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Cesarean Sections for High-Risk Births: Health, Fertility and Labor Market Outcomes

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Abstract

Despite the fact that Cesarean section (C-section) is the most commonly performed surgery in a number of industrialized countries, little is known about the long-term consequences for the mothers and children involved. In this study, I use a sample of high-risk births—namely, breech births, in which the fetus is presented with its head upward instead of downward—to study the causal effect of C-sections on child health and on the health, fertility and labor market responses for mothers. Because selection into C-section may be endogenous, I exploit an information shock to doctors in 2000, in which new scientific evidence about the benefits of planned C-sections for breech births led to a sharp 23% increase in planned C-sections. Using Swedish registry data, I find that having a C-section improves child health in both the short and long run, indicated by higher Apgar scores at birth and fewer nights hospitalized during ages 1-7. I find little evidence to suggest any significant impact on maternal health, future fertility or maternal labor market outcomes.

Keywords: Cesarean Section, Fertility, Maternal Health, Child Health, Birth Technology, Labor Market Outcomes
JEL Codes: J13, I11, I12, I38, J24.

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1 Introduction

Cesarean section (C-section) is the most frequently performed major surgical procedure in industrialized countries, yet the impact of this intervention on mothers and children is not fully understood. Because the choice of delivery mode is endogenous to maternal and child outcomes, with any pre-existing conditions likely being correlated with the outcomes of the procedure, assessing the causal effects of C-sections can be difficult. Using detailed Swedish registry data, I focus on a sample of “at-risk” births, consisting of breech births (when the fetus is presented with its head upward instead of downward), to estimate the causal impact of planned C-sections on child and maternal health, future fertility and labor market outcomes. To deal with potential selection into C-section, I exploit exogenous variation in C-sections generated by an information shock to the medical society in 2000. This information shock, consisting of the dissemination of new scientific evidence about the benefits of planned C-sections for breech births, led to a sharp increase of 23% in the use of the procedure for this particular group in Sweden.

C-sections are common, 28% of all births are delivered via C-section in OECD countries. The global rates of C-sections have dramatically increased from the 1970s to today, with rates exceeding 30% in many countries, including Australia, China, Italy, and the United States (Gibbons et al., 2010). The strong increase in C-section rates worldwide cannot be attributed solely to demographic or maternal health changes, rather, C-sections are also performed for nonmedical reasons, possibly driven by supply-side incentives which lead to suboptimal use of the procedure (Betran et al., 2015; Currie and MacLeod, 2008; Currie, J. and MacLeod, W. B., 2017; Halla et al., 2016; Johnson and Rehavi, 2016). The use of C-section is widely recognized by the medical society as a lifesaving measure for mother and child when medically indicated. However, as for most surgical procedures, C-sections may also lead to undesirable consequences including adverse health outcomes for the child and the mother (Clark et al., 2008), deterioration of the outcomes at any subsequent pregnancies (Daltveit et al., 2008), lower future fertility (Card et al., 2018; Gurol-Urganci et al., 2013; Halla et al., 2016; Norberg and Pantano, 2016; O’Neill et al., 2013) and consequences for maternal labor supply (Halla et al., 2016).[1]

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[1] The negative association between C-sections and future fertility has still not been fully explained but has been posited to be due to factors such as physiological channels (Hurry et al., 1984), psychological channels (Lobel and DeLuca, 2007; Rowlands and Redshaw, 2012), and maternal preferences (Bhattacharya et al., 2006; Norberg and Pantano, 2016; Tollånes et al., 2007). Having a C-section could affect future fertility outcomes for a number of reasons. First, complications from the surgery procedure may cause involuntary infertility (biological channels) (Hurry et al., 1984). Second, the time for recovery from a C-section compared with a vaginal birth is usually longer. Third, if a C-section is considered more traumatic than a vaginal delivery, then the psychological cost of childbearing increases with C-sections, reducing the willingness of mothers to have subsequent births (psychological channels) (Lobel and DeLuca,

Additional motivation for studying the impact of C-sections is to examine whether medical interventions during childbirth can alleviate long term differences in child health and whether this occurs at a cost to the mother in terms of her health and labor market outcomes. It is widely recognized that early life conditions have long-lasting impacts on future socioeconomic outcomes (Almond et al., 2017). Given that investments in early stages play a greater role in the production of human capital than do investments later in life, medical interventions at birth could function as an efficient means for narrowing gaps in later life outcomes (Almond and Currie, 2010; Cunha and Heckman, 2007). The evidence suggests that medical interventions early in life improve immediate health, long term health and educational performance (Almond et al., 2010; Bharadwaj et al., 2013, 2017; Breining et al., 2015; Cutler and Meara, 2000; Daysal, 2015). However, considering the potential negative consequences of increased medicalization of childbirth (Costello and Osrin, 2005) and because of the rapid increase in medical spending on infants compared with older individuals (Cutler and Meara, 2000), a better understanding of medical interventions at birth, and especially in the case of high-risk births, is important.

In this paper, I study the causal impact of planned C-sections among a particular group of high-risk births consisting of breech births. Breech births are high-risk because a fetus positioned with its head upward experiences a more difficult passage through the birth canal and is thus more likely to suffer from complications including oxygen deficiency during a vaginal delivery (Kotaska et al., 2009). This high-risk group is of particular interest since breech births are easily identified and constitute a fairly large portion, approximately 4%, of all term births in most populations and because they exhibit significantly poorer health compared to babies born in a normal position (cephalic position) (Herbst and Thorngren-Jerneck, 2001).

To deal with endogeneity, I use an identification strategy analogue to Jensen and Wüst (2015), exploring exogenous variation in planned C-sections created by new scientific evidence, which was made available to the medical society in 2000, showing the benefits of planned C-sections for breech births. The new scientific evidence, constituting an “information shock”, consisted of preliminary results from a large-scale international randomized control trial by Hannah et al. (2000), called the “Term Breech Trial”, and a cohort study by Herbst and Thorngren-Jerneck (2001).[2] This information shock led to a substantial and immediate increase in the rate of planned C-sections for breech births in Sweden, from 47% to over 60% between 2000 and 2001 (Herbst, 2005).[3] I use this

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2007; Rowlands and Redshaw, 2012). Fourth, maternal preferences may also be a contributing factor (Bhattacharya et al., 2006; Norberg and Pantano, 2016; Tollånes et al., 2007).

[2] See section 2 for a detailed description of the these studies and the dissemination to the medical society.

[3] The Term Breech Trial by Hannah et al. (2000) is considered a landmark study within obstetrics, with a strong

sharp discontinuity to identify the effects of C-sections on indices of child and maternal health and maternal labor market outcomes up to 8 years following birth.

The results from this study show that the information shock led to a substantive and significant increase in planned C-section deliveries of 11 percentage points among singleton breech births at term, corresponding to a roughly 23% increase. No change in delivery mode was found for pregnancies with normal fetal position. Importantly, I find no evidence of changes in the composition of mothers receiving a planned C-section or in the proportion of breech births being reported. Likewise, I find no discontinuities when examining placebo dates.[4]

The results suggest that planned C-sections for breech births improve child health by 0.91 standard deviations, which is driven by an increase in Apgar score[5] of 0.65 units and by 6 fewer hospital nights during ages 1-7.[6] Thus, improving child health in both the short and long run. While the beneficial impact of the rise in C-sections on child health are clear, the findings suggest a limited impact on mothers. I find no significant impact of planned C-sections on maternal health at birth or at subsequent births. Similarly, no significant effect is found on future fertility (in terms of both the total number of future births and the probability of no future birth), except for a marginally significant estimate when using normal births as a control group. Furthermore, I do not find any effects on the index of labor market outcomes for the mother, but a marginally significant reduction in income from parental leave when examining the effect on each component of the index, possibly driven by improvements in child health.[7] The results are robust to a number of sensitivity checks, including alternative specifications (using quadratic trends, cubic trends and triangular kernel and a smaller window of time), and a difference-in-differences design using births with normal fetal position (cephalic births) as controls.

This study contributes to two strands of literature, the economic and biomedical literature, on the benefits and costs of medical interventions for high-risk births, by exploring exogenous variation in

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impact in C-section rates across multiple industrialized countries including Denmark, Australia, UK, Netherlands, Malaysia, Finland, and Saudi Arabia (Sharoni et al., 2015). While there is still lack of consensus on the preferred delivery mode for term breech births, the impact of this study is considered as one of the most influential papers within medicine, "Rarely in medical history have the results of a single research project so profoundly and so ubiquitously changed medical practice as in the case of this publication (the Term Breech Trial)" (Glezerman, 2006). See section 2 for a longer discussion.

[4] Except for one marginally significant negative impact for the year prior the shock.

[5] Apgar stands for appearance, pulse, grimace response, activity, respiration. This score is an assessment made by a physician 1, 5, and 10 minutes after birth. A score of 10 indicates perfect health and 1 extremely poor health.

[6] Child health is measured by a summary index according to Anderson (2008), outlined in Section 3.2.

[7] These estimates are not significantly different from zero when using FDR corrected p-values.

C-sections and using detailed Swedish registry data. Previous biomedical studies tend to suffer from endogeneity issues, small sample sizes or short time horizons (Gurol-Urganci et al., 2013; Hannah et al., 2004; Herbst, 2005; Herbst and Thorngren-Jerneck, 2001; O'Neill et al., 2013; Whyte et al., 2004).[8] In contrast, I can credibly identify the causal impact of C-sections using Swedish registry data with the universe of breech births, alongside a richer set of maternal covariates for a longer time period.

Within economics there is a small but growing literature on the causal impact of C-sections.[9] Studies examining the causal impact of C-sections among low risk births include Halla et al. (2016), who use exogenous variation in emergency C-sections, originating from supply-side incentives to accelerate deliveries across weekdays, to assess the effect on fertility in Austria. Their findings suggest that emergency C-sections at first birth reduce fertility by approximately 17% and cause a temporary rise in maternal employment such that income increases by 14%.[10] Using a similar strategy, Costa-Ramón et al. (2018) use exogenous variation in the probability of having a C-section by time of day and find that C-sections without medical indication lead to lower Apgar scores but no extreme morbidity. In a study by Card et al. (2018), proximity to hospitals with higher and lower C-section rates are used as an instrument for examining the causal impact of C-sections on health outcomes in the US. Their results indicate that C-sections increase emergency hospital visits for infants and mothers but lead to lower infant mortality. In contrast to Halla et al. (2016), they find no effect on subsequent fertility but find a higher likelihood of repeated C-sections. Their results suggest that C-sections, without medical indication, lead to higher Apgar scores. In a study by Amaral-Garcia et al. (2017), Internet access is used as exogenous variation in C-sections. Their findings suggest that an increase in the probability of C-section has no impact on either maternal or child health.[11]

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[8] Two follow-up studies were conducted two years after the Term Breech Trial, assessing the impact of planned C-sections for breech births on child outcomes (Whyte et al., 2004) and maternal outcomes (Hannah et al., 2004). These studies were conducted through surveys of a sub-sample of women participating in the Term Breech Trial. Surprisingly, no significant impact was found on either child health (Whyte et al., 2004) or maternal health or fertility (Hannah et al., 2004). Compared to these studies, the current study adds value by examining birth outcomes at any subsequent births. In addition, this study has a longer time horizon, which is of particular importance when studying the impact on future fertility because the average birth spacing exceeds 3 years.

[9] This study also relates to the literature on C-sections and incentives, information and staffing in maternity wards (Borra et al., 2014; Currie, J. and MacLeod, W. B., 2017; Facchini, 2018; Frakes, 2013; Johnson and Rehavi, 2016; Shurtz, 2014).

[10] Another study investigating the link between C-sections and fertility is Norberg and Pantano (2016). Using multiple data sources and estimation techniques, they find a negative association between C-sections and future fertility, which is at least partly attributed to maternal preferences.

[11] An additional study on the impact of C-sections on child health is Jachetta (2015). By using exogenous variation in medical malpractice premiums as an instrument, C-sections are found to increase the risk of asthma.

Using Danish registry data and leveraging the Term Breech Trial for exogenous variation in the likelihood of C-section among breech births, Jensen and Wüst (2015) find that C-sections among breech births improve child health, indicated by higher Apgar scores and fewer visits to the doctor over the first three years of life. No impact on maternal morbidity was detected but there was an increase in the number of days spent at the hospital after delivery.[12] The current study adds value in the following ways: First, the data used in this study allows me to follow individuals over a longer time period for up to 8 years following birth, which is important for identifying effects of long-run health, fertility and future births outcomes. Second, compared to previous studies, this study examines a broader set of outcomes including future pregnancy outcomes and labor market outcomes including income from both sickness and parental benefits.

In summary, this study suggests that an increase in planned C-sections, among the high-risk group of breech births, improve short- and long-run child health. However, it appears to have limited consequences for maternal health and labor market outcomes. These findings are particularly relevant for countries with low rates of planned C-sections for breech births. Singleton breech births at term represent a reasonably large share (approximately 4%) of all births. Thus, interventions that can improve health among this high-risk group are important. The results from these exercises show that the gap in child health between this risk group and normal births nearly vanishes in the face of this medical intervention. Moreover, this study contributes to the general literature on the causal effects of C-sections, and although it focuses primarily on breech births, the results may be of interest for other high-risk groups as well.

2 Background

2.1 Information shock to the medical society

New scientific evidence regarding preferred delivery mode for breech births became available to the medical society, when the large scale international randomized controlled trial, called the Term

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[12] This study extends the analysis of Jensen and Wüst (2015) in the following ways: First, I focus on a broader set of outcomes including subsequent fertility and maternal labor outcomes not previously studied for this population of high-risk births. Second, the data used in this study allows me to follow individuals over a longer time period for up to 8 years and with a sample size more than twice as large in comparison, providing greater statistical power. Third, this study covers first time mothers, while in the case of Denmark the increase in C-sections only occurred among second time mothers. Analyzing the impact for first time mothers may be of particular interest because any second birth is likely to be endogenous to the first.

Breech Trial by Hannah et al. (2000), were published in The Lancet in October 2000. This landmark study suggested that planned C-section is the preferred delivery mode for singleton breech births at term. The Term Breech Trial has been described as the most influential study in obstetrics, nearly eliminating vaginal delivery for term breech births in a number of industrialized countries (Glezerman, 2006; Sharoni et al., 2015).

A couple of months before publication, preliminary results from the Term Breech Trial and a Swedish cohort study by Herbst and Thorngren-Jerneck (2001) was presented at the annual meeting of the Swedish College of Obstetricians and Gynecologists in August 2000 (Alexandersson et al., 2005).[13] Both studies suggested that planned C-section is superior to vaginal delivery for breech births at term.[14] After the publication of the Term Breech Trial in October, the Swedish College of Obstetricians and Gynecologists organized an additional meeting in December the same year, to further discuss the implications of the Term Breech Trial.

This information shock to the medical society led to an immediate response in medical practice in Sweden, resulting in a sharp increase in planned C-sections among breech births (Alexandersson et al., 2005). Although there were no formal changes made to the national guidelines for specific selection criteria on mode of delivery for breech births, multiple sources suggest that the dissemination of new evidence on preferred delivery mode from the Term Breech Trial and Herbst and Thorngren-Jerneck (2001), at the annual meeting of the Swedish College of Obstetricians and Gynecologists, caused a strong increase in planned C-sections.[15] First, increased support among the members of the Swedish College of Obstetricians and Gynecologists, in favor of planned C-

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[13] The annual meeting started with a symposium on "Term breech: C-section or vaginal delivery? (Sätesändeläge i fullgången graviditet-kejsarsnitt eller vaginal förlossning?)" and consisted of several lecturers on the topic of preferred delivery mode. The internal newsletter of the Swedish College of Obstetricians and Gynecologists "Medlemsbaldet nr 4, 2000" includes a detailed description of the Swedish College of Obstetricians and Gynecologists annual meeting and this symposium.

[14] The results from Hannah et al. (2000) showed that perinatal and neonatal mortality as well as severe neonatal morbidity were significantly lower in breech births delivered with planned C-section (1.6%) than with planned vaginal delivery (5.0%). The Term Breech Trial was terminated prematurely because of findings of statistical differences in perinatal outcomes between the two groups, making it unethical to continue the randomization (Hannah et al., 2000). Herbst and Thorngren-Jerneck (2001) find that babies delivered by planned vaginal delivery had lower Apgar scores (by 3-5%) and exhibited higher neonatal neurological morbidity (by 3%).

[15] National guidelines issued by the National Board of Health and Welfare for specific selection criteria on mode of delivery for breech presentation pregnancies have been available in Sweden since 1974. Under these guidelines, vaginal delivery can be attempted if certain criteria are fulfilled, including normal fetal growth, pelvis size, spontaneous start of delivery, and abundant amniotic fluid. During the 1980s and 1990s, studies from several countries (including Sweden) on preferred delivery mode for breech presentation pregnancies showed increasing support for and use of planned C-sections (Herbst, 2005). During the 1970s to early 2000, the rate of planned C-sections for breech births rapidly increased from 10 to nearly 50%.

section, was reported from the symposium on breech births at the annual meeting in 2000.[16] Second, the data show an evident pattern of altered Swedish obstetric practice regarding delivery mode among breech presentation births attributed to new evidence-based recommendations (Alexandersson et al., 2005), consistent with many other industrialized countries at this time (Sharoni et al., 2015). In Figure 1, trends in the proportion of C-sections among breech births at term are presented. The trends show a sharp increase in the rate of planned C-sections, from approximately 47% in 2000 to over 60% in 2001 (Figure 1a). The trends at the monthly level (see Figure 1b) display how C-sections increased after the annual meeting in August 2000.

2.2 Breech births in the Swedish context

In Sweden, all residents have access to universal health care, including health care during pregnancy, childbirth and antenatal care, which is provided free of charge.[17] Midwifes are the main care-givers through the process of pregnancy and childbirth, and obstetricians or gynecologists (OB/GYN) are available in case of complications, to prescribe medicines and for medical procedures. The assignment of a birth clinic is usually based on the residency of the woman, but expectant mothers can to some extent choose another birth clinic dependent on the clinic's capacity to admit additional patients.

Near the end of the pregnancy, around weeks 36-37, the fetal position is examined by a midwife at the prenatal care unit. If the fetal position is suspected to be breech or deviates from normal presentation in some other way, the woman is referred to a specialist maternity care unit, where the OB/GYN tries to manually turn the baby into a cephalic position using a procedure called "external cephalic version" (ECV). If this is successful (and if the baby stays in cephalic position until delivery) vaginal delivery is attempted following the normal procedures. If the ECV is unsuccessful (which is the case for around 50% of all attempts), a planned C-section is usually scheduled 7-10 days before the expected date of delivery (based on the date of last period and ultrasound examination). However, vaginal delivery may be attempted if certain criteria are fulfilled including normal fetal growth, pelvis size, spontaneous start of delivery and abundant amniotic fluid. Importantly,

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[16] An immediate poll of the members of the Swedish College of Obstetricians and Gynecologists after the symposium on breech births at the annual meeting showed strong support for planned C-section compared with vaginal delivery (internal newsletter of the Swedish College of Obstetricians and Gynecologists, "Medlemsbaldet nr 4, 2000").

[17] All residents in Sweden are guaranteed access to public health care, which is primarily provided by the county councils ("Landsting") and funded by central and local taxation. Only 2.5% of all residents have taken out private health insurance (Anell, 2008).

not all breech presentations are identified prior to birth. If a breech presentation is discovered at the time of delivery, the decision-making process is similar to if discovered before (Karolinska Universitetssjukhuset, 2016).

3 Data

3.1 Data description

I use Swedish administrative population-level data to study the impact of C-sections on child and maternal outcomes. I use data for all births in Sweden between 1973 and 2011 from cohorts born between 1940 and 1985 (including their children and parents) which are identified via the Swedish Multi-generational Registry (Flergenerationsregistret) and the Swedish Medical Registry (Svenska födelseregistret). Based on this sample, covering more than 98% of all births in Sweden during 1973-2011, multiple data registries on health and labor market outcomes are combined, and data are complete for the period 1991-2011.

Information on pregnancy and birth outcomes is obtained from the Swedish Medical Birth Registry, provided by the National Board of Health and Welfare. It contains information on all births in Sweden since 1973 beyond 22 weeks of gestational age. This registry provides detailed information on pregnancy, delivery and postpartum conditions and procedures, including maternal characteristics and previous health conditions. In addition, it also provides extensive data on perinatal and neonatal outcomes for the child, including fetal position, gestation and birth weight. This data contain information on *delivery mode*, whether vaginal delivery or C-section delivery. As a C-section delivery can be either a planned or emergency surgical procedure, information about the indication (whether a planned or emergency C-section) for the procedure is of interest. The birth registry lacks detailed information about the indication for C-sections before 2000. Instead, it provides information on whether delivery started or ended with C-section. For this reason, deliveries that started with C-section are used as a proxy for planned C-section, and deliveries that end with C-section (after attempting vaginal delivery) are used as a proxy for emergency C-section. Deliveries of term births that start with C-section are considered a good proxy for planned C-sections (Källén et al., 2005).

In order to define treatment status, I need to identify whether the birth occurred before or after the information shock. Information on the exact date of birth is unfortunately not available. As an approximation for date of birth, I use the discharge date from the maternity unit minus the number of average hospital nights for corresponding delivery mode. In the year 2000, the number of nights spent at the hospital after delivery by C-section was, on average, four nights, compared with two nights for vaginal delivery (The Swedish National Board of Health and Welfare, 2003). Another important variable for this analysis is *fetal position*, in which breech birth is defined as complete, frank, or footling breech,[18]

Data on hospitalization are obtained from the National Patient Registry, provided by the National Board of Health and Welfare, and contains information on inpatient care at all Swedish hospitals, including length of each hospital stay. Because of data availability, I use the mother's discharge date from the maternity unit, via the Medical Birth Registry, as a proxy for the date of delivery. Thus, for the mother, I can observe hospitalization only after readmission to the hospital. Mortality data are identified using the Cause of Death Registry, which is provided by the National Board of Health and Welfare and includes information on all deaths of registered residents in Sweden.

Data on labor market outcomes are obtained from the Longitudinal Integration Database for Health Insurance and Labor Market Studies (LISA), which is provided by Statistics Sweden and contains annual information on education and earnings for all individuals above age 16 starting from 1991. To assess the impact of birth technology on labor market responses, I focus on the following variables: *income from gainful employment*, defined as total annual gross earnings (in cash) and net income from active business; *income from parental leave*, defined as the total annual income from parental leave (this includes income from parental allowance, temporary parental leave, and child care allowance); *income from sick leave*, defined as the total annual income resulting from illness, injury, or rehabilitation (including a sick pay period of 14 days). All income variables are expressed by annual amount in SEK. Education is measured by the highest level of educational attainment (levels 1 to 7).[19]

3.2 Index construction and multiple hypothesis testing

Since I test a large number of outcome variables, the analysis is prone to type 1 errors. To account for this potential issue, I compute summary indices as suggested by Anderson (2008), combing

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[18] ICD-10: O80.1, O83, O64.1, P03.0, or codes defined by Swedish Medical Birth Registry: MAG00, MAG03, MAG10, MAG11, MAG20, or MAG96.

[19] Level 1 is primary education less than 9 years, level 2 is primary education of 9 years, level 3 is secondary education at most 2 years, level 4 is secondary education of 3 years, level 5 is tertiary education less than 3 years, level 6 is tertiary education 3 years or more, and level 7 is graduate studies.

multiple outcomes into one measure for child health, maternal health at birth, maternal health at subsequent birth, and labor market outcomes. The indices are computed as follows: The direction of each outcome is oriented such that a higher value indicates a better outcome. All outcomes are standardized, subtracting the mean and dividing it by the standard deviation of the control group. For each category of interest, an index is created using the standardized variables weighted by the inverse of the covariance matrix. This means that variables with lower correlation with the other variables within the category provide new information and will therefore obtain a higher weight than variables with high correlation.[20] The indices are computed in such a way that mean in the control group is zero with standard deviation one.

I construct 4 indices in total. The *Child health index* consists of Apgar score (scale 1-10, positively coded), Apgar score below 7 (negatively coded), infant mortality (negatively coded), nights hospitalized (inpatient admission overnight) within the first year of life (negatively coded), and between ages 1 and 7 (negatively coded). The *Maternal health index* consists of maternal sepsis (negatively coded) and postpartum hemorrhage (negatively coded), nights hospitalized postbirth (inpatient admission overnight within one year of birth, negatively coded). The *Maternal health at subsequent birth index* consists of maternal sepsis (negatively coded) and postpartum hemorrhage (negatively coded), nights hospitalized postbirth within one year from birth (negatively coded), and emergency C-section (negatively coded) at subsequent birth. Finally, the *Maternal labor market index* consists of the annual labor income (in SEK is positively coded), parental benefits (negatively coded), and sickness benefits (negatively coded).

In addition, fertility outcomes using a fixed time period of 8 years after birth are analyzed focusing on the total number of future births, a binary measure of any future birth, and birth spacing. Finally, effects on income from gainful employment, sickness benefits, and parental benefits are analyzed separately.

The issue of multiple comparisons is further addressed by controlling for *false discovery rates (FDR)*, which is the proportion of type I errors. Corrected p-values are estimated using the step-up procedure suggested by Benjamini and Hochberg (1995).

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[20] The results are robust to using a non-weighted index. These results are available upon request.

3.3 Sample and descriptive statistics

For this analysis, data from multiple registers are combined for the time period August 1997 to August 2003 (i.e., 36 months before and after the information shock). I restrict the sample to mothers with a singleton and live birth, in which the fetus is presented in breech position at term (gestational age equal to 37 weeks or above).[21] Multiple births and preterm births are omitted from the analysis since the information shock of preferred delivery mode considers only singleton breech births at term. I cannot observe whether external cephalic version was attempted. Thus, my sample consists of fetuses in breech presentation, in which births with successful external cephalic version are implicitly omitted from the sample. The final sample of breech babies covers 13,174 births.[22]

To illustrate how breech births are related to normal (cephalic) births at term, I present summary statistics in Table 1 of unconditional means and standard deviations in child and maternal characteristics among breech births (columns 1-3) and normal position births (columns 4-6).[23] A t-test of differences in means between breech and normal births is presented (column 7) together with its p-values (column 8). This table shows a clear pattern in that singleton babies presented in breech at term tend to have poorer health outcomes at birth than babies in normal position. On average, birth weight is 250 grams lower for babies in breech position and gestational age is one week shorter. Breech babies are less likely to be male (0.46 compared with 0.51), suggesting negative selection of male fetuses in utero[24] and more likely to suffer from fetal malformation (8.4% compared with 3.1%). Apgar score is lower in absolute terms as well as for the dichotomous measures of low health at birth (below score 7). The likelihood of infant death is higher for breech babies, by 3.2%, compared with normal position babies, by 1.3. Other health indicators show a similar pattern in which babies in breech position exhibit inferior health compared with those in normal position. These differences may not be due only to breech position but also to delivery mode and underlying maternal characteristics. However, the differences in child health remain when comparing child health between breech vaginal birth and normal vaginal birth.[25]

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[21] According to the Swedish National Board of Health and Welfare, a breech birth is identified by maternal diagnosis by ICD-10 codes O80.1, O83, O64.1, and P03.0. Breech implies breech or footling position.

[22] During this period, there are 405,743 singleton term births with normal presentation. Subsamples of different time periods around the information shock are also used for the analysis. I exclude births with no information on year of birth or date of discharge (577 observations) as well as observations without information on gestational age (48 observations), since these variables are pertinent for defining treatment status.

[23] The samples of normal position births include singleton births at term (born in week 37 or later).

[24] For example male fetuses are less likely to survive under distress (Almond and Mazumder, 2011).

[25] These differences also remain when holding gestational age constant, regressing breech status on child health. These results are available upon request.

Maternal health outcomes show a similar pattern of adverse health and obstetric outcomes. A striking difference between breech and normal position births is the delivery mode. Among breech births, planned C-section delivery is the most common method (55.6%) compared with emergency C-section (26.6%). In comparison, among normal position births, 3.9% of all deliveries are planned C-sections, and 4.5% are emergency C-sections. Mothers with breech births have slightly higher educational attainment and higher annual labor income (135,481 SEK compared with 118,000 SEK) prior to birth, but no statistical differences are seen for the amount of sickness benefits prior to birth. This suggests that women having breech births are not disadvantaged in terms of education and income compared with mothers with normal position births. Finally, in panel D, the indices confirm the summary statistics presented, showing that child and maternal health are poorer among breech births (0.045, -0.021, -0.010) compared with normal position births (0.107, 0.016, 0.157). This is, however, not the case for the labor market index, which exhibits better outcomes (0.083) compared with normal births (-0.037).

Trends in delivery mode, child and maternal outcomes among breech births at term are presented in Figures 1, 4, 5, and 6. These graphs show monthly level (as well as yearly level for C-sections) trends around the information shock, where 0 is the month of information shock. The red vertical dashed line indicates the month of the information shock, and each dot represents the average rate of C-sections on a monthly basis. Figure 1 show a sharp increase in C-sections among breech births at term, which is driven by an increase in planned C-section deliveries compared with emergency C-sections.[26] Descriptive evidence of improvements in child health after the information shock is visible for most outcomes (Figure 4) but less of a pattern can be seen for maternal outcomes except for income from parental leave, which appears to decrease after the information shock (Figure 5).

The proportion of breech births during this period appears to be constant across the cutoff. Moreover, no discontinuous increase in C-section deliveries can be detected among normal position births (see Figure 3).[27]

4 Empirical analysis

The intrinsic endogeneity problem when studying the impact of C-sections is that delivery mode can be correlated with prebirth characteristics of the mother and the child. Thus, a simple correlation

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[26] The proportion of emergency C-sections are presented in Figure A1.

[27] The regression analysis confirms this finding and is further elaborated on in Tables 2 and A1.

between outcomes and delivery mode will suffer from selection bias—it is likely that important, but unobservable, prebirth maternal and child characteristics differ systematically between C-section births and vaginal births. To overcome this issue, I use the information shock to the medical society as exogenous variation in planned C-sections. I do this by first capturing the impact of the information shock to the medical society by employing a pre-post analysis. If we assume that maternal characteristics are similar across the time of the information shock, births delivered shortly prior to the information shock would function as a control group for births delivered shortly after. The key identifying assumption required for this empirical strategy to be valid is that the information shock is exogenous to the timing of the birth. Second, the causal impact of C-sections is identified using the information shock to the medical society as an instrumental variable (IV), which is estimated using a two stage least squares model (2SLS).[28] The IV estimates can thus be interpreted as the average treatment effect on "compliers", which are births delivered by planned C-section due to the information shock.

I start by examining the first stage relationship, i.e. the impact of the information shock on delivery mode for singleton breech births at term, which is estimated according to Equation 1 using an ordinary least squares model.

$$P(\text{C-section}_{it} = 1) = \alpha_1 + \alpha_2 InfoShock_t + f(t) + X_{it}\delta + \varepsilon_{it} \tag{1}$$

The outcome variable is denoted by $P(\text{C-section})$ across individual i and time t, which is equal to one if birth is delivered by planned C-section and zero otherwise. The variable $InfoShock_t$ is a binary variable equal to one if birth occurs after the 25 of August 2000 and zero if birth occurs before.[29] Split time trends $f(t)$ are included, consisting of a first-order polynomial of normalized daily calendar time away from the information shock in August 2000, allowing for different slopes across the cutoff. The calendar time is normalized such that the cutoff date, 25 of August 2000, is zero where treatment is positive to the right of this threshold. By including $f(t)$, I allow for different trends (slopes) before and after the information shock. In certain specifications, a full set of child and maternal characteristics X_{it}, consisting of binary measures of birth order, maternal age, county of residency, quarter of birth, nationality (born in Sweden or not), tobacco usage during

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[28] This approach is analogue to a fuzzy regression discontinuity design using calendar time as the running variable. However, because I have limited amount of data close to the cut-off and because of seasonality in childbearing (which is accounted for by controlling for birth-quarter fixed effects), using a shorter time period than less than one year is undesirable.

[29] Date of birth is not available. Instead, I use the discharge date as an approximation for date of birth. More information is available in Section 3.

the first trimester, sex of the baby, educational attainment, is included.[30] The idiosyncratic error term is denoted ε_{it} clustered on the discrete values of the assignment variable, day-month-year, suggested by Lee and Card (2008).[31] Robustness checks are conducted with respect to the choice of polynomials, kernel, and time period.

The second stage analysis is described by Equation 2, where the relationship between various outcomes Y_i and delivery mode, which can be attributed to the information shock, is established. This relationship is estimated using a 2SLS method where the estimated effect can be interpreted as the local average treatment effect on compliers.

$$Y_{it} = \beta_1 + \beta_2 P(\widehat{\text{C-section}_{it}} = 1) + g(t) + X_{it}\theta + \xi_{it} \tag{2}$$

The predicted likelihood of having a C-section due to the information shock is expressed by $P(\widehat{\text{C-section}_{it}} = 1)$ and estimated according to Equation 1. Trends, time-varying controls, and the error term are handled analogously to Equation 1, such that each variable included in the first stage is included in the second stage.

In addition to the date of birth being independent of the information shock, the IV strategy is valid provided that the following assumptions are satisfied (Angrist and Pischke, 2009): First, the *exclusion restriction* implies that the information shock affects outcomes only via a higher likelihood of having had a C-section and not other medical practices and treatments. Second, the instrument must be *relevant* such that the information shock is strongly correlated with the adaptation of a new delivery practice—that is, C-sections among breech births. Finally, *monotonicity* implies that the information shock should have either a positive or zero treatment effect (such that C-sections are more likely after the information shock but never less likely). These issues are further discussed in section 5.1.1.

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[30] Information on birth hospital or birth county is unfortunately not available; instead the baby's registered county of residence is used as an approximation for birth county.

[31] There is an ongoing debate about clustering when using time as the running variable; see Hausman and Rapson (2017). The results are robust to alternative clustering on the level of the mother.

5 Results

5.1 Effects on the probability of C-section and obstetric care

The sharp increase in planned C-sections among breech births is presented visually in Figures 1a and 1b, and in regressions estimated according to Equation 1 presented in Table 2 (columns 1-2). The results indicate that the information shock to the medical society had a strong significant impact of 11.4 percentage points on the probability of planned C-section among breech births. The estimate and precision remain robust to the inclusion of maternal and child characteristics such as maternal weight, height, nationality, education, tobacco use during the first trimester, and sex of the baby, as well as age, birth order, birth-quarter, and county fixed effects.[32] F statistics for each regression are presented in Table 2. The F statistics with and without controls, of 40 (see columns 1-2) is well above 10 (the 'rule of thumb" threshold suggested by Staiger and Stock (1994)). Thus, the results imply that there is a strong significant effect of the information shock to the medical society on the proportion of C-sections among breech births corresponding to a 23% increase when compared with the mean of the dependent variable in the pretreatment period.

While an increase in planned C-sections among breech births is expected, there should be no impact on the proportion of planned C-sections among births with normal fetal position.[33] This is tested analogously to breech births and presented in Table 2 (columns 3-4). The estimates are both statistically insignificant and small in magnitude, with a F statistic of 0.4. Hence, the results show no indication of altered delivery mode among normal position births. These results suggest not only that there were no changes in delivery mode among normal position births but also that the rise in C-sections among breech births did not crowd out C-sections for nonbreech births (due to constraints in the surgical team at the hospital).[34]

Panel A of Table 3 demonstrates the robustness of the first-stage results to alternative functional form and time period. These specifications include a global linear trend (column 1), a triangular kernel that places more weight on observations close to the cutoff and less on those farther away

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[32] As birth timing is not exogenous (Quintana-Domeque et al., 2016), seasonality is controlled for using birth-quarter fixed effects.

[33] Analogous to the sample of singleton term breech births, the sample of normal position births excludes preterm births ($<$ gestational week 37), multiple births, and births in fetal positions other than prostrate neck or head presentations.

[34] Similarly, the information shock suggests that planned C-section is the preferred delivery mode for singleton breech births at term only, which is why we expect to see no impact on either breech twins or preterm breech. Consistent with this, no significant impact is found for either of these two groups. These results are available upon request.

(column 2) and an alternative sample of a shorter time period of a 24-month window before and after the information shock (column 3) as well as a shorter time period of a 12-month window (column 4), quadratic trends (column 5), cubic trends (column 6).[35] A full set of fixed effects and maternal and child characteristics are included. These estimates of 0.11-0.12 are very similar to the baseline estimate of 0.11 with a F statistic above 10 except for the 12-month window (with a F statistic of 7.4).[36]

To get a better understanding of the effect of the information shock, the impact on supplementary or intermediate medical interventions during delivery for breech births is examined and presented in panel B, Table 3. The results are estimated analogously to the baseline specification, expressed by Equation 1, with a full set of covariates and fixed effects. The results imply that the information shock had no statistically significant impact on emergency C-sections (column 1), indicating that the rise in planned C-sections originated from women who would otherwise have given birth by vaginal delivery. There is no significant impact on induced labor (column 2) or the usage of forceps or vacuum extractor (column 4) but a strong significant increase in the use of spinal anesthesia (column 3), which has a similar estimate (0.13) to the increase in planned C-sections (0.11). The increase in the usage of spinal anesthesia is an automatic response to the increase in C-sections, since spinal anesthesia is routinely used during planned C-sections. Finally, the likelihood of having an episiotomy,[37] a surgical procedure used at vaginal birth (column 5), drops by 5.7 percentage points, which is expected, since this procedure is not necessary during a C-section.

Finally, heterogeneous effects of the information shock on the probability of C-section across the following subsample are examined and presented in Table 4: birth order (panel A, columns 1-3), age group (panel A, columns 4-7), educational level (panel B, columns 1-3), and BMI classification level (panel B, columns 4-6).[38] The information shock led to a strong significant increase in planned C-sections for first- and second-time mothers, mothers of all educational levels, all women under age 35, and both normal and overweight women.[39] This indicates that a broad category of women had a planned C-section due to the information shock, however, no impact was found for women

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[35] There is an ongoing debate regarding the use of higher polynomials greater than two; see Gelman and Imbens (2014) for a detailed discussion.

[36] The F statistic using the 12-month window is above ten when not including quarterly fixed effects. Controlling for seasonality is demanding when using a short time period.

[37] Surgical incision made in the perineum to widen the opening of the vagina for a faster delivery.

[38] These observables are chosen because of data availability and because birth order, age, BMI, and SES are considered important determinants for delivery mode (Ecker et al., 2001; Sebire et al., 2001; Sheiner et al., 2004).

[39] While the magnitudes across educational levels differ slightly, with higher likelihood of planned C-section for women with more education, these differences are statistically different only for mothers with secondary and tertiary education.

above age 35, women with their third or higher order birth or obese women. Additionally, these results suggest that the monotonicity assumption is satisfied, implying that the information shock had either a positive or null effect but never a negative effect on the probability of having a planned C-section.

5.1.1 Validity of the first stage

There are a number of potential threats to the identification. First, a potential issue is that the information shock could have led to changes in the frequency of breech births being reported. Similarly, if there were fewer attempts to turn the fetus to a normal position (external cephalic version) due to the information shock, the proportion of breech births would increase and possible selection issues could arise. By examining the proportion of breech births around the time of the information shock I may alleviate this concern. In Figure 2, the proportion of breech births is presented. The trend in the proportion of breech births exhibits a highly constant development over time including the time of the information shock in 2000. Additionally, this is formally tested in Table A1, which confirms that the proportion of breech births remained unchanged at the time of the information shock.[40] Moreover, a McCrary test shows no evidence of a discontinuity in the number of breech births at the time of the information shock. The McCrary regression result for the information shock is -0.025 (se 0.13) and is visually presented in Figure A2.

To investigate maternal selection, a balancing test of covariates across the discontinuity is conducted, testing for compositional changes by running regressions with maternal characteristics as the outcome variable and the information shock as the explanatory variable. The results are presented in panel A, Table 5 and suggest that for breech mothers, there was no significant change in observable maternal characteristics such as age, height, weight, educational attainment, labor income, or sickness benefits before birth at the time of the information shock. I also test for compositional changes among maternal characteristics on mothers receiving a planned C-section, presented in panel B, Table 5. Similarly, no significant impact on maternal characteristics is observed across the information shock.[41] The conclusion from these exercises is that based on observable charac-

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[40] Manipulation of the running variable is less likely for several reasons: the fertility decision was made before any knowledge of the information shock was available: it is unlikely that women would be able to delay or move the delivery to an earlier date: the preliminary results presented to the medical society were not announced in the public media.

[41] In addition, I regress the likelihood of having a planned C-section on a fully interacted model, in which the maternal characteristics are interacted with the treatment status (post information shock). None of these interactions are significantly different from zero except for height. This result is available upon request.

teristics, I find no evidence in favor of changed maternal characteristics. This can alleviate concern to some extent regarding both selection and demographic changes at the time of the information shock.

Finally, I conduct placebo regressions for examining discontinuities at other points in the distribution of the running variable. More specifically, by using a bandwidth of 12 months before and after the placebo date, I examine whether there are any discontinuities in the proportion of planned C-sections on 25 of August in one to three years before or after 2000. By doing this, I also check for seasonality in planned C-sections to rule out that planned C-sections usually increase during this time of year. The results are presented in Table 6 and show no signs of significant changes in the probability of planned C-section at any of the placebo dates, except for a marginally significant negative estimate for the placebo date of August 25, 1999.

5.2 Effects on health, fertility and labor market outcomes

5.2.1 Baseline results

The baseline results on child and maternal health, subsequent fertility outcomes, and labor market outcomes are presented in Table 7. For each outcome, I present the reduced form estimates (panel A, estimated according to Equation 1) and IV estimates (panel B, estimated according to Equation 2). The reduced form estimates capture the overall impact of the information shock on all breech births, while the IV estimates capture the impact of C-sections attributed to the information shock on complying women. All regressions include a full set of covariates and fixed effects. Starting with the impact on child health presented in Table 7, the reduced form effect of the information shock suggests a significant increase in child health by 0.105 standard deviations (SD). Turning to the IV-estimates, which give us the impact on births delivered with C-sections due to the information shock, child health improved by 0.912 SD (panel B in Table 7). When looking at the separate components of the child index, presented in Table 8, there is a consistent pattern of improved infant and child health in terms of higher Apgar score, lower probability of low Apgar score, lower infant mortality, and fewer nights hospitalized within the first year of life and during ages 1-7. Yet the significant effects (below 5% significance level using conventional p-values and below 10% using FDR), originate from a higher level in absolute Apgar score by 0.65 unit change (column 2) and lower number of nights hospitalized during ages 1-7 by approximately 6 nights (column 10). This result is interesting, since it suggests that both short- and long-term health improved for children delivered by C-sections due to the information shock.

Turning to the effects on maternal health, presented in Table 7 (columns 2) and, for each component separately, in Table 9. While these separate estimates indicate a lower risk of sepsis and fewer nights hospitalized (re-admission), none of these effects are significantly different from zero, meaning that we cannot infer any significant impact on maternal morbidity. For the selected sample of women having at least one more birth within eight years after her breech birth, potential effects on maternal health outcomes are analyzed in Table 7 (column 3). The estimated effect on maternal health at subsequent births suggests no significant impact. When examining each outcome separately in Table 10, no significant impact is found.[42] The impact on subsequent fertility is investigated and presented in Table 7 (columns 4-6). These estimates suggest a negative but insignificant impact on future fertility measured by total number of future births and a binary measure of the probability of not having another birth.

The effects on the labor market index are explored and presented in Table 7 (column 7).[43] No significant impact on the index is found. However, when incomes, average annual incomes for 5 years after giving birth, from labor earnings, sickness benefits, and parental benefits are examined separately (Table 11), a reduction in parental benefits by 39%, significant below 5% significance level using conventional p-values, is found.[44] While this result is in line with having a healthier child, when correcting the p-values using FDR however, the impact is no longer significant, which should invoke some caution in the interpretation of the results. In addition to using the average impact within five years from giving birth, event studies are carried out, examining the impact for each year separately, one through five years after the information shock, presented in Figure A3. While there is a negative effect on income from parental benefits, no significant effect is found on income from parental benefits or any other labor market outcomes.

Because labor market and future fertility outcomes could be endogenous to the first birth, I re-estimate the impact using a sample of first-time mothers only, presented in Table A2. A similar

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[42] While I focus on emergency C-sections at any subsequent birth (for measuring adverse outcomes at subsequent birth), the impact on repeated planned C-sections is also examined and found insignificantly affected by C-sections generated by the information shock. This result is available upon request.

[43] A C-section delivery alone does not qualify a woman for sickness benefits from the Swedish Social Insurance Agency. Moreover, the level of sickness and parental benefits depend on labor income (individually set in proportion to the labor earnings the year before giving birth). However, all Swedish residents receive a minimum amount of benefits when sick or becoming a parent.
Three sources of income are analyzed: labor income, income from sickness benefits and income from maternity leave. Unfortunately, data on labor supply (e.g., working hours) are not available. Income data are available only on an annual basis.

[44] Similar results are found for three, five and seven year averages after giving birth.

result to the baseline results, is found for the first-time mothers, but with slightly lower precision and magnitudes.

The results are further analyzed using alternative functional form and period presented in Table 12, such that all results are re-estimated using a global trend (panel A), a triangular kernel (panel B), a smaller window of 24 and 12 months before and after the information shock (panels C and D), and quadratic and cubic trends (panels E and F). These results show that the 2SLS estimates on child health (ranging from 0.75-1.76 SD) are consistent across specifications yet larger in magnitude compared to the baseline of 0.91 SD. Similarly to the baseline results, the impact on fertility, maternal health, birth spacing, and labor market outcomes remain insignificantly different from zero regardless of the specification with the exception of number of future births which is marginally significant when including cubic trends.

5.3 Additional robustness and sensitivity

A number of robustness and sensitivity checks are conducted for the baseline results. As an alternative approach for dealing with issues including other interventions occurring at the same time, demographic changes, correlation between season of birth, and maternal and child characteristics, I report the difference-in-differences (DiD) estimates. Here outcomes for breech births are compared with those for normal position births before and after the information shock.[45]

The DiD estimates are presented in Table 13 and support the findings in the baseline model. As the baseline results, the DiD estimates suggest a strong significant increase in the probability of C-section by 11.3 percentage points (with a magnitude that is virtually the same 11.5 percentage points) and a strong positive impact on child health index by 1.14 SD when considering the 2SLS estimate.

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[45] I conduct a DiD analysis to examine the consistency of the estimates across models. The DiD is estimated according to:

$$Y_{it} = \gamma_1 + \gamma_2 (Breech \times InfoShock)_{it} + \gamma_3 Breech_i + f(t) + Breech_i \times f(t) + \pi_t + X_{it}\mu + \varepsilon_{it} \tag{3}$$

in which *Breech* is a binary variable equal to one if breech and zero if singleton normal position birth at term. γ_2 is the parameter of interest (DiD estimate), capturing the relative change in outcomes for breech births compared with normal position births due to the information shock. The interaction term $Breech \times InfoShock$ is equal to one if a birth is a breech birth born post the information shock and zero otherwise. Split time trends $f(t)$ are included as well as breech-specific time trends $Breech_i \times f(t)$. π indicates day-month-year fixed effects, accounting for time factors. The vector of maternal and child control variables X_{it} and the error term ε are handled analogously to Equation 1. Additionally, I combine the IV strategy with the DiD approach using the information shock as an instrument for planned C-sections and normal position births as a control group.

The trust we can invoke in DiD estimates depends on whether the identifying assumption of parallel trends is satisfied. To explore the plausibility of the parallel trend assumption, I test for differences in the pretreatment trends in the outcome variables by conducting multiple event studies. For the event studies, I fully interact a binary indicator of breech birth with the years before and after the information shock such that each coefficient represents an interaction term between year and breech birth. The year of treatment, 2000, is the omitted base category following general convention. The results are presented in Figure A4 and suggest a highly significant sharp increase in planned C-sections as well as significant improvements in child health after the information shock but no impact on any other outcomes. Importantly, the event studies also suggest that pretrends in the outcome variables are not significantly different between breech and normal positions. That is, out of eight outcomes, only one coefficient for one outcome (maternal health) is significantly different from zero. Hence, these tests indicate that there are common trends in the outcome variables in the pretreatment period.

I consider alternative dates for the information shock using alternative cutoffs, including the date of publication of the Term Breech Trial and the date of the Swedish College of Obstetricians and Gynecologists's extra meeting held in December 2000. To do this, I first remove observations between the annual meeting of the Swedish College of Obstetricians and Gynecologists in August and each of the alternative dates separately, since these births are at least partially treated in line with the documented response from the medical society according to Alexandersson et al. (2005). First, I use the date of the publication of the Term Breech Trial by Hannah et al. (2000), presented in panel A, Table A3, and show that the results are robust but with a slightly lower estimate for child health of 0.71 SD (compared with the baseline of 0.91 SD). Then I use the date of the extra meeting held in December 2000, presented in panel B, which suggests that the results are similar to the baseline results but with a marginally significant negative estimate for the number of future births by 0.042. Because of data availability, I use the discharge date from the maternity unit minus the number of average hospital nights for the corresponding delivery mode (four nights for C-section and two nights for vaginal delivery) as an approximation of the date of birth. This procedure may, however, result in a measurement error. To deal with this potential issue, I exclude a small window across the information shock, dropping births one week before and after the shock. The results are presented in panel C, Table A3, and are similar to the baseline results, showing a positive significant impact on child health by 0.84 SD.

5.4 Interpreting the results

The results from this study should be interpreted with regard to the risk margin of women delivering with planned C-section due to the information shock. Among singleton breech births, 47% were already being delivered with planned C-sections before August 2000. Therefore, the marginal births were most likely not the highest risk births since the proportion of planned C-sections among obese or older women was already high, and no significant effect of the information shock was found on these groups. It is therefore noteworthy that the impact on child health is substantial—especially since the increase in planned C-sections appears to be attributed to fewer vaginal births rather than fewer emergency C-sections.

Regarding external validity, when interpreting the results, one should also consider the fact that breech births constitute a particular high-risk group. The effects from marginal planned C-sections are compared with those of high-risk vaginal births within this group, which may not be generalizable to births with normal position. While we cannot extrapolate the results regarding improved child health from more planned C-sections to normal births, it is plausible that medical interventions improving health at birth could have long-term consequences for child health (in terms of lower morbidity). Finally, breech births constitute a fairly large group across most populations worldwide, which can be easily identified. Breech births are a continuous high-risk group in need of extra medical interventions. Yet the preferred delivery mode continues to be a controversial topic with substantial variation in planned C-sections across industrialized countries. The findings in this paper are thus policy relevant, suggesting that countries with lower proportion of planned C-sections among breech births could improve child health.

By doing a simple back-of-the-envelope calculation, the costs of having a planned C-section can be explored. In Sweden, the average cost of a planned C-section ranges from 54,135 to 88,635 SEK, depending on how complicated the procedure is compared with 30,984 to 47,572 SEK per vaginal birth.[46] The average cost of inpatient care per hospital night for children is 14,400 SEK. While switching from a vaginal delivery to a planned C-section would increase the cost at birth (by 12,000 SEK per night), taking into account the reduction in hospitalization during childhood plus the average number of extra hospital nights for mothers who had a C-section, would save as much as 19,897 to 54,397 SEK per birth.[47]

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[46] Information regarding average costs can be found in Table A4. The cost of each procedure depends on whether the birth is complicated. There is no standard rate for a breech vaginal birth. However, a breech vaginal birth is considered complicated and in need of extra resources such as the attendance of a senior OB/GYN.

[47] Since I cannot measure whether planned C-sections lead to longer hospitalization for mothers, I use the average

6 Conclusion

In this study, I examine the impact of planned C-sections on the health and welfare of children and mothers among a particular group of high-risk births consisting of breech births. To overcome the intrinsic endogeneity issue of selection into C-sections, I use exogenous variation from an information shock of new scientific evidence to the medical society in Sweden. This shock led to a precipitous rise in planned C-sections for breech births by 23%. By using detailed Swedish register data for the time period 1997-2003, I use this shock in a reduced form pre-post analysis and as an instrumental variable in a 2SLS model. The detailed Swedish register data enables me to examine the impact of planned C-sections on a broader set of outcomes not previously examined as well as for a longer time period.

I find that planned C-sections (generated by the information shock to the medical society) led to strong improvements in child health. These improvements include a 0.65 unit increase in Apgar score and a reduction in hospital stay by 6 nights. These results are in line with previous research (Hannah et al., 2000; Herbst, 2005; Herbst and Thorngren-Jerneck, 2001; Jensen and Wüst, 2015). No significant impact was found for maternal morbidity at birth, or maternal morbidity at any future births or maternal labor market outcomes, except for a decrease in income from parental benefits, however, only marginally significantly so. Although the estimates on future fertility are negative they are not significantly different from zero for most specifications.

This study shows how increased use of C-sections among breech births can improve child health in both the short and long run, implying that improved health at birth has a lasting impact during childhood.

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hospital stay for a C-section, which is two nights longer for a C-section than for a vaginal birth.

References

ALEXANDERSSON, O., M. BIXO, AND U. HÖGBERG (2005): “Evidence-based changes in term breech delivery practice in Sweden,” *Acta obstetricia et gynecologica Scandinavica*, 84, 584–587.

ALMOND, D. AND J. CURRIE (2010): “Human Capital Development Before Age Five,” NBER Working Papers 15827, National Bureau of Economic Research, Inc.

ALMOND, D., J. CURRIE, AND V. DUQUE (2017): “Childhood Circumstances and Adult Outcomes: Act II,” Tech. rep., National Bureau of Economic Research.

ALMOND, D., J. J. DOYLE, A. E. KOWALSKI, AND H. WILLIAMS (2010): “Estimating Marginal Returns to Medical Care: Evidence from At-risk Newborns,” *The Quarterly Journal of Economics*, 125, 591–634.

ALMOND, D. AND B. MAZUMDER (2011): “Health capital and the prenatal environment: the effect of Ramadan observance during pregnancy,” *American Economic Journal: Applied Economics*, 56–85.

AMARAL-GARCIA, S., M. NARDOTTO, C. PROPPER, AND T. VALLETTI (2017): “Internet and Health Choices: Evidence from the UK,” .

ANDERSON, M. L. (2008): “Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects,” *Journal of the American statistical Association*, 103, 1481–1495.

ANELL, A. (2008): “The Swedish health care system,” *New York: The Common wealth*.

ANGRIST, J. D. AND J.-S. PISCHKE (2009): *Mostly harmless econometrics: an empiricist’s companion*, Princeton University Press.

BENJAMINI, Y. AND Y. HOCHBERG (1995): “Controlling the false discovery rate: a practical and powerful approach to multiple testing,” *Journal of the royal statistical society. Series B (Methodological)*, 289–300.

BETRAN, A., M. TORLONI, J. ZHANG, AND A. GÜLMEZOGLU (2015): “WHO Statement on caesarean section rates,” *BJOG: An International Journal of Obstetrics & Gynaecology*.

BHARADWAJ, P., K. V. LØKEN, AND C. NEILSON (2013): “Early Life Health Interventions and Academic Achievement,” *American Economic Review*, 103, 1862–91.

Bharadwaj, P., P. Lundborg, and D.-O. Rooth (2017): “Birth weight in the long run,” *Journal of Human Resources*, 0715–7235R.

Bhattacharya, S., M. Porter, K. Harrild, A. Naji, J. Mollison, E. Van Teijlingen, D. Campbell, M. Hall, and A. Templeton (2006): “Absence of conception after caesarean section: voluntary or involuntary?” *BJOG: An International Journal of Obstetrics & Gynaecology*, 113, 268–275.

Borra, C., L. Gonzalez, and A. Sevilla (2014): “The Impact of Eliminating a Child Benefit on Birth Timing and Infant Health,” IZA Discussion Papers 7967, Institute for the Study of Labor (IZA).

Breining, S., N. M. Daysal, M. Simonsen, and M. Trandafir (2015): “Spillover effects of early-life medical interventions,” .

Card, D., A. Fenizia, and D. Silver (2018): “The Health Effects of Cesarean Delivery for Low-Risk First Births,” Working Paper 24493, National Bureau of Economic Research.

Clark, S. L., M. A. Belfort, G. A. Dildy, M. A. Herbst, J. A. Meyers, and G. D. Hankins (2008): “Maternal death in the 21st century: causes, prevention, and relationship to cesarean delivery,” *American journal of obstetrics and gynecology*, 199, 36–e1.

Costa-Ramón, A. M., A. Rodríguez-González, M. Serra-Burriel, and C. Campillo-Artero (2018): “It’s about time: Cesarean sections and neonatal health,” *Journal of health economics*, 59, 46–59.

Costello, A. and D. Osrin (2005): “Epidemiological transition, medicalisation of childbirth, and neonatal mortality: three Brazilian birth-cohorts,” *The Lancet*, 365, 825–826.

Cunha, F. and J. Heckman (2007): “The technology of skill formation,” Tech. rep., National Bureau of Economic Research.

Currie, J. and W. B. MacLeod (2008): “First do no harm? Tort reform and birth outcomes,” *The Quarterly Journal of Economics*, 123, 795–830.

Currie, J. and MacLeod, W. B. (2017): “Diagnosing expertise: Human capital, decision making, and performance among physicians,” *Journal of Labor Economics*, 35, 1–43.

Cutler, D. M. and E. Meara (2000): “The technology of birth: Is it worth it?” in *Forum for Health Economics & Policy*, vol. 3.

DALTVEIT, A. K., M. C. TOLLÅNES, H. PIHLSTRØM, AND L. M. IRGENS (2008): "Cesarean delivery and subsequent pregnancies," *Obstetrics & Gynecology*, 111, 1327–1334.

DAYSAL, N. M. (2015): "early-life medical care and human capital accumulation," *IZA World of Labor*.

ECKER, J. L., K. T. CHEN, A. P. COHEN, L. E. RILEY, AND E. S. LIEBERMAN (2001): "Increased risk of cesarean delivery with advancing maternal age: indications and associated factors in nulliparous women," *American journal of obstetrics and gynecology*, 185, 883–887.

FACCHINI, G. (2018): "Low Staffing in the Maternity Ward: Keep Calm and Call the Surgeon," *Job market paper*.

FRAKES, M. (2013): "The impact of medical liability standards on regional variations in physician behavior: evidence from the adoption of national-standard rules," *American Economic Review*, 103, 257–76.

GELMAN, A. AND G. IMBENS (2014): "Why high-order polynomials should not be used in regression discontinuity designs," Tech. rep., National Bureau of Economic Research.

GIBBONS, L., J. M. BELIZÁN, J. A. LAUER, A. P. BETRÁN, M. MERIALDI, F. ALTHABE, ET AL. (2010): "The global numbers and costs of additionally needed and unnecessary caesarean sections performed per year: overuse as a barrier to universal coverage," *World health report*, 30, 1–31.

GLEZERMAN, M. (2006): "Five years to the term breech trial: the rise and fall of a randomized controlled trial," *American journal of obstetrics and gynecology*, 194, 20–25.

GUROL-URGANCI, I., S. BOU-ANTOUN, C. LIM, D. CROMWELL, T. MAHMOOD, A. TEMPLETON, AND J. VAN DER MEULEN (2013): "Impact of Caesarean section on subsequent fertility: a systematic review and meta-analysis," *Human Reproduction*, det130.

HALLA, M., H. MAYR, G. J. PRUCKNER, AND P. GARCIA-GOMEZ (2016): "Cutting Fertility? The Effect of Cesarean Deliveries on Subsequent Fertility and Maternal Labor Supply," .

HANNAH, M. E., W. J. HANNAH, S. A. HEWSON, E. D. HODNETT, S. SAIGAL, A. R. WILLAN, AND T. B. T. COLLABORATIVE (2000): "Planned caesarean section versus planned vaginal birth for breech presentation at term: a randomised multicentre trial," *The Lancet*, 356, 1375–1383.

HANNAH, M. E., H. WHYTE, W. J. HANNAH, S. HEWSON, K. AMANKWAH, M. CHENG, A. GAFNI, P. GUSELLE, M. HELEWA, E. D. HODNETT, ET AL. (2004): "Maternal outcomes at 2 years after planned cesarean section versus planned vaginal birth for breech presentation at term: the international randomized Term Breech Trial," *American journal of obstetrics and gynecology*, 191, 917–927.

HAUSMAN, C. AND D. S. RAPSON (2017): "Regression Discontinuity in Time: Considerations for Empirical Applications," Working Paper 23602, National Bureau of Economic Research.

HERBST, A. (2005): "Term breech delivery in Sweden: mortality relative to fetal presentation and planned mode of delivery," *Acta obstetricia et gynecologica Scandinavica*, 84, 593–601.

HERBST, A. AND K. THORNGREN-JERNECK (2001): "Mode of delivery in breech presentation at term: increased neonatal morbidity with vaginal delivery," *Acta obstetricia et gynecologica Scandinavica*, 80, 731–737.

HURRY, D. J., B. LARSEN, AND D. CHARLES (1984): "Effects of postcesarean section febrile morbidity on subsequent fertility." *Obstetrics & Gynecology*, 64, 256–260.

JACHETTA, C. (2015): "Cesarean Sections and Later Child Health Outcomes," *Job market paper*.

JENSEN, V. M. AND M. WÜST (2015): "Can Caesarean section improve child and maternal health? The case of breech babies," *Journal of health economics*, 39, 289–302.

JOHNSON, E. M. AND M. M. REHAVI (2016): "Physicians treating physicians: Information and incentives in childbirth," *American Economic Journal: Economic Policy*, 8, 115–141.

KÄLLÉN, K., H. RYDSTRÖM, AND P. OTTERBLAD OLAUSSON (2005): "Kejsarsnitt I Sverige 1990-2001," *Redovisningar av forskningsresultat från EpC och IMS*.

KAROLINSKA UNIVERSITETSSJUKHUSET (2016): "Vändningsförsök," *Karolinska Universitetssjukhuset*.

KOTASKA, A., S. MENTICOGLOU, R. GAGNON, D. FARINE, M. BASSO, H. BOS, M.-F. DELISLE, K. GRABOWSKA, L. HUDON, W. MUNDLE, ET AL. (2009): "Vaginal delivery of breech presentation: No. 226, June 2009," *International Journal of Gynecology & Obstetrics*, 107, 169–176.

LEE, D. S. AND D. CARD (2008): "Regression discontinuity inference with specification error," *Journal of Econometrics*, 142, 655–674.

LOBEL, M. AND R. S. DELUCA (2007): "Psychosocial sequelae of cesarean delivery: review and analysis of their causes and implications," *Social science & medicine*, 64, 2272–2284.

McCrary, J. (2008): "Manipulation of the running variable in the regression discontinuity design: A density test," *Journal of Econometrics*, 142, 698–714.

Norberg, K. and J. Pantano (2016): "Cesarean sections and subsequent fertility," *Journal of Population Economics*, 29, 5–37.

O'Neill, S. M., P. M. Kearney, L. C. Kenny, T. B. Henriksen, J. E. Lutomski, R. A. Greene, and A. S. Khashan (2013): "Caesarean delivery and subsequent pregnancy interval: a systematic review and meta-analysis," *BMC pregnancy and childbirth*, 13, 1.

Quintana-Domeque, C., D. Clarke, S. Oreffice, et al. (2016): "The Demand for Season of Birth," Tech. rep.

Rowlands, I. J. and M. Redshaw (2012): "Mode of birth and women's psychological and physical wellbeing in the postnatal period," *BMC pregnancy and childbirth*, 12, 138.

Sebire, N. J., M. Jolly, J. Harris, J. Wadsworth, M. Joffe, R. Beard, L. Regan, and S. Robinson (2001): "Maternal obesity and pregnancy outcome: a study of 287 213 pregnancies in London," *International journal of obesity*, 25, 1175.

Sharoni, L., D. J. Lyell, and C. F. Weiniger (2015): "Too late to back out? Options for breech presentation management," *Journal of epidemiology and community health*, jech–2015.

Sheiner, E., A. Levy, T. S. Menes, D. Silverberg, M. Katz, and M. Mazor (2004): "Maternal obesity as an independent risk factor for caesarean delivery," *Paediatric and Perinatal Epidemiology*, 18, 196–201.

Shurtz, I. (2014): "Malpractice Law, Physicians' Financial Incentives, and Medical Treatment: How Do They Interact?" *The Journal of Law and Economics*, 57, 1–29.

Staiger, D. O. and J. H. Stock (1994): "Instrumental variables regression with weak instruments," .

The Swedish National Board of Health and Welfare (2003): "Medicinsk födelseregistrering 2001," Tech. Rep. 2003-42-1, The National Board of Health and Welfare (Socialstyrelsen).

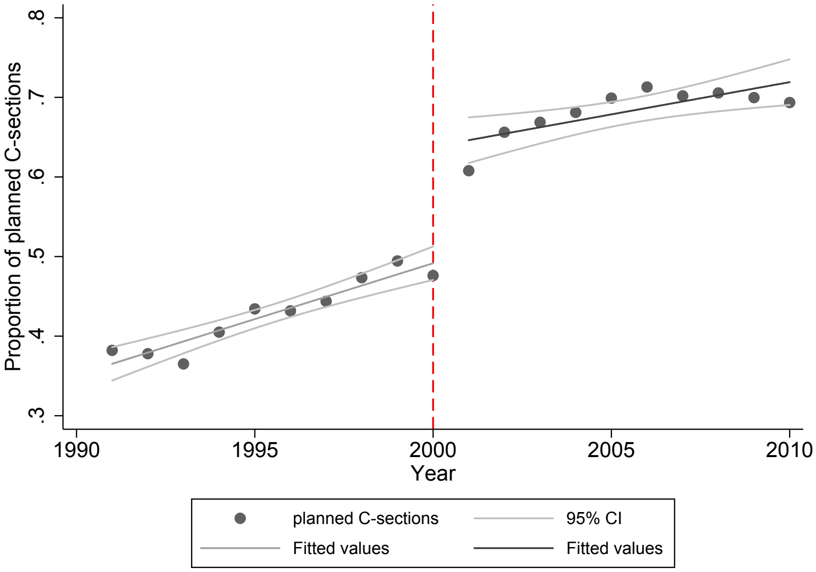
Tollånes, M. C., K. K. Melve, L. M. Irgens, and R. Skjaerven (2007): "Reduced fertility after cesarean delivery: a maternal choice," *Obstetrics & Gynecology*, 110, 1256–1263.

Whyte, H., M. E. Hannah, S. Saigal, W. J. Hannah, S. Hewson, K. Amankwah, M. Cheng, A. Gafni, P. Guselle, M. Helewa, et al. (2004): “Outcomes of children at 2 years after planned cesarean birth versus planned vaginal birth for breech presentation at term: the International Randomized Term Breech Trial,” *American journal of obstetrics and gynecology*, 191, 864–871.

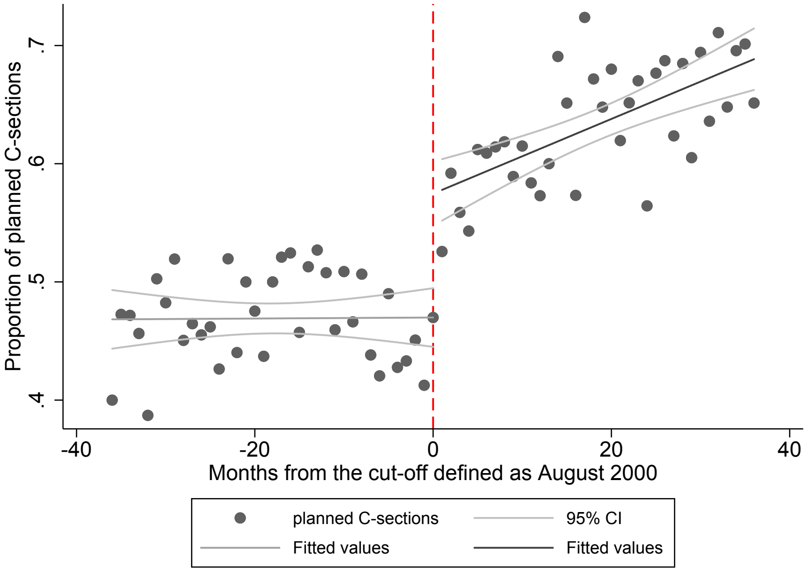
Figures and Tables

Figure 1: Trends in C-sections for breech births

(a) Yearly data, planned C-sections

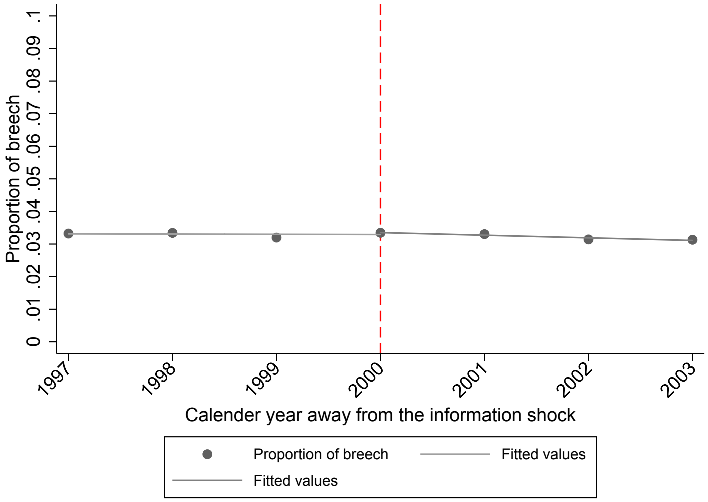


(b) Monthly data, planned C-sections



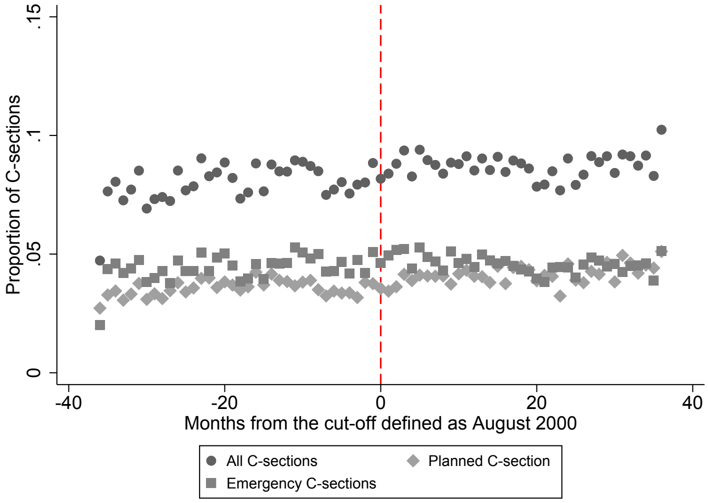
Note to Figure 1: The data are obtained from the Swedish Medical Birth Registry. Yearly and monthly trends in planned C-sections among singleton breech births at term (≥37 gestational weeks) are presented in Figures 1a and 1b, respectively. The red vertical line indicates the time of the information shock to the Swedish medical society.

Figure 2: The proportion of breech births over time



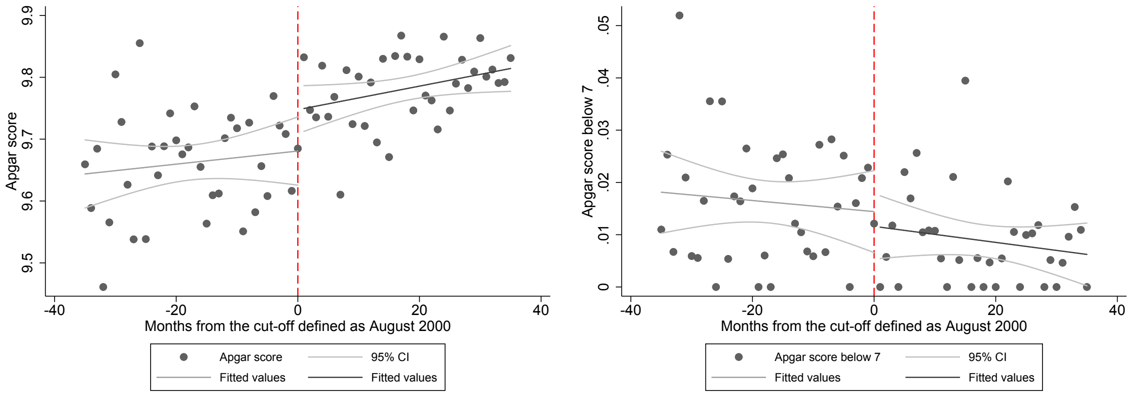
Note to Figure 2: The data are obtained from the Swedish Medical Birth Registry. The proportion of singleton breech births at term (≥37 gestational weeks) over time is presented in Figure 2. The red vertical line indicates the time of the information shock to the Swedish medical society.

Figure 3: Trends in C-sections for normal position births

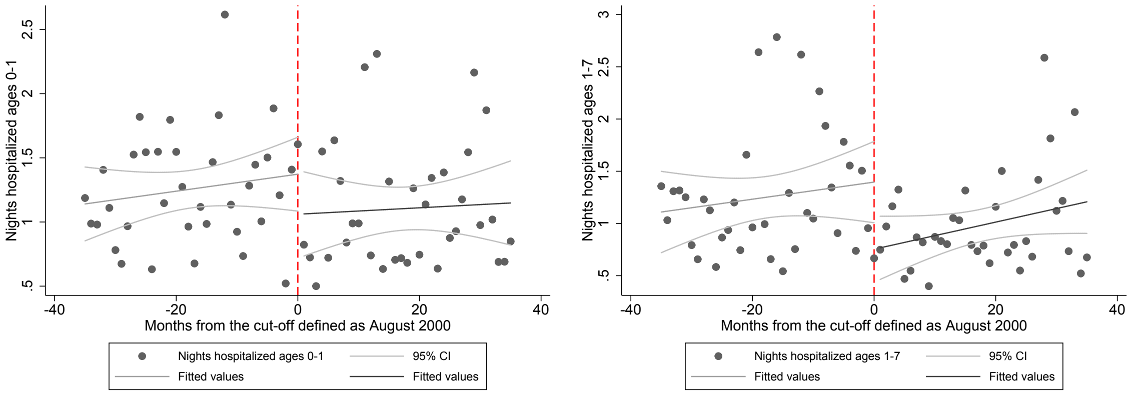


Note to Figure 3: The data are obtained from the Swedish Medical Birth Registry. Monthly trends in emergency, planned C-sections and all types of C-sections among singleton normal position (cephalic) births at term (≥37 gestational weeks) are presented in Figure 3. The red vertical line indicates the date of the information shock to the Swedish medical society.

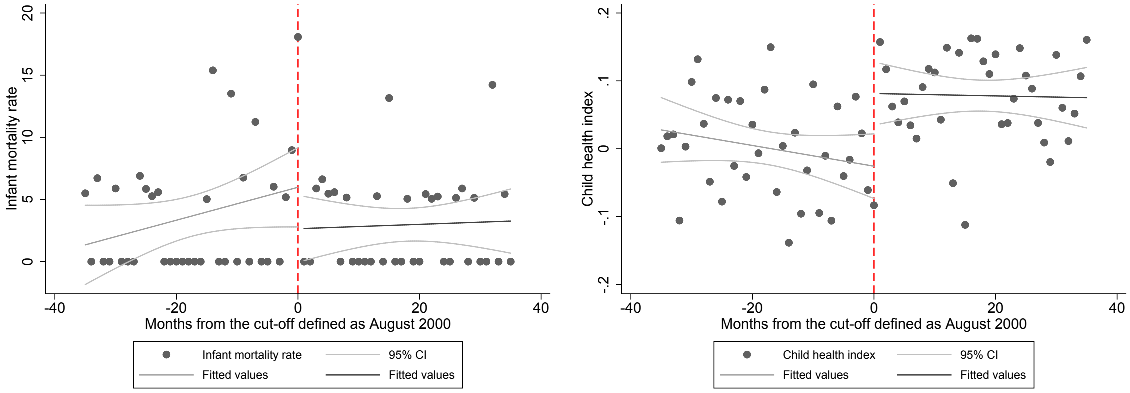
Figure 4: Child health outcomes


(a) Apgar score

(b) Apgar score below 7


(c) Nights hospitalized age 0-1

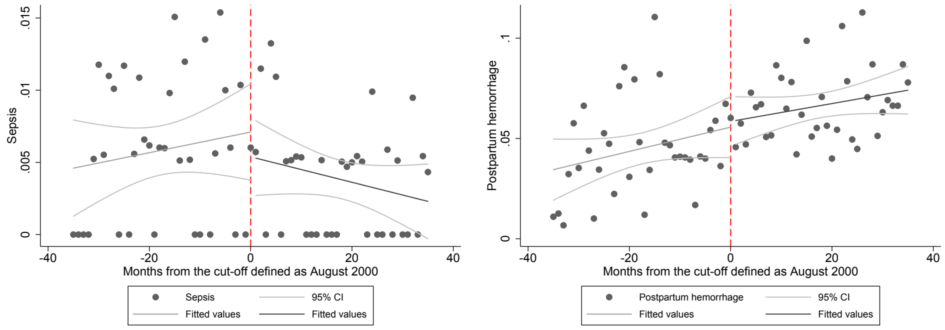
(d) Nights hospitalized ages 1-7

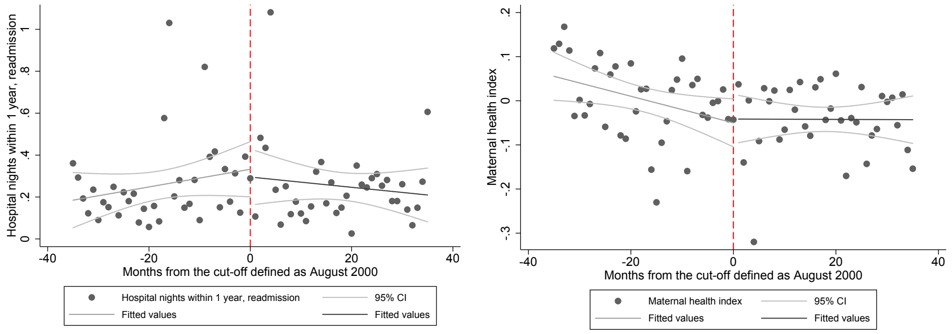

(e) Infant mortality rate

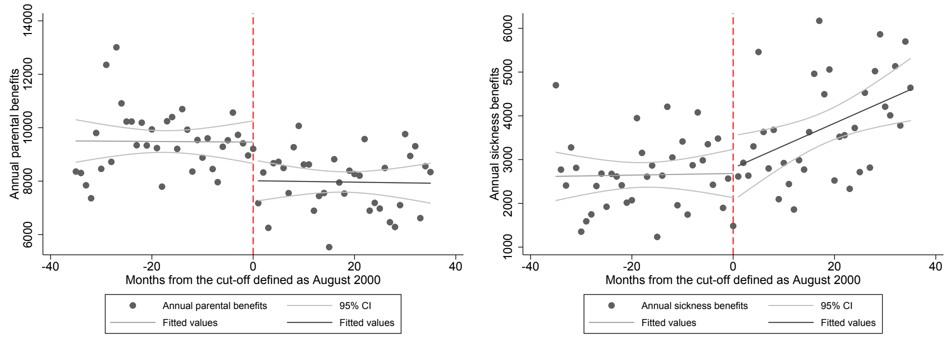
(f) Child health index

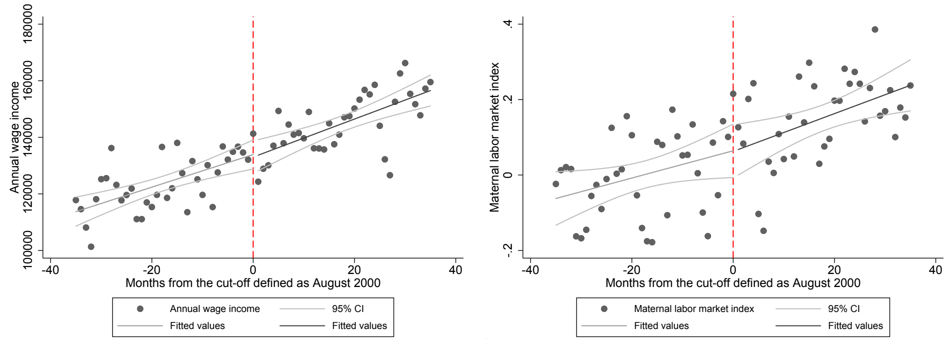
Note to Figure 4: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies. Monthly trends in child health outcomes among singleton breech births at term (≥37 gestational weeks) are presented in Figure 4. The red vertical line indicates the date of the information shock to the Swedish medical society.

Figure 5: Maternal health and labor outcomes


(a) Maternal sepsis **(b)** Postpartum hemorrhage

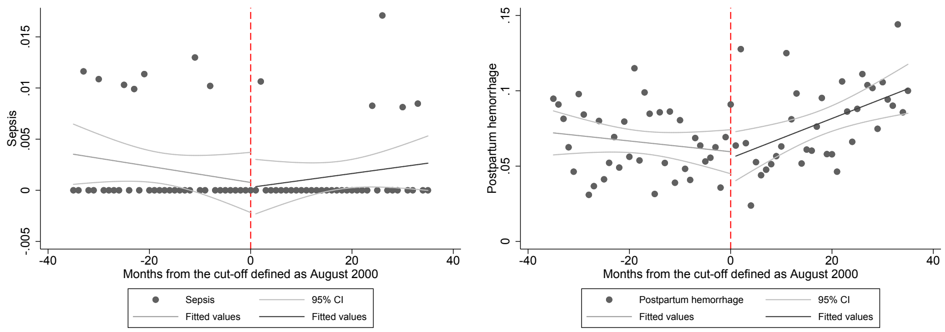

(c) Postbirth hospitalization **(d)** Maternal health index


(e) Annual income from parental benefits **(f)** Annual income from sickenss benefits

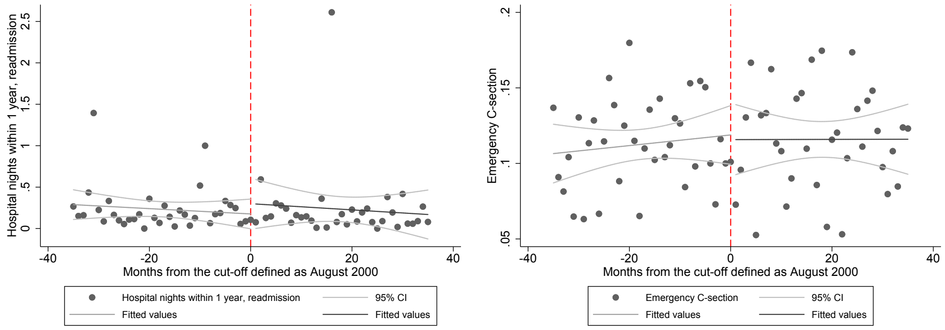

(g) Annual income from labor earnings **(h)** Maternal labor index

Note to Figure 5: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies. Monthly trends in maternal outcomes among singleton breech births at term ($\geq$37 gestational weeks) are presented in Figure 5. The red vertical line indicates the date of the information shock to the Swedish medical society.

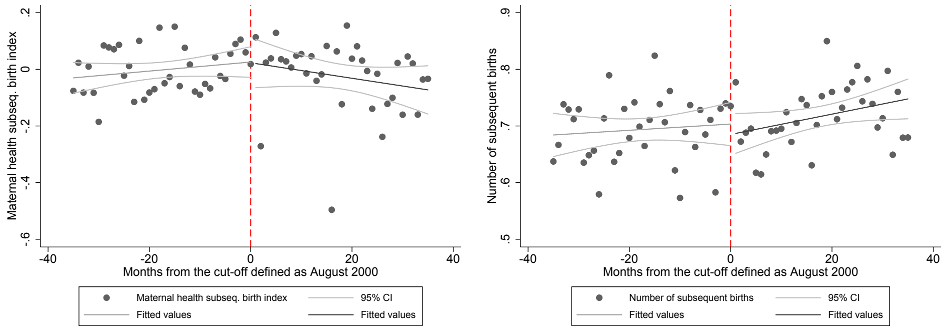
Figure 6: Trends in maternal health outcomes at subsequent births and subsequent fertility


(a) Maternal sepsis

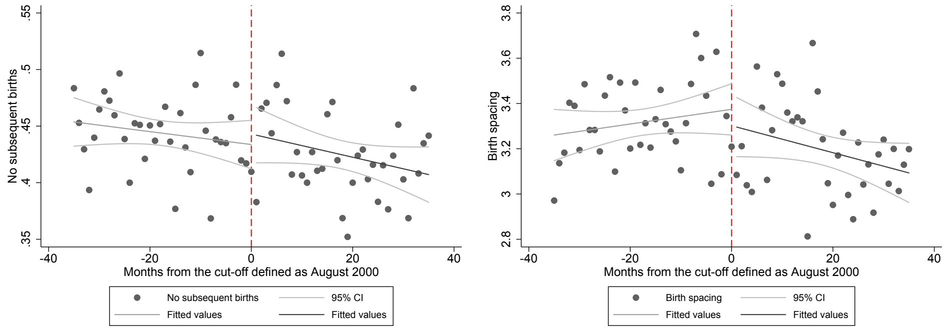
(b) Postpartum hemorrhage


(c) Postbirth nights hospitalized

(d) Emergency C-sections


(e) Maternal health index

(f) Number of subseq. births within 8 years


(g) No more births within 8 years

(h) Birth spacing

Note to Figure 6: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies. Monthly trends in maternal outcomes, among mothers with a previous breech birth, are presented in Figure 6. The red vertical line indicates the date of the information shock to the Swedish medical society.

Table 1: Summary statistics

	Breech births			***Normal position (cephalic) births***			t-test	
	Mean (1)	SD (2)	N (3)	Mean (4)	SD (5)	N (6)	t-stat (7)	p-values (8)
Panel A: Child characteristics and birth outcomes								
Birth weight (kg)	3,387.509	480.252	13,140	3,634.758	492.660	404,737	56.661	0.000
Gestation (weeks)	38.689	1.211	13,174	39.724	1.291	405,743	90.689	0.000
Male fetus	0.458	0.498	13,174	0.515	0.500	405,741	12.896	0.000
Fetal malformation	0.084	0.277	13,174	0.031	0.172	405,743	-34.169	0.000
Apgar score	9.725	0.813	13,099	9.769	0.677	403,788	7.251	0.000
Apgar score below 7	0.012	0.111	13,099	0.007	0.086	403,788	-6.403	0.000
Infant mortality (×100)	3.188	56.375	13,174	1.353	36.759	405,743	-5.523	0.000
Nights hospitalized age 0-1	1.180	6.529	13,158	0.818	5.600	405,271	-7.252	0.000
Nights hospitalized age 1-7	1.106	6.784	13,116	0.919	6.976	404,722	-3.013	0.003
Panel B: Maternal birth and fertility outcomes								
Planned C-section	0.556	0.497	13,174	0.039	0.193	405,743	-278.683	0.000
Emergency C-section	0.266	0.442	13,173	0.045	0.208	405,742	-113.989	0.000
Induction of labor	0.017	0.129	13,174	0.100	0.299	405,743	31.596	0.000
Sepsis	0.005	0.070	13,174	0.001	0.036	405,743	-10.829	0.000
Hemorrhage	0.056	0.231	13,174	0.053	0.223	405,743	-1.828	0.068
Hospital nights (readmission)	0.254	2.489	12,779	0.260	3.917	388,643	0.162	0.871
Sepsis, future	0.073	0.260	7,560	0.051	0.221	205,072	-8.277	0.000
Hemorrhage, future	0.002	0.041	7,560	0.001	0.027	205,072	-3.173	0.002
Hospital nights, future (readmission)	0.219	3.072	7,285	0.213	2.330	194,368	-0.200	0.841
Emergency C-section, future	0.114	0.317	7,558	0.041	0.197	205,041	-30.820	0.000
Number of children	2.279	0.931	13,174	2.534	1.061	405,743	27.264	0.000
Number of of subsequent births	0.707	0.723	13,174	0.645	0.759	405,743	-9.228	0.000
No future births	0.433	0.495	13,174	0.501	0.500	405,743	15.351	0.000
Birth spacing (years)	3.249	1.609	7,560	3.378	1.750	205,072	6.275	0.000
Panel C: Maternal characteristics								
Age	29.872	4.895	13,174	29.608	4.997	405,740	-5.983	0.000
Height	166.437	6.263	12,286	166.433	6.245	375,540	-0.080	0.936
Weight	67.062	12.403	11,710	67.373	12.460	357,272	2.660	0.008
BMI	24.192	4.213	11,410	24.320	4.227	347,560	3.183	0.001
Asthma	0.060	0.237	13,174	0.054	0.227	405,743	-2.553	0.011
Ulcerative colitis	0.005	0.072	13,174	0.004	0.062	405,743	-2.470	0.013
Epilepsy	0.002	0.049	13,174	0.003	0.053	405,743	0.843	0.399
Diabetes	0.004	0.063	13,174	0.003	0.050	405,743	-3.267	0.001
Hypertensia	0.002	0.048	13,174	0.002	0.043	405,743	-1.059	0.289
Smoke 1st trimester	0.116	0.321	12,481	0.113	0.317	382,150	-1.069	0.285
Smoke 3rd trimester	0.073	0.260	8,884	0.081	0.272	281,161	2.707	0.007
Education	4.406	1.365	13,128	4.345	1.387	403,995	-4.939	0.000
Labor income	135,481	98,142	13,174	118,000	92,860	405,743	-21.227	0.000
Sickness benefits	3,228	11,149	13,174	3,319	9,879	405,743	1.034	0.301
Parental benefits	8,724	15,771	13,047	14,027	18,270	401,802	32.759	0.000
Panel D: Index								
Child health index	0.045	0.898	13,174	0.107	0.733	405,725	9.456	0.000
Maternal health index	-0.021	0.996	13,174	0.016	1.083	405,743	3.878	0.000
Maternal health at sub. birth index	-0.010	1.034	7,560	0.157	0.780	205,072	18.041	0.000
Maternal labor index	0.083	1.021	13,174	-0.037	1.002	405,743	-13.440	0.000

Note to Table 1: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry and Longitudinal Integration Database for Health Insurance and Labor Market Studies. The sample includes singleton term ($\geq$37 gestational weeks) births presented in breech position (columns 1-3) and normal position (cephalic) (columns 4-6) for the time period August 1997 to August 2003. Mean values (columns 1 and 4), standard deviations (columns 2 and 5), t-test (column 7), and p-values (column 8) are displayed.

Table 2: Impact of information shock on the probability of C-section

	Breech Births		Normal (Cephalic) Births	
	(1) Planned C-section	(2) Planned C-section	(3) Planned C-section	(4) Planned C-section
Information shock	0.114***	0.115***	0.001	0.001
	(0.018)	(0.018)	(0.001)	(0.001)
Maternal weight		0.002***		0.001***
		(0.000)		(0.000)
Maternal height		-0.004***		-0.002***
		(0.001)		(0.000)
Fetal malformation		-0.030*		0.013***
		(0.016)		(0.002)
Smoking 1st trimester		0.017		0.006***
		(0.014)		(0.001)
Male fetus		0.012		0.002***
		(0.008)		(0.001)
Native		0.061***		0.005***
		(0.013)		(0.001)
Fixed effects	NO	YES	NO	YES
F-stat	40.39	40.68	0.42	0.37
R^2	0.029	0.063	0.000	0.020
Obs	13,174	13,174	405,743	405,743
Mean of dep. var.	0.556	0.556	0.039	0.039

Note to Table 2: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Each column presents a separate regression with OLS estimates of the impact of the information shock on the probability of planned C-section for breech births (columns 1-2) and for normal position (cephalic) births (columns 3-4). Only singleton births at term ($\geq$37 gestational weeks) are considered for analysis. Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in columns 2 and 4. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 3: Impact of information shock

Panel A: Effects on planned C-section

	(1) Global linear trend	(2) Triangular kernel	(3) Twenty-four months	(4) Twelve months	(5) Quadratic trends	(6) Cubic trends
Information shock	0.114***	0.116***	0.125***	0.107***	0.123***	0.122***
	(0.018)	(0.019)	(0.023)	(0.039)	(0.026)	(0.023)
Fixed effects	YES	YES	YES	YES	YES	YES
F-stat	39.32	35.25	30.19	7.43	21.60	27.06
R^2	0.062	0.064	0.063	0.073	0.063	0.063
Obs	13,174	13,160	8,681	4,296	13,174	13,174
mean of dep. var.	0.556	0.543	0.547	0.521	0.556	0.556

Panel B: Effects on obstetric outcomes

	(1) Emergency C-section	(2) Induced labor	(3) Spinal anesthesia	(4) Forceps vacuum	(5) Episiotomy
Information shock	-0.018	-0.007	0.132***	-0.001	-0.057***
	(0.016)	(0.005)	(0.017)	(0.002)	(0.009)
Fixed effects	YES	YES	YES	YES	YES
F-stat	1.25	2.03	61.32	0.27	36.81
R^2	0.023	0.014	0.121	0.006	0.054
Obs	13,173	13,174	13,174	13,174	13,174
mean of dep. var.	0.266	0.017	0.640	0.002	0.044

Note to Table 3: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. In panel A, each column presents a separate OLS regression of the impact of the information shock on the probability of planned C-section including a global linear trend (column 1), a triangular kernel (column 2), a sample with a time period of 24 months (column 3), a sample with a time period of 12 months (column 4), split quadratic trends (column 5) and split cubic trends (column 6). In panel B, each column presents a separate OLS regression of the impact of the information shock on the probability of emergency C-section (column 1), probability of induced labor (column 2), probability of spinal anesthesia (column 3), probability of using forceps or vacuum extractor (column 4) and probability of episiotomy (column 5). In panel B, linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 4: Heterogeneous effects

Panel A:	*Birth order*			*Age groups*			
	(1) OLS Birth order 1	(2) OLS Birth order 2	(3) OLS Birth order ≥ 3	(4) OLS Ages < 25	(5) OLS Ages 25-29	(6) OLS Ages 30-34	(7) OLS Ages ≥ 35
Information shock	0.130*** (0.022)	0.085** (0.037)	0.083 (0.052)	0.112** (0.049)	0.126*** (0.029)	0.130*** (0.030)	0.057 (0.042)
Fixed effects	YES	YES	YES	YES	YES	YES	YES
F-stat	34.91	5.43	2.59	5.20	18.54	18.75	1.87
R^2	0.062	0.072	0.081	0.067	0.062	0.062	0.071
Obs	8,250	3,300	1,624	1,791	4,510	4,568	2,305
mean of dep. var.	0.567	0.549	0.515	0.538	0.531	0.564	0.604

Panel B:	*Education*			*BMI classification*		
	(1) OLS Primary education	(2) OLS Secondary education	(3) OLS Tertiary education	(4) OLS BMI < 25	(5) OLS BMI 25-29.9	(6) OLS BMI ≥ 30
Information shock	0.090*** (0.033)	0.109*** (0.028)	0.146*** (0.032)	0.110*** (0.023)	0.182*** (0.037)	0.085 (0.061)
Fixed effects	YES	YES	YES	YES	YES	YES
F-stat	7.49	15.11	20.87	23.08	23.59	1.92
R^2	0.071	0.059	0.076	0.064	0.069	0.122
Obs	3,749	5,393	3,986	7,543	2,767	1,100
mean of dep. var.	0.544	0.564	0.559	0.551	0.556	0.616

Note to Table 4: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. In panel A, *Birth order*, each column presents a separate OLS regression of the impact of the information shock on the probability of planned C-section across birth order: first-time mothers (column 1), second birth (column 2), and third or higher-order births (column 3). In panel A, *Age groups*, each column presents a separate OLS regression of the impact of the information shock on the probability of planned C-section for the following age groups: ages < 25 (column 4), ages 25-29 (column 5), ages 30-34 (column 6) and ages ≥ 35 (column 7). In panel B, *Education*, each column presents a separate OLS regression of the impact of the information shock on the probability of planned C-section for the following educational levels: primary education (column 1), secondary education (column 2), and tertiary education (column 3). In panel B, *BMI classification*, each column presents a separate OLS regression of the impact of the information shock on the probability of planned C-section for the following BMI levels: normal weight (column 4), overweight (column 5), and obese (column 6). Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 5: Maternal characteristics

Panel A: *Maternal characteristics*

	(1) Age	(2) Weight (kilograms)	(3) Height (centimeters)	(4) Education	(5) Labor income	(6) Sick benefits
Information shock	0.211	0.350	0.018	0.053	1130.674	51.169
	(0.162)	(0.451)	(0.230)	(0.048)	(3331.997)	(376.521)
Fixed effects	YES	YES	YES	YES	YES	YES
F-stat	1.70	0.60	0.01	1.23	0.12	0.02
R^2	0.161	0.024	0.008	0.058	0.093	0.026
Obs	13,174	11,710	12,286	13,128	13,174	13,174
mean of dep. var.	29.872	67.062	166.437	4.406	1.35e+05	3,228.527

Panel B: *Maternal characteristics, C-section*

	(1) Age	(2) Weight (kilograms)	(3) Height (centimeters)	(4) Education	(5) Labor income	(6) Sick benefits
Information shock	-0.069	0.582	0.221	0.103	-2090.744	-212.213
	(0.224)	(0.634)	(0.332)	(0.064)	(4670.100)	(570.326)
Fixed effects	YES	YES	YES	YES	YES	YES
F-stat	0.09	0.84	0.44	2.56	0.20	0.14
R^2	0.159	0.031	0.015	0.056	0.095	0.033
Obs	7,328	6,537	6,855	7,305	7,328	7,328
mean of dep. var.	30.084	67.397	166.308	4.429	1.41e+05	3,626.278

Note to Table 5: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. In panel A, each column presents a separate OLS regression of the impact of the information shock on maternal characteristics such as age (column 1), weight (column 2), height (column 3), educational attainment (column 4), average labor income 5 years prior to birth (column 5), and average sickness benefits 5 years prior to birth (column 6). In panel B, each column presents a separate OLS regression of the impact of the information shock on maternal characteristics among women delivering with planned C-section: age (column 1), weight (column 2), height (column 3), educational attainment (column 4), average labor income 5 years prior to birth (column 5), and average sickness benefits 5 years prior to birth (column 6). All income variables are adjusted and expressed in 2016 prices. Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 6: Placebo discontinuities

	(1) Planned C-section	(2) Planned C-section	(3) Planned C-section	(4) Planned C-section	(5) Planned C-section	(6) Planned C-section
25-Aug-97	0.0497					
	(0.0359)					
25-Aug-98		0.0177				
		(0.0384)				
25-Aug-99			-0.0663*			
			(0.0399)			
25-Aug-01				0.0511		
				(0.0348)		
25-Aug-02					0.0081	
					(0.0366)	
25-Aug-03						-0.0307
						(0.0350)
R^2	0.056	0.060	0.058	0.058	0.044	0.044
Obs	4,260	4,194	4,253	4,434	4,711	4,941
mean of dep. var.	0.454	0.479	0.474	0.617	0.658	0.668

Note to Table 6: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. Using a bandwidth of 12 months before and after, each column represents a regression examining possible discontinuities in planned C-section using placebo dates of 25 August 1997-1999 and 2001-2003. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics and binary variables for missing values are included in each regression. Linear split time trends are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 7: The impact of planned C-sections on child and maternal outcomes

Panel A: *Reduced form estimates*

	(1) Child health index	(2) Maternal health index	(3) Maternal health at sub. birth index	(4) Number of future births	(5) No more births	(6) Birth spacing	(7) Maternal labor index
Information shock	0.105***	0.019	0.026	-0.032	0.019	-0.018	-0.039
	(0.032)	(0.036)	(0.042)	(0.022)	(0.014)	(0.076)	(0.033)
Fixed effects	YES	YES	YES	YES	YES	YES	YES
R^2	0.033	0.021	0.018	0.264	0.320	0.074	0.219
Obs	13,174	13,174	7,560	13,174	13,174	7,560	13,174
Control mean	0.000	0.000	0.000	0.696	0.443	3.322	0.000
Control sd	1.000	1.000	1.000	0.727	0.497	1.664	1.000

Panel B: *2SLS estimates*

	(1) Child health index	(2) Maternal health index	(3) Maternal health at sub. birth index	(4) Number of future births	(5) No more births	(6) Birth spacing	(7) Maternal labor index
Planned C-section	0.912***	0.169	0.223	-0.277	0.170	-0.154	-0.337
	(0.299)	(0.313)	(0.358)	(0.199)	(0.127)	(0.632)	(0.288)
Fixed effects	YES	YES	YES	YES	YES	YES	YES
Obs	13,174	13,174	7,560	13,174	13,174	7,560	13,174
Control mean	0.000	0.000	0.000	0.696	0.443	3.322	0.000
Control sd	1.000	1.000	1.000	0.727	0.497	1.664	1.000

Note to Table 7: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. In panel A, each column presents a separate OLS regression of the impact from information shock, on child health index (column 1), maternal health index (column 2), maternal health at subsequent birth index (column 3), number of subsequent births within 8 years from breech birth (column 4), probability of no more births within 8 years (column 5), birth spacing within 8 years (column 6), and labor market index (column 7). In panel B, each column presents a separate 2SLS regression of the impact of planned C-sections, on child health index (column 1), maternal health index (column 2), maternal health at subsequent birth index (column 3), number of subsequent births within 8 years from breech birth (column 4), probability of no more births within 8 years (column 5), birth spacing within 8 years (column 6), and labor market index (column 7). Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 8: The impact on child health

	Child Health									
	(1) Apgar scores	(2) Apgar scores	(3) Apgar scores < 7	(4) Apgar scores < 7	(5) Infant mortality (×100)	(6) Infant mortality (×100)	(7) Hospital nights age 0-1	(8) Hospital nights age 0-1	(9) Hospital nights ages 1-7	(10) Hospital nights ages 1-7
Information shock	0.076**		-0.004		-3.364		-0.292		-0.690***	
	[0.030]		[0.004]		[2.200]		[0.229]		[0.230]	
Planned C-section		0.652**		-0.037		-29.337		-2.549		-6.068***
		[0.260]		[0.035]		[19.460]		[1.999]		[2.237]
FDR p-value (Treat)	0.089	0.092	0.729	0.728	0.473	0.494	0.607	0.607	0.041	0.092
Observations	13099	13099	13099	13099	13174	13174	13158	13158	13116	13116
Control mean	9.659	9.659	0.017	0.017	0.004	0.004	1.255	1.255	1.252	1.252
Control sd	0.920	0.920	0.128	0.128	0.060	0.060	5.998	5.998	7.871	7.871

Note to Table 8: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. Reduced form estimates are presented for each outcome in columns 1, 3, 5, 7, and 9 and the 2SLS estimates are presented in columns 2, 4, 6, 8 and 10. Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. FDR corrected p-values are reported for each estimate.

Table 9: The impact on maternal health

	Maternal health					
	(1) Post-birth hosp.	(2) Post-birth hosp.	(3) Sepsis	(4) Sepsis	(5) Hemorrhage	(6) Hemorrhage
Information shock	-0.065		-0.001		0.001	
	[0.104]		[0.003]		[0.008]	
Planned C-section		-0.554		-0.012		0.005
		[0.880]		[0.022]		[0.069]
FDR p-value (Treat)	0.729	0.729	0.729	0.729	0.943	0.943
Observations	12779	12779	13174	13174	13174	13174
Control mean	0.260	0.260	0.006	0.006	0.046	0.046
Control sd	2.646	2.646	0.077	0.077	0.209	0.209

Note to Table 9: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. Reduced form estimates are presented for each outcome in columns 1, 3 and 5 and the 2SLS estimates are presented in columns 2, 4 and 6. Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. FDR corrected p-values are reported for each estimate.

Table 10: The impact on maternal health outcomes at subsequent birth

	Maternal health at subsequent birth							
	(1) Emergency c-section	(2) Emergency c-section	(3) Post-birth hosp.	(4) Post-birth hosp.	(5) Hemorrhage	(6) Hemorrhage	(7) Sepsis	(8) Sepsis
Information shock	-0.014		0.060		-0.003		-0.001	
	[0.015]		[0.102]		[0.011]		[0.002]	
Planned C-section		-0.115		0.514		-0.028		-0.006
		[0.128]		[0.868]		[0.097]		[0.013]
FDR p-value (Treat)	0.729	0.729	0.729	0.729	0.826	0.826	0.729	0.729
Observations	7558	7558	7285	7285	7560	7560	7560	7560
Control mean	0.114	0.114	0.228	0.228	0.066	0.066	0.002	0.002
Control sd	0.317	0.317	2.699	2.699	0.248	0.248	0.044	0.044

Note to Table 10: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. Reduced form estimates are presented for each outcome in columns 1, 3, 5, and 7 and the 2SLS estimates are presented in columns 2, 4, 6, and 8. Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. FDR corrected p-values are reported for each estimate.

Table 11: The impact on maternal labor outcomes

	Maternal labor outcomes					
	(1) Sickness benefits	(2) Sickness benefits	(3) Parental benefits	(4) Parental benefits	(5) Wage income	(6) Wage income
Information shock	-473.91		-1839.8**		-2176.1	
	[742.56]		[855.09]		[3546.7]	
Planned C-section		-4132.5		-16043**		-18976
		[6508.2]		[7856.9]		[31102]
FDR p-value (Treat)	0.7293	0.7292	0.1572	0.2059	0.7293	0.7292
Observations	13174	13174	13174	13174	13174	13174
Control mean	8,428	8,428	38,891	38,891	139,302	139,302
Control sd	20,510	20,510	26,173	26,173	106,840	106,840

Note to Table 11: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. Reduced form estimates are presented for each outcome in columns 1, 3 and 5 and the 2SLS estimates are presented in columns 2, 4 and 6. All income variables are adjusted and expressed in 2016 prices. Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$. FDR corrected p-values are reported for each estimate.

Table 12: Alternative specifications

	(1) Child health index	(2) Maternal health index	(3) Maternal health at sub. birth index	(4) Number of future births	(5) No more births	(6) Birth spacing	(7) Maternal labor index
Panel A: Global trend							
Information shock	0.104***	0.019	0.028	-0.032	0.020	-0.015	-0.039
	(0.032)	(0.036)	(0.042)	(0.022)	(0.014)	(0.076)	(0.033)
Planned C-section	0.918***	0.165	0.236	-0.281	0.172	-0.127	-0.345
	(0.302)	(0.315)	(0.364)	(0.201)	(0.129)	(0.640)	(0.292)
Observations	13,174	13,174	7,560	13,174	13,174	7,560	13,174
Panel B: Triangular Kernel							
Information shock	0.114***	-0.015	0.041	-0.035	0.021	-0.009	-0.036
	(0.035)	(0.039)	(0.044)	(0.024)	(0.015)	(0.082)	(0.036)
Planned C-section	0.988***	-0.133	0.360	-0.301	0.178	-0.076	-0.311
	(0.321)	(0.342)	(0.401)	(0.214)	(0.135)	(0.710)	(0.315)
Observations	13,160	13,160	7,551	13,160	13,160	7,551	13,160
Panel C: 24 months							
Information shock	0.094**	-0.027	0.056	-0.044	0.024	-0.002	-0.050
	(0.037)	(0.042)	(0.067)	(0.028)	(0.018)	(0.096)	(0.040)
Planned C-section	0.749**	-0.217	0.444	-0.352	0.193	-0.019	-0.396
	(0.309)	(0.340)	(0.545)	(0.231)	(0.146)	(0.745)	(0.330)
Observations	8,681	8,681	4,972	8,681	8,681	4,972	8,681
Panel D: 12 months							
Information shock	0.187***	0.012	0.030	-0.026	0.030	-0.086	0.006
	(0.063)	(0.064)	(0.106)	(0.049)	(0.030)	(0.165)	(0.070)
Planned C-section	1.756**	0.111	0.295	-0.247	0.286	-0.857	0.059
	(0.795)	(0.598)	(1.056)	(0.476)	(0.315)	(1.630)	(0.648)
Observations	4,296	4,296	2,428	4,296	4,296	2,428	4,296
Panel E: Quadratic trends							
Information shock	0.123***	-0.078	0.044	-0.047	0.029	-0.009	-0.035
	(0.045)	(0.055)	(0.063)	(0.034)	(0.021)	(0.110)	(0.050)
Planned C-section	1.006**	-0.636	0.405	-0.381	0.235	-0.085	-0.289
	(0.405)	(0.468)	(0.611)	(0.290)	(0.180)	(1.012)	(0.408)
Observations	13,174	13,174	7,560	13,174	13,174	7,560	13,174
Panel F: Cubic trends							
Information shock	0.121***	-0.057	0.046	-0.050*	0.028	0.005	-0.036
	(0.041)	(0.049)	(0.054)	(0.030)	(0.019)	(0.098)	(0.044)
Planned C-section	0.995***	-0.472	0.403	-0.407	0.233	0.048	-0.297
	(0.364)	(0.412)	(0.505)	(0.258)	(0.160)	(0.866)	(0.365)
Observations	13,174	13,174	7,560	13,174	13,174	7,560	13,174

Note to Table 12: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. Each column presents both the reduced and 2SLS estimate on each outcome analogue to the baseline results (in Table 2), including a global linear trend (panel A), a triangular kernel (panel B), a sample with a time period of a 24 months window before and after the information shock (panel C), a sample with a time period of a 12 months window before and after the information shock (panel D), split quadratic trends (panel E) and split cubic trends (panel F). Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 13: Difference-in-differences estimates

Difference-in-differences estimates, reduced form

	(1) Planned C-section	(2) Child health index	(3) Maternal health index	(4) Maternal health at sub. birth index	(5) Number of future births	(6) No more births	(7) Birth spacing	(8) Maternal labor index
Information shock	0.113***	0.129***	0.021	0.003	-0.040*	0.022	0.002	-0.038
	(0.018)	(0.044)	(0.048)	(0.057)	(0.022)	(0.014)	(0.077)	(0.032)
Breech	0.429***	-0.124***	-0.078**	-0.193***	-0.029*	0.006	0.111**	0.041*
	(0.013)	(0.036)	(0.034)	(0.039)	(0.016)	(0.010)	(0.055)	(0.024)
Obs	418,917	418,899	418,917	212,632	418,917	418,917	212,632	418,917
Control mean	0.046	0.000	0.000	0.000	0.646	0.499	3.377	0.000
Control sd	0.208	1.000	1.000	1.000	0.758	0.500	1.749	1.000

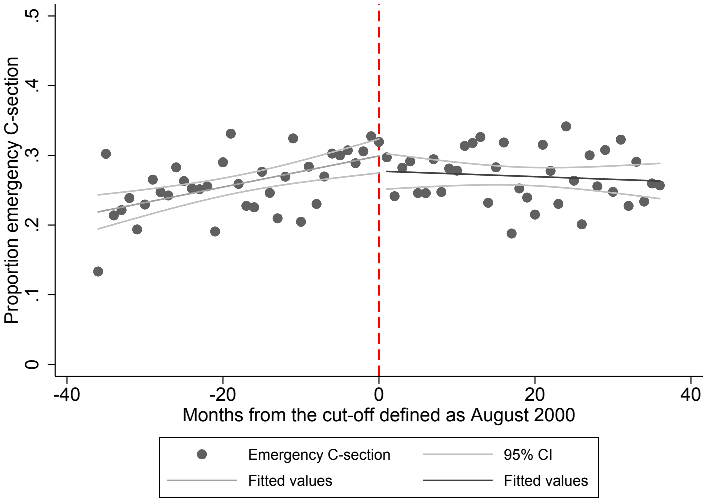
Difference-in-differences-IV estimates

	(1) Child health index	(2) Maternal health index	(3) Maternal health at sub. birth index	(4) Number of future births	(5) No more births	(6) Birth spacing	(7) Maternal labor index
Planned C-section	1.142***	0.183	0.027	-0.353*	0.195	0.021	-0.337
	(0.410)	(0.425)	(0.521)	(0.206)	(0.130)	(0.700)	(0.290)
Breech	-0.614***	-0.157	-0.205	0.123	-0.078	0.101	0.185
	(0.207)	(0.208)	(0.259)	(0.101)	(0.064)	(0.352)	(0.143)
Obs	418,899	418,917	212,632	418,917	418,917	212,632	418,917
Control mean	0.000	0.000	0.000	0.646	0.499	3.377	0.000
Control sd	1.000	1.000	1.000	0.758	0.500	1.749	1.000

Note to Table 13: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton births at term ($\geq$37 gestational weeks) are considered for analysis. In panel A, each column presents a separate difference-in-differences regression of the impact of the information shock on planned C-sections (column 1), child health index (column 2), maternal health index (column 3), maternal health at subsequent birth index (column 4), number of subsequent births within 8 years from breech birth (column 5), probability of no more births within 8 years (column 6), birth spacing within 8 years (column 7), and maternal labor market index (column 8). In panel B, each column presents a separate difference-in-differences regression using information shock as instrument for planned C-sections. Controls are handled analogue to the baseline specification (see notes to Table 7). * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

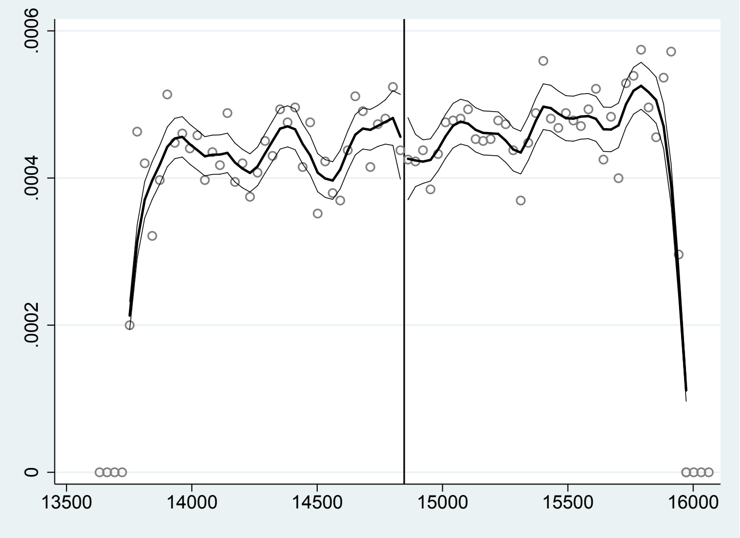
Appendices

Figure A1: Trends in emergency C-sections



Note to Figure A1: The data are obtained from the Swedish Medical Birth Registry. Monthly trend in emergency C-sections among singleton breech births at term (≥37 gestational weeks) is presented in Figure A1. The red vertical line indicates the date of the information shock to the Swedish medical society.

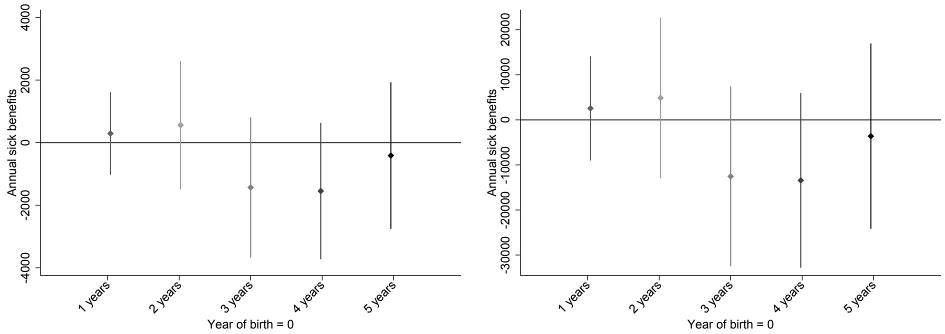
Figure A2: McCrary density test plot



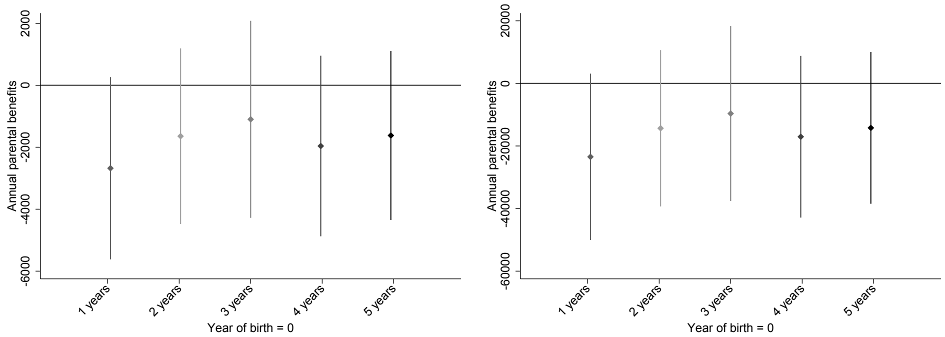
Note to Figure A2: The data are obtained from the Swedish Medical Birth Registry for the time period 25 August 1997 to 25 August 2003. McCrary density test of sorting across the event date (McCrary, 2008). The vertical line indicates the date of the information shock to the Swedish medical society.

Figure A3: Labor market outcomes, event study

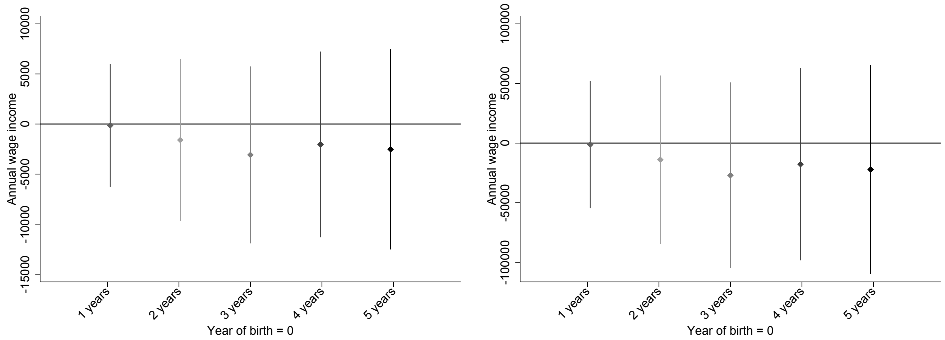
(a) Sickness benefits, reduced form estimates **(b)** Sickness benefits, IV estimates



(c) Parental benefits, reduced form estimates **(d)** Parental benefits, IV estimates

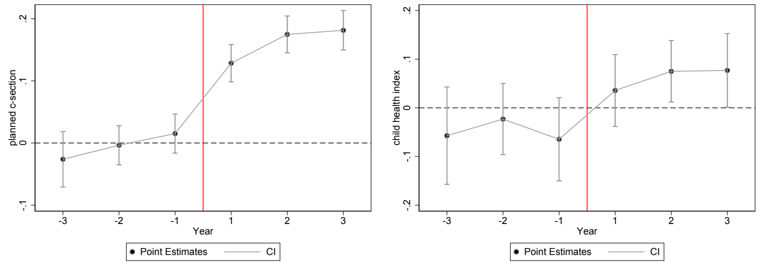


(e) Labor income, reduced form estimates **(f)** Labor income, IV estimates

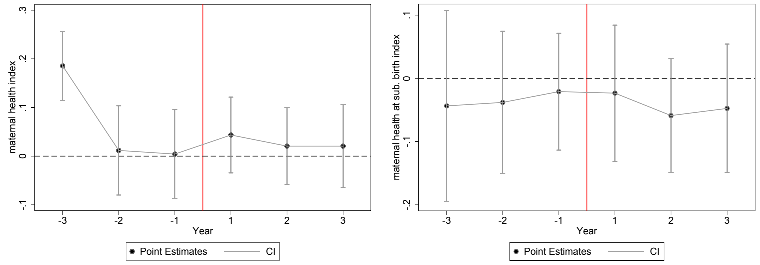


Note to Figure A3: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton births at term ($\geq$37 gestational weeks) are considered for analysis. The coefficient plots of the reduced form and 2SLS estimates on labor market outcomes for each year separately, 1,2...5 years after giving birth (year 0). Income is expressed in adjusted annual income (in 2016 prices) in absolute level. The reduced form effects on income from sickness benefits are presented in figure A3e and the 2SLS estimates are presented in figure A3f. The reduced form effects on income from parental benefits are presented in figure A3a and the 2SLS estimates are presented in figure A3b. The reduced form effects on labor income are presented in figure A3c and the 2SLS estimates are presented in figure A3d. Maternal age, birth order, month, year and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level.

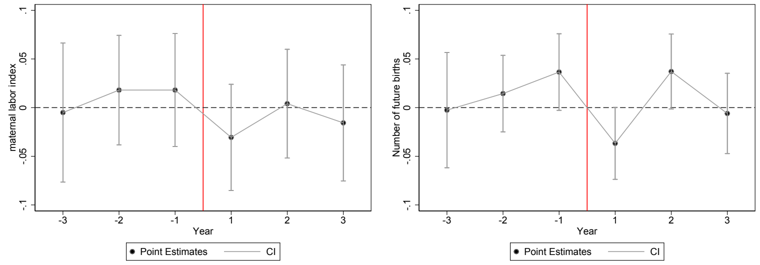
Figure A4: Difference-in-differences estimates, event studies



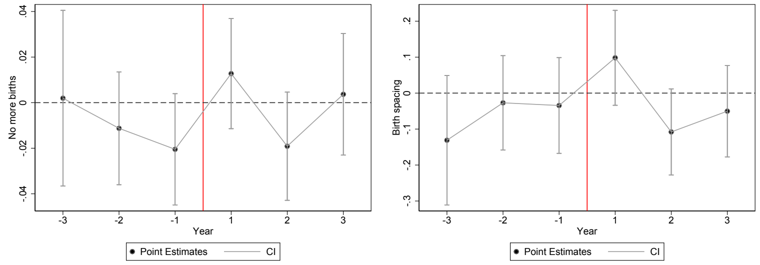
(a) Planned C-sections **(b)** Child health index



(c) Maternal helath index **(d)** Maternal health at subseq. birth index



(e) Maternal labor market index **(f)** Number of subseq. births within 8 years



(g) No subseq. births within 8 years **(h)** Birth spacing within 8 years

Note to Figure A4: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton births at term (≥37 gestational weeks) are considered for analysis. Each figure presents coefficients of interactions between each year and breech births. The red vertical line represents the year of the information shock, which is the omitted category. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level.

Table A1: Proportion of term singleton breech births

	Proportion of breech births	
	(1) proportion breech	(2) proportion breech
Information shock	0.0008	0.0001
	(0.0012)	(0.0013)
Fixed effects	NO	YES
R^2	0.004	0.058
Obs	2,191	2,191
mean of dep. var.	0.032	0.032

Note to Table A1: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. The proportion of breech births is collapsed to daily level. Each column presents a separate OLS regression of the impact of the information shock on the proportion of breech births. Linear split-breech specific trends are included in all regressions. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A2: The impact of planned C-sections on child and maternal outcomes for first-time mothers

Panel A: *Reduced form estimates*

	(1) Child health index	(2) Maternal health index	(3) Maternal health at sub. birth index	(4) Number of future births	(5) No more births	(6) Birth spacing	(7) Maternal labor index
Information shock	0.085**	0.004	0.012	-0.044	0.023	-0.046	0.003
	(0.036)	(0.046)	(0.045)	(0.031)	(0.019)	(0.077)	(0.038)
Fixed effects	YES	YES	YES	YES	YES	YES	YES
R^2	0.025	0.017	0.018	0.099	0.119	0.051	0.222
Obs	8,250	8,250	6,353	8,250	8,250	6,353	8,250
Control mean	0.000	0.000	0.000	0.956	0.238	3.205	0.000
Control sd	1.000	1.000	1.000	0.696	0.426	1.578	1.000

Panel B: *2SLS estimates*

	(1) Child health index	(2) Maternal health index	(3) Maternal health at sub. birth index	(4) Number of future births	(5) No more births	(6) Birth spacing	(7) Maternal labor index
Planned C-section	0.641**	0.029	0.091	-0.332	0.172	-0.352	0.024
	(0.275)	(0.345)	(0.350)	(0.239)	(0.145)	(0.592)	(0.288)
Fixed effects	YES	YES	YES	YES	YES	YES	YES
Obs	8,250	8,250	6,353	8,250	8,250	6,353	8,250
Control mean	0.000	0.000	0.000	0.956	0.238	3.205	0.000
Control sd	1.000	1.000	1.000	0.696	0.426	1.578	1.000

Note to Table A2: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) among first-time mothers are considered for analysis. In panel A, each column presents a separate OLS regression of the impact from information shock, on child health index (column 1), maternal health index (column 2), maternal health at subsequent birth index (column 3), number of subsequent births within 8 years from breech birth (column 4), probability of no more births within 8 years (column 5), birth spacing within 8 years (column 6), and labor market index (column 7). In panel B, each column presents a separate 2SLS regression of the impact of planned C-sections, on child health index (column 1), maternal health index (column 2), maternal health at subsequent birth index (column 3), number of subsequent births within 8 years from breech birth (column 4), probability of no more births within 8 years (column 5), birth spacing within 8 years (column 6), and labor market index (column 7). Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A3: Alternative dates

	Planned C-section	**Child health index**	**Maternal health index**	**Maternal health at sub. birth index**	**Number of future births**	**No more births**	**Birth spacing**	**Maternal labor index**
Panel A: *Date of the publication of TBT as cutoff*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Information shock	0.121***	0.086**	0.024	0.033	-0.036	0.021	0.007	-0.037
	(0.019)	(0.035)	(0.039)	(0.043)	(0.023)	(0.015)	(0.080)	(0.034)
Planned C-section		0.710**	0.199	0.261	-0.300	0.177	0.055	-0.305
		(0.291)	(0.319)	(0.341)	(0.197)	(0.127)	(0.623)	(0.281)
Obs	12,854	12,854	12,854	7,375	12,854	12,854	7,375	12,854
Panel B: *Date of the SFOG meeting as cutoff*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Information shock	0.131***	0.084**	0.053	0.021	-0.042*	0.019	0.063	-0.055
	(0.020)	(0.037)	(0.037)	(0.048)	(0.024)	(0.016)	(0.085)	(0.036)
Planned C-section		0.642**	0.405	0.150	-0.321*	0.145	0.455	-0.418
		(0.284)	(0.285)	(0.349)	(0.195)	(0.126)	(0.615)	(0.279)
Obs	12,482	12,482	12,482	7,168	12,482	12,482	7,168	12,482
Panel C: *Remove 1 week before and after the shock*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Information shock	0.120***	0.101***	0.022	0.021	-0.032	0.021	-0.016	-0.040
	(0.018)	(0.033)	(0.036)	(0.043)	(0.022)	(0.014)	(0.076)	(0.033)
Planned C-section		0.839***	0.185	0.167	-0.270	0.171	-0.131	-0.332
		(0.285)	(0.303)	(0.344)	(0.192)	(0.124)	(0.605)	(0.279)
Obs	13,086	13,086	13,086	7,509	13,086	13,086	7,509	13,086

Note to Table A3: The data are obtained from the Swedish Medical Birth Registry, Patient Registry, Death Registry, and the Longitudinal Integration Database for Health Insurance and Labor Market Studies, for the time period 25 August 1997 to 25 August 2003. Only singleton breech births at term ($\geq$37 gestational weeks) are considered for analysis. The baseline results are replicated by using the date of the publication of the Term Breech Trial as cutoff (panel A), or by using the date of the extra meeting held by the Swedish College of Obstetricians and Gynecologists as cutoff (panel B) or by finally removing observations 1 week before and after the shock (panel C). Linear split time trends are included in each regression. Maternal age, birth order, birth-quarter and county fixed effects, time-varying maternal and child characteristics, and binary variables for missing values are included in each regression. Standard errors are clustered at day-month-year level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table A4: Costs and rates

Delivery modes

Code	Delivery mode	Cost (SEK)
P05C	Vaginal complicated	47,572
P05E	Vaginal uncomplicated	30,984
P01A	C-section extremely complicated	88,635
P01C	C-section complicated	68,503
P01E	C-section uncomplicated	54,135

Hospitalization

In-patient care	Average hourly rate (SEK)	per night(SEK)
Care at maternity unit	500/h	12,000
Neonatal care, gestation >36	540/h	12,960
Children's hospital	600/h	14,400

Note to Table A4: Data obtained from Karolinska Universitetssjukhuset Huddinge.