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Building Health across Generations: Unraveling the Impact of Early Childcare on Maternal Health*

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Abstract

In contemporary households, women often shoulder most organisation and caregiving responsibilities leading them to play a crucial role in family dynamics. While previous research has established that public early childcare affects child outcomes and maternal employment, less attention has been given to its effects on maternal health despite its relevance within the household. This study investigates the impact of public early childcare on maternal short- and long-term health. Based on administrative health records covering 90% of the German population over a decade, we leverage the exogenous variation in childcare coverage rates across counties and time induced by a major German early childcare expansion. Our results reveal an intra-household transmission of communicable diseases: mothers experience 4–8% more infections and 2–4% more respiratory diseases for a 10 percentage point rise in childcare coverage rates when their children are 1–2 years old. In contrast, mothers benefit from reductions in obesity and anaemia, and heterogeneity analyses show a lower prevalence of mood- and stress-related disorders for multiparous and older mothers. The policy implications of our findings extend beyond the health impacts of early childcare on mothers and shed light on the broader dynamics within families.

Keywords: childcare, maternal health, administrative health data, intergenerational effects

JEL classification: I10, I12, J13, D64

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1 Introduction

Health influences individuals in various aspects of their lives, including well-being, educational attainment, labour market outcomes, and income (Currie & Madrian, 1999, Dolan et al., 2008, García-Gómez et al., 2013). Moreover, its impact ripples across generations, shaping the trajectories of families through downward spillover effects to younger generations (e.g., Aaskoven et al., 2022, Bencsik et al., 2023), horizontal spillover effects to partners, spouses, and siblings (e.g., Black et al., 2021, Jeon & Pohl, 2017), and upward spillover effects to older generations (e.g., Breivik & Costa-Ramón, 2022, Eriksen et al., 2021). This interconnectedness becomes crucial in the context of mothers, who often bear the main responsibility for family organisation and caregiving within households (OECD Development Centre & OECD, 2020). As a result, family dynamics might particularly benefit from healthier mothers and be disrupted when mothers experience health problems.

In recent times, there has been a shift from family-care duties to labour market participation as mothers allocate less time to household activities and more to paid work. Family policies such as the provision of public formal childcare for children under six have played a pivotal role in enabling this transition (e.g., Havnes & Mogstad, 2011a, Lefebvre & Merrigan, 2008, Nollenberger & Rodríguez-Planas, 2015). In addition to labour market outcomes, previous literature concerning the effects of public formal childcare also focuses on child outcomes (e.g., Baker et al., 2019, Berlinski et al., 2009, Datta Gupta & Simonsen, 2010, Felfe et al., 2015, van den Berg & Siflinger, 2022), and fertility (e.g., Bauernschuster et al., 2016). However, the availability of public childcare may affect not only child outcomes and parental —especially maternal— decisions on labour supply and family size but also their health, which has received little attention in the economic literature despite its relevance within the family context (Baker et al., 2008, Haeck et al., 2022, Herbst & Tekin, 2014). This paper contributes to bridging this gap by estimating the effect of public early childcare on maternal short- and long-term health.

While the provision of public childcare is in general not explicitly designed to enhance maternal health, childcare attendance may affect it through various direct and indirect mechanisms, including monetary and non-monetary returns and upward intergenerational health effects. (Non-)monetary mechanisms encompass financial stress arising from increases in childcare and household expenditures, improvements in maternal employment and labour market outcomes, parents' perceived quality of childcare, and the transfer of information among teaching staff and parents within childcare centres. The intergenerational health effects from children to mothers occur as children attending childcare might learn and share health-promoting skills

and practices, experience an earlier detection of severe conditions (e.g., cancer), and a higher likelihood of the occurrence of health shocks (e.g., accidents and injuries), or transmit infectious diseases contracted in centres to other family members.

In this paper, we estimate the causal effect of a large-scale public childcare expansion for children under three in West Germany on maternal short- and long-term health. West Germany has experienced low female labour market participation, limited access to public childcare, and traditional gender role attitudes (Campa & Serafinelli, 2019, Müller & Wrohlich, 2016). Early childcare availability has been modest, with fewer than 5% of children accessing such services before the mid-2000s (see Figure 1 in Section 2). From 2005, several reforms to expand childcare slots for children under three were implemented and childcare coverage rates reached almost 30% by 2019. The introduction of highly subsidised formal childcare for children younger than three indeed encouraged West German mothers to join the labour force (Huber & Rolvering, 2023, Müller & Wrohlich, 2020), while boosting fertility (Bauernschuster et al., 2016), improving child outcomes (Barschkett, 2022, Felfe & Lalive, 2018, Sandner et al., 2022), shrinking the child penalty (Lim & Duletzki, 2023), and promoting less-traditional gender norms (Zoch & Schober, 2018). However, the impact of the childcare expansion in West Germany on other life dimensions such as maternal health remains understudied.

The childcare expansion in West Germany induced exogenous temporal and spatial variation in childcare coverage rates for children younger than three, which we leverage in a two-way fixed effects framework. Our analyses are based on unique administrative health records encompassing 90% of the West German population and comprising all outpatient care contacts spanning from 2010 to 2019. Our sample covers all publicly health-insured women who gave birth between 2010 and 2018, amounting to about three million mothers. Specifically, we follow mothers from the birth of their first child up to their eighth birthday and estimate dynamic health effects by the child's age. To comprehensively assess the impact of the childcare expansion on maternal health, we explore communicable diseases (infections, respiratory and ear diseases), non-communicable diseases (obesity, anaemia), mental health disorders, and healthcare consumption metrics (treatment cases, healthcare costs).

Our findings provide compelling evidence supporting the idea of an intra-household transmission of communicable diseases: mothers experience 3.9–8% (compared to sample means) more infections and 1.5–3.9% more respiratory diseases due to a 10 percentage point (pp) rise in childcare coverage rates when their child is aged 1–2 years old. While for children there is a substitution of infectious illness spells from elementary school to the first years of childcare (Barschkett,

2022), effects for mothers fade out as the child grows up. In contrast, mothers benefit from childcare availability with a 7–10.9% reduction in obesity and a 5–7.3% decrease in anaemia from early childcare ages. Although overall mental health effects are not statistically significant, heterogeneity analysis uncovers a lower prevalence of mood- and stress-related disorders for multiparous and older mothers. In terms of healthcare consumption, we observe a similar pattern to communicable diseases: an increase of 1–1.7% in treatment cases and 1.6–2.6% in healthcare costs at early childcare ages. Our results are robust to extensive robustness checks, including the validation of the plausibility of the parallel trends and exogeneity assumptions, adjustments for multiple hypotheses testing, and sensitivity analyses for children born before the observation period.

Our study contributes to several strands of the literature. First, we contribute to the literature on the impact of family policies, more precisely childcare policies, on (parental) health. There is a large field of literature assessing the effects of various family policies, including parental leave (e.g., Danzer et al., 2022, Danzer & Lavy, 2018), informal care (e.g., Barschkett et al., 2021, del Boca et al., 2018), and formal childcare (e.g., Baker et al., 2008, Barschkett, 2022, Bosque-Mercader, 2022, Cattan et al., 2021, van den Berg & Siflinger, 2022) on various child outcomes, including health. Much less is known about the effects of such reforms on parents, beyond labour supply (e.g., Ginja et al., 2020, Huber & Rolvering, 2023, Müller & Wrohlich, 2020) and fertility (e.g., Bauernschuster et al., 2016, Lalive & Zweimüller, 2009). Studies on the effects of public childcare availability on parental health have focused on self-reported mental health or general health measures.[1] Baker et al. (2008) found detrimental effects of a low-quality public childcare expansion in Quebec (Canada) on fathers' general health status and mothers' depression scores. However, Haeck et al. (2022) pointed out that the effects fade out when children reach school age. Similarly, Herbst & Tekin (2014) reported lower levels of overall health and an increase in symptoms consistent with anxiety, depression, and parenting stress, for mothers exposed to childcare in the US.

The few studies assessing parental health are based on survey data, which include broad and subjective health measures mainly targeting mental health. Our study is the first to use administrative health records to estimate the effect of the provision of public childcare on maternal health, enabling a comprehensive analysis of various outcomes, ranging from communicable diseases to conditions related to health behaviours (e.g., obesity), mental health, and healthcare

[1] Other studies examined subjective maternal life satisfaction due to its correlation with mental health (Lombardo et al., 2018) and reached mixed conclusions. Schmitz (2020) reported increases in maternal life satisfaction in Germany following a childcare expansion for children above three, while Herbst & Tekin (2014) found a negative effect in the US. Brodeur & Connolly (2013) showed no impact on mothers' life satisfaction, but a decrease in happiness in Canada.

consumption. These previous studies focused on the North American context, which exhibits large differences in the social welfare system compared to European countries such as Germany, including childcare and healthcare systems, the quality of childcare, and maternal labour market participation. Hence, our paper is the first to contribute with evidence for Europe. In addition, the reform in Germany targets children below three, while the childcare reforms in the US and Canada affected all children below school age. Therefore, our paper isolates the effects of childcare availability for very young children on maternal health. Lastly, we are able to estimate dynamic effects by age, i.e., considering both short- and long-term horizons. Most previous studies instead provided evidence of immediate health effects.

Second, we contribute to the literature on intergenerational health effects. While the literature has mostly focused on downward intergenerational effects, e.g., parental income or education affecting child health (e.g., Arendt et al., 2021, Kuehnle, 2014), evidence on upward intergenerational effects is scarce (De Neve & Kawachi, 2017). Examples of upward spillover effects to older generations are papers that demonstrated the detrimental effects of children's severe health conditions on parental labour market outcomes (e.g., Breivik & Costa-Ramón, 2022, Eriksen et al., 2021), resulting from the increased caregiving time and the worsening of maternal mental health (Breivik & Costa-Ramón, 2022). Furthermore, the most extreme health shock —the loss of a child— was shown to negatively impact various parental outcomes, including labour income, employment status, marital status, and hospitalisations (van den Berg et al., 2017). To the best of our knowledge, there is no evidence of the effects of less severe child health conditions on parental health. As the childcare expansion in West Germany has been shown to affect child health in terms of a shift in immunity development from elementary school age to early childcare age (e.g., Barschkett, 2022), maternal health might be affected through intergenerational transmission of health.

This paper is structured as follows. We first outline the institutional setting in Section 2. We present our data in Section 3 and describe our empirical methodology and identification strategy in Section 4. In Section 5, we discuss our main results, test their robustness, and provide heterogeneity analyses. Finally, we summarise and conclude in Section 6.

2 Institutional Setting

In Germany, compulsory general education begins at age six, while optional early childhood education provides formal childcare for ages 0–2 (*Kinderkrippe*) and for ages 3–6 (*Kindergarten*).

Historically, Germany has reported low fertility rates and limited maternal labour force partici-

pation, particularly for mothers with children under three (Müller & Wrohlich, 2020). These are often attributed to the low supply of public formal childcare, especially in West Germany. In contrast, East Germany strongly advocated for public childcare facilities during the German division and experienced higher childcare coverage rates for children aged one to six even after the reunification (Bauernschuster & Schlotter, 2015). West Germany eventually reached childcare coverage rates above 90% for kindergarten ages in the 2000s (Müller & Wrohlich, 2020) thanks to the implementation of the Child and Adolescent Support Law (*Kinder- und Jugendhilfegesetz*) in 1996 for which all children aged three and older were legally entitled to a childcare slot. However, access to public childcare for children aged 0–2 in West Germany remained limited, with childcare coverage rates below 5% until the mid-2000s (Barschkett, 2022). Given the differences in childcare provision between East and West Germany[2], our analysis focuses on early childcare in West Germany for children aged 0–2.

Childcare centres, where childcare at ages 0–2 is offered, focus on child development of both cognitive and non-cognitive skills (Felfe & Lalive, 2018). To achieve this goal, they are required to maintain high-quality standards, including opening for a minimum of four hours on weekdays and limiting groups up to ten children under the supervision of a state-recognised educator, often assisted by one or two aides (Felfe & Lalive, 2018). In 2021, for children under three, groups ranged from 8 to 15 children and the average child-staff ratio was 4:1 (Eurydice, 2023).

Childcare at ages 0–2 has been characterised by excess demand. In 2005, 36% of parents with children in this age group sought childcare slots, while childcare centres only accommodated around 7% of slots (Bien et al., 2006). Childcare centres assign slots on a first-come-first-served basis, with priority given to single-parent households and families with previously enrolled siblings, and use waiting lists as a rationing mechanism to allocate excess demand (Felfe & Lalive, 2018). For children aged 2–3 in West Germany, born between 2002 and 2008, the average time spent in childcare centres was 6.4 hours per working week, while they spent most of their time with their mother (42.8 hours) followed by extended family members (19.2 hours with father, grandparents, siblings or other relatives), and to a lesser extent, in informal childcare (1.5 hours with a childminder or a nanny) (Felfe & Lalive, 2012).[3]

In the mid-2000s, several public policy reforms were introduced to expand the supply of child-

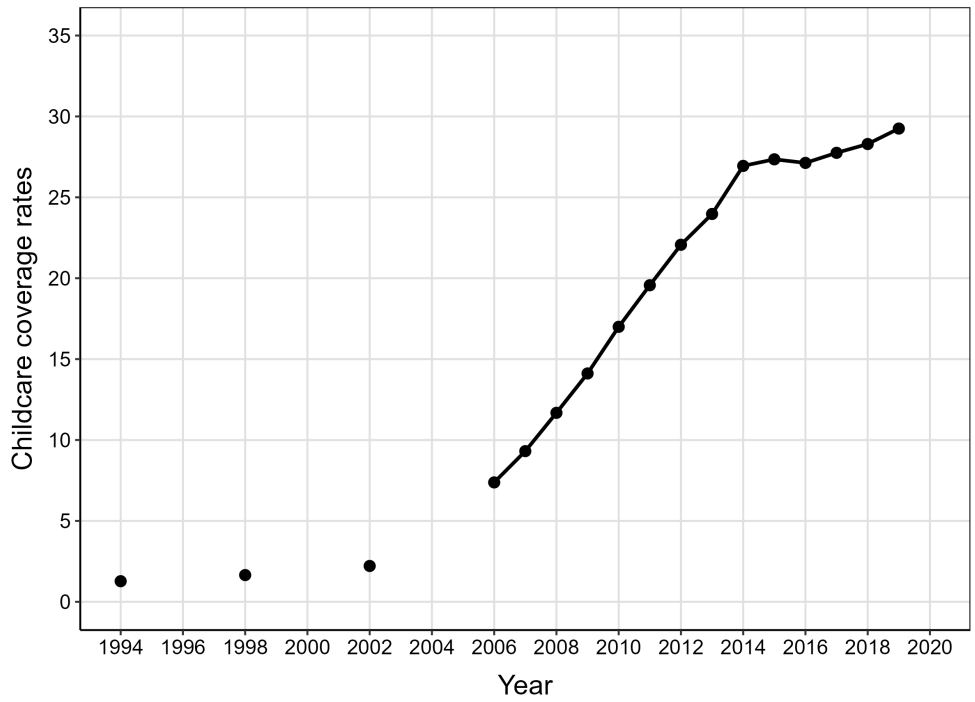
[2]East and West Germany also differ in social preferences, gender role attitudes, family structure, fertility, female labour force participation, and family policies (Alesina & Fuchs-Schündeln, 2007, Boelmann et al., 2021, Campa & Serafinelli, 2019, Jirjahn & Chadi, 2020, Müller & Wrohlich, 2020).

[3]These statistics consider average estimates regardless of attending childcare. Children who attended (did not attend) childcare spent 18.6 hours (no hours) per working week in formal childcare, 39 hours (44.7 hours) with the mother, 18.4 hours (19.6 hours) with the extended family, and 0.5 hours (2.1 hours) in informal childcare (Felfe & Lalive, 2012).

care slots for children younger than three. In 2005, the Childcare Expansion Law (*Tagesbetreuungsausbaugesetz*) was enacted aiming at adding 230,000 slots by 2010 in West Germany. In 2007, the federal government, states, and counties agreed on a summit (the *Krippengipfel*) to set the target of achieving a 35% childcare coverage rate for children under the age of three by 2013. By the end of 2008, the Support for Children Law (*Kinderförderungsgesetz*) was implemented and legally entitled all children aged one and older to a subsidised childcare slot, either in childcare centres or with childminders, by August 2013.

These reforms resulted in an expansion of childcare slots for children under the age of three, leading to an increase in childcare coverage rates since the mid-2000s.[4,5] Figure 1 plots the trend of childcare coverage rates for children under three in West Germany from 1994 to 2019. Before the expansion, childcare coverage rates were below 5%. After the introduction of the reforms, childcare coverage rates started to increase from 7.4% in 2006 to 26.9% in 2014, with a slower growth continuing until it reached 29.3% by 2019. The expansion of childcare slots led to higher fertility and mothers' labour market participation rates (Bauernschuster et al., 2016, Müller & Wrohlich, 2020), but it failed in achieving the 35% childcare coverage rate target.

Figure 1: Childcare coverage rates for children under three (1994–2019)



Note: Trend of childcare coverage rates for children under three years old in West Germany between 1994 and 2019.
Source: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019), own calculations.

[4]Childcare coverage rate is defined as the number of children either enrolled in childcare centres or with childminders divided by the total number of children living in a county in a given year.

[5]Despite the expansion, the demand for childcare slots at ages 0–2 remained higher than its supply (Müller & Wrohlich, 2016). Thus, we assume a full take-up of new childcare slots in our identification strategy.

Childcare is highly subsidised by the federal government, states, and municipalities, although states and municipalities are responsible for funding and municipalities ensure its provision, resulting in significant regional disparities (Huebener et al., 2020). In 2006, childcare costs for children under three amounted to €14.1 billion, with 79% covered by public subsidies, 14% by parents, and the remainder by private non-profit organisations (Bauernschuster et al., 2016). Parents' contributions are income-dependent and vary from one state to another, with some incurring minimal or no childcare costs and others paying over €300 for a full-day slot (Eurydice, 2023).[6] The childcare expansion was also subject to complex decisions regarding the creation of new slots taken at different authority levels. Although objectives and strategies were set at the federal level, municipalities were responsible for operational planning, objective implementation, and predicting childcare demand, and states oversaw the approval of proposals for new childcare centres by private non-profit organisations, a process characterised by variation among counties (Barschkett, 2022, Bauernschuster et al., 2016). All in all, the reforms led to an expansion of highly subsidised childcare slots whose intensity varied considerably across regions.

Figure 2 shows the geographical distribution of childcare coverage rates for children under three by county for 2002, 2011, 2014, and 2019. In 2002, rates were consistently less than 5% across almost all counties. Childcare coverage rates increased up to 19.6% and 26.9% on average in 2011 and 2014, respectively. However, the geographical variation of childcare coverage rates ranged from 9.2% to 37.6% in 2011 and from 13.9% to 46.9% in 2014. The increase in childcare coverage rates also varied across counties from 6.6pp to 34.7pp between 2002 and 2011, slowing down from 1.5pp to 17.6pp between 2011 and 2014. In 2019, most counties exceeded 25% coverage.

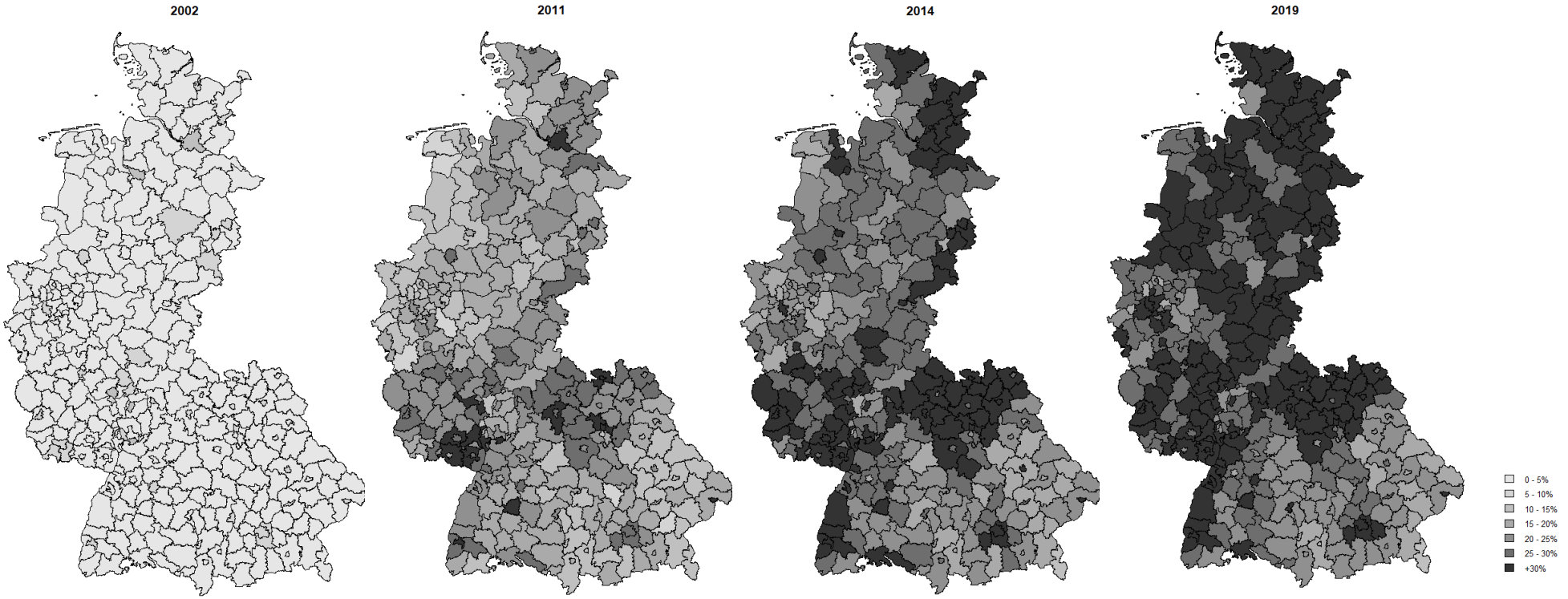
3 Data

Our main data are from administrative health records containing all outpatient care contacts with physicians, specialists, and therapists between 2010 and 2022 from all public health insurers in Germany. We only consider outpatient care contacts between 2010 and 2019 and exclude records from 2020 due to the Covid-19 pandemic.

Health insurance is mandatory for all citizens and permanent residents in Germany, resulting in universal health coverage through a combination of public and private health insurance schemes (Blümel et al., 2020). Almost 90% of the German population is covered by public health insurers,

[6] For couples with two children aged two and three, earning 67% of the average wage and using full-time centre-based childcare, net childcare costs as a percentage of household income were 13% in Germany in 2008, similar to the OECD average but considerably lower than other countries such as the US (31%) and the UK (22%) (OECD, 2023). By 2019, Germany's percentage dropped to 1%, which was significantly below the OECD average of 11%, the US's 29%, and the UK's 22%.

Figure 2: Childcare coverage rates for children under three by county



Note: Childcare coverage rates for children under three years old by West German counties in 2002, 2011, 2014, and 2019. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019), own calculations.

primarily funded by mandatory contributions from both employers and employees combined with tax revenues. Individuals with incomes exceeding a threshold (€62,550 in 2020) and certain professional groups (e.g., civil servants and self-employed) have the option to voluntarily enrol in a private health insurance company.

Physicians assign a standardised diagnosis to each outpatient contact for reimbursement by the patient's health insurance company. The 17 Associations of Statutory Health Insurance Physicians collect and forward these claims from all publicly-insured individuals in Germany to the National Association of Statutory Health Insurance Physicians (*Kassenärztliche Bundesvereinigung*, henceforth KBV). The administrative data used in this study are derived from the claims received by the KBV.

3.1 Sample

Our sample consists of publicly-insured women who gave birth in West Germany between 2010 and 2018.[7] While we have data on all births per mother during our sample period, we consider the year of birth of the mother's first observed child and define it as their entry point into the main sample. The first-born child serves as our "focal" child and is the main subject of our analyses. Unless explicitly stated, we refer to the "focal" child when using the term "child". Moreover, we restrict our sample to mothers aged 15 to 49 at the time of the focal child's birth and born between 1961 and 2003.

We follow mothers using a unique patient ID based on their name and surname, date of birth, and postal code. Through this ID, we observe all outpatient diagnoses received by mothers in West Germany from 2010 until 2019. Our focus is on mothers' diagnoses starting when their child reached age one (i.e., when the family started being exposed to formal childcare), which occurred between 2011 and 2019. Our main sample then includes information on mothers' diagnoses when the focal child was aged 1–8 in 2011–2018 for children born in 2010, and aged 1–8 in 2012–2019 for those born in 2011, aged 1–7 in 2013–2019 for those born in 2012, and so on.[8]

Each diagnosis constitutes an observation in our dataset. Following the approach by Barschkett et al. (2022), we construct our panel of mothers in two steps. First, for intensive margin out-

[7] In line with the methodology by Melchior et al. (2017), we examine physician billing practices for pregnant women using the *GOP 01770* flat fee-per-case code. Physicians bill this code four times: once per quarter during pregnancy and up to eight weeks post-delivery. To identify women who gave birth between 2010 and 2018, we focus on women with four consecutive times billing of this code. Specifically, we include women whose first flat fee was billed between April 1, 2009, and March 31, 2018, and whose fourth flat fee was billed three quarters after, that is, between January 1, 2010, and December 31, 2018.

[8] We do not include mothers' diagnoses when their focal child was aged nine in 2019 for children born in 2010 because they cannot be compared with any other birth cohort in our model.

comes, we count the occurrences of a diagnosis in a year. For extensive margin outcomes, we create a binary indicator to identify patients with at least one relevant diagnosis per year. Second, we aggregate the data annually so that each mother appears only once per year. The panel is unbalanced since mothers only appear when they receive outpatient care. To address this, we impute zeros for years when mothers did not receive relevant diagnoses.[9] Our final panel includes around 340,000 mothers per focal child's birth cohort and a total of 3.1 million mothers.

3.2 Health Outcomes

We have data on mothers' diagnoses spanning from 2011 to 2019, coinciding with the ages of one to eight of the focal child. This allows us to conduct analyses of both child-age-specific and aggregated health effects on mothers.

The KBV data include ICD-10 codes, which allow us to group maternal health by diagnosis. We group diagnoses based on the three-character ICD-10 code and assess three aspects of health: *physical health*, *mental health*, and *healthcare consumption*. *Physical health* is measured by communicable and non-communicable diseases. Communicable diseases comprise conditions that children catch in childcare centres according to previous evidence (Barschkett, 2022) and potentially transmit to their mothers: infections (ICD-10 codes A00–B99), respiratory diseases (ICD-10 codes J00–J99), and ear diseases (ICD-10 codes H60–H95). Non-communicable diseases encompass potential health consequences due to changes in maternal health behaviours derived from childcare attendance such as boosting potential information transfer about health-promoting routines and encouraging mothers to shift their time from parenting to non-parenting activities: obesity (ICD-10 codes E65–E68) and anaemia (ICD-10 codes D50–D53).

Childcare attendance can also impact maternal well-being and trigger or ameliorate certain mental health disorders. We categorise *mental health* into two groups: mood-related disorders, such as depression (ICD-10 codes F30–F39), and stress-related disorders, including anxiety (ICD-10 codes F40–F48).

To measure communicable diseases and anaemia, we count the number of diagnoses per mother and year as intensive margin measures. For obesity and mental health disorders, we create binary indicators equal to one for women with at least one diagnosis per year and zero otherwise as extensive margin measures. These definitions are analogous to Barschkett (2022), ensuring

[9] Publicly-insured mothers who gave birth in 2010–2018 but did not receive any outpatient care between 2010 and 2019 are not captured in the sample. However, 90% of women in Germany receive outpatient care at least once per year (RKI, 2014). Moreover, our dataset covers 79.8% of births in 2010–2018 in Germany and 87.8% of mothers in our sample have consistently received outpatient care each year since their first child was born. Therefore, the proportion of mothers not receiving any outpatient care should be minimal.

comparability with her study that uses the same data.

We assess *healthcare consumption* by calculating treatment cases and healthcare costs. Healthcare consumption is determined by the number of treatment cases a patient receives in a year. A treatment case is defined as the treatment of an insured patient billed by a doctor and to a public health insurance fund within a quarter. A mother has one treatment case in a quarter if she visits the same doctor in that specific quarter regardless of the number of visits. If a mother visits two different doctors in a quarter, she has two treatment cases for that quarter. We then aggregate quarterly treatment cases at the annual level. Healthcare costs billed by ambulatory care doctors in a quarter are aggregated at the annual level and adjusted to 2009 fees.

3.3 Childcare Coverage Rates and Control Variables

The KBV data do not contain information on childcare enrolment or attendance. We therefore assign each mother the average childcare coverage rate for children under three when her focal child was aged 1–2 and in the county where she resided when her focal child was aged one. The childcare coverage rate is defined as the number of children enrolled in childcare centres or with childminders divided by the total number of children residing in a county in a given year. The German Youth Institute reported childcare coverage rates for children under three in 1994, 1998, and 2002, and the German Statistical Office has published annual data since 2006. Our analysis focuses on the 324 counties in West Germany, excluding Berlin.

Lastly, the KBV data include a few individual-level socio-demographic characteristics used as control variables such as mother's age and birth cohort, number of children per mother between 2010 and 2019, focal child's age and birth quarter and cohort, county of residence, and year of outpatient care attendance. We also use county-level characteristics (e.g., economic indicators, demographic factors) from INKAR online database in sensitivity analyses in Section 5.2.

3.4 Descriptive Statistics

Table 1 shows summary statistics of the variables of interest. Our sample consists of 3.1 million mothers and 15.9 million mother-child-age observations.

The number of communicable diseases for mothers exhibits an inverted U-shape as their focal child grows up. The average number of infections per mother and year is 0.46 for ages 1–8. Specifically, it starts at 0.40 at age one, increases to 0.49 at age four, and then decreases to 0.45 at age eight. In the case of respiratory (ear) diseases, the average is 1.34 (0.22) for ages 1–8 and the number of diagnoses is 1.04 (0.18) at age one, peaks at 1.50 (0.25) at age four, and declines

to 1.35 (0.24) at age eight.

Instead, non-communicable conditions and mental health disorders for mothers linearly increase as their focal child ages. The average prevalence of obesity is 10% for ages 1–8, ranging from 8% at age one to 11% at ages 6–8. Similarly, the number of anaemia diagnoses starts at 0.08 at age one, increasing to 0.13 from age seven, with an average of 0.11 for ages 1–8. Concerning mental health conditions, stress-related disorders are more common among mothers, with an average prevalence of 25% for ages 1–8, compared to mood-related disorders, with a prevalence of 12%. In particular, the prevalence of stress-related disorders increases from 20% at age one to 27% at ages 5–8, while mood-related disorders increase from 9% at age one to 15% at ages 7–8.

Table 1: Summary statistics by child's age

Outcomes: Mean (SD)	Age 1	Age 2	Age 3	Age 4	Age 5
Infections (no. per year)	0.40 (0.85)	0.47 (0.92)	0.48 (0.94)	0.49 (0.95)	0.48 (0.95)
Respiratory diseases (no. per year)	1.04 (1.78)	1.31 (2.01)	1.46 (2.13)	1.50 (2.18)	1.47 (2.19)
Ear diseases (no. per year)	0.18 (0.65)	0.21 (0.71)	0.24 (0.76)	0.25 (0.79)	0.25 (0.79)
Obesity (prevalence)	0.08 (0.28)	0.09 (0.29)	0.10 (0.30)	0.10 (0.30)	0.10 (0.31)
Anaemia (no. per year)	0.08 (0.43)	0.10 (0.47)	0.11 (0.50)	0.11 (0.53)	0.12 (0.54)
Mood-related disorders (prevalence)	0.09 (0.29)	0.10 (0.31)	0.12 (0.32)	0.13 (0.33)	0.13 (0.34)
Stress-related disorders (prevalence)	0.20 (0.40)	0.24 (0.43)	0.26 (0.44)	0.26 (0.44)	0.27 (0.44)
Treatment cases (no. per year)	8.94 (6.54)	10.06 (7.07)	10.19 (7.20)	10.00 (7.19)	9.80 (7.15)
Healthcare costs (EUR per year)	398.1 (504.8)	485.7 (572.7)	488.7 (592.3)	465.6 (591.0)	449.3 (596.5)
CC when child is 1–2	26.63 (6.80)	26.23 (6.71)	25.77 (6.63)	25.31 (6.57)	24.80 (6.51)
Age (mother)	31.60 (5.40)	32.61 (5.40)	33.62 (5.40)	34.62 (5.41)	35.62 (5.41)
No. children per mother	0.02 (0.15)	0.15 (0.36)	0.28 (0.45)	0.36 (0.51)	0.42 (0.56)
Observations	3,060,816	2,760,319	2,454,931	2,153,331	1,849,002

Outcomes: Mean (SD)	Age 6	Age 7	Age 8	Ages 1–8
Infections (no. per year)	0.47 (0.94)	0.45 (0.94)	0.45 (0.94)	0.46 (0.92)
Respiratory diseases (no. per year)	1.42 (2.18)	1.37 (2.17)	1.35 (2.18)	1.34 (2.08)
Ear diseases (no. per year)	0.24 (0.79)	0.24 (0.80)	0.24 (0.81)	0.22 (0.75)
Obesity (prevalence)	0.11 (0.31)	0.11 (0.31)	0.11 (0.32)	0.10 (0.30)
Anaemia (no. per year)	0.12 (0.56)	0.13 (0.58)	0.13 (0.60)	0.11 (0.51)
Mood-related disorders (prevalence)	0.14 (0.35)	0.15 (0.35)	0.15 (0.36)	0.12 (0.32)
Stress-related disorders (prevalence)	0.27 (0.44)	0.27 (0.44)	0.27 (0.45)	0.25 (0.43)
Treatment cases (no. per year)	9.58 (7.08)	9.44 (7.05)	9.40 (7.04)	9.70 (7.03)
Healthcare costs (EUR per year)	434.1 (599.6)	423.0 (594.3)	421.4 (599.8)	449.3 (575.3)
CC when child is 1–2	24.11 (6.40)	23.11 (6.16)	21.97 (5.92)	25.29 (6.69)
Age (mother)	36.61 (5.42)	37.60 (5.41)	38.57 (5.41)	34.25 (5.81)
No. children per mother	0.46 (0.60)	0.49 (0.63)	0.51 (0.67)	0.28 (0.50)
Observations	1,532,114	1,203,942	837,729	15,852,184

Note: Mean (standard deviation) of maternal health outcomes, childcare coverage rates, and controls by child's age and aggregated for ages 1–8. CC = Childcare coverage rate. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Regarding healthcare consumption, treatment cases and healthcare costs for mothers also display an inverted U-shaped pattern as their focal child grows older, reaching its peak at age three. On average for ages 1–8, there are 9.70 treatment cases per mother and year with associated healthcare costs amounting to 449.3€.

Mothers experience an average childcare coverage rate of 25.3% when their focal child was aged

1–2, exhibiting a significant variation both across time and counties of 6.7pp. Additionally, the average age of mothers in our sample period is 34, ranging from 32 when their focal child is aged one to 39 when their focal child reaches the age of eight. Finally, the focal child at age one has no sibling born between 2010 and 2019. After age two, the number of children per mother rises and reaches an average of 0.28.

4 Empirical Strategy

Our aim is to estimate the effect of early childcare availability on maternal health. We exploit the temporal and spatial variation of the expansion of highly subsidised formal childcare for children under age three in West Germany. The childcare expansion led to a gradual rise in childcare coverage rates from the mid-2000s until 2014 with a subsequent notable deceleration as illustrated in Figure 1. However, Figure 2 shows substantial variation in the pace of expansion at the county level. Mothers were exposed to the childcare expansion with varying degrees of intensity depending on when and where their children were at ages 1–2. Similar to previous studies analysing the impact of the childcare expansion in West Germany (e.g., Bauernschuster et al., 2016, Müller & Wrohlich, 2020, Sandner et al., 2022), we leverage this variation in treatment intensity across counties and time and regress maternal health on childcare coverage rates controlling for county and birth cohort fixed effects in a two-way fixed effects model. Two-way fixed effects models estimate the treatment effect assuming parallel trends of the outcomes of interest in the absence of treatment, given that the treatment effect is homogeneous across groups and periods (Callaway & Sant'Anna, 2021, de Chaisemartin & D'Haultfœuille, 2020, Goodman-Bacon, 2021).

We estimate the following main specification:

$$y_{mcdty} = \beta CC_{ct} + \mathbf{X}'_{my}\boldsymbol{\delta} + \boldsymbol{\mu}_d + \boldsymbol{\theta}_t + \boldsymbol{\lambda}_y + \varepsilon_{mcdty} \tag{1}$$

where y_{mcdty} is the health outcome of mother m who gave birth to her focal child in t (2010–2018), lived in county c when her focal child was aged one, and resided in county d when she attended outpatient care in year y (2011–2019).[10] CC_{ct} is the average childcare coverage rate

[10] Given the skewness of healthcare costs, we use healthcare costs in logs in equation (1) (Jones et al., 2015).

for children under three when her focal child was aged 1–2.[11,12] $\mathbf{X}_{my}$ is a vector of control variables including mother's age, number of children per mother between 2010 and 2019, and binary variables for the focal child's birth quarter. $\boldsymbol{\mu}_d$ are county fixed effects where the mother resided when she attended outpatient care to control for systematic time-invariant differences in county characteristics, $\boldsymbol{\theta}_t$ are cohort of birth fixed effects of the focal child to account for common factors of all mothers whose focal child was born in the same year, and $\boldsymbol{\lambda}_y$ are year fixed effects to capture any secular trend in outpatient care. ε_{mcdty} is the error term. We cluster standard errors at the county level to allow for serial correlation in maternal health outcomes. We also report adjusted p-values (q-values) for multiple hypotheses testing following Benjamini & Hochberg (1995) and Anderson (2008) to control for type I errors in Section 5.2.

The parameter β measures the intention-to-treat (ITT) effect of increasing the regional childcare coverage rate for children under three by 1pp on maternal health. In Section 5.1, we show the estimates of parameters in equation (1) for a 10pp increase in childcare coverage rates for maternal health outcomes both by age of the focal child and aggregating ages 1–8. In our regression for all ages, we weight observations by the inverse proportion of mothers in each age group relative to the total sample size to account for decreasing subsample sizes as age increases.

Our identification strategy relies on three key assumptions. First, the expansion of childcare slots should have led to an increase in the enrolment of children under three in public childcare. Germany has been characterised by an excess demand for childcare at ages 0–2 even after the childcare expansion, amounting to 16% in West Germany (Müller & Wrohlich, 2016). We thus assume that the childcare reforms expanded the supply of childcare slots and induced a full take-up of new slots. To verify this assumption, we estimate the effect of the childcare expansion on childcare coverage rates using a standard difference-in-differences model. Following Havnes & Mogstad (2011b), we define our treatment variable as one for counties with an increase in childcare coverage rates between 2011 and 2014 above the median (treatment group), and zero otherwise (control group).[13] We then interact our treatment variable with a binary variable equal to one for post-reform years in 2011–2019 and zero for pre-reform years 1994–2010, and

[11] Due to data restrictions, equation (1) exploits the spatial and temporal variation in childcare coverage rates induced by the childcare expansion between 2011–2019. Despite not covering the first years of the childcare expansion, the variation across counties and over time in this period was substantial as depicted in Figures 1 and 2 and Table 1.

[12] Our sample comprises mothers who gave birth in 2010–2018. We assume that mothers were initially exposed to formal childcare when their focal child was aged 1–2 in 2011–2019. In our main specification, we therefore assume that the first observed births in our sample period (birth of the focal child) are the first actual births of the mothers under study. However, some mothers may have given birth before 2010 and been exposed to formal childcare before 2011. We address this by conducting robustness tests in Section 5.2.

[13] We deviate from previous literature (Barschkett, 2022, Bauernschuster et al., 2016, Müller & Wrohlich, 2020) and exploit the variation of childcare between 2011 and 2014 instead of considering a previous initial year given that mothers in our sample are exposed to childcare from 2011.

control for county and year fixed effects. Table A.1 reports an increase in childcare coverage rates and thus a rise in childcare participation assuming full take-up due to the expansion.

Second, the parallel trends assumption claims that county-specific trends of maternal health outcomes in West Germany should have evolved in parallel in the absence of the childcare expansion. In other words, we need to check that the parameter β estimates the effect of the childcare expansion on maternal health instead of the continuation of counties' differential pre-reform trends. To test the plausibility of the parallel trends assumption, we perform several checks. To begin with, we compare the evolution of maternal health outcomes before they were exposed to the childcare expansion (i.e., before her focal child turns one) in treated and control counties. Treated counties are those with an increase in childcare coverage rates between 2011 and 2014 above the median, and control counties are those with an increase below the median. Figure A.1 shows that the evolution of maternal health outcomes up to nine years before the first birthday of their focal child exhibits the same trend in treated and control counties. Next, we provide graphical evidence of pre-reform parallel trends for childcare coverage rates for children under three in Figure A.2.

Following Schmidheiny & Siegloch (2023), we estimate a distributed-lag model to further evaluate the plausibility of the parallel trends assumption:

$$y_{mcdty} = \sum_{\ell=-2}^{3} \gamma_\ell CC_{c,t-\ell} + \mathbf{X}'_{my}\boldsymbol{\delta} + \boldsymbol{\mu}_d + \boldsymbol{\theta}_t + \boldsymbol{\lambda}_y + \varepsilon_{mcdty} \tag{2}$$

where γ_ℓ estimate the incremental changes of the dynamic (cumulative) treatment effects, β_ℓ, of childcare coverage rates on maternal health. The pre-treatment effects are denoted by the leads ($\ell < 0$), and the post-treatment effects are denoted by the lags ($\ell \geq 0$). Contemporaneous and lagged childcare coverage rates might causally affect current maternal health, but leads of childcare coverage rates should not be correlated with current maternal health. Therefore, if the parallel trends assumption holds, the estimates of β_ℓ where $\ell < 0$ should be statistically indistinguishable from zero. Schmidheiny & Siegloch (2023) showed that event study designs with binned endpoints —with coefficients β_ℓ— are equivalent to distributed-lag models —with coefficients γ_ℓ.[14] To recover and plot the dynamic treatment effects β_ℓ in an event study, we cumulatively sum the incremental changes γ_ℓ starting from a reference period. We choose $\ell = -1$ as the reference period and set $\beta_{-1} = 0$. We then cumulate upwards the post-treatment effects $\ell > -1$ as $\beta_\ell = \beta_{\ell-1} + \gamma_\ell$, and cumulate negatively downwards the pre-treatment effects $\ell < -1$

[14] More specifically, Schmidheiny & Siegloch (2023) showed that event study designs with binned endpoints at $\ell = \bar{\ell}$ and $\ell = \underline{\ell}$ are equivalent to distributed-lag models with $\bar{\ell}$ lags and $|\underline{\ell}| - 1$ leads. In our case, $\bar{\ell} = \underline{\ell} = 3$.

as $\beta_{\ell-1} = \beta_\ell - \gamma_\ell$.[15] For the sake of brevity, we estimate equation (2) only after the mother and the focal child have been completely exposed to early childcare, i.e., when the focal child is aged two. Figure A.3 plots the event studies and illustrates that pre-treatment effects are statistically insignificant for all outcomes, supporting the underlying assumption of parallel trends.

Our identification strategy does not entail the childcare expansion to be exogenous to time-invariant county characteristics given that we control for county fixed effects ($\boldsymbol{\mu}_d$) in equation (1). It, however, requires that the expansion of highly subsidised childcare be orthogonal to time-variant determinants of maternal health. To begin with, a threat to our identification is contemporaneous policies that were correlated with the childcare expansion. Most of these policies were implemented at the federal or state level (Sandner et al., 2022). Federal-level policies are common to all mothers regardless of county of residence and thus taken into account by cohort of birth ($\boldsymbol{\theta}_t$) and year ($\boldsymbol{\lambda}_y$) fixed effects. To account for state-level policies, we add to our main specification state-year fixed effects as a robustness check in Section 5.2. However, county-specific time-variant determinants might still be correlated with the childcare expansion and maternal health. We then prove that the childcare expansion was exogenous to these determinants and that they did not evolve differently across counties by showing that the trends of a set of county characteristics were similar in counties with above- and below-median treatment intensities in Figure A.4.[16] We further check that time-variant county characteristics do not lead to omitted variable bias by adding them as controls in Section 5.2.

Third, an additional concern is selective migration across West German counties. Families (or mothers) may have moved across counties in search of available childcare slots. If such migration was correlated with maternal health (e.g., wealthier families being healthier and more informed about where available slots are), our results would be biased. We rule out this possibility by excluding from our analysis mothers who moved across counties when their focal child was younger than three in a robustness check.

5 Results

In this section, we report and discuss our main results. We then provide a wide range of robustness checks to test the sensitivity of our results and a set of heterogeneity analyses.

[15] Given that we have three leads and lags, $\beta_{-1} = 0$, $\beta_{-2} = -\gamma_{-1}$, and $\beta_{-3} = -\gamma_{-1} - \gamma_{-2}$ for the leads, and $\beta_0 = \gamma_0$, $\beta_1 = \gamma_0 + \gamma_1$, $\beta_2 = \gamma_0 + \gamma_1 + \gamma_2$, and $\beta_3 = \gamma_0 + \gamma_1 + \gamma_2 + \gamma_3$ for the lags.

[16] County characteristics include economic and political indicators, demographic factors, and childcare measures.

5.1 Main Results and Discussion

In Figure 3, we present estimates illustrating the impact of the childcare expansion on maternal health. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. We break down the results by the age of the focal child and also aggregate them for children aged 1–8.

Communicable diseases

Mothers with higher exposure to the childcare expansion experience an increase in infections and respiratory diseases when their focal child is aged 1–2. A 10pp rise in childcare coverage rate amounts to 0.02–0.03 more infections (or 3.9–8% more compared to sample means) and 0.03–0.04 more respiratory diseases (or 1.5–3.9% more). These findings align with the positive effects on infections and respiratory diseases for 1–2-year-old children in Barschkett (2022) and support the idea that children may catch certain communicable diseases at childcare centres which are transmitted to other family members (Schlinkmann et al., 2018). This increase vanishes from age three, although mothers are diagnosed with 0.02 fewer respiratory diseases (or 1.1–1.3% less) when their child is aged 4–5. Unlike Barschkett (2022), the effects on maternal infections and respiratory diseases at early ages are smaller in magnitude and the impact fades out in general at older ages. This may be attributed to mothers having higher immunity levels than their children, who experience a shift in immunity development from elementary school age to early childcare age. When aggregating ages 1–8, we find a positive effect only for infections (around 0.01 or 1.5% more infections). No consistent effect on ear diseases is observed across ages, except for a small reduction of 0.01 (or 2–2.5% less) at ages 3–4.

Non-communicable diseases

Figure 3 suggests that the childcare expansion generally reduces the prevalence of obesity in mothers. There is a positive (negative) impact on obesity when the focal child is one (two), but this effect is smaller compared to older ages. After age two, the probability of being diagnosed with obesity decreases by approximately 0.01pp (or 7–10.9% less compared to sample means). Similarly, mothers receive 0.01 fewer diagnoses of anaemia (or 5–7.3% less) when their focal child is aged 2–7. The aggregated effects for ages 1–8 on obesity and anaemia exhibit similar magnitudes to the significant age-specific effects. These beneficial health effects may be determined by healthier lifestyles (Contoyannis & Jones, 2004). First, early skill learning shapes the evolution of health capital (Cunha & Heckman, 2007), while children may convey health-promoting habits learnt in formal childcare to their families. Likewise, information ex-

change occurs through parent-staff communication and social interactions with other parents in childcare settings (Endsley & Minish, 1991, Small, 2009). If this exchange includes information on healthy habits such as physical exercise, balanced nutrition, regular medical checkups, and consistent sleep patterns, it may indeed influence mothers' behaviours towards a healthier lifestyle.

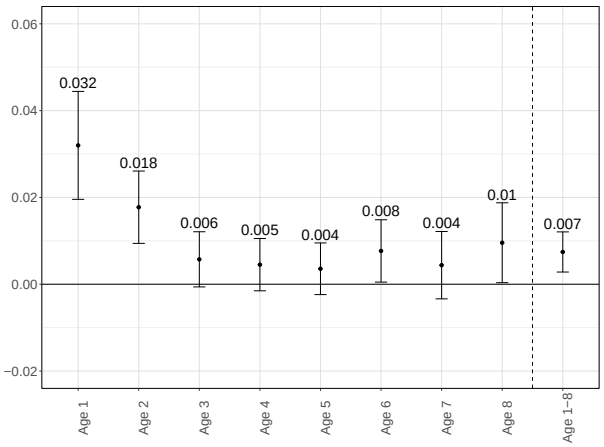
Second, centre-based care enables mothers to shift their time from parenting to non-parenting activities. As a result of the childcare expansion in West Germany, mothers spent less time with their children without affecting the quality of their parenting duties (Jessen et al., 2022). Maternal labour market participation increased, driven by a rise in long-hours (20–35h) part-time employment (Müller & Wrohlich, 2020). As a result, employed mothers usually do not have time for other non-parenting activities than paid work (Jessen et al., 2022). The persistent health benefits of obesity and anaemia from early childcare age until elementary school age might be a consequence of the expansion stimulating both short- and long-term maternal employment resulting in higher earnings (Huber & Rolvering, 2023) and family income, which is associated with healthier behaviours (Cawley & Ruhm, 2011). The rise in maternal employment and earnings raised maternal-to-paternal wages and mothers' bargaining power within the household (Sandner et al., 2022), who devote a higher share of the household budget to calorie- and protein-rich diets and human capital goods such as health (Thomas, 1993). Non-working mothers might instead have additional leisure time to focus on their physical well-being, such as exercising or eating healthier, while their children attend childcare. However, any potential changes in mothers' healthy behaviours due to the childcare expansion did not appear to affect the prevalence of obesity in children (Barschkett, 2022).

Mental disorders

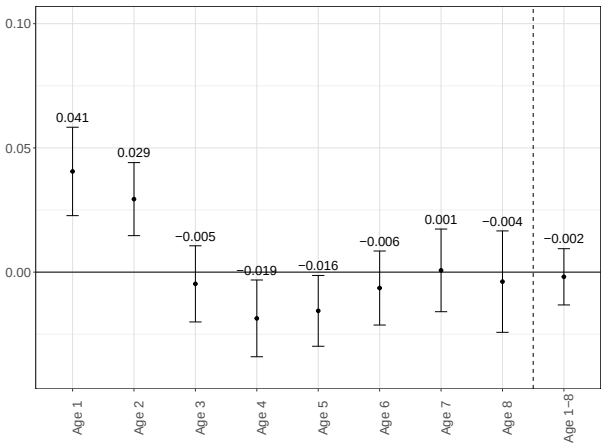
We observe no age-specific or aggregated effects on the probability of being diagnosed with either mental health mood-related disorders or stress-related ones. This absence of effect might stem from a genuine lack of impact on maternal mental health, similar to findings in children's mental health (Barschkett, 2022). Alternatively, positive and negative mechanisms might cancel each other out. Childcare attendance could trigger mother's mental health disorders, for example, through maternal separation anxiety, feelings of guilt related to allocating less time to children, especially in a society with traditional gender norms like West Germany (Campa & Serafinelli, 2019), or work-family conflicts, which are associated with poorer health (Bianchi & Milkie, 2010, Nilsen et al., 2017). Conversely, it may improve them, for instance, via enhancing child development (Felfe & Lalive, 2018) if parents have altruistic utility functions (Becker &

Figure 3: Effect of the childcare expansion on maternal health outcomes

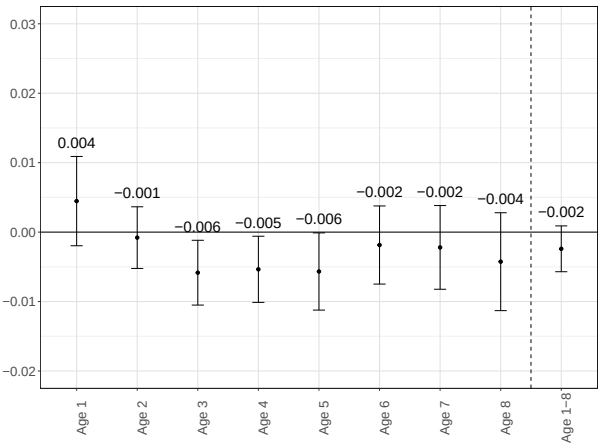
(a) Infections



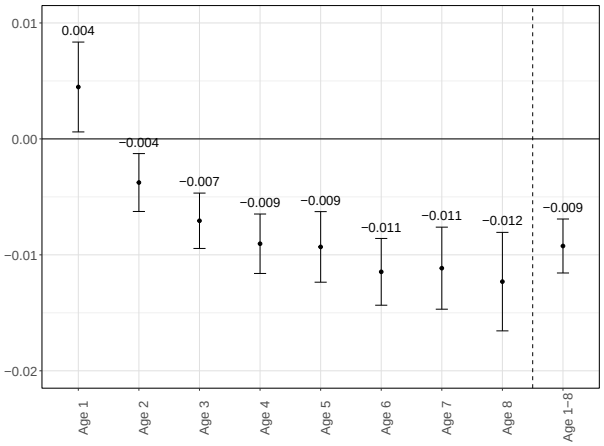
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

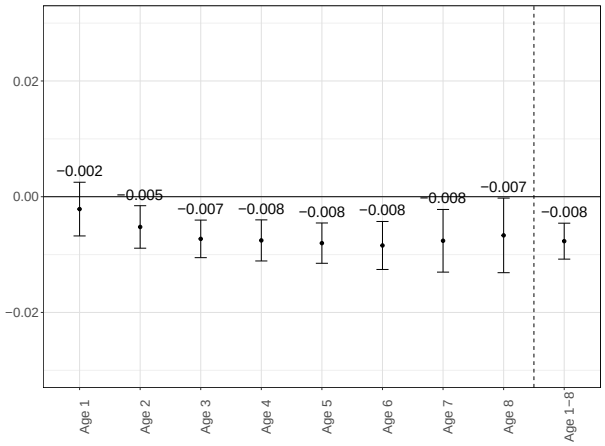
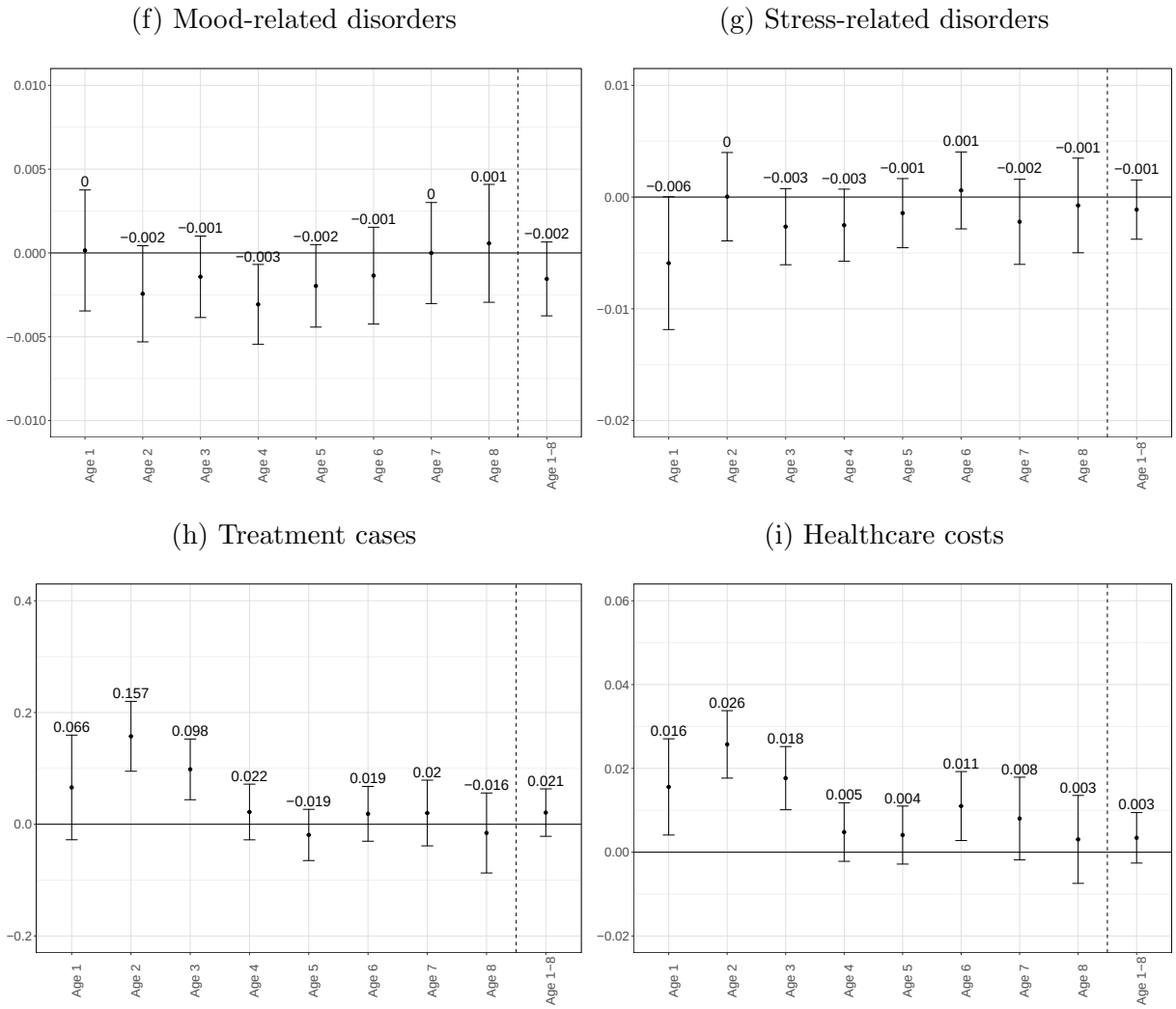


Figure 3: Effect of the childcare expansion on maternal health outcomes (*continued*)



Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1). The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Barro, 1988, Doepke et al., 2019), shifting time to more enjoyable activities, or, if joining the labour force, fulfilling career aspirations (Carr, 1997), widening the family network by interacting with colleagues (Holt-Lunstad, 2022), and raising mothers' earnings and influence within the household (Sandner et al., 2022). Compared to our null effects, studies in the US and Canada (Baker et al., 2008, Haeck et al., 2022, Herbst & Tekin, 2014) indicated short-term detrimental effects on maternal mental health, although these effects vanished when children reached age five. However, these studies are not directly comparable to ours due to differences in childcare policies, data sources, and identification strategies.

Healthcare consumption

Lastly, the childcare expansion increases treatment cases for mothers when their focal child is younger, in particular at ages two and three. A 10pp rise in childcare coverage rate leads to 0.16 and 0.10 more treatment cases (or 1.7% and 1% more compared to sample means) at ages two and three, respectively. The significance of the results diminishes for older ages and aggregated ages 1–8. The estimates for healthcare costs reveal a similar trend: positive for 1–3-year-olds (1.6–2.6% more) but generally insignificant for older ages and aggregated ages 1–8. More treatment cases and healthcare costs at early ages could be interpreted as a decline in maternal health potentially due to the increase in communicable diseases, which require more intensive use of primary care resources than non-communicable diseases (Finley et al., 2018, ZI, 2015). This interpretation aligns with findings in maternal overall health status from Herbst & Tekin (2014) in the US, but contrasts with the null effects from Baker et al. (2008) and Haeck et al. (2022) in Canada. Moreover, Barschkett (2022) shows an increase in treatment cases for children at early childcare ages, followed by a decrease at older ages. Given that German women experience the primary responsibility for family obligations such as childcare (EIGE, 2021), Barschkett (2022)'s and our findings suggest an intensification of family workload along with own sickness, particularly during the early years of motherhood. Our results could also imply a different time constraint when employed, revealing that mothers may seek more healthcare services even for less severe illnesses to obtain a doctor's note to be absent from the workplace and care for their sick child. These interpretations might explain the work-family conflicts that working mothers face, which are in turn associated with worse health (Bianchi & Milkie, 2010, Nilsen et al., 2017). Alternatively, more treatment cases and healthcare costs could indicate a higher usage of preventive care, reflecting a change in maternal healthy behaviour.

5.2 Robustness Checks

We perform several checks to validate the robustness of our findings against potential biases arising from choices made in model specification and sample selection. Overall, the estimates across the different sensitivity analyses align closely with our baseline results.

Identifying assumptions

To further validate the assumptions underlying our identification strategy, we conduct additional tests on the exogeneity of the childcare expansion and the threat of selective migration.

State-level policies. Most recent family policies in Germany have been implemented at the federal or state level. While federal-level policies are accounted for using birth cohort and year

fixed effects, contemporaneous state-level policies might introduce bias if they coincided with the childcare expansion and impacted maternal health. Figure B.1 illustrates that our main findings for ear diseases, anaemia, mental health disorders, and treatment cases are broadly robust to adding state-year fixed effects, which control for state-level policies. Given that state-year fixed effects capture a significant portion of the variation in county-level childcare coverage rates, the statistical significance of the results diminishes for infections when the focal child is aged 1–2, respiratory diseases at age five, and obesity and healthcare costs at age one. The remaining age-specific and aggregated estimates for these conditions, however, align with our main results.

County characteristics and childcare quality. Certain time-variant county characteristics may have influenced the pace of the childcare expansion and affected the overall population health, including maternal health. Although having parallel pre-reform trends (see Figure A.4), we now examine various county characteristics such as economic and political indicators, demographic factors, and childcare measures, and regress them against childcare coverage rates, controlling for county and year fixed effects. The estimates in Table B.1 indicate that the childcare coverage rate predicts the share of conservative votes and migrants, population inflow and outflow, life expectancy, population density, the percentage of population aged between 30 and 50, total and women employment and unemployment rates (as observed by Müller & Wrohlich (2020) and Huber & Rolvering (2023)), and fertility rate (as found by Bauernschuster et al. (2016)). Moreover, Table B.1 reveals that the childcare expansion led to an increase in childcare centres, reflecting the construction of new facilities and the expansion of existing ones to accommodate the additional supply of childcare slots. Instead, there is no statistically significant association between childcare coverage rates and childcare quality, as measured by the ratio of childcare slots to teaching staff. This minimises potential biases in our estimates arising from changes in childcare quality due to the childcare expansion. Given the mixed findings in Table B.1, we add county characteristics as control variables in our analysis and show that the baseline results are similar to the estimates of this alternative specification in Figure B.2.

Selective migration. Our estimates would be biased if families (or mothers) relocated across counties where more childcare slots were supplied, and if this migration was correlated with maternal health. To address this concern, in Figure B.3, we exclude all mothers who moved across counties when the focal child may have attended childcare (i.e., aged 0–2). The results after excluding movers remain similar to the baseline results, despite some being slightly less precisely estimated.

First-time mothers

Our sample consists of mothers aged 15–49 and born in 1961–2003 who gave birth to their focal child in 2010–2018. The underlying assumption in our model is that the first observed births in our sample period represent the first actual births of the mothers under study. That is, we assume these mothers were first exposed to formal childcare when the focal child was aged 1–2 in 2011–2019. However, some of these mothers might indeed have given birth before 2010 and been exposed to formal childcare prior to 2011.

We rerun our main specification for a subsample of "real" first-time mothers who gave birth in 2010–2018 and exclude mothers who might have given birth before 2010. This selection process involved three steps. We first calculate the total number of children per mother using our data on all births from 2010 to 2022. We then compute the percentage of mothers within our sample with one, two, and three or more children per mother's birth cohort (i.e., 1961–2003). Second, we consider the national statistics of the number of women with zero, one, two, and three or more children per women's birth cohort published by the German Statistical Office (2023b) and calculate the percentage of mothers in Germany with one, two, and three or more children in 2022 per mother's birth cohort. To identify potential cases where mothers might have given birth before 2010, we mimic the national percentage distribution within our sample. This involved random assignments of mothers to either have more children born before 2010 or maintain their existing number of children. For example, the national percentage of mothers born in 1982 with one, two, and three or more children is 27.8%, 48.8%, and 23.4%, respectively. In our sample, the corresponding percentages are 56.7%, 36.8%, and 6.5%, respectively. To align our data with the national statistics, we randomly assign mothers with one child in our sample to have two children (one born before 2010) until we reach 27.8%. We then repeat this procedure for the percentage of mothers with two and three or more children. That is, among mothers who have two or more children, the national percentage of mothers born in 1982 with two and three or more children is 67.7% and 32.4%, respectively, and the percentage in our sample is 84.9% and 15.1%, respectively. To match with the national percentages, we randomly assign mothers with two children in our sample to have three or more children until our sample mirrored the national proportions of 67.7% among mothers with two or more children, or 48.8% among all mothers. We repeat this process for all mother's birth cohorts.[17]

[17]The national statistics provide information on the number of women with zero, one, two, and three or more children for women born from 1947 to 1992. Given that our mothers were born between 1961 and 2003, we apply a linear extrapolation for cohorts born in 1993–1995. For cohorts born in 1996 and later, we instead assume that the percentage of mothers in our sample with one, two, and three or more children closely resembles the national percentages since these mothers were younger than 15 in 2010 being unlikely that they had given birth to more children before 2010.

We show that the results are robust to excluding mothers who potentially had given birth before 2010 in Figure B.4. In Figure B.5, we substitute the number of children per mother between 2010 and 2019 with the control variable encompassing the number of children born before 2010 and up to 2022, and show that the estimates are fairly consistent with the main results.

Additional checks

Multiple hypotheses testing. Given the large number of health outcomes in this study, we adjust p-values (q-values) for multiple hypotheses testing following Benjamini & Hochberg (1995) and Anderson (2008) to control for the false discovery rate (i.e., the expected proportion of null hypotheses rejected that are type I errors).[18] The results are presented in Table B.2, which displays the coefficients of the main findings alongside the corresponding q-values. Notably, the statistical significance of our main estimates remained unchanged after the adjustment of p-values for multiple hypotheses testing.

Extensive/Intensive margin measures. In our main specification, we count the number of diagnoses for communicable diseases and anaemia (intensive margin measures), while we use a binary indicator for the prevalence of obesity and mental health disorders (extensive margin measures). In Figure B.6, we switch definitions and investigate the extensive margin for communicable diseases and anaemia and the intensive margin for obesity and mental health disorders. The direction and statistical significance of the effects are very similar to the main results. For infections and respiratory diseases, the childcare expansion increases their prevalence when the focal child is one to two years old and when aggregating ages 1–8. Instead, the effects on the prevalence of infections and respiratory diseases for older ages and of ear diseases for any age group are no longer statistically significant. The estimates for non-communicable diseases are in line with our main results, revealing an increase in the number of diagnoses of obesity when the focal child is aged one and a subsequent decrease in obesity and the prevalence of anaemia from age two and aggregated ages. Finally, the findings for the number of diagnoses for mood-related disorders align with our estimates, while the childcare expansion decreases the number of diagnoses for stress-related disorders for ages 3–4 and aggregated ages 1–8.

5.3 Heterogeneity Analysis

To explore the nuanced impact of the childcare expansion on mothers with diverse characteristics, we conduct heterogeneity analyses. At the individual level, our dataset allows the differentiation

[18] Q-values are calculated within age groups and two families of outcomes: 1) *physical and mental health*, and 2) *healthcare consumption*.

of mothers based on the number of children they have and the age at which they had their focal child.[19] This analysis enables us to unravel variations in the effects of childcare availability, providing insights into how maternal experiences differ based on family size and the timing of childbirth.

Number of children. To investigate variations in the impact of the childcare expansion on maternal health, we stratify our sample based on the number of children per mother. Specifically, we distinguish between mothers with a single child (i.e., the focal child) and those with more than one child, utilising the variable encompassing children born before 2010 (see Section 5.2) and up to 2022. Focusing solely on children born after 2010 introduces variation in the number of siblings only from the age of two, as it comprises only children born subsequent to the presumed firstborn (i.e., the focal child).[20]

Figure C.1 illustrates that, across nearly all outcomes, the effects are more pronounced for mothers with multiple children. Although the estimates for infections are similar for both groups, multiparous mothers experience reductions in respiratory and ear diseases when their focal child is aged three to five. Mothers with two or more children, whose focal child born during the observation period is 3–5 years, likely had the siblings of the focal child before 2010. Hence, this divergence may be attributed to the fact that these mothers likely have no young child (1–2 years old) attending childcare. Consequently, mothers in this group encounter fewer respiratory and ear diseases than the comparison group where the focal child starts childcare at age three. Notably, effects on obesity and anaemia are slightly larger and more persistent for multiparous mothers. Despite overall null effects, mothers with two or more children exhibit improved mental health in terms of mood-related disorders when their focal child born after 2010 is aged 2–6 and stress-related disorders at ages 3–5 and seven. These positive effects for multiparous mothers may be attributed to the growing challenge of reconciling family-care duties, work, and leisure time with an increasing number of young children. Childcare availability may facilitate this balance, alleviating stress. Regarding healthcare consumption, results are comparable across the two groups, with more persistent effects for mothers with a single child, although effect sizes are larger for multiparous mothers.

Maternal age at first birth. Subsequently, we investigate whether the impact of childcare availability varies based on maternal age at the time of first (focal) childbirth. To conduct this

[19] Moreover, we extend our heterogeneity analysis to the county level, examining dimensions that characterise socio-economic status (SES). However, the outcomes do not indicate heterogeneity across mothers from lower and higher SES areas. Results are available upon request.

[20] When employing the variable exclusively considering the number of children born after 2010, findings from age two are very similar.

analysis, we focus on mothers without prior children before the focal child. The inclusion of all mothers in the analysis would hinder the isolation of the effect of maternal age, as the age at first birth and the presence of earlier births are inherently correlated. The sample is divided at the median age (29 years) at birth of the focal child, generating distinct subsets of "young" mothers (below the median age) and "old" mothers (equal to or above the median age).[21]

As depicted in Figure C.2, outcomes predominantly exhibit higher statistical significance and more substantial effects for older mothers. While positive effects on infections extend up to age four for younger mothers, older mothers manifest a reduction in respiratory diseases when their focal child is aged three and four, indicating that older mothers derive greater benefits from childcare availability. Similarly, the impact on obesity and anaemia is more pronounced for older mothers. Furthermore, older mothers experience an improvement in mental health disorders. In particular, the prevalence of mood-related disorders (stress-related disorders) decreases when their focal child is aged 3–5 (one and three). The advantageous effects, particularly for older mothers, may be attributed to the increasing challenges of childbearing with advancing age, resulting in greater relief facilitated by childcare. Additionally, women who opt for childbearing at older ages are on average more educated and may be more oriented toward their careers, implying a disproportionate benefit from childcare in reconciling career aspirations and family obligations. Furthermore, Jessen et al. (2020) showed that children below three are more likely to attend childcare when their parents are highly educated, implying that the beneficial effects for older, and potentially more educated, mothers might stem from a higher take-up rate. Notably, older mothers exhibit higher healthcare consumption, evidenced by more treatment cases and healthcare costs compared to their younger counterparts.

6 Conclusion

This paper provides novel insights into the causal effects of a large-scale public childcare expansion for children below three on maternal health. For identification, we exploit temporal and spatial variation in the childcare expansion speed across West German counties in a two-way fixed effects approach. Our results show that mothers with higher exposure to the childcare expansion exhibit an increased susceptibility to infections (3.9–8% more diagnoses for a 10pp rise in childcare coverage rates) and respiratory diseases (1.5–3.9% more diagnoses) when their child is aged 1–2. While children who commence childcare before the age of three witness a decline in communicable diseases during their elementary school years compared to their non-

[21] The median maternal age at first birth in our restricted sample (29) is similar to the national statistics in Germany: 28.9 in 2010, 29.5 in 2014, and 30.1 in 2019 (German Statistical Office, 2023a).

childcare counterparts (Barschkett, 2022), these effects wane for mothers. Similar patterns are visible for healthcare consumption. Conversely, mothers more exposed to the childcare expansion experience sustained, long-term reductions in obesity (7-–10.9% lower prevalence) and anaemia (5–7.3% fewer diagnoses). Furthermore, heterogeneity analysis reveals that mothers with more than one child and those above the median age at the birth of their first child benefit from the childcare expansion in terms of mental health, encountering a reduction in mood- and stress-related disorders. The results are robust to extensive robustness checks.

The implications of our findings extend beyond the immediate health impacts on mothers and shed light on the broader dynamics within families. The rise in communicable diseases and healthcare consumption, particularly during the first two years of childcare attendance, presents a notable challenge to maternal productivity. Nevertheless, our results also reveal positive effects on maternal health, specifically reductions in obesity and anaemia, along with enhanced mental health for specific subgroups. Recognising the pivotal role of maternal health in shaping the family environment, these shifts could reverberate throughout the household. While immediate challenges arising from increased infectious illness burdens for both children and mothers could pose difficulties for the entire family in the first years of childcare attendance, the unintended yet advantageous improvements in other health dimensions, coupled with the broader societal benefits of the expansion —such as increased labor market participation (Huber & Rolvering, 2023, Müller & Wrohlich, 2020) and fertility rates (Bauernschuster et al., 2016), and reduced child maltreatment (Sandner et al., 2022)—, underscore the expansion's significance and positive societal impact.

Our findings present valuable insights for crafting policy initiatives to enhance maternal health and, consequently, the overall well-being of families especially those with young children in childcare. To address the observed challenges in reconciling work, childcare, and illness burdens, policymakers may consider implementing generous sick leave policies tailored to families with young children in childcare, offering flexibility, including the option to work from home. Additionally, launching targeted campaigns promoting hygiene practices both at home and in childcare facilities emerges as a proactive strategy to combat and prevent the transmission of communicable diseases, ultimately benefiting child and maternal health. Our results provide evidence that particularly mothers with multiple children benefit from childcare. Given that demand for childcare still exceeds the supply (Müller & Wrohlich, 2016), a potential policy consideration could be prioritising families with multiple children in slot allocation. However, the primary focus of policymakers should remain on expanding childcare slots to a level where such prioritisation measures become unnecessary.

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Appendices

A Empirical Strategy

Table A.1: Effect of the childcare expansion on childcare coverage rates

	Dependent variable:	
	Childcare coverage rates	
	(1)	(2)
Treat	-0.774^{*}	
	(0.359)	
Post	16.557^{***}	
	(0.273)	
Treat × Post	2.371^{***}	2.371^{***}
	(0.369)	(0.369)
County FE	No	Yes
Time FE	No	Yes
Observations	5,508	5,508

Note: $^{+}$p<0.1; *p<0.05; **p<0.01; ***p<0.001. Estimates of linear regressions of childcare coverage rates against the interaction between *Treat* and *Post* variables. Column (1) controls for *Treat* and *Post* variables and column (2) controls for county and year fixed effects (FE). *Treat* is a binary variable equal to one for counties with an increase in childcare coverage rates between 2011 and 2014 above the median (treatment group), and zero for counties with an increase below the median (control group). *Post* is a binary variable equal to one for post-reform years 2011-2019, and zero for pre-reform years 1994-2010. Robust standard errors clustered at county-level in parentheses. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019), own calculations.

Figure A.1: Trends of maternal health outcomes in treatment and control groups

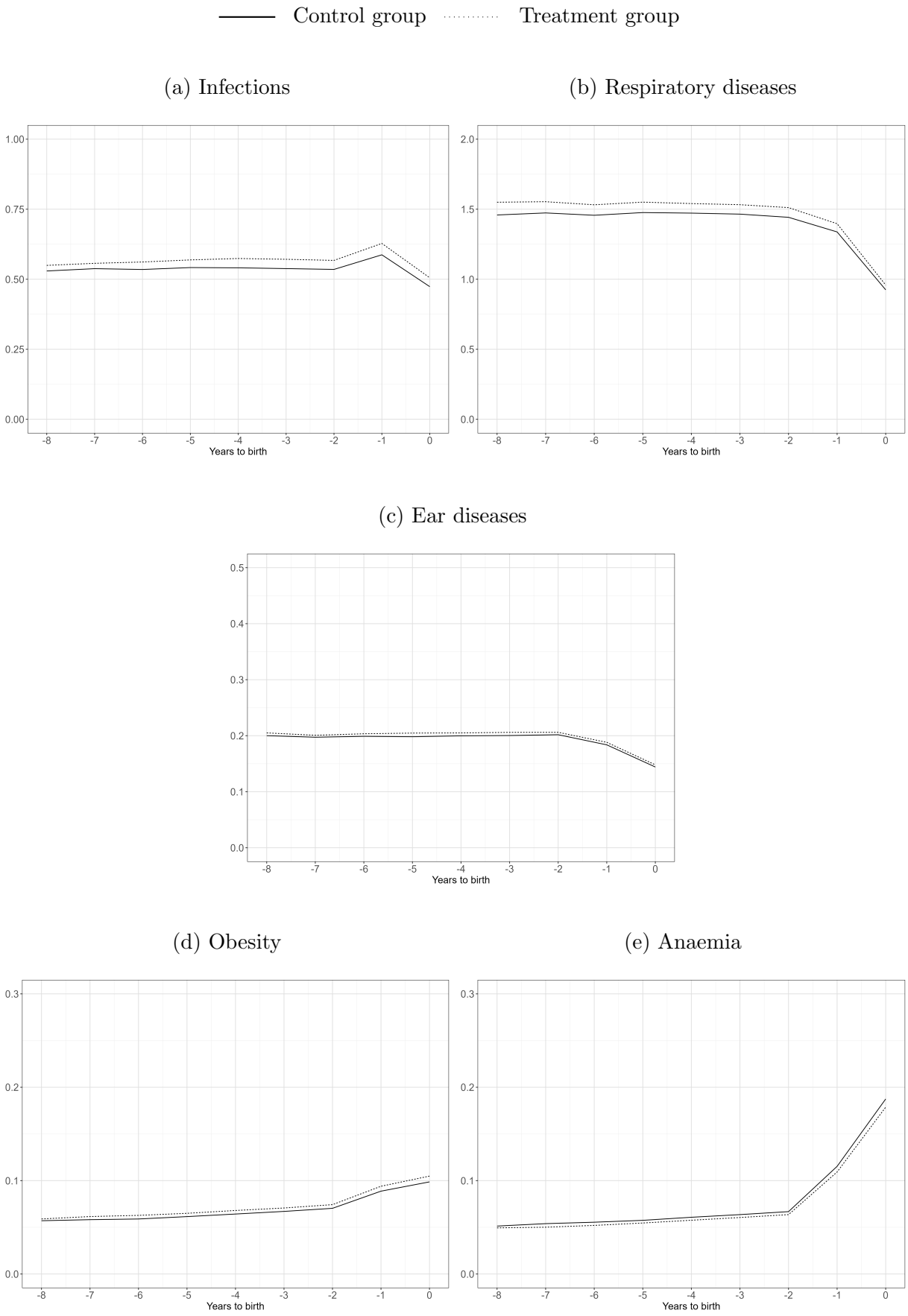
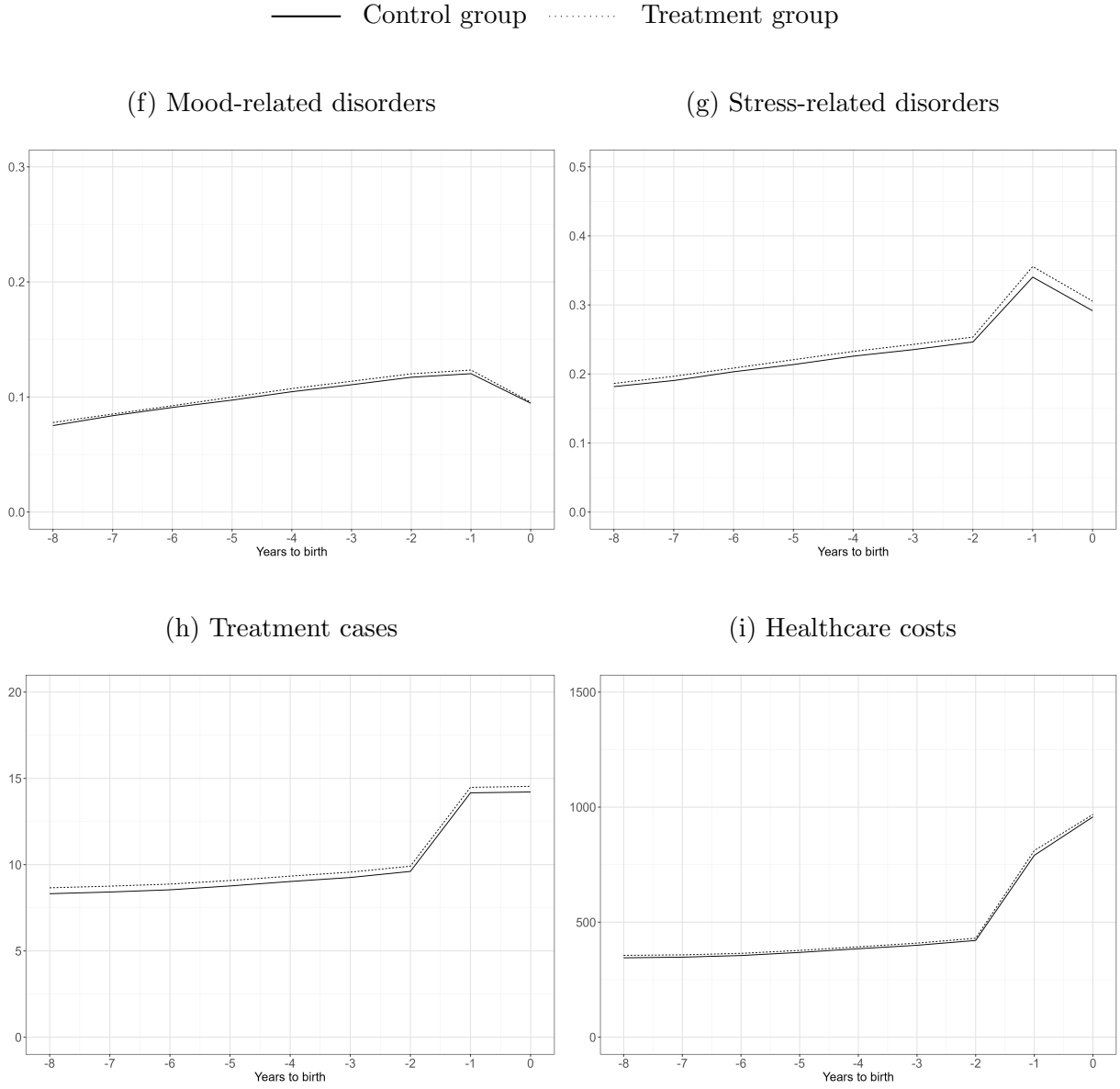
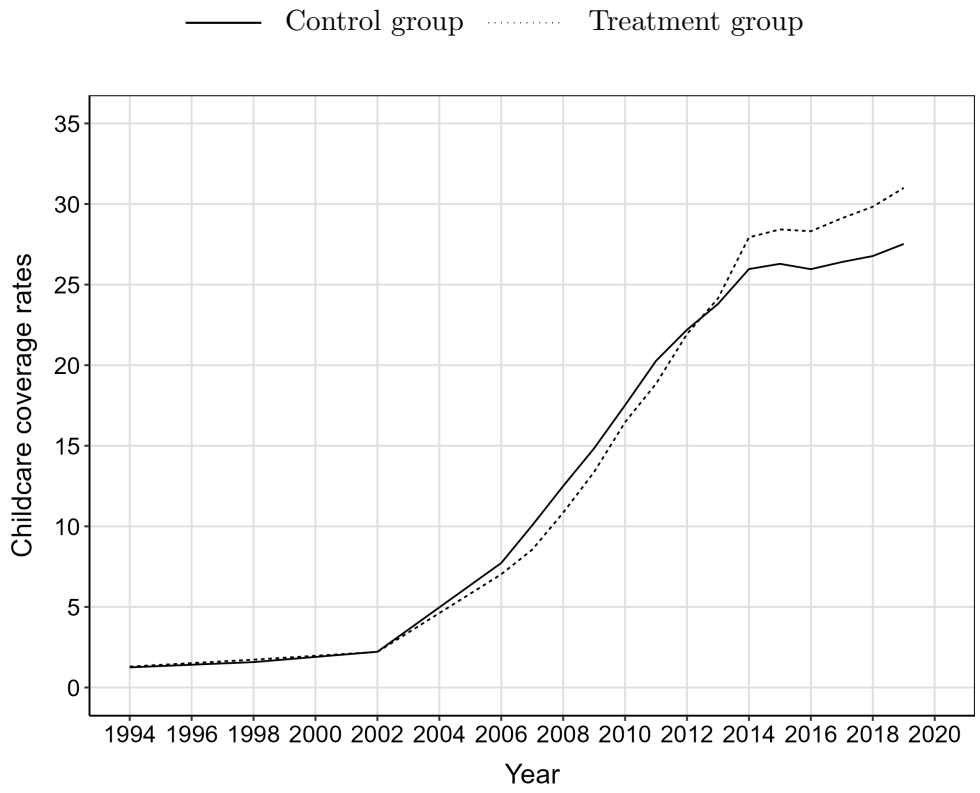


Figure A.1: Trends of maternal health outcomes in treatment and control groups (*continued*)



Note: Trends of maternal health outcomes before giving birth to their focal child in treatment and control groups. Treatment group (dotted line) includes counties with an increase in childcare coverage rates between 2011 and 2014 above the median and control group (solid line) includes counties with an increase below the median. The x-axis refers to the years to birth of the focal child. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes, own calculations.

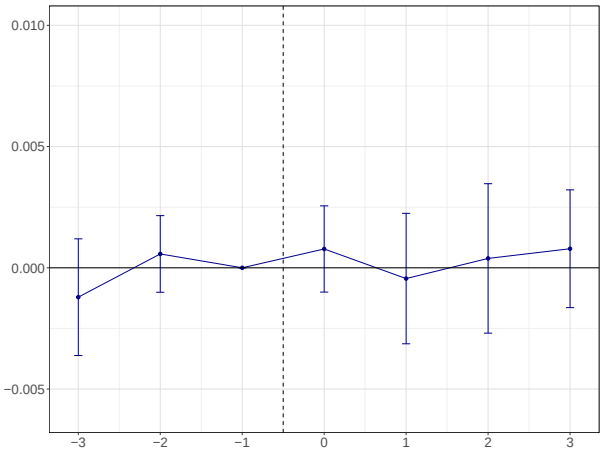
Figure A.2: Trends of childcare coverage rates in treatment and control groups



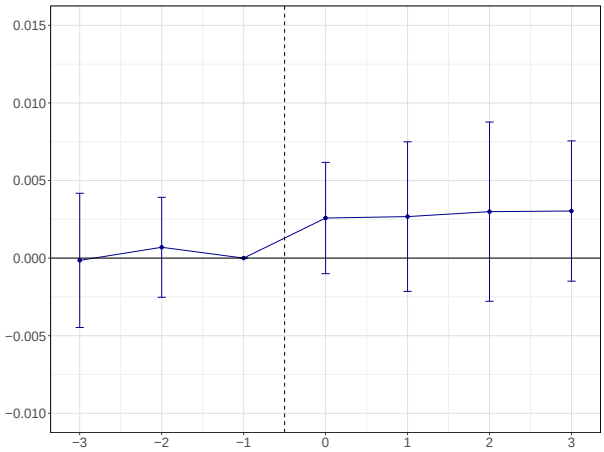
Note: Trends of childcare coverage rates in treatment and control groups between 1994 and 2019. Treatment group (dotted line) includes counties with an increase in childcare coverage rates between 2011 and 2014 above the median and control group (solid line) includes counties with an increase below the median. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019), own calculations.

Figure A.3: Effect of the childcare expansion on maternal health outcomes when the focal child is aged two with leads and lags

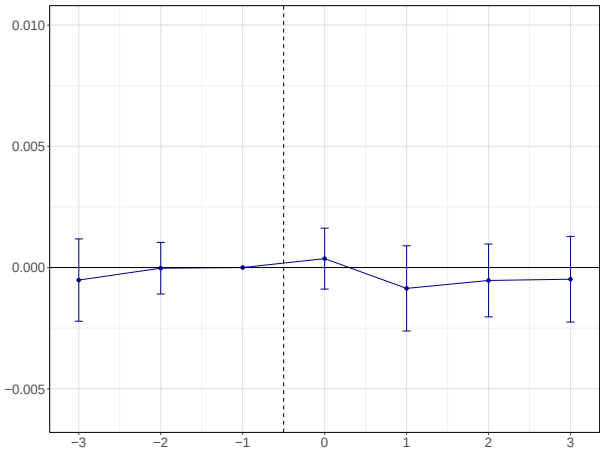
(a) Infections



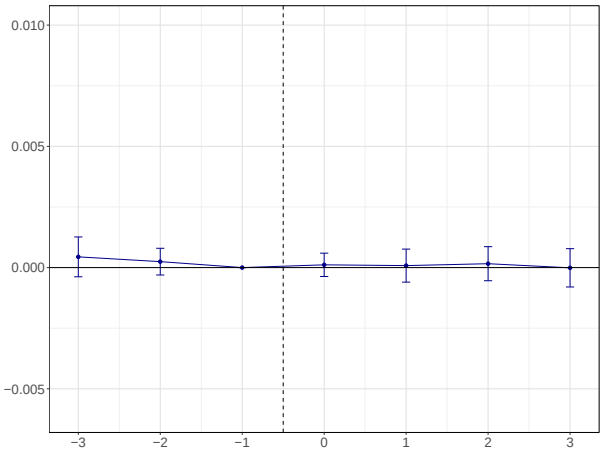
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

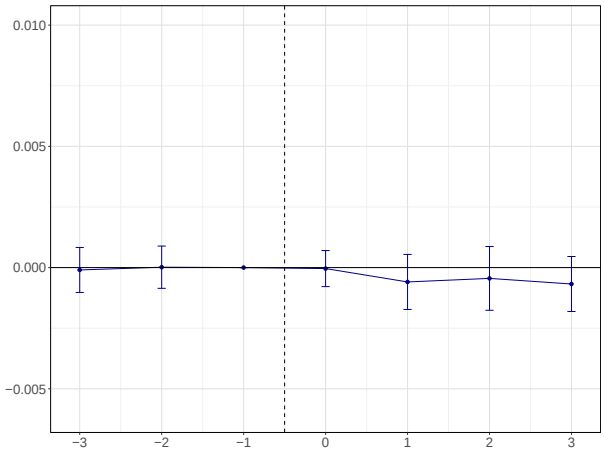
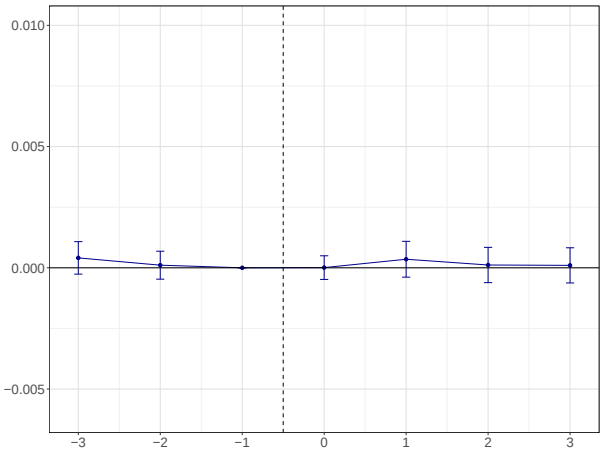
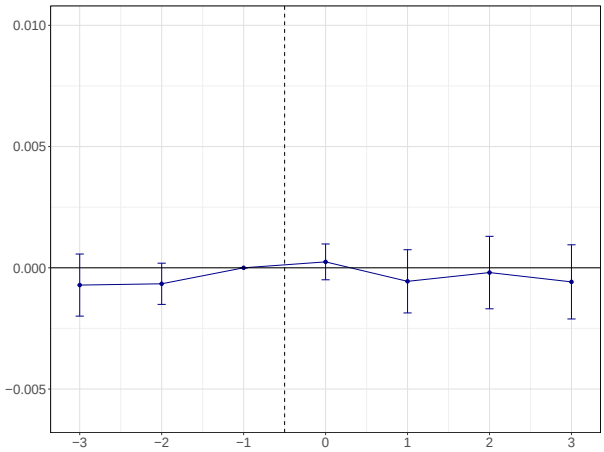


Figure A.3: Effect of the childcare expansion on maternal health outcomes when the focal child is aged two with leads and lags (*continued*)

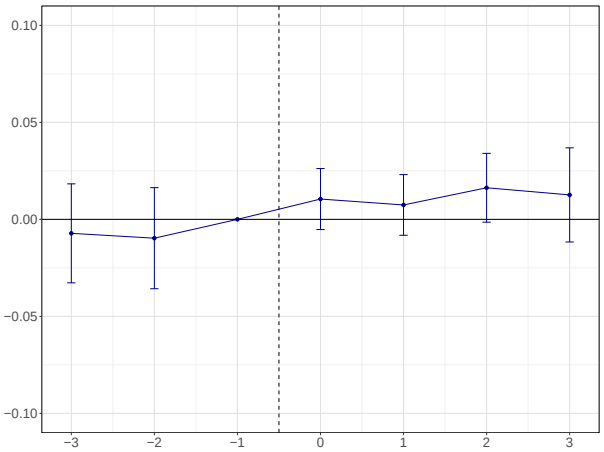
(f) Mood-related disorders



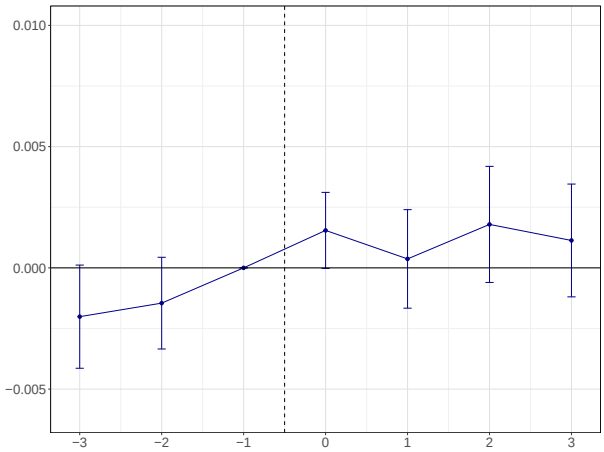
(g) Stress-related disorders



(h) Treatment cases



(i) Healthcare costs

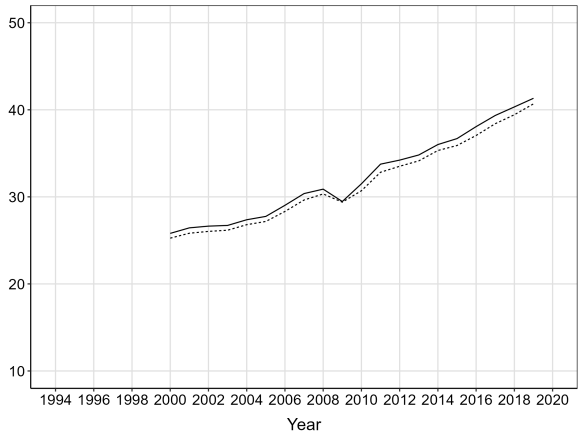


Note: Estimates of the effects of the childcare expansion on health outcomes for mothers with a 2-year-old focal child recovered from equation (2) with leads and lags of childcare coverage rates, following Schmidheiny & Siegloch (2023). The graphs plot the effect of a 1pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

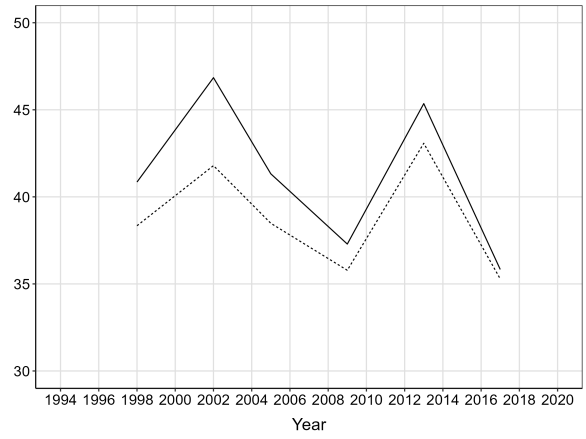
Figure A.4: Trends of county characteristics in treatment and control groups

Control group Treatment group

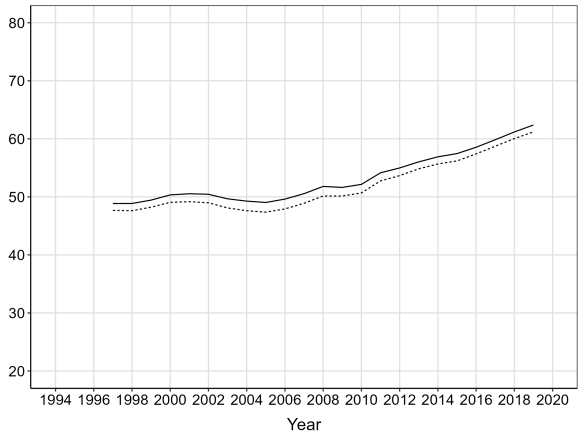
(a) GDP per capita



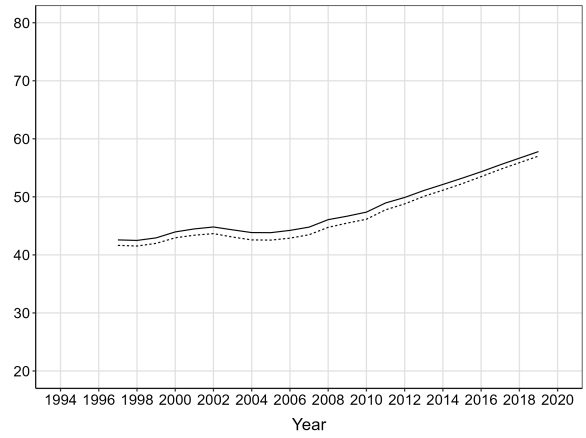
(b) Share of conservative votes



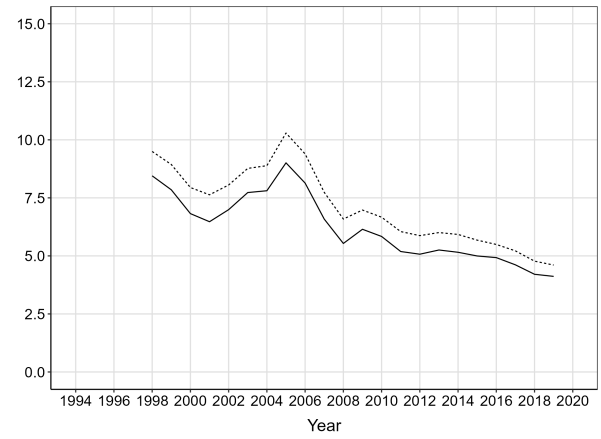
(c) Total employment rate



(d) Women employment rate



(e) Total unemployment rate



(f) Women unemployment rate

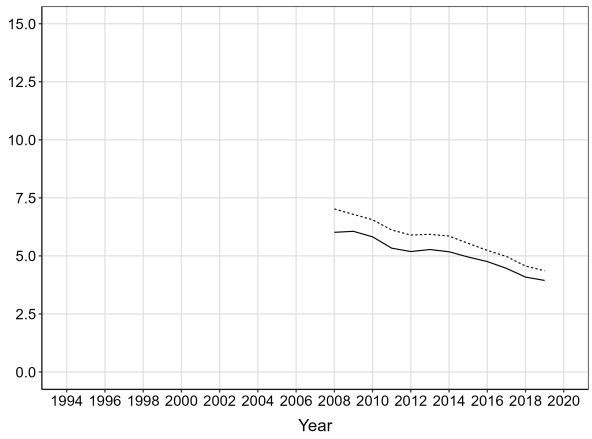
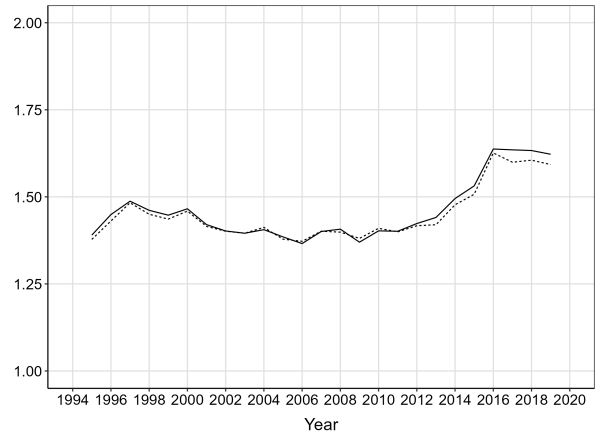


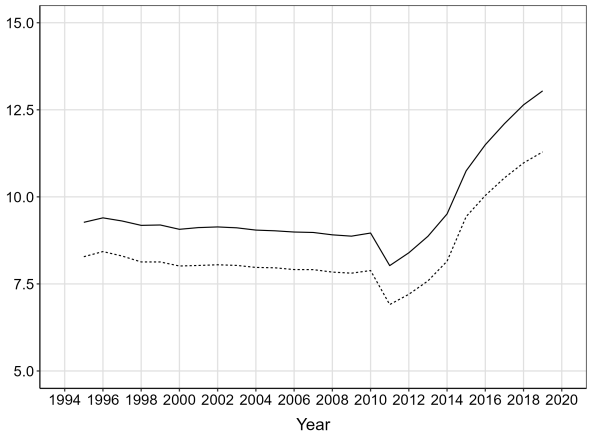
Figure A.4: Trends of county characteristics in treatment and control groups (*continued*)

Control group Treatment group

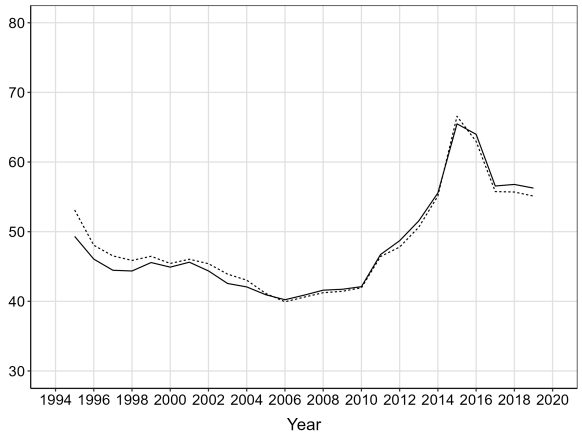
(g) Fertility rate



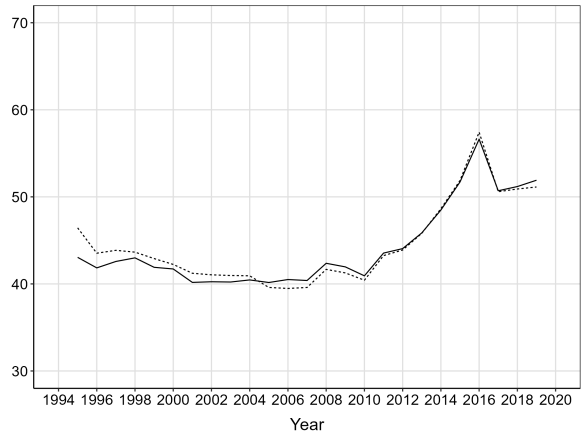
(h) Share of migrants



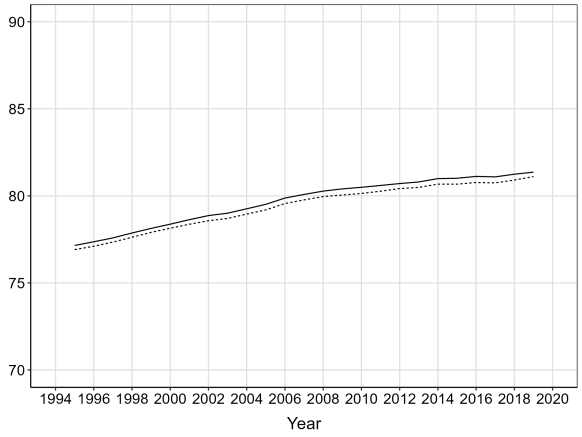
(i) Inflow of population into counties



(j) Outflow of population into counties



(k) Life expectancy



(l) Population density

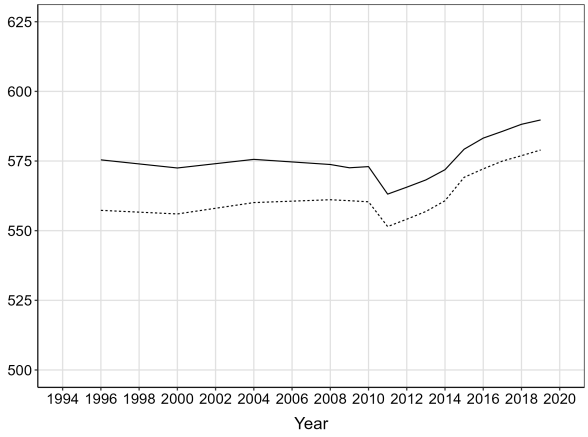
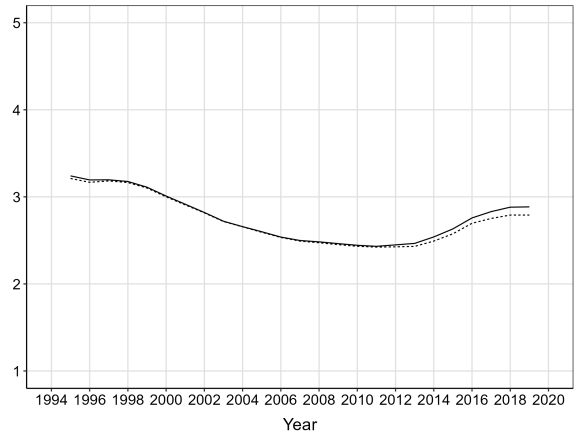


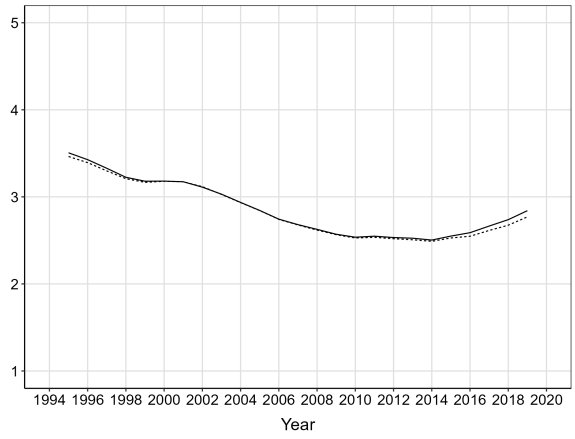
Figure A.4: Trends of county characteristics in treatment and control groups (*continued*)

Control group Treatment group

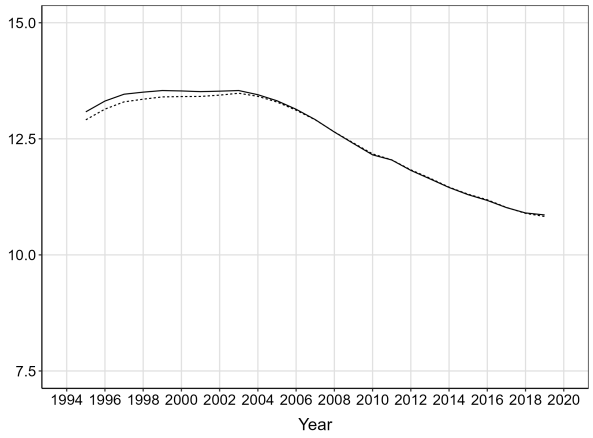
(m) % Population under age 3



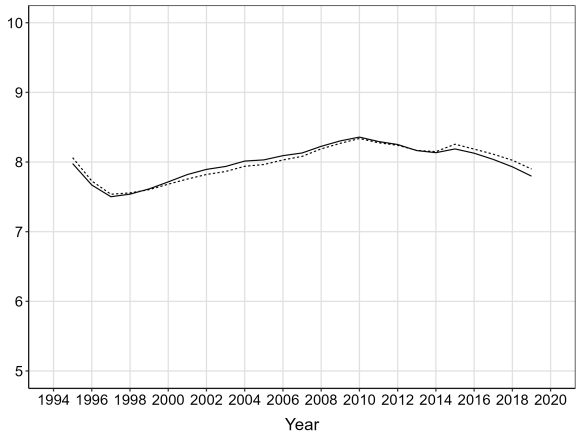
(n) % Population aged between 3 and 6



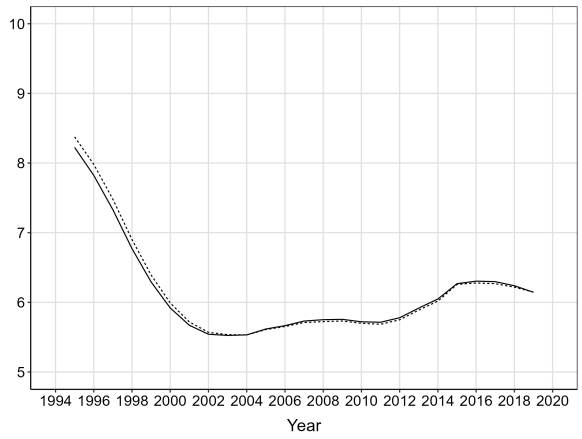
(o) % Population aged between 6 and 18



(p) % Population aged between 18 and 25



(q) % Population aged between 25 and 30



(r) % Population aged between 30 and 50

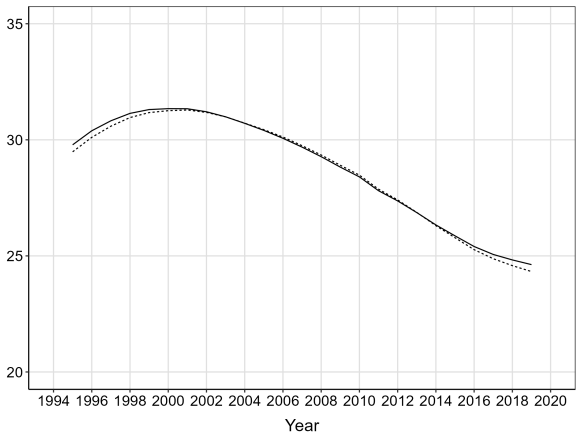
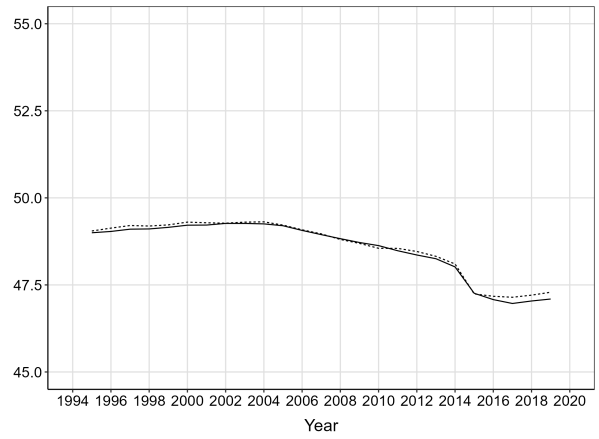


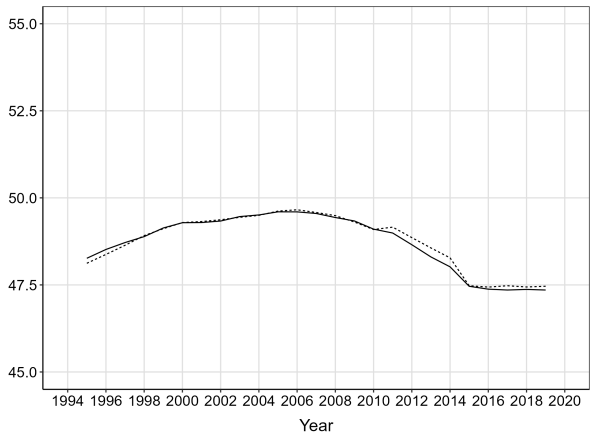
Figure A.4: Trends of county characteristics in treatment and control groups (*continued*)

Control group Treatment group

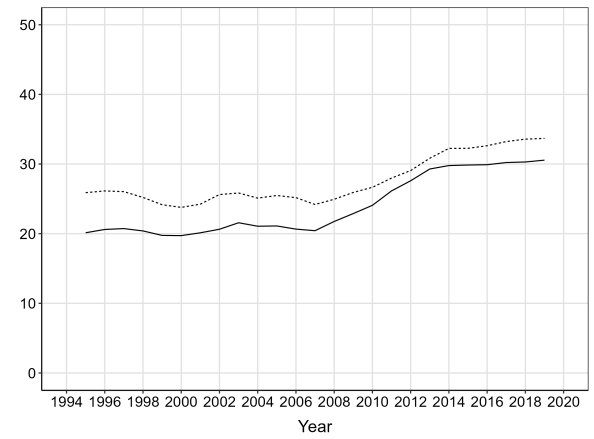
(s) % Women aged between 18 and 25



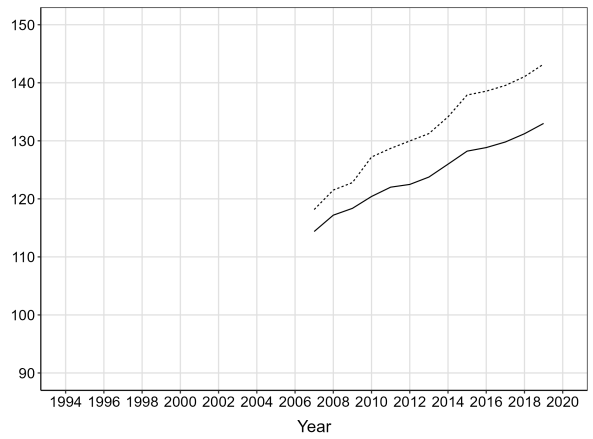
(t) % Women aged between 25 and 30



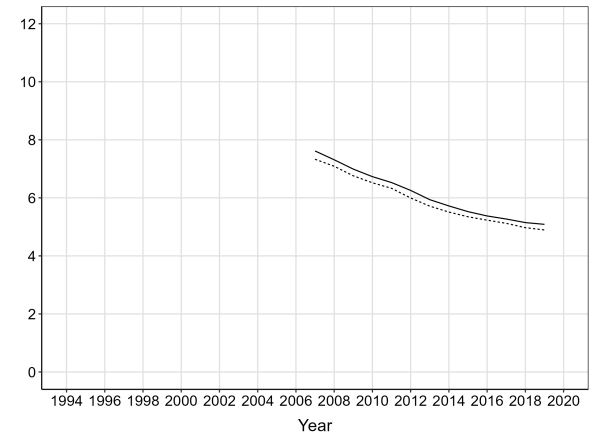
(u) Students aged between 18 and 25



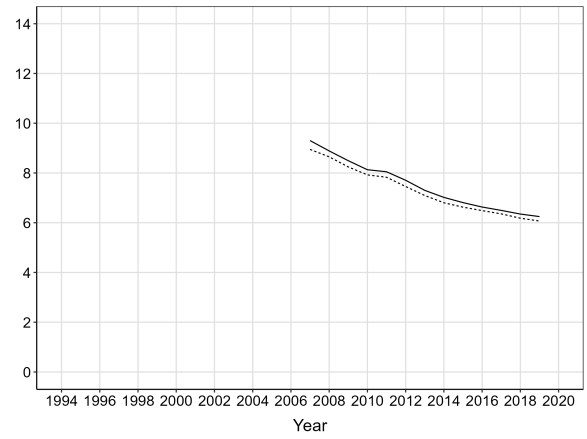
(v) Childcare centres



(w) Childcare slots to total staff



(x) Childcare slots to teaching staff



Note: Trends of county characteristics in treatment and control groups between 1995 and 2019. Treatment group (dotted line) includes counties with an increase in childcare coverage rates between 2011 and 2014 above the median and control group (solid line) includes counties with an increase below the median. *Source*: INKAR (1995–2019) and German Statistical Office (2007–2019) for county characteristics, and German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, own calculations.

B Robustness Checks

Table B.1: Effect of childcare coverage rates on county characteristics

	GDP per capita	Share of conservatives votes	Total employment rate	Women employment rate	Total unemployment rate	Women unemployment rate	Fertility rate	Share of migrants
CC	−0.048	0.089*	0.029+	0.041*	−0.038***	−0.030***	0.001*	−0.034***
	(0.037)	(0.044)	(0.017)	(0.018)	(0.009)	(0.007)	(0.001)	(0.010)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,480	1,944	7,452	7,452	7,128	3,888	8,100	8,100
	Inflow of population into counties	Outflow of population into counties	Life expectancy	Population density	% Population under 3	% Population aged between 3 and 6	% Population aged between 6 and 18	% Population aged between 18 and 25
CC	−0.286**	−0.217*	0.015***	1.312**	−0.003	−0.002	−0.010	0.007
	(0.095)	(0.090)	(0.003)	(0.450)	(0.002)	(0.002)	(0.007)	(0.006)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,100	8,100	8,100	4,860	8,100	8,100	8,100	8,100
	% Population aged between 25 and 30	% Population aged between 30 and 50	% Women population aged between 18 and 25	% Women population aged between 25 and 30	Students per 100 individuals aged between 18 and 25	Childcare centres	Children slots to total staff	Childcare slots to teaching staff
CC	−0.006	−0.066***	0.004	0.005	−0.302+	0.819**	0.012*	0.009
	(0.005)	(0.008)	(0.011)	(0.010)	(0.177)	(0.268)	(0.005)	(0.006)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,100	8,100	8,100	8,100	8,100	4,199	4,199	4,199

Note: +p<0.1; *p<0.05; **p<0.01; ***p<0.001. Estimates of linear regressions of county characteristics against childcare coverage rates (CC) controlling for county and year fixed effects (FE). Robust standard errors clustered at county-level in parentheses. Data of childcare coverage rates are available for 1994, 1998, 2002 and 2006–2019. Linear interpolations between 1994 and 1998, 1998 and 2002, and 2002 and 2006 have been calculated. *Source*: INKAR (1995–2019) and German Statistical Office (2007–2019) for county characteristics, and German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, own calculations.

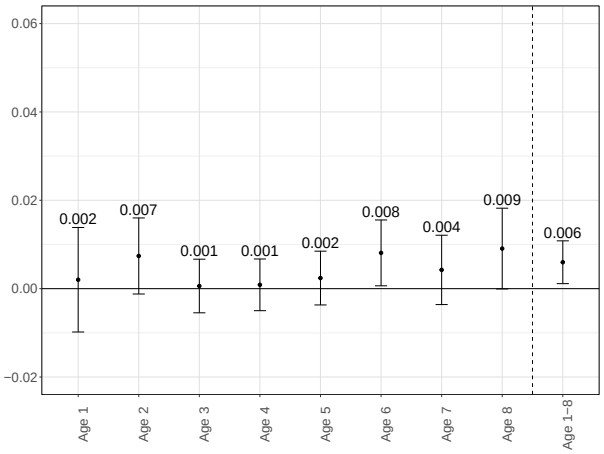
Table B.2: Effect of the childcare expansion on maternal health outcomes adjusting p-values for multiple hypotheses testing

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Ages 1-8
Infections	0.032***	0.018***	0.006	0.005	0.004	0.008+	0.004	0.010+	0.007**
	(0.000)	(0.000)	(0.134)	(0.142)	(0.283)	(0.084)	(0.473)	(0.098)	(0.004)
Respiratory diseases	0.041***	0.029***	-0.005	-0.019*	-0.016+	-0.006	0.001	-0.004	-0.002
	(0.000)	(0.000)	(0.557)	(0.032)	(0.074)	(0.570)	(0.997)	(0.763)	(0.757)
Ear diseases	0.004	-0.001	-0.006*	-0.005*	-0.006+	-0.002	-0.002	-0.004	-0.002
	(0.244)	(0.863)	(0.033)	(0.038)	(0.079)	(0.616)	(0.677)	(0.418)	(0.236)
Obesity	0.004+	-0.004**	-0.007***	-0.009***	-0.009***	-0.011***	-0.011***	-0.012***	-0.009***
	(0.054)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Anaemia	-0.002	-0.005**	-0.007***	-0.008***	-0.008***	-0.008***	-0.008*	-0.007+	-0.008***
	(0.434)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)	(0.021)	(0.098)	(0.000)
Mood-related disorders	0.000	-0.002	-0.001	-0.003*	-0.002	-0.001	0.000	0.001	-0.002
	(0.941)	(0.134)	(0.296)	(0.027)	(0.164)	(0.570)	(0.997)	(0.763)	(0.236)
Stress-related disorders	-0.006+	0.000	-0.003	-0.003	-0.001	0.001	-0.002	-0.001	-0.001
	(0.089)	(0.989)	(0.178)	(0.142)	(0.368)	(0.748)	(0.473)	(0.763)	(0.483)
Treatment cases	0.066	0.157***	0.098***	0.022	-0.017	0.019	0.020	-0.016	0.021
	(0.169)	(0.000)	(0.000)	(0.396)	(0.421)	(0.465)	(0.513)	(0.682)	(0.340)
Healthcare costs	0.016*	0.026***	0.018***	0.005	0.004	0.011*	0.008	0.003	0.003
	(0.016)	(0.000)	(0.000)	(0.358)	(0.421)	(0.017)	(0.222)	(0.682)	(0.340)

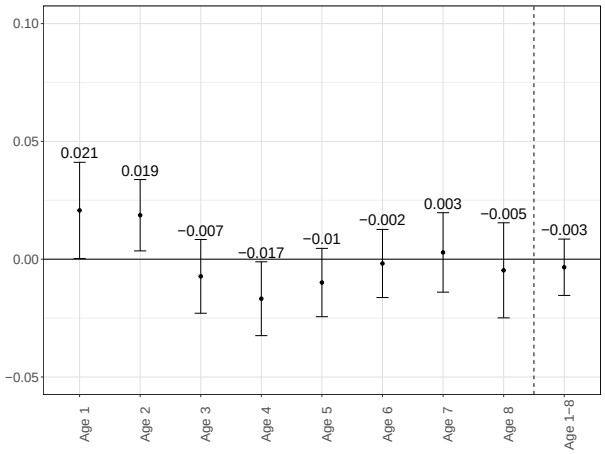
Note: +p<0.1; *p<0.05; **p<0.01; ***p<0.001. Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) adjusting p-values from clustered standard errors at county level for multiple hypotheses testing (q-values in parentheses). The table reports the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Figure B.1: Effect of the childcare expansion on maternal health outcomes with state-year fixed effects

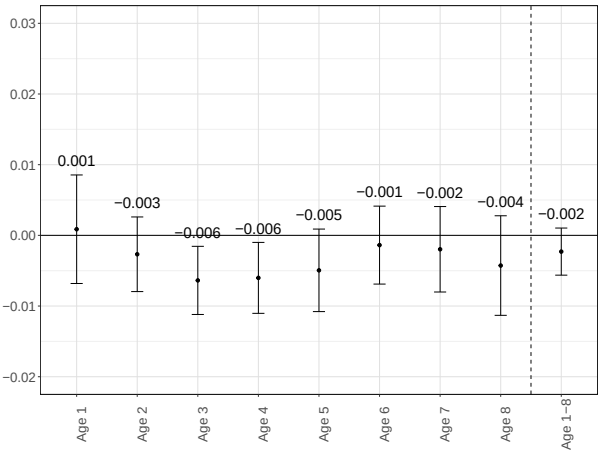
(a) Infections



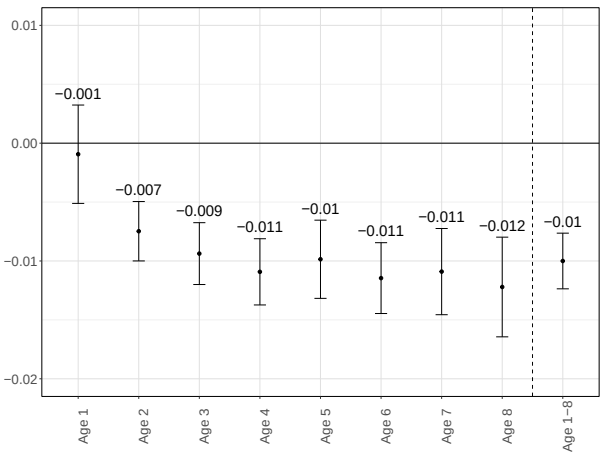
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

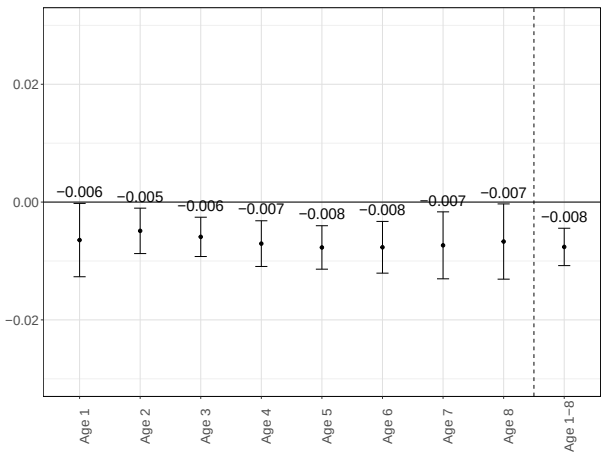
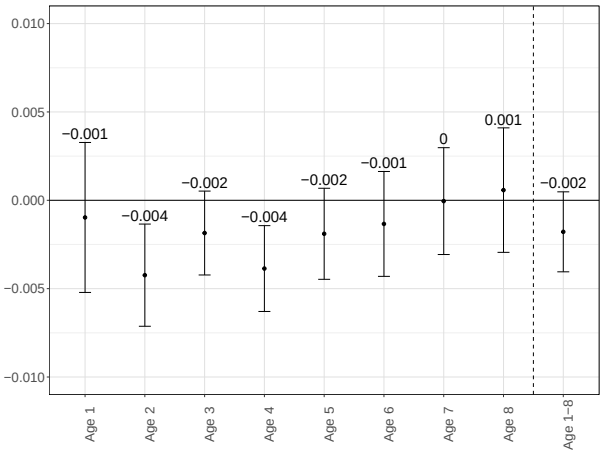
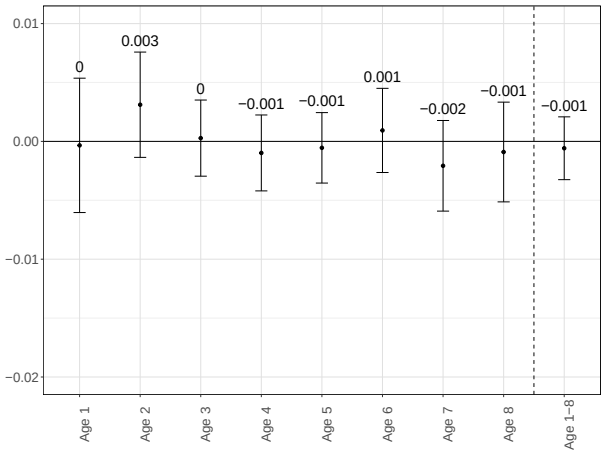


Figure B.1: Effect of the childcare expansion on maternal health outcomes with state-year fixed effects (*continued*)

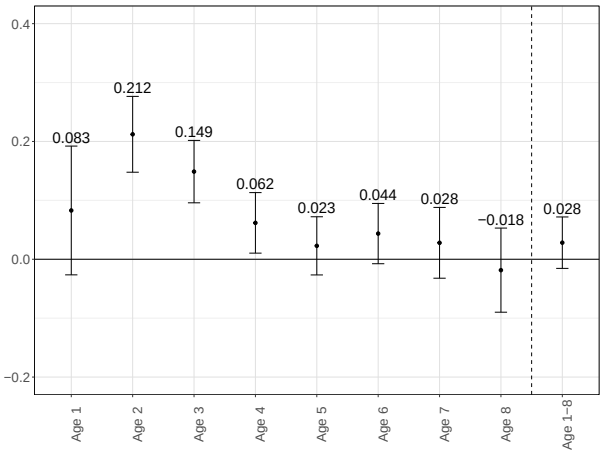
(f) Mood-related disorders



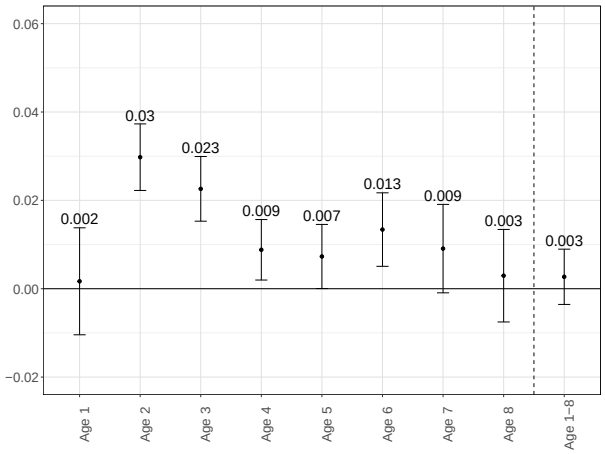
(g) Stress-related disorders



(h) Treatment cases



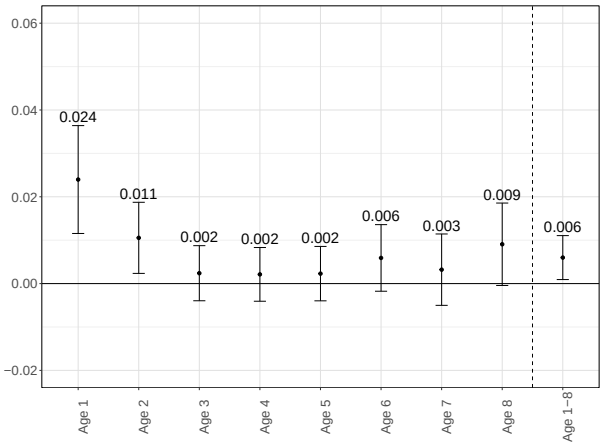
(i) Healthcare costs



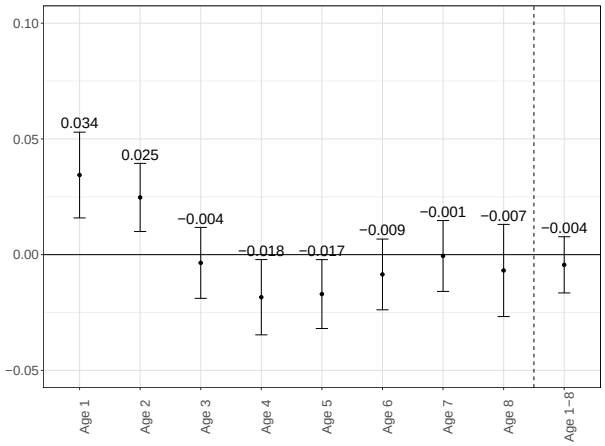
Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) controlling for state-year fixed effects. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Figure B.2: Effect of the childcare expansion on maternal health outcomes with county characteristics

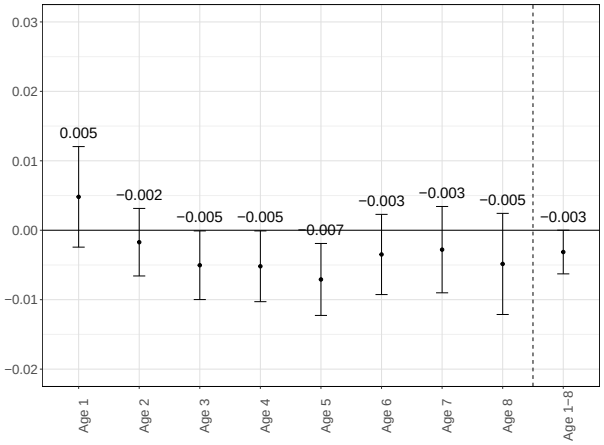
(a) Infections



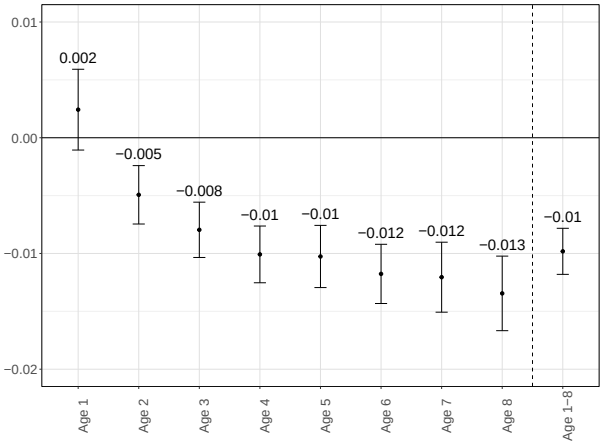
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

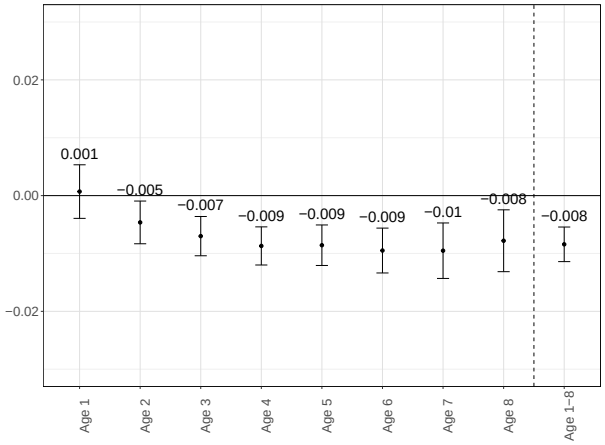
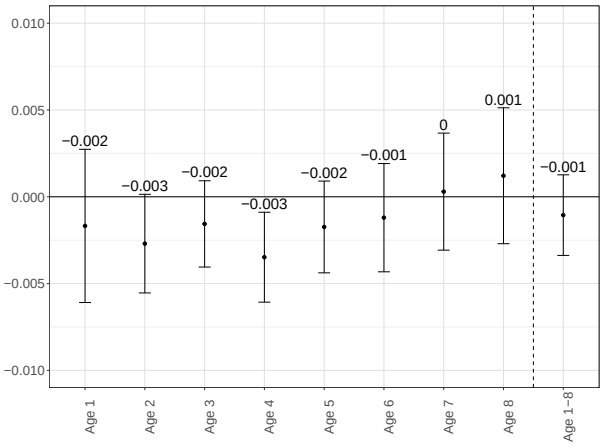
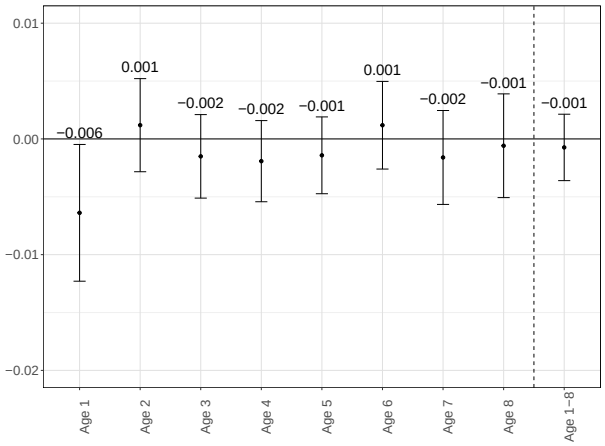


Figure B.2: Effect of the childcare expansion on maternal health outcomes with county characteristics (*continued*)

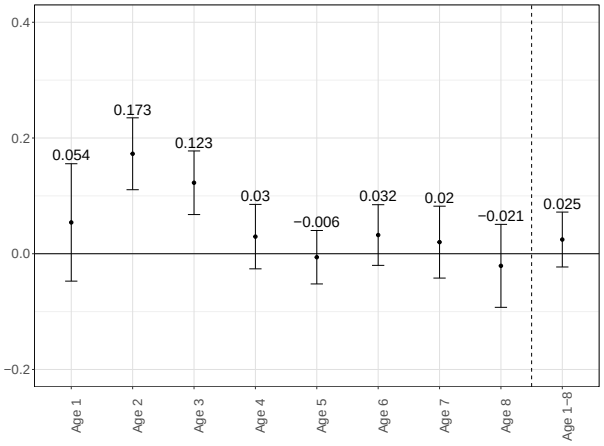
(f) Mood-related disorders



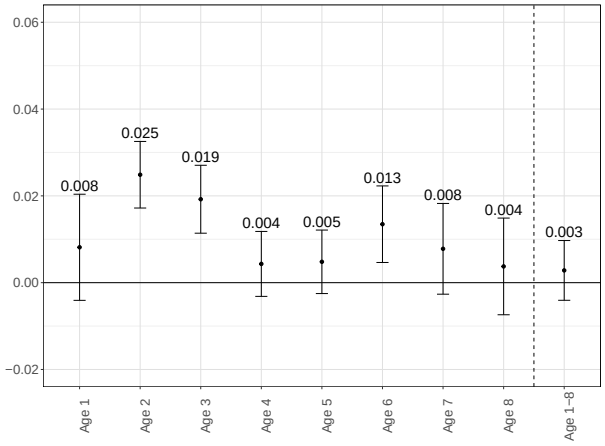
(g) Stress-related disorders



(h) Treatment cases



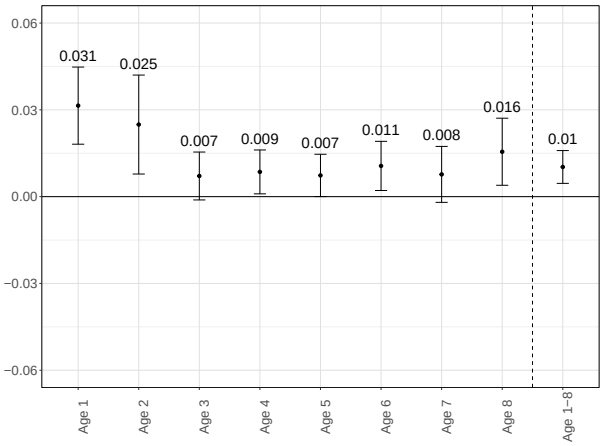
(i) Healthcare costs



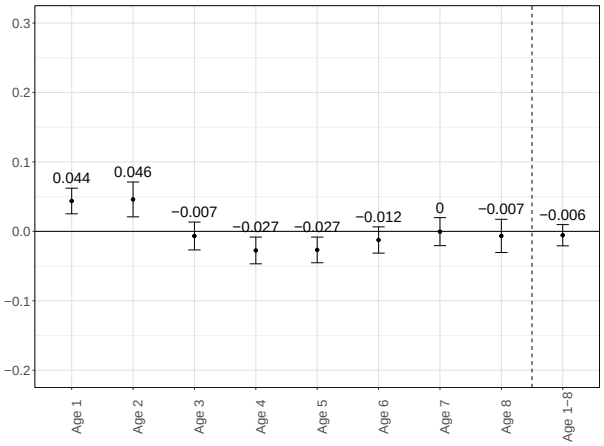
Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) controlling for county characteristics (GDP per capita, women employment rate, unemployment rate, fertility rate, share of migrants, population density, % of population under three, 3–6, 6–18, 18–25, 25–30, and 30–50, and childcare slots to teaching staff). The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: INKAR (1995–2019) and German Statistical Office (2007–2019) for county characteristics, German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Figure B.3: Effect of the childcare expansion on maternal health outcomes excluding movers

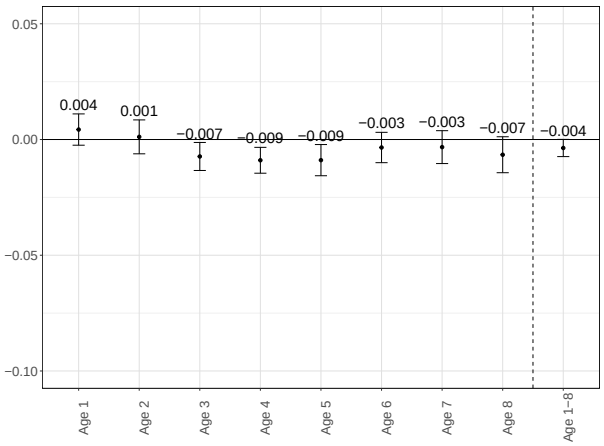
(a) Infections



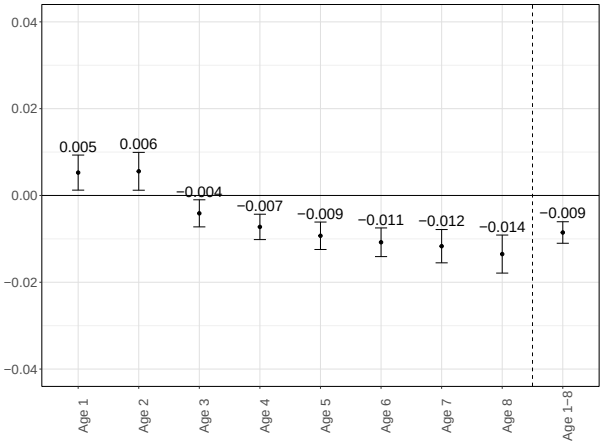
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

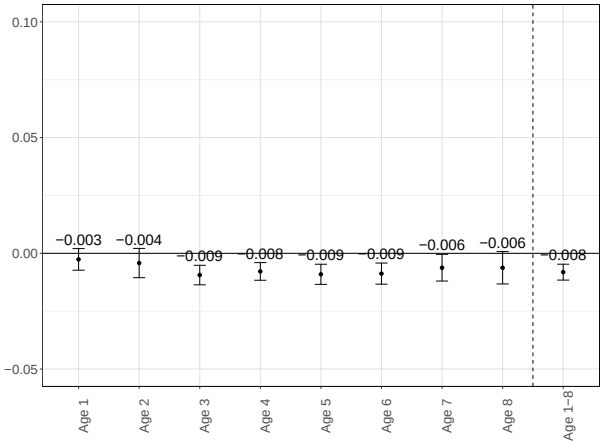
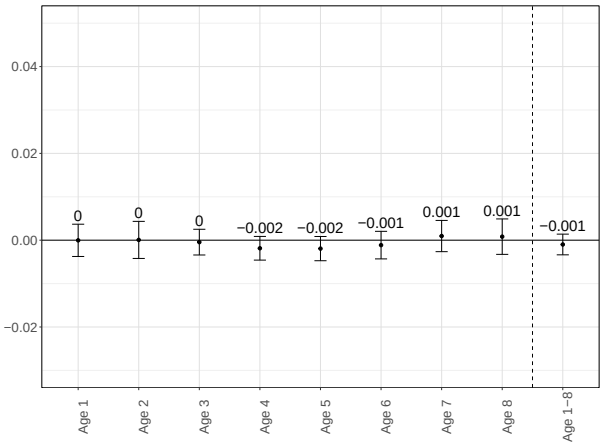
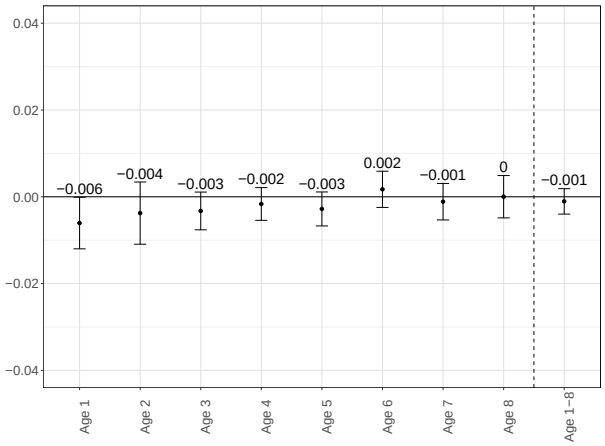


Figure B.3: Effect of the childcare expansion on maternal health outcomes excluding movers (*continued*)

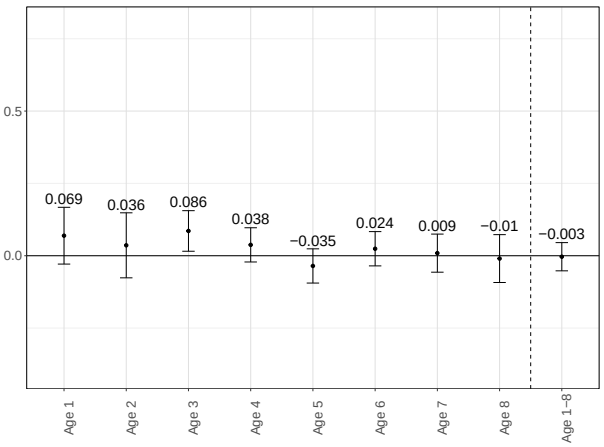
(f) Mood-related disorders



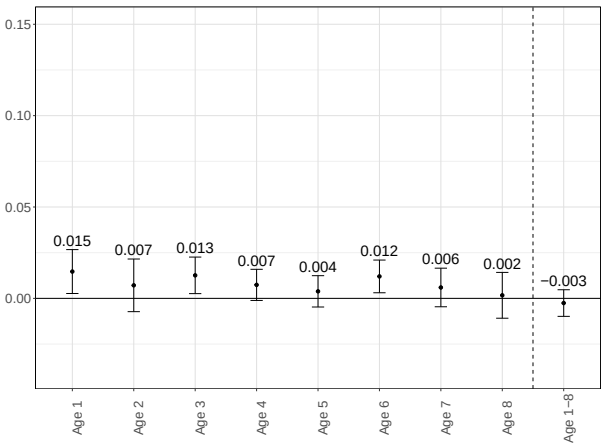
(g) Stress-related disorders



(h) Treatment cases



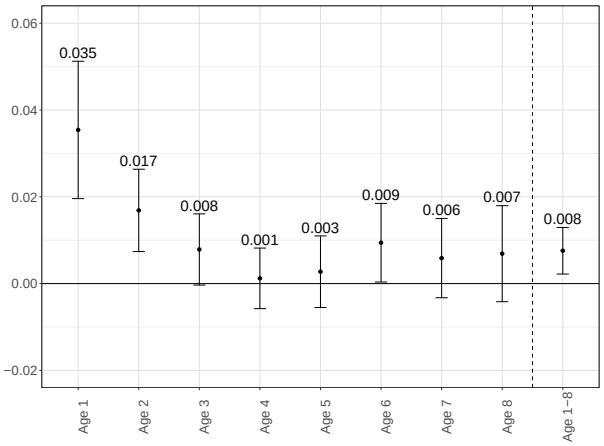
(i) Healthcare costs



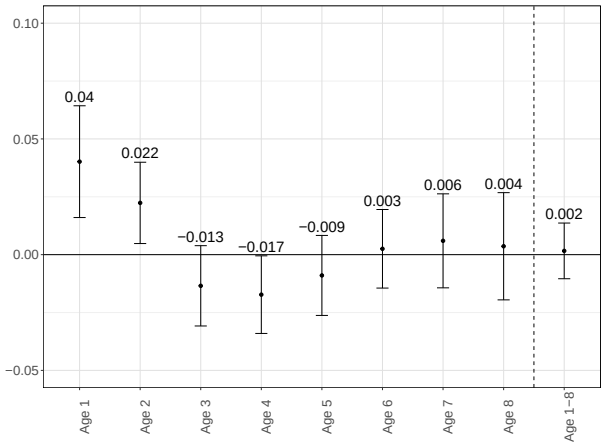
Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) excluding mothers who moved across counties when their focal child was aged 0–2. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Figure B.4: Effect of the childcare expansion on maternal health outcomes excluding mothers who gave birth before 2010

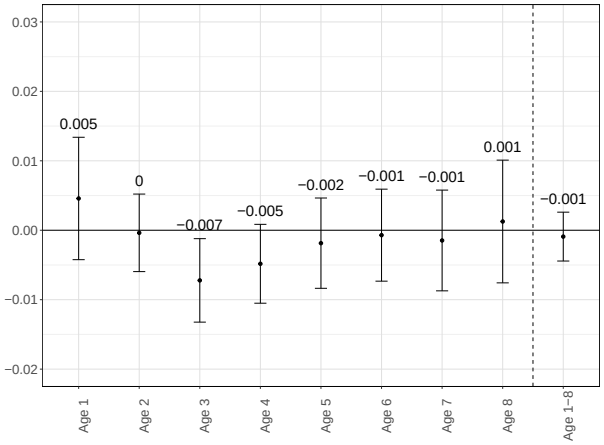
(a) Infections



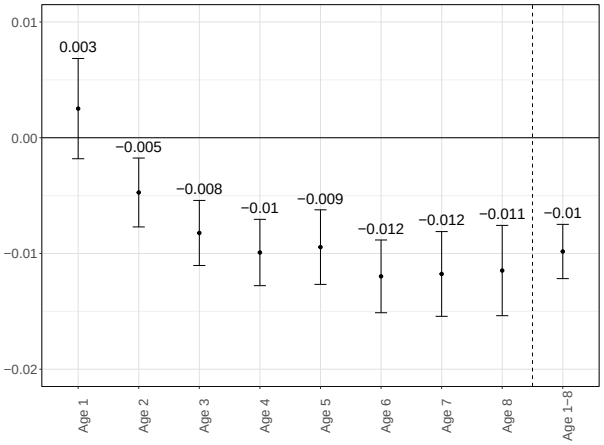
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

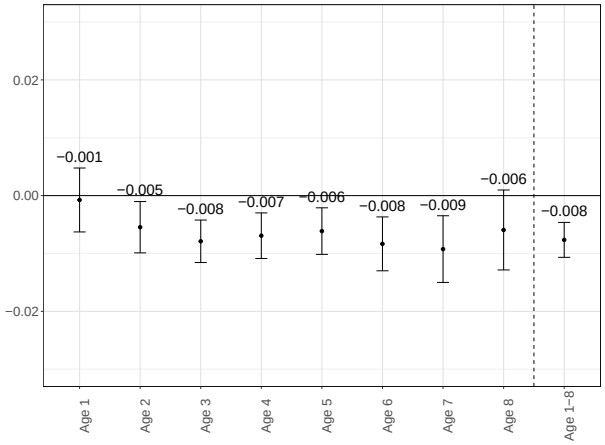
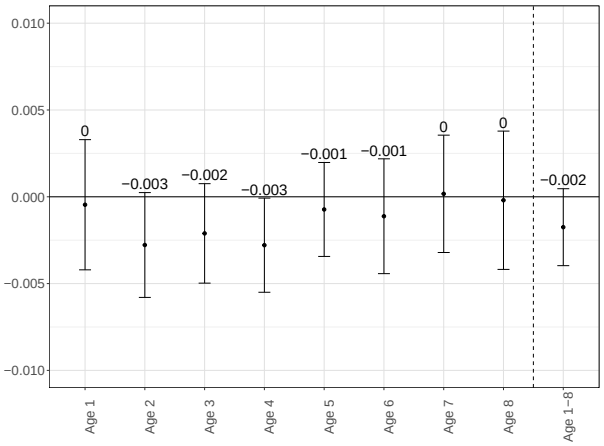
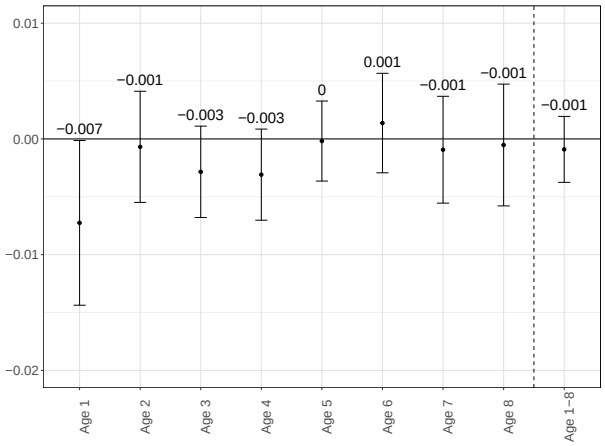


Figure B.4: Effect of the childcare expansion on maternal health outcomes excluding mothers who gave birth before 2010 (*continued*)

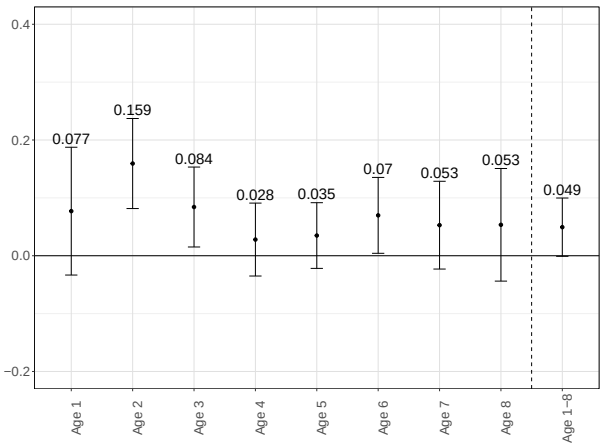
(f) Mood-related disorders



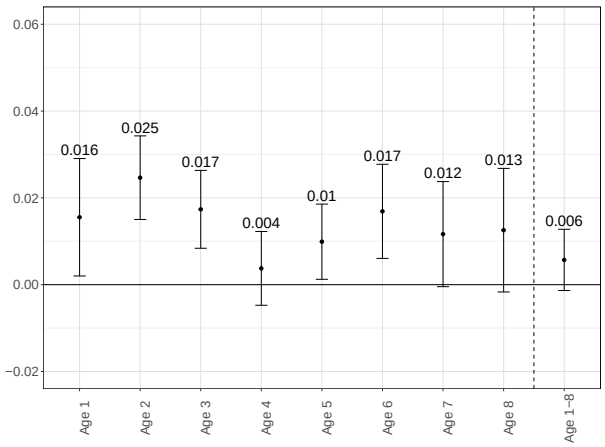
(g) Stress-related disorders



(h) Treatment cases



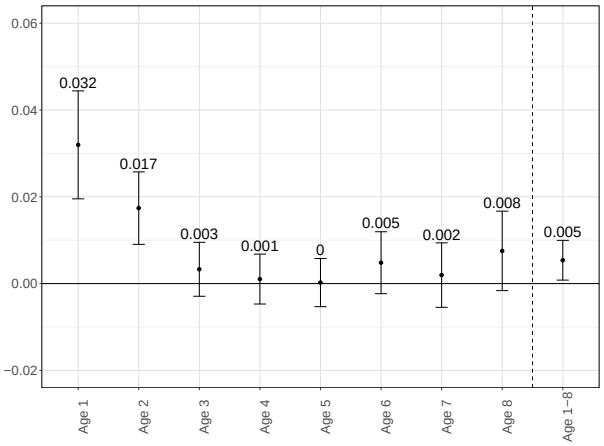
(i) Healthcare costs



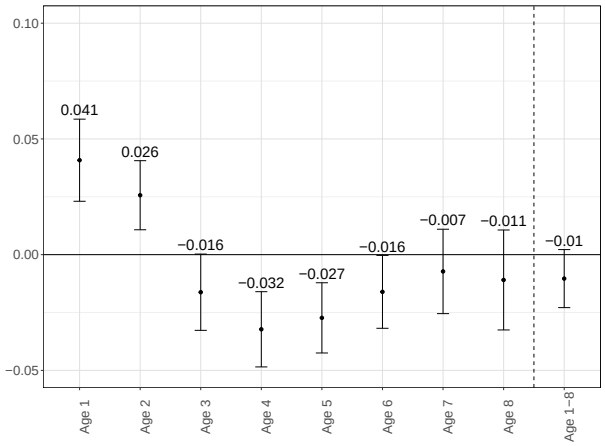
Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) excluding mothers who potentially had given birth before 2010. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Figure B.5: Effect of the childcare expansion on maternal health outcomes controlling for number of children per mother before 2010 and up to 2022

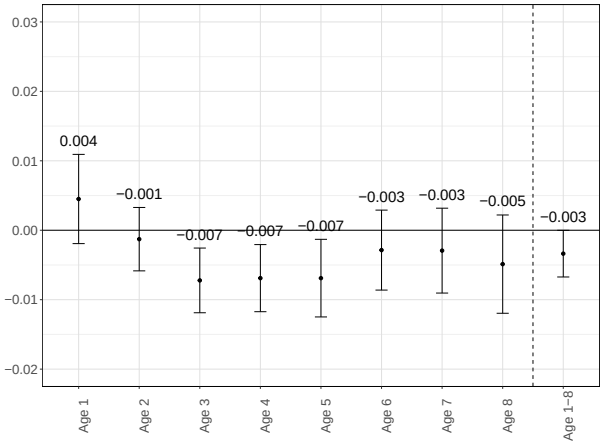
(a) Infections



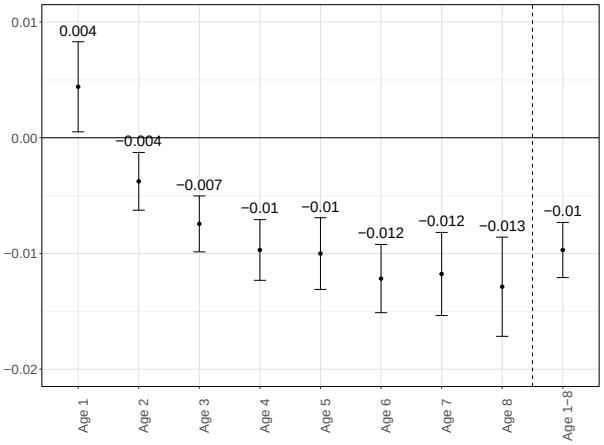
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

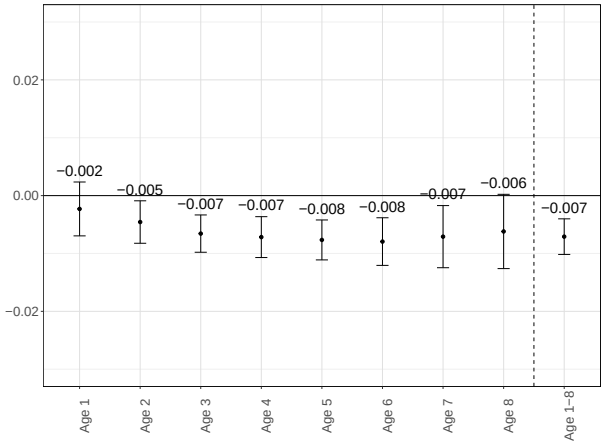
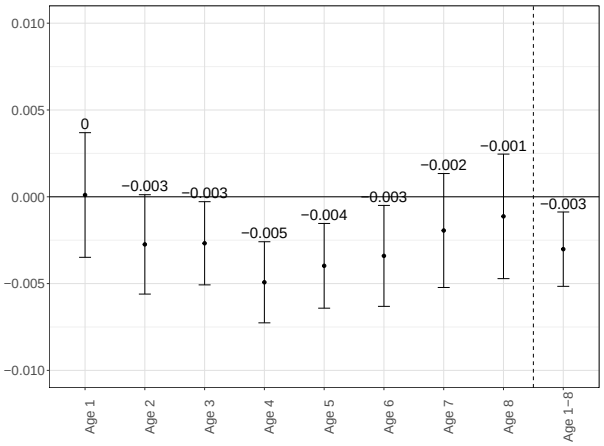
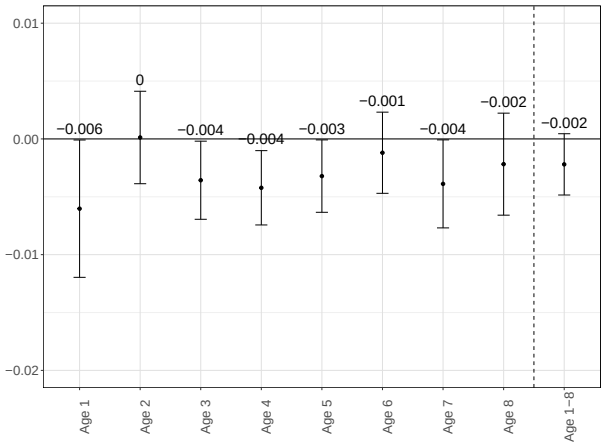


Figure B.5: Effect of the childcare expansion on maternal health outcomes controlling for number of children per mother before 2010 and up to 2022 (*continued*)

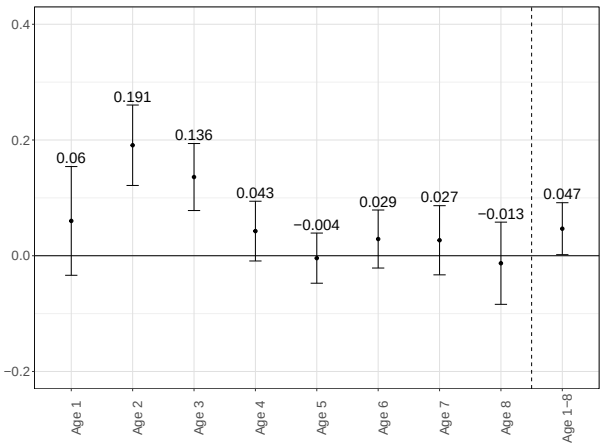
(f) Mood-related disorders



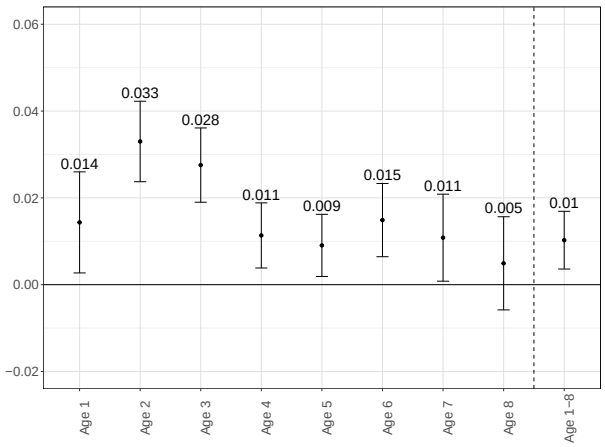
(g) Stress-related disorders



(h) Treatment cases



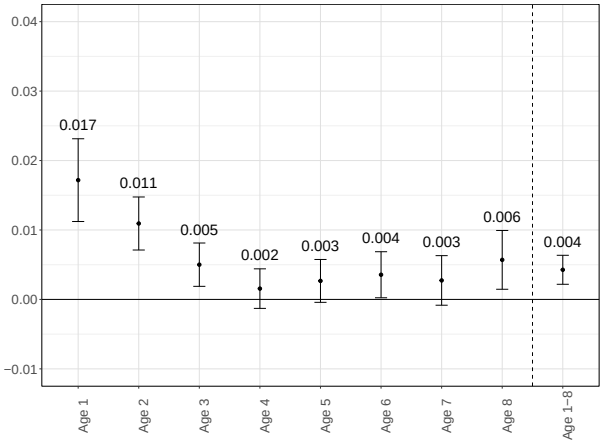
(i) Healthcare costs



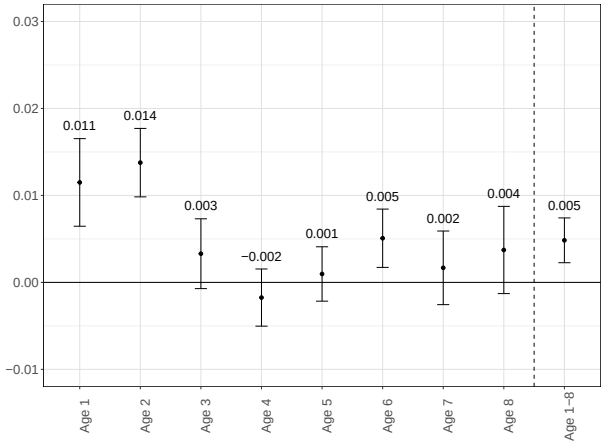
Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) controlling for the number of children per mother before 2010 and up to 2022. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Figure B.6: Effect of the childcare expansion on maternal health outcomes with extensive and intensive margin measures

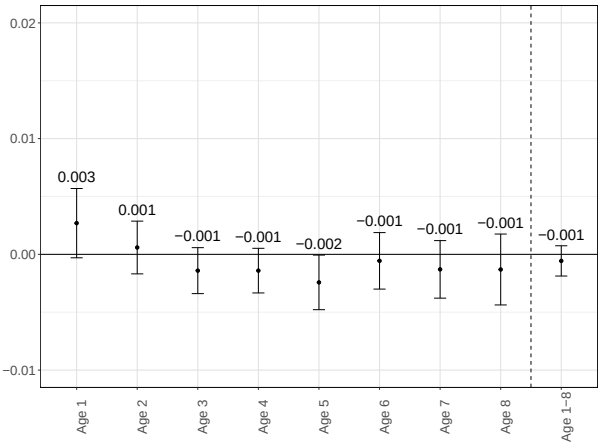
(a) Infections



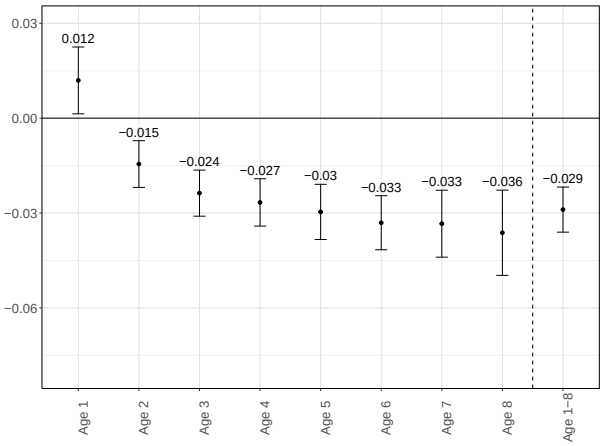
(b) Respiratory diseases



(c) Ear diseases



(d) Obesity



(e) Anaemia

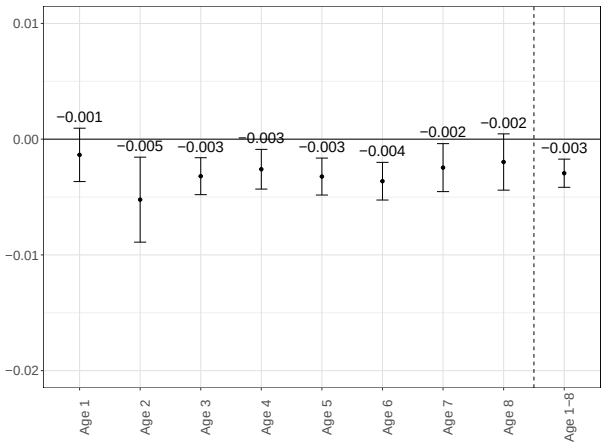
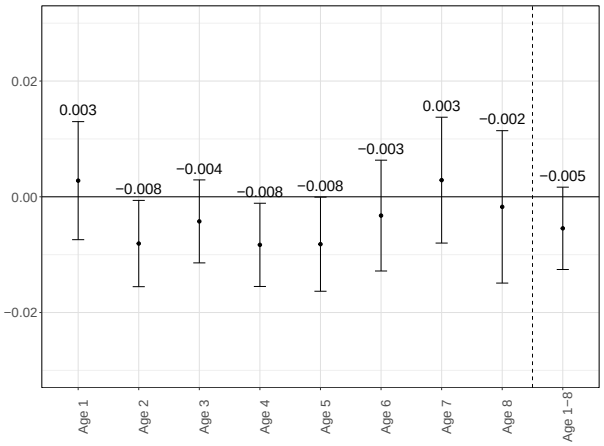
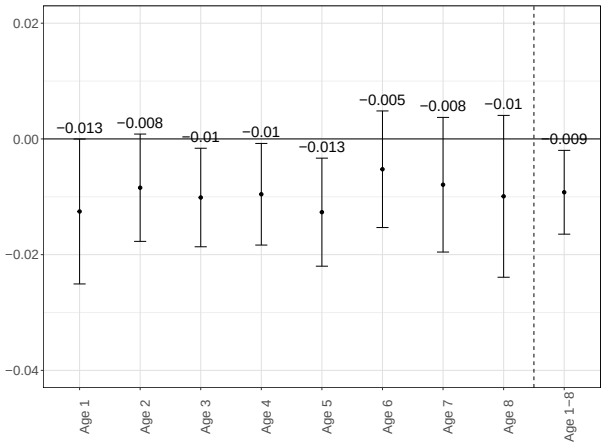


Figure B.6: Effect of the childcare expansion on maternal health outcomes with extensive and intensive margin measures (*continued*)

(f) Mood-related disorders



(g) Stress-related disorders

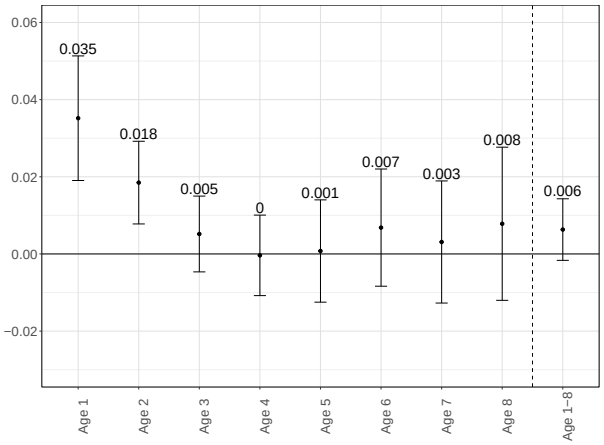


Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1). Infections, respiratory and ear diseases, and anaemia are extensive margin measures. Obesity and mental health disorders are intensive margin measures. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

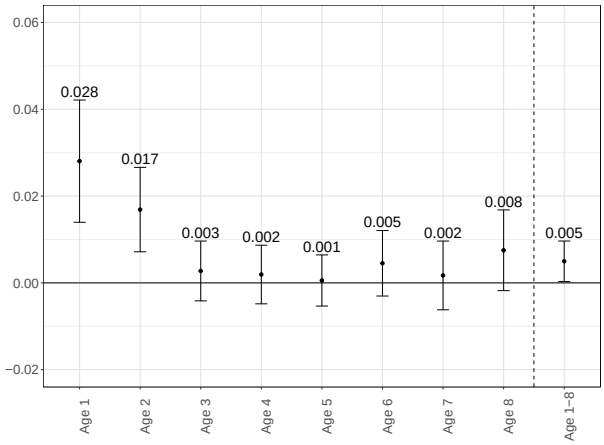
C Heterogeneity Analysis

Figure C.1: Heterogeneity results: Effect of the childcare expansion on maternal health outcomes by number of children

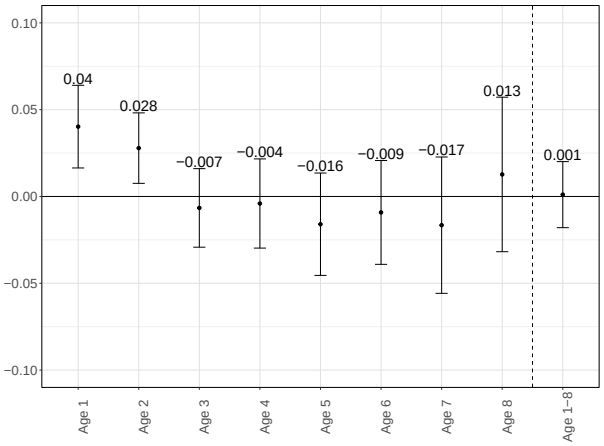
(a) Infections (1 child)



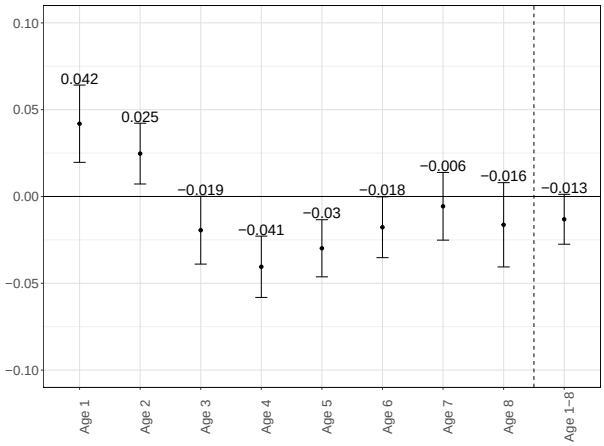
(b) Infections (2+ children)



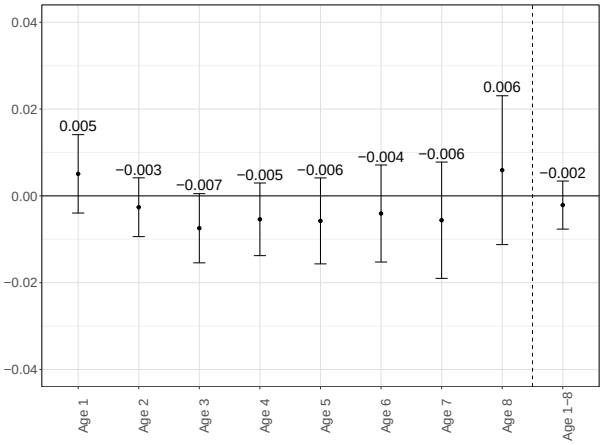
(c) Respiratory diseases (1 child)



(d) Respiratory diseases (2+ children)



(e) Ear diseases (1 child)



(f) Ear diseases (2+ children)

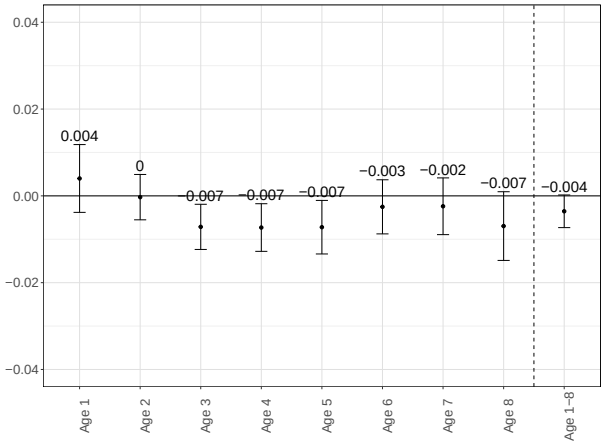
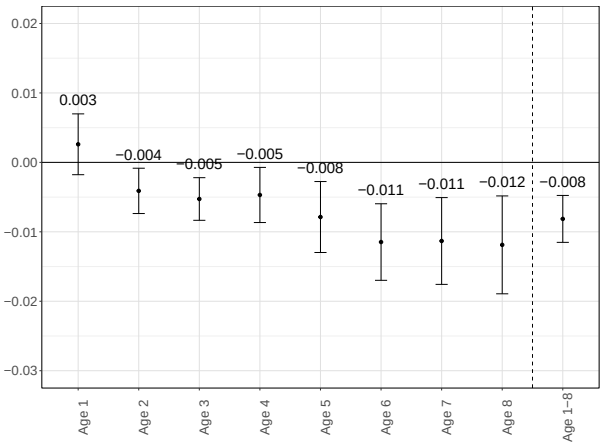
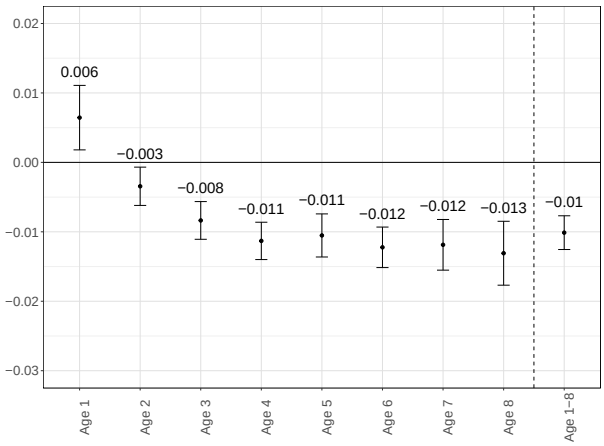


Figure C.1: Heterogeneity results: Effect of the childcare expansion on maternal health outcomes by number of children (*continued*)

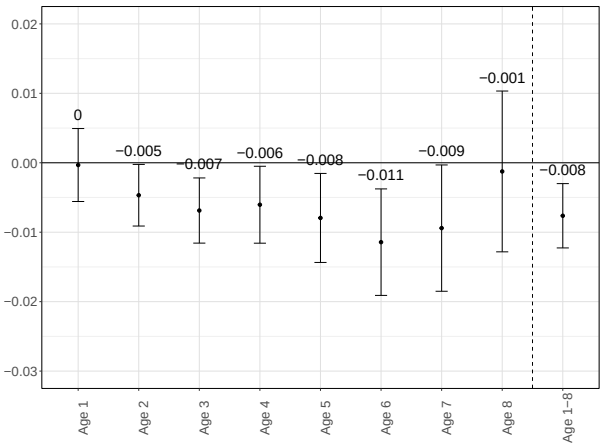
(g) Obesity (1 child)



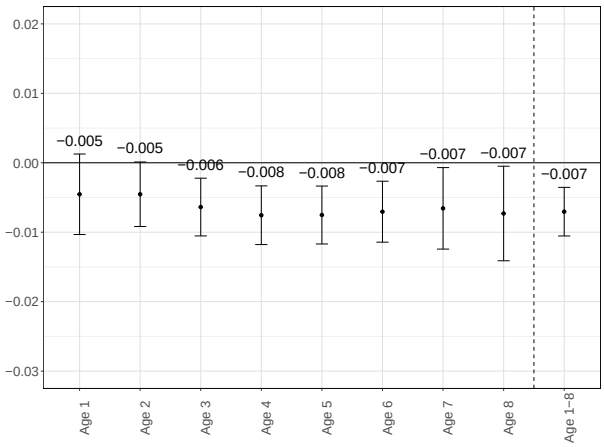
(h) Obesity (2+ children)



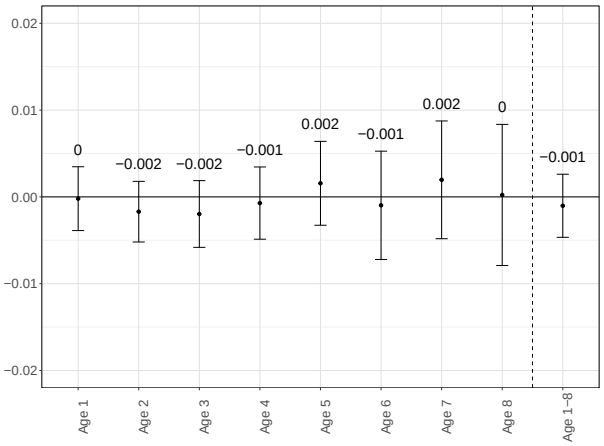
(i) Anaemia (1 child)



(j) Anaemia (2+ children)



(k) Mood-related disorders (1 child)



(l) Mood-related disorders (2+ children)

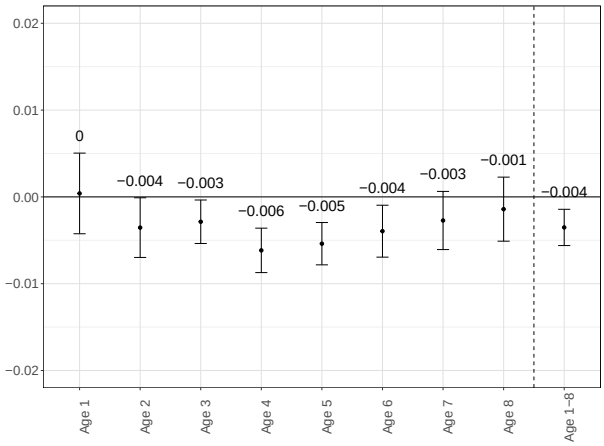
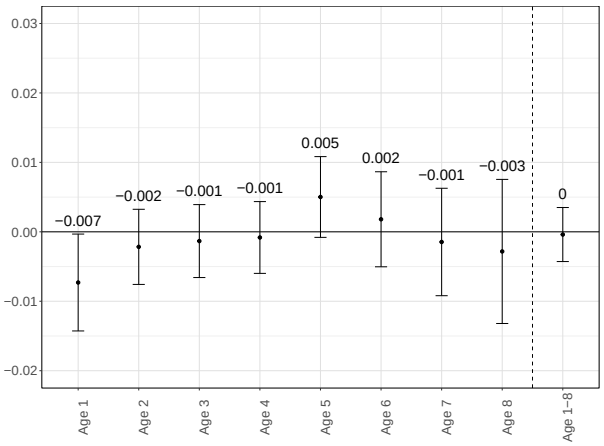
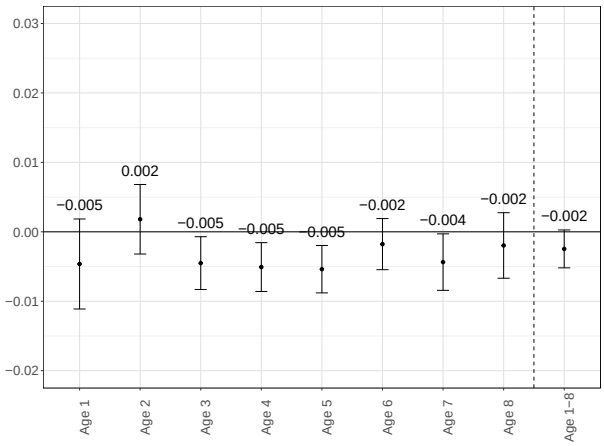


Figure C.1: Heterogeneity results: Effect of the childcare expansion on maternal health outcomes by number of children (*continued*)

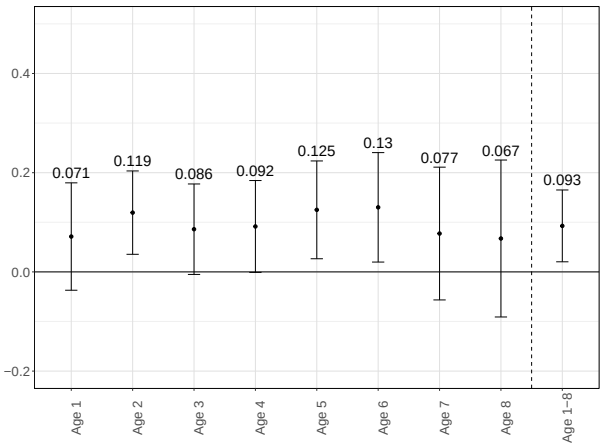
(m) Stress-related disorders (1 child)



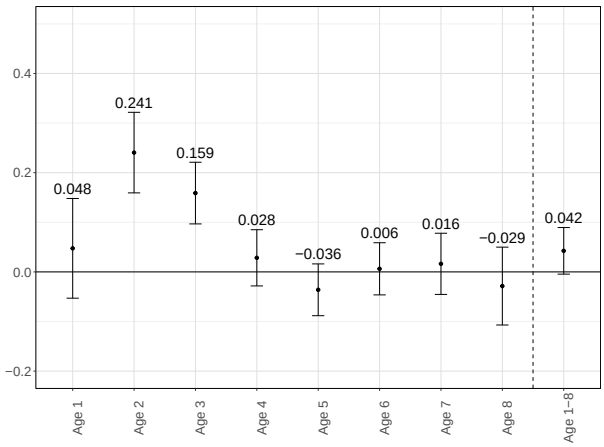
(n) Stress-related disorders (2+ children)



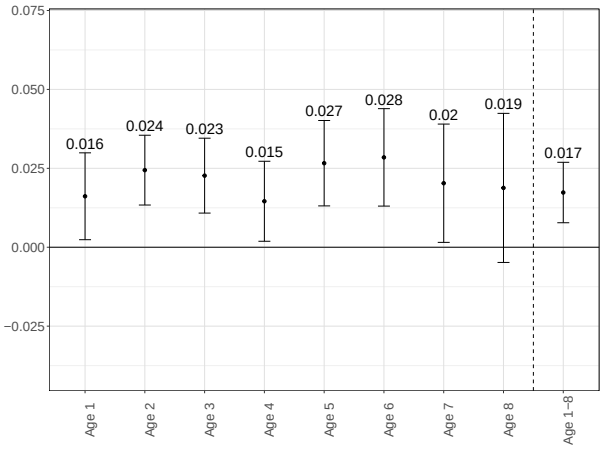
(o) Treatment cases (1 child)



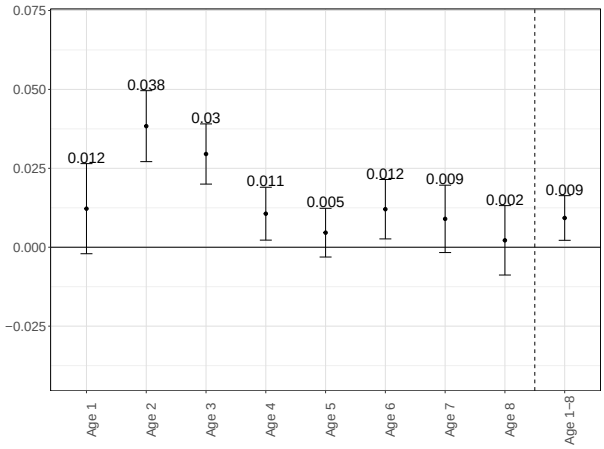
(p) Treatment cases (2+ children)



(q) Healthcare costs (1 child)



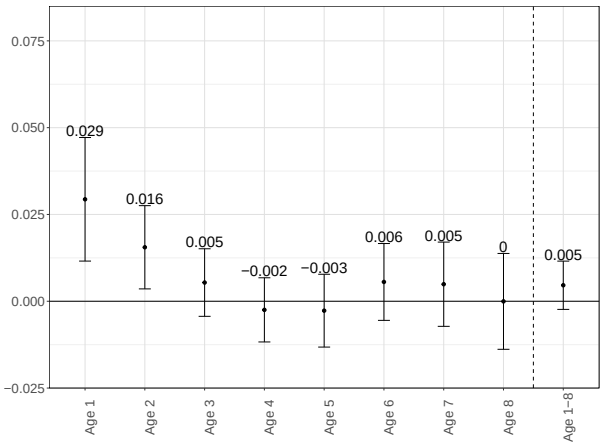
(r) Healthcare costs (2+ children)



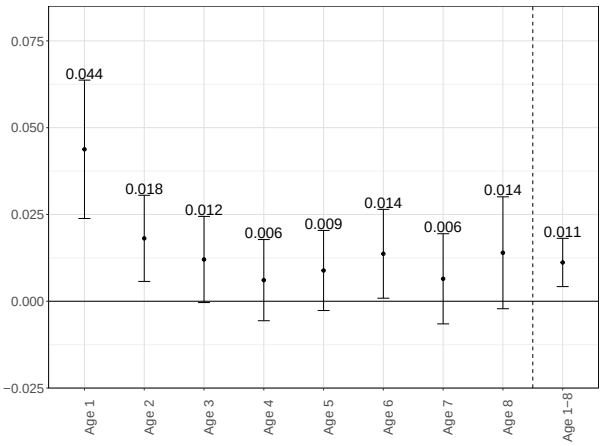
Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) by number of children. To measure the number of children per mother, the variable adjusted for the number of births before 2010 and up to 2022 is used. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.

Figure C.2: Heterogeneity results: Effect of the childcare expansion on maternal health outcomes by maternal age at first birth

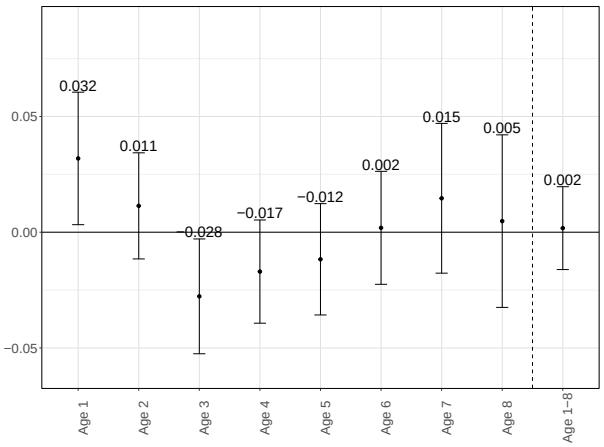
(a) Infections (age ≥ median age)



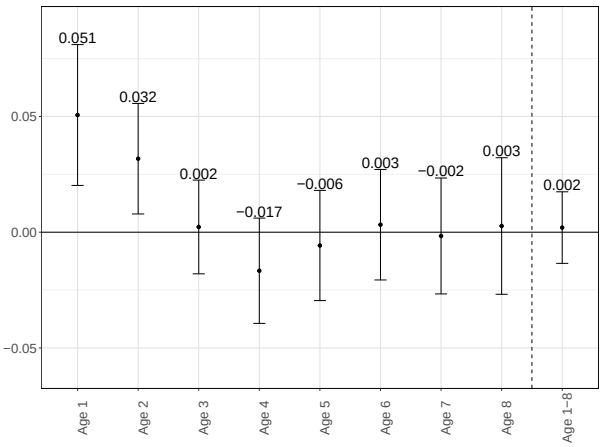
(b) Infections (age < median age)



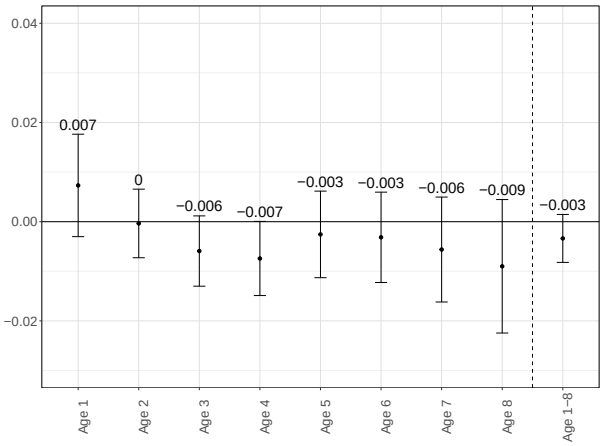
(c) Respiratory diseases (age ≥ median age)



(d) Respiratory diseases (age < median age)



(e) Ear diseases (age ≥ median age)



(f) Ear diseases (age < median age)

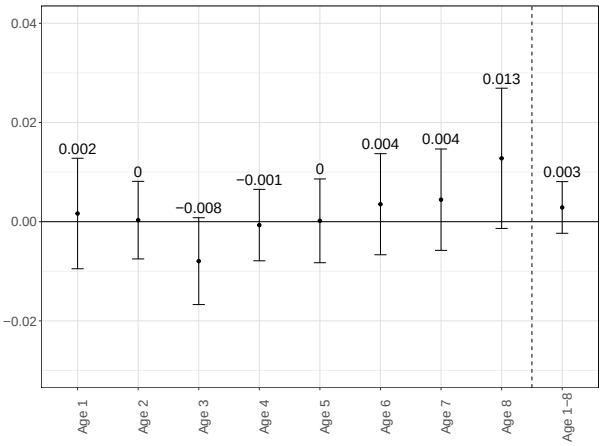
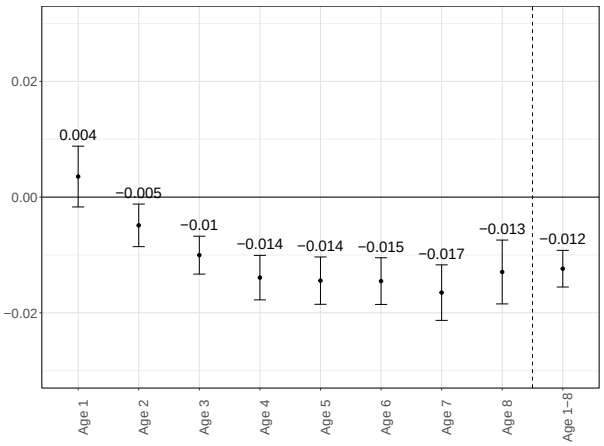
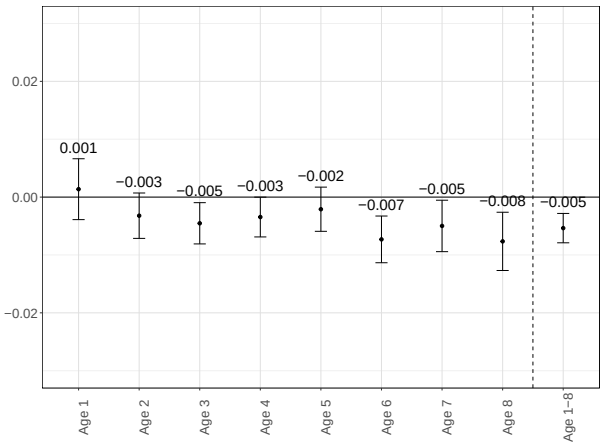


Figure C.2: Heterogeneity results: Effect of the childcare expansion on maternal health outcomes by maternal age at first birth (*continued*)

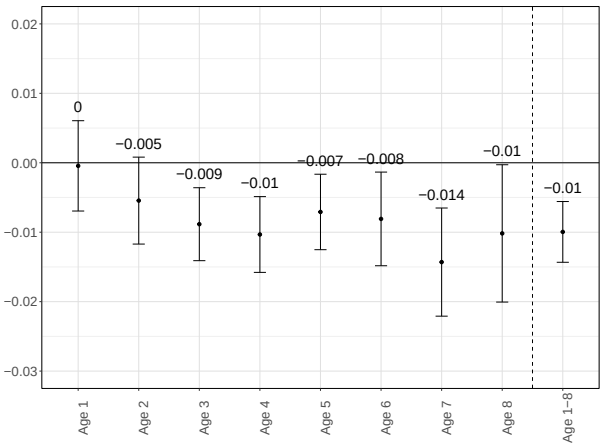
(g) Obesity (age ≥ median age)



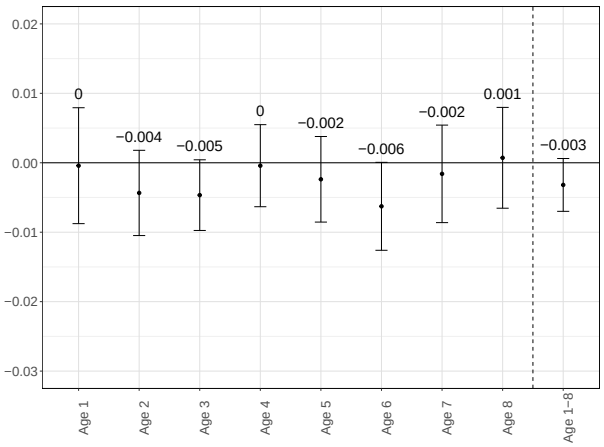
(h) Obesity (age < median age)



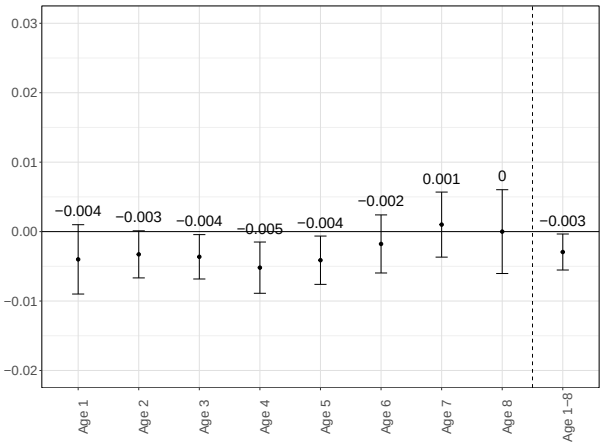
(i) Anaemia (age ≥ median age)



(j) Anaemia (age < median age)



(k) Mood-related disorders (age ≥ median age)



(l) Mood-related disorders (age < median age)

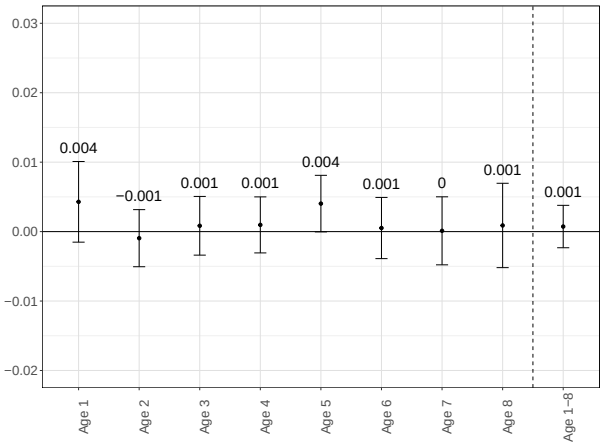
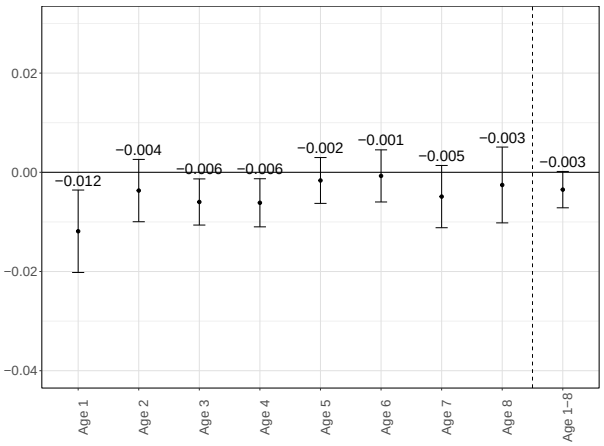
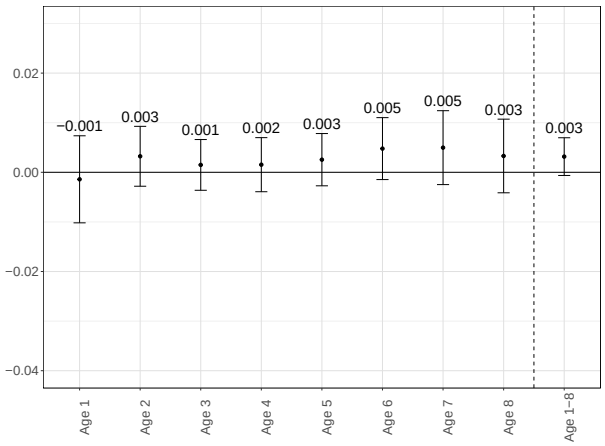


Figure C.2: Heterogeneity results: Effect of the childcare expansion on maternal health outcomes by maternal age at first birth (*continued*)

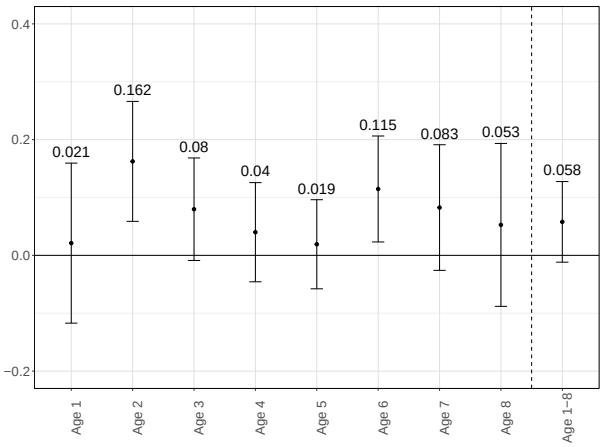
(m) Stress-related disorders (age ≥ med. age)



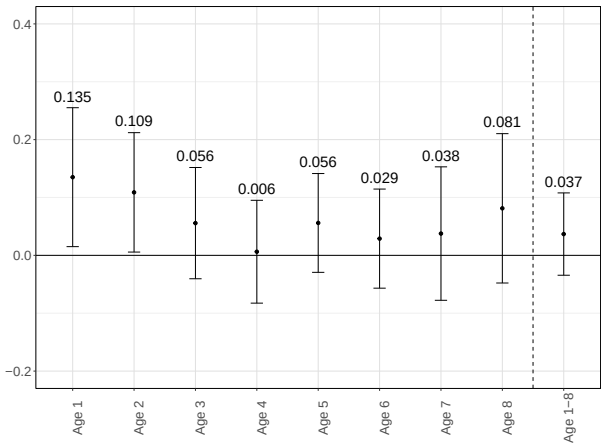
(n) Stress-related disorders (age < median age)



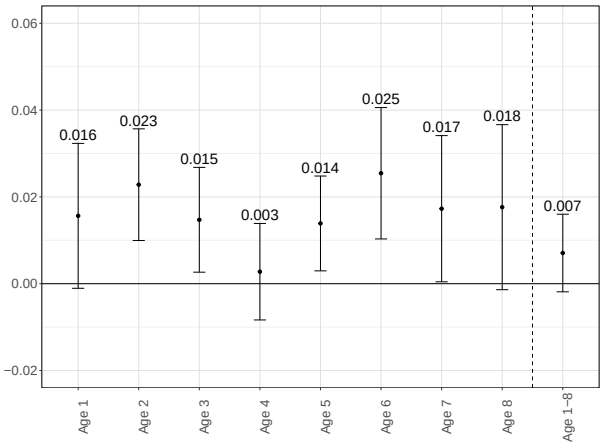
(o) Treatment cases (age ≥ median age)



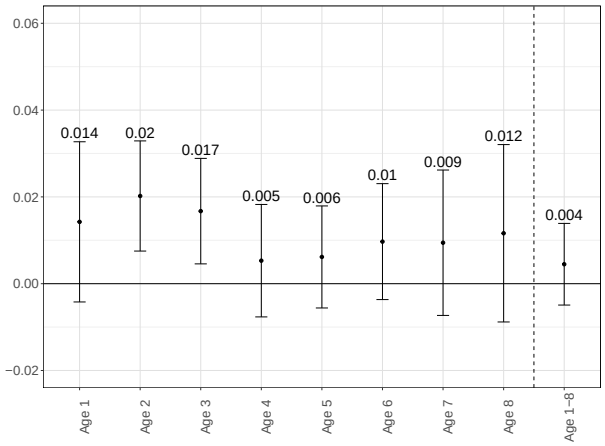
(p) Treatment cases (age < median age)



(q) Healthcare costs (age ≥ median age)



(r) Healthcare costs (age < median age)



Note: Age-specific and aggregated estimates of the effects of the childcare expansion on health outcomes for mothers with a 1–8-year-old focal child based on equation (1) by maternal age at first birth. Median age is equal to 29. The graphs plot the effect of a 10pp increase in childcare coverage rates for children under three on maternal health. The estimates are plotted together with their 95% confidence intervals from robust standard errors clustered at the county level. The sample includes only mothers who did not have children before 2010. *Source*: German Youth Institute (1994, 1998, 2002) and German Statistical Office (2006–2019) for childcare coverage rates, and KBV (2010–2019) for maternal health outcomes and control variables, own calculations.