-0.065
Age at birth	28.95	29.07	-0.024	30.82	30.91	-0.017
Employed	0.92	0.94	-0.068	0.89	0.91	-0.050
Labor earnings (1,000EUR)	38.66	40.66	-0.080	38.42	39.24	-0.026
Hours Working	1,578.01	1,600.18	-0.040	1,506.53	1,514.93	-0.013
GP fees (1,000EUR)	0.05	0.05	0.021	0.06	0.06	0.019
GP depression counseling (DNBC)/test (NHV)	0.01	0.01	0.006	0.04	0.03	0.010
Psychologists/psychiatrists consultation	0.01	0.01	0.022	0.02	0.02	0.019

Notes: Samples include first-time native born mothers observed from four years before to four years after first birth, their first-born children, and the fathers of these children. Columns 1–3 present, for the period covered by the DNBC sample (1998–2002), means for the first births not included (Column 1) and included (Column 2) in the DNBC sample, as well as the standardized difference between these means. Columns 4–6 present, for the period covered by the NHV sample (2012–2017), means for the first births not included (Column 4) and included (Column 5) in the NHV sample, as well as the standardized difference between these means. All parental characteristics are measured 2 years before the birth unless noted otherwise. All monetary variables are expressed in 2015 DKK and converted to euros.

Appendix Table B2: Descriptive statistics of the analysis samples: Mothers with and without postpartum depression (unweighted)

	DNBC sample (birth cohorts: 1998–2002)			NHV sample (birth cohorts: 2012–2017)		
	Mother not depressed (<i>N</i> = 27,305) (1)	Mother depressed (<i>N</i> = 2,965) (2)	Std. diff. (3)	Mother not depressed (<i>N</i> = 40,408) (4)	Mother depressed (<i>N</i> = 3,704) (5)	Std. diff. (6)
A. Child characteristics						
Female child	0.49	0.49	0.002	0.49	0.48	0.020
B. Mother's characteristics at baseline						
Years of schooling	14.13	13.76	0.177	14.58	14.22	0.136
High education indicator	0.33	0.28	0.116	0.34	0.30	0.086
Age at birth	26.72	26.47	0.059	28.63	28.65	-0.004
Employed	0.95	0.93	0.114	0.92	0.89	0.101
Labor earnings (1,000EUR)	29.40	25.90	0.195	30.29	26.72	0.168
Hours Working	1,443.52	1,346.51	0.156	1,354.73	1,296.07	0.088
GP fees (1,000EUR)	0.11	0.14	-0.238	0.13	0.17	-0.307
GP depression counseling (DNBC)/test (NHV)	0.01	0.03	-0.100	0.08	0.15	-0.223
Psychologists/psychiatrists consultation	0.02	0.04	-0.141	0.06	0.11	-0.183
Employed in:						
Occupation with high-earning women	0.76	0.77	-0.029			
Occupation with low gender wage gap	0.37	0.40	-0.055			
Public sector				0.44	0.46	-0.040
C. Father's characteristics at baseline						
Years of schooling	14.17	13.85	0.145	14.17	13.87	0.095
Age at birth	29.09	28.88	0.044	30.91	30.97	-0.011
Employed	0.94	0.93	0.057	0.91	0.90	0.033
Labor earnings (1,000EUR)	41.01	37.44	0.147	39.40	37.51	0.065
Hours Working	1,606.10	1,544.83	0.110	1,515.25	1,511.39	0.006
GP fees (1,000EUR)	0.05	0.06	-0.080	0.06	0.06	0.000
GP depression counseling (DNBC)/test (NHV)	0.01	0.01	-0.047	0.03	0.04	-0.053
Psychologists/psychiatrists consultation	0.01	0.01	-0.061	0.02	0.03	-0.064

Notes: Samples include first-time native born mothers observed from four years before to four years after first birth, their first-born children, and the fathers of these children. Columns 1–3 present, for the DNBC sample, means for the sample of mothers classified as not depressed (Column 1) and as depressed (Column 2), as well as the standardized difference between these means. Columns 4–6 present, for the NHV sample, means for the sample of mothers classified as not depressed (Column 4) and as depressed (Column 5), as well as the standardized difference between these means. All parental characteristics are measured 2 years before the birth unless noted otherwise. All monetary variables are expressed in 2015 DKK and converted to euros.

Appendix Table B3: Descriptive statistics of the analysis samples: Mothers with and without postpartum depression (extended weights)

	DNBC sample (birth cohorts: 1998–2002)		NHV sample (birth cohorts: 2012–2017)		Std. diff. (6)
	Mother not depressed (<i>N</i> = 27,305) (1)	Mother depressed (<i>N</i> = 2,965) (2)	Mother not depressed (<i>N</i> = 40,408) (4)	Mother depressed (<i>N</i> = 3,704) (5)	
A. Child characteristics					
Female child	0.49	0.49	0.48	0.48	0.000
B. Mother's characteristics at baseline					
Years of schooling	13.76	13.76	14.21	14.22	-0.004
High education indicator	0.27	0.28	0.31	0.30	0.022
Age at birth	26.26	26.47	28.23	28.65	-0.087
Employed	0.92	0.93	0.89	0.89	0.000
Labor earnings (1,000EUR)	25.90	25.90	26.77	26.72	0.002
Hours Working	1,367.45	1,346.51	1,291.75	1,296.07	-0.006
GP fees (1,000EUR)	0.14	0.14	0.17	0.17	0.000
GP depression counseling (DNBC)/test (NHV)	0.03	0.03	0.15	0.15	0.000
Psychologists/psychiatrists consultation	0.04	0.04	0.11	0.11	0.000
Employed in:					
Occupation with high-earning women	0.78	0.77			
Occupation with low gender wage gap	0.38	0.40			
Public sector			0.44	0.46	-0.040
C. Father's characteristics at baseline					
Years of schooling	13.85	13.85	13.93	13.87	0.019
Age at birth	28.86	28.88	30.59	30.97	-0.067
Employed	0.93	0.93	0.90	0.90	0.000
Labor earnings (1,000EUR)	37.47	37.44	37.44	37.51	-0.002
Hours Working	1,558.69	1,544.83	1,495.61	1,511.39	-0.025
GP fees (1,000EUR)	0.06	0.06	0.06	0.06	0.000
GP depression counseling (DNBC)/test (NHV)	0.01	0.01	0.04	0.04	0.000
Psychologists/psychiatrists consultation	0.01	0.01	0.02	0.03	-0.062

Notes: Samples include first-time native born mothers observed from four years before to four years after first birth, their first-born children, and the fathers of these children. Columns 1–3 present, for the DNBC sample, means for the sample of mothers classified as not depressed (Column 1) and as depressed (Column 2), as well as the standardized difference between these means. Columns 4–6 present, for the NHV sample, means for the sample of mothers classified as not depressed (Column 4) and as depressed (Column 5), as well as the standardized difference between these means. All parental characteristics are measured 2 years before the birth unless noted otherwise. All monetary variables are expressed in 2015 DKK and converted to euros. The sample of non-depressed mothers is weighted using inverse probability weights as described in Section 4, based on the extended set of mother's characteristics that additionally includes maternal years of schooling, maternal employment, and maternal mental health-related GP contacts.

Appendix Table B4: Role of concurrent shocks

	DNBC sample (birth cohorts: 1998–2002)			NHV sample (birth cohorts: 2012–2017)		
	Mother not depressed (<i>N</i> = 27,305) (1)	Mother depressed (<i>N</i> = 2,965) (2)	Std. diff. (3)	Mother not depressed (<i>N</i> = 40,408) (4)	Mother depressed (<i>N</i> = 3,704) (5)	Std. diff. (6)
<i>I. Unweighted</i>						
A. Birth characteristics						
Birth weight (grams)	3,500.64	3,447.56	0.092	3,440.52	3,391.37	0.087
Low birth weight indicator	0.04	0.06	−0.112	0.04	0.06	−0.091
Preterm birth indicator	0.06	0.07	−0.067	0.06	0.08	−0.080
C-section indicator	0.18	0.19	−0.028	0.20	0.23	−0.073
B. Mother's characteristics at baseline						
Income ratio	0.44	0.43	0.037	0.44	0.42	0.078
Has partner (married/cohabiting)	0.64	0.57	0.158	0.69	0.65	0.085
<i>II. Weighted, baseline weights</i>						
A. Birth characteristics						
Birth weight (grams)	3,498.52	3,447.56	0.088	3,438.35	3,391.37	0.083
Low birth weight indicator	0.04	0.06	−0.107	0.04	0.06	−0.091
Preterm birth indicator	0.06	0.07	−0.062	0.06	0.08	−0.078
C-section indicator	0.18	0.19	−0.028	0.20	0.23	−0.073
B. Mother's characteristics at baseline						
Income ratio	0.41	0.43	−0.056	0.42	0.42	0.000
Has partner (married/cohabiting)	0.62	0.57	0.121	0.68	0.65	0.063

Notes: Samples include first-time native born mothers observed from four years before to four years after first birth, their first-born children, and the fathers of these children. Columns 1–3 present, for the DNBC sample, means for the sample of mothers classified as not depressed (Column 1) and as depressed (Column 2), as well as the standardized difference between these means. Columns 4–6 present, for the NHV sample, means for the sample of mothers classified as not depressed (Column 4) and as depressed (Column 5), as well as the standardized difference between these means. All parental characteristics are measured 2 years before the birth unless noted otherwise. In panel II, the sample of non-depressed mothers is weighted using inverse probability weights as described in Section 4.

Appendix Table B5: Education and job characteristics, mothers with and without postpartum depression

	Mother not depressed (1)	Mother depressed (2)	Std. diff. (3)
<i>I. Unweighted</i>			
A. DNBC			
At least some college education	0.33	0.28	0.116
% women among top-20% in occupation above median	0.76	0.77	-0.029
Gender gap in occupation above median	0.37	0.40	-0.055
B. NHV			
At least some college education	0.34	0.30	0.086
Employed in public sector	0.44	0.46	-0.040
<i>II. Weighted, baseline weights</i>			
A. DNBC			
At least some college education	0.30	0.28	0.041
% women among top-20% in occupation above median	0.78	0.77	0.013
Gender gap in occupation above median	0.37	0.40	-0.049
B. NHV			
At least some college education	0.31	0.30	0.022
Employed in public sector	0.44	0.46	-0.040

Notes: Samples include first-time native born mothers observed from four years before to four years after first birth. Columns 1 and 2 present means for the sample of mothers classified as not depressed (Column 1) and as depressed (Column 2), as well as the standardized difference between these means (Column 3). All parental characteristics are measured 2 years. Occupation and employment refer to the last job held 2–4 years before birth. The means of non-depressed mothers in panel II are weighted using inverse probability weights as described in Section 4.