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Cutting Fertility? The Effect of Cesarean Deliveries on Subsequent Fertility and Maternal Labor Supply*

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Abstract

The incidence of Cesarean deliveries (CDs) has been on the rise. The procedure's cost and benefits are discussed controversially; in particular, since non-medically indicated cases seem widespread. We study the effect of CDs on subsequent fertility and maternal labor supply. Identification is achieved by exploiting variation in the supply-side's incentives to induce non-medically indicated CDs across weekdays. On weekends and public holidays obstetricians' are less likely to induce CDs (due tighter capacity constraints in hospital). On Fridays and other days preceding a holiday, they face an increased incentive to induce CDs (due to their demand for leisure on non-working days). We use high-quality administrative data from Austria. Women giving birth on different weekdays are pre-treatment observationally identical. Our instrumental variable estimates show that a non-planned CD at parity one decreases life cycle fertility by almost 17 percent. This reduction in fertility translates into a temporary increase in maternal employment.

JEL Classification: I12, J13, J11, J22, J21.
Keywords: Caesarean delivery, Caesarean section, fertility, female labor supply.

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1 Introduction

The economic research on the introduction of the oral contraceptive pill has demonstrated that medical innovations have the ability to shape demographic developments and dramatically transform society at large (Goldin and Katz, 2002, Bailey, 2006). Other aspects of human reproduction, which were advanced by medical innovations, are less well studied. In this paper, we analyze the effects of birth technology. Over the last few decades, we saw an unprecedented growth in caesarean deliveries (CDs).[1] We show that CDs have, albeit smaller, but still far-reaching consequences. Non-medically indicated CDs reduce subsequent fertility and increase maternal labor supply.

There is clear consensus that CD improves maternal and child health outcomes when medically indicated.[2] In recent decades, the incidence of CD has substantially increased in almost all OECD member countries. On average, CD rates (i. e., the percentage of all live births delivered by Caesarian increased from 14 percent in 1990 to 20 percent in 2000, and almost 28 percent in 2013 (OECD, 2015). It seems indisputable that this upward trend in CD rates can only be partly explained by changes in the incidence of medical indications. Potential complementary explanations are the increase in mother's age at first birth, the rise in *in-vitro* fertilization (OECD, 2013), malpractice liability concerns (Currie and MacLeod, 2008), reductions in the risk of CD, scheduling convenience for doctors and patients (OECD, 2013, Brown III, 1996), and changes in patient preferences (Sachs et al., 1999).

This drastic development raises the question how non-medically indicated CD affect welfare. Clearly, a CD is more costly than a vaginal birth. In many OECD countries, the average cost for a CD is more than two times greater than for a vaginal birth (Koechlin et al., 2010). Thus, the overuse of CD constitutes a moral hazard problem in health insurance markets, and puts an unwarranted burden on healthcare systems (Gibbons et al., 2010). More importantly, non-medically indicated CDs may exert direct detrimental effects on mother or child. This question is, however, comparably harder to answer. A naïve comparison of CD delivering mothers (henceforth, CD mothers) and non-CD mothers, is most likely biased due to the presence of factors that promote a CD and also have an effect on the outcomes under consideration. The existing literature comprises a large number of observational studies examining a wide range of mother and child outcomes.[3] One demographic outcome studied in this literature is subsequent fertility.

Why should CDs affect subsequent fertility? CD mothers may either reduce subsequent fertility involuntarily or voluntarily. These two cases coincide with a physiological and psychological mechanism. It is certainly plausible that a CD causes later physiological reproductive constraints.

[1] A CD is defined as the delivery of a child through surgical incisions made through the mother's abdomen and uterus (*ICD-10 Procedure Coding System*: 10D00Z0).

[2] Among others, breech presentation, complications of labor such as fetal distress, cord prolapse, placenta praevia, and other complications and preexisting conditions (e.g. some cases of HIV infection) are widely accepted factors that require a CD (NICE, 2011).

[3] For a comprehensive collection of the relevant literature, see Caughey et al. (2014). A notable methodological exception is the so-called 'Term Breech Trial'. In this randomized controlled trial, expecting mothers with persistent breech position were randomly assigned either to a planned CD or a planned vaginal delivery. The main findings were that infant mortality (perinatal and neonatal) and serious neonatal morbidity was significantly lower for CD births. No difference was found for maternal mortality or serious morbidity (Hannah et al., 2000). A survey conducted among a subsample of participating mothers two years after birth did not reveal any important differences between groups in other maternal outcomes, such as breast feeding, relationship with child or partner, subsequent pregnancy, sexual problems, or distressing memories of the birth experience (Hannah et al., 2004). Importantly, several authors criticize the 'Term Breech Trial' based on serious flaws in design and implementation (Kotaska, 2004, Turner, 2006, Glezerman, 2006).

While surgical procedures have improved over time, CD mothers still recover more slowly after giving birth and are at a higher risk of many medical conditions, which could lead to involuntary infertility.[4] The alternative explanation (i.e. CD mothers reduce fertility voluntarily) may operate through different channels: First, CD mothers reduce fertility since they face higher expected cost of another birth. A CD is an indication for another CD and it is associated with a higher risk of complications in a future pregnancy (Daltveit et al., 2008). Observational studies show that maternal morbidity increases progressively with the number of CDs performed (Silver et al., 2006). Second, CD mothers may have had a longer recovery after birth compared to mothers who had a normal vaginal delivery. This may increase the psychological problems after childbirth and reduce the willingness to have another child in the future (Declercq et al., 2006, Weisman et al., 2010). Third, CD mothers may reduce fertility due to tighter constraints caused by the first child. A large number of observational studies highlights negative associations between CD and child outcomes.[5] Assuming that this association captures a causal relationship, CD mothers may decide to spend more time and resources on their first-born and forgo another child.

Negative association between CDs and subsequent fertility Both macro and micro data show a negative association between CD and subsequent fertility. Figure 1 depicts the correlation between CD rates and the total fertility rates based on the sample of 23 European OECD-member countries. The negative correlation of -0.68 is significant at the 99.9 percent level. Likewise, the dominant finding in observational studies based on micro data is that fertility is delayed and reduced after CD compared to vaginal delivery (Gurol-Urganci et al., 2013, O'Neill et al., 2013). While illustrative, this evidence — much like the above cross-country correlation — does not establish a causal relationship.

Despite the undisputed significance of fertility for macroeconomic development, labor market participation, and the sustainability of social systems, the potential causal link between CD and fertility has received little attention in the economic literature. A notable exception is Norberg and Pantano (2016), who exploit several data sources and adopt different empirical strategies to pin down the importance of maternal choices for the (negative) association between CD and subsequent fertility. Although the paper does not claim to identify a causal effect, it provides suggestive evidence for maternal responses as an important part of the link between CD and subsequent fertility: CD at index pregnancy is associated with a lower incidence of future live births, a higher rate of self-reported infertility and miscarriage of future pregnancies, and also with a higher overall rate of active contraception.

Establishing a causal relationship We analyze whether a non-medically indicated CD affects subsequent fertility behavior and maternal labor supply. To establish a causal link, we exploit three facts. First, obstetricians have considerable control over whether a delivery is completed vaginally or by CD. Second, hospitals have less capacities for surgical procedures on weekends and public holidays. Third, obstetricians have a preference for leisure on weekends (as compared to

[4]For instance, Smith et al. (2003) report a twofold increased risk for unexplained stillbirth among previous CD mothers after controlling for several maternal characteristics.

[5]These studies relate CDs to respiratory problems (Thavagnanam et al., 2008), allergies (Koplin et al., 2008), obesity (Goldani et al., 2011), diabetes (Cardwell et al., 2008), as well as cognitive and emotional development (Martins and Gaffan, 2000). Almgren et al. (2014) provide recent evidence that CD may cause negative epigenetic changes in the babies' DNA. In contrast, the only design-based approaches we are aware of finds a positive effect of a CD in the case of breech positions, where it increases the APGAR score and reduces health care utilization in the first year of life (Jensen and Wüsst, 2015).

weekdays). As a result, one finds — despite nature's almost uniform distribution of births across time — differential likelihoods of CDs across weekdays. This holds true after excluding planned CDs, which are always scheduled on working days. There is a 5 percentage points lower likelihood of a CD on weekends and public holidays, and a 1 percentage point higher likelihood of a CD on Fridays and other working days before public holidays.[6] We argue that the differential likelihood of a CD for expectant mothers, who are admitted to hospital on a certain weekday, is driven by obstetricians' demand for leisure and not correlated with mother factors. Accordingly, we exploit this variation in CDs across weekdays within an instrumental variables (IV) approach. The first IV is the admission on a weekend or public holiday. The second IV is the admission on a Friday or any other working day before a public holiday. Our identifying assumption is that the weekday of admission is not correlated with unobserved determinants of subsequent fertility or labor supply. While this assumption is fundamentally untestable, it is very reassuring that women admitted on different weekdays are observationally identical. Their unadjusted means of socio-economic characteristics are undistinguishable, and they exhibit the same average labor market history. This suggest that our IVs are as good as randomly assigned. One potential concern regarding the exclusion restriction of the first (but not the second) IV is the quality of medical services provided on weekends or public holidays. Due to lower staffing and availability of clinical services, the medical quality could be lower. This might reduce subsequent fertility. While there is little empirical evidence for reduced quality on weekends in neonatal units, any such effect would provide us with a more conservative result. Both IVs provide identical results.

Preview of main results Our empirical analysis is based on high-quality administrative data from Austria. We observe the universe of all births between 1995 and 2007, along with information on mode of delivery, health indicators for newborns, and mother's socio-economic information. We focus on all mothers at parity one and match information on their subsequent fertility and maternal labor supply up to the year 2013. Our main result is that non-medically indicated CDs (triggered by hospitals' free surgical capacity or by obstetricians' demand for leisure) reduce subsequent fertility permanently and increase maternal labor supply over a period of about six years. The probability of a second birth decreases by about 17 percentage points, and the one of a third by 6 percentage points after 10 years. This translates into a reduction in life-cycle fertility of 17 percent. The resulting increase in maternal employment (over a period of six years after first birth) generates an additional maternal labor income of about 14 percent. The estimated treatment effects on fertility do not vary along mothers' characteristics. In contrast, the labor supply effects are driven by highly educated mothers. All estimated treatment effects are highly statistically significant and are very similar across the two IV approaches.

The remainder of the paper is organized as follows. In Section 2, we discuss our research design. In Section 3, we present the estimation results and provide some sensitivity checks. Section 4 summarizes and concludes the paper.

[6] The sharp increase in unplanned CDs on Fridays (between 3pm to 9pm) was first noted by Brown III (1996), who attributed this anomaly to the obstetrician demand for leisure on weekends.

2 Research design

In this section, we first argue that supply-determination of CDs provides a source of exogenous variation. Then, we specify the particular source of supply-determination we exploit and discuss the assumption under which this allows identification of a causal CD effect on subsequent maternal behavior. Following this, we present our econometric estimation strategy. Finally, we discuss the institutional background and present our data along with descriptive statistics.

2.1 A classification of different reasons for CD

As discussed in the introduction, CDs are performed for various reasons. Some of these reasons will also be correlated with subsequent maternal behavior. Thus, a naïve estimation of the effects of a CD at first birth on subsequent behavior will most likely give biased estimates. For the sake of argument, we conceptionally distinguish the following cases:

- *Medically indicated CD*: A CD is performed due to medical indications which impede a vaginal birth. Most likely, an obstetrician always performs a CD if there is absolute medical indication that obligates her to do so. The patient is expected to follow the obstetrician's recommendation.

Other cases are influenced by either obstetrician's subjective consideration or incentives and potentially by the patient's preferences. We distinguish between non-medically indicated and semi-medically indicated CDs:

- *Non-medically indicated CD*: A CD is performed without medical indication. In this case, the CD is either recommended by the obstetrician or requested by the mother:
  - *Supply-determined CD*: The CD is performed on obstetrician's recommendation. Obstetricians may act in their own (or in their employers') interest and suggest a CD even if there is no medical indication. Potential motives are to increase revenues or to avoid unpleasant working hours.
  - *Demand-determined CD*: The CD is performed due to the patient's request. Women may prefer a CD because of scheduling convenience or to avoid anxiety and labor pain associated with vaginal birth.
- *Semi-medically indicated CD*: Whether a CD is necessary is not always obvious. Often obstetricians have to decide between CD and vaginal delivery based on their subjective judgment. Patients will most likely follow their doctors' advice. Put differently, we hypothesize that CDs in this category are overwhelmingly supply- and not demand-determined.

Medical indications (which always necessitate a CD) may be either exogenous or endogenous. Women with some pre-existing conditions (e.g. some cases of HIV infection) will have a CD and their future fertility will most likely differ from other women. Other medically indicated CDs may be driven by circumstances that are not correlated with future fertility (e.g. breech position). Non-medically indicated CDs may also either be endogenous or exogenous. They are endogenous if women requesting a CD tend to have a different fertility behavior. Whether this is true or not is hard to assess. Most importantly, supply-side determined CDs are — in the absence of sorting — by definition exogenous to the mother. The empirical relevance for this type of a CD is, however, hard to asses since doctors have a strong incentive to conceal this unethical behavior.[7]

The incidence of non-medically supply-determined CD can be expected to be higher the more the doctor (or his/her employer) is driven by profit-maximizing behavior.[8] Semi-medically indicated CDs (where we also expect the supply side to be the driving force) may result from a fully altruistic action solely guided by the Hippocratic Oath and/or also from profit maximizing behavior. Whether a woman will receive a CD is therefore determined by the doctor's and/or hospital's characteristics. These supply side characteristics should not affect women's fertility behavior, as long as women do not select themselves to certain supply-side characteristics.

Obviously, one cannot directly distinguish between these different types of CDs in observational data. However, we suggest two alternative IV estimation strategies that aim to isolate variation in non-medically and semi-medically supply-determined CDs.

2.2 The quantitative importance of supply-determined CDs

There are different ways to assess the importance of supply-determined CDs. The most common empirical strategy is to examine the variation in the incidence of CDs across regions, hospitals, and providers, while implicitly assuming that one can control for differences in medical indications and demand side factors. The dominant finding in this literature is that practice patterns vary substantially and non-medical supply-determined factors explain the recent dynamics in CD rates.[9] These differences can be explained by physicians, who differ in terms of risk aversion, patience and other individual attitudes, but also by differences in legal regulations or reimbursement for different types of deliveries.[10]

2.2.1 The variation in CDs across weekdays

We suggest to identify supply-side determined CDs by exploiting the variation in the incidence of CDs across weekdays. We use data from the *Austrian Birth Register* from 1995 to 2007 to motivate this approach. Panel A of Figure 2 shows CD rates across weekdays. There are two striking observations. First, there are clearly less CDs on Saturdays and Sundays. On weekends, we observe a CD-rate of 16.7 %, whereas the average rate on weekdays is 23.0 %. The most obvious explanation for this difference of more than 6 percentage points is that planned CDs

[7]In contrast, there is anecdotical evidence for non-medically demand-determined CD. Austrian women report that their request for a CD was fulfilled without any discussion, even in the absence of medical indication. Medical guidelines recommend doctors to offer women a planned CD if they demand it only after discussion and support (NICE, 2011).

[8]The empirical relevance for this type of CD is hard to assess since doctors have a strong incentive to conceal this unethical behavior.

[9]Evidence for substantial differences across regions, hospitals and providers is available, e. g. for the U.S. (Menacker and Hamilton, 2010), Canada (Hanley et al., 2010), the UK (Bragg et al., 2010), France (FHF, 2008), Switzerland (OFSP, 2013), and several Latin American countries (Belizán et al., 1999). For instance, Kozhimannil et al. (2013) report that among 593 U.S. hospitals nationwide, CD rates for low-risk pregnancies vary from 2.4 to 36.5 percent in 2009. Epstein and Nicholson (2009) study the variation across physicians. Based on physician data from the states of Florida and New York, they conclude that that physicians' idiosyncratic treatment styles explain nearly 30% of the variation in CDs (after controlling for a large set of relevant patient characteristics).

[10]Gruber and Owings (1996), Grant (2009), Triunfo and Rossi (2009) provide theoretical and/or empirical evidence that changes in doctors' reimbursement for different modes of delivery have an influence on the treatment intensity. Dubay et al. (1999), Currie and MacLeod (2008) analyze the impact of the medicolegal framework on physicians' inclination to perform CDs and find that physicians are able to adjust their behavior to changes in the legal environment.

are not scheduled on weekends. On top of that, obstetricians may less likely recommend (non-medically or semi-medically indicated) CDs given that hospitals face a certain capacity constraint on weekends. Below we will try to isolate the second effect. The second striking feature is the higher CD rate on Fridays which amounts to 24.1 %, as compared to the other working days with an average rate of 22.8 %. This pattern was first noted by Brown III (1996), who analyzed data from US military hospitals in the early 1990s. Military obstetricians did not earn extra income for performing a CD. Brown III (1996) attributed the sharp increase in unplanned CDs on Fridays (between 3pm and 9pm) to the obstetrician demand for leisure on weekends.[11] In our terminology, this means that non-medically (or semi-medically) indicated CDs are more likely to occur on a Friday (as compared to other working days), since obstetricians want to finish their shift on time to enjoy the weekend.[12]

Our estimation strategy relies on (non-medically or semi-medically) supply-side determined CDs. Therefore, we would like to exclude all scheduled planned CDs. These are either medically indicated or non-medically demand-determined. To focus on non-scheduled CDs (as opposed to planned ones), we exclude all observations with a gestation length shorter than 39 weeks from the analysis. This sample restriction is rationalized by the medical advice of Austrian scholars to perform a scheduled CD in week 38 of gestation (Husslein and Langer, 2000). Panel B of Figure 2 shows the CD rate across weekdays for the reduced sample. Two findings are noticeable. First, as compared to the full sample, CD-rates are lower across all weekdays. Second, the relative difference in CD rates between weekends and weekdays decreases after exclusion of pregnancies shorter than 39 weeks. Both facts support our interpretation that the reduced sample comprises by and large only non-scheduled CDs. We interpret the remaining differential between weekdays and weekends as the result of a reduced likelihood of (non-medically or semi-medically) supply-determined CDs given a limited medical capacity during weekends. The difference between Fridays and other working days remains approximately the same in the reduced sample and may result from the obstetricians' demand for leisure on weekends. Panel C of Figure 2 shows CD-rates across weekdays for the sample including observations with a gestation length shorter than 39 weeks only. The vast majority of planned CDs should be included in this sample. This assumption is supported by the fact that the CD rates in this sample are substantially higher, and the weekend-weekday gradient increases as compared to the full sample in Panel A.

Public holidays Given our explanations for an increased CD rate on Fridays (obstetrician demand for leisure on weekends) and the reduced CD rate on weekends (capacity constraints), we expect to find equivalent patterns between working days other than Friday that precede a public holiday, and public holidays during the week.[13] In Panel D of Figure 2, we distinguish between: (i) working days (except Fridays) preceding a working day, (ii) Fridays and other working days preceding a public holiday (pre-leisure day), and (iii) Saturdays, Sundays and public holidays (leisure day). Panels E and F of Figure 2 show the distribution of CD rates based on this new division of days for the samples with a gestation length shorter or at least 39 weeks, respectively.

[11] We cannot observe the time when the expectant mother enters the hospital.

[12] This pattern in the incidence of CDs is also found in Californian data (Spetz et al., 2001).

[13] Austria has 13 nation-wide public holidays per year. Our data covers a period of 13 years or 4,748 days. Of these, 156 days (or 3.3 percent) were public holidays, which happen to be on a weekday. Further, there were 86 days (or 1.8 percent) preceding a public holiday, which were neither a Friday, a Saturday, a Sunday, or a public holiday.

The figures support our interpretation that extra CDs before non-working days are caused by the obstetricians' demand for leisure, and are as such fully supply-determined.

Below we present descriptive statistics, which show that mothers' average pre-treatment socio-economic characteristics are observationally identical, irrespective of whether the birth took place on a leisure day, a pre-leisure day or any other working day.

2.3 Data, sample restrictions, and descriptive statistics

Our empirical analysis is based on two administrative datasets from Austria. The first source of data is the *Austrian Birth Register* (ABR). It includes the universe of all live births in Austria with individual-level information on birth characteristics such as date, place, mode of delivery, gestational length, and birth weight. This information is complemented by maternal socio-economic characteristics such as age, educational attainment, marital status, occupation and religious denomination. Different births to the same mother can be linked by a unique mother identifier. The ABR is available from 1971 to 2007, but information on the mode of delivery is only available since 1995.

The second source of data is the *Austrian Social Security Database* (ASSD). These are administrative records to verify pension claims and are structured as a matched employer-employee dataset. This allows us to observe the mother's labor market status and the date of all her live births in the period between 1973 to 2014. For each mother, we observe on a daily base where she is employed, along with information on occupation, experience, and tenure. Information on earnings is provided per year and per employer. The limitations of the data are top-coded wages and the lack of information on (contracted) working hours (Zweimüller et al., 2009).

We examine all first time Austrian mothers who had a singleton inpatient birth between 1995 and 2007, and analyze their subsequent fertility and labor market behavior until 2013.[14] To minimize the number of planned CDs, we focus on births with a gestation length of more than 39 weeks. Over the observation period, the incidence of CDs has increased substantially. The CD rate has increased from about 12 percent in 1995 to approximately 27 percent in 2007 (see Figure A.1 in the Web Appendix). Similar to other developed countries, there is no particular development in Austria that could explain the rise in CD rates by an increase in medical conditions. A more plausible explanation is that either the demand and/or the supply for non-medically (or semi-medically) justified CDs has increased over time.

Table 1 provides descriptive statistics for a list of socio-economic characteristics by treatment status. Column (1) refers to mothers with vaginal delivery, and column (2) to CD mothers. We find significant differences: CD mothers are on average 1.7 years older, have somewhat higher educational attainment, are more likely married (plus 2.2 percentage points), and are less likely Catholic (minus 2 percentage points). There are smaller differences in birth outcomes. The gestational age is identical and birth weights are comparable.[15] However, female newborns are substantially

[14] We focus on Austrian mothers, since non-Austrian mothers are more likely to leave the country, and/or to give birth abroad. Since the ABR only records births that took place in Austria, we might have measurement error in non-Austrian mothers' subsequent fertility. In a sensitivity check, we provide results including foreign mothers only. We further exclude outpatient births, since a CD always takes place in a hospital. Outpatient births are a very rare phenomenon in Austria. The average yearly rate of outpatient births among first time mothers was only 1.2 percent between 1995 and 2007.

[15] These results are influenced by our sample construction (we excluded observations with a gestation length shorter than 39 weeks).

under-represented among CD mothers (46 percent). Table 2 compares outcome variables by treatment status. Regarding fertility, we see that CD mothers are less likely to have a second (and a third child) in the period of six years after their first birth. Six years after the first birth, CD mothers are more than 8 percentage points less likely to have a second child. CD mothers are more likely employed before the first birth and are also more likely employed thereafter. We conclude that CD mothers and non-CD mothers differ substantially already before treatment.

2.4 Institutional setting

Austria represents a Bismarckian-type health-care system that is predominantly funded by employment-based social insurance contributions. Patients hold mandatory health insurance administered through nine *Regional Health Insurance Funds* ("Gebietskrankenkassen"), which cover private employees and their dependents, and 16 social security institutions providing health insurance for particular occupational groups such as farmers, civil servants, and self-employed persons.[16] More than 99 percent of the Austrian population is insured with free access to (almost all) health-care services. Health insurance covers all expenditures associated with sickness and maternity, for both in- and outpatient health-care services. In particular, medical expenses during pregnancy and the costs of delivery are fully covered, irrespective of the mode of delivery.[17]

Expectant mothers can freely choose the hospital for delivery, though most mothers select the nearest hospital running a maternity department, in particular when they expect a spontaneous delivery. CDs are universally available across Austrian hospitals, and a planned CD can be scheduled in any preferred obstetrics department.[18] Those mothers, who hold a voluntary and private supplemental health insurance, can additionally choose their treating obstetrician and midwives. In contrast to several (Anglo Saxon) health-care systems, all treating doctors, midwives and the nursing staff are permanently employed by the chosen hospital. According to the duty hours of the health-care staff members, the largest capacity of hospital staff is available during weekdays. However, even if less staff is present during weekends and public holidays, a complete surgical team must be continuously available in every obstetrics department over 24 hours, 7 days a week. This infrastructure guarantees that unplanned CDs can be performed at all times.

2.5 Estimation strategy

We analyze the effect of the mode of delivery at first birth on subsequent maternal behavior. In particular, we are interested whether a CD of mother i (as compared to a vaginal birth) has a causal impact on her fertility and maternal labor supply. Therefore, we define a binary variable $CD_{i(t=0)}$ equal to one if the mode of delivery at first birth (in period $t = 0$) is a CD, and zero otherwise. Fertility is captured by the binary variable $F_{i(t+p)}$, equal to one if the mother gives

[16] The *Regional Health Insurance Funds* cover approximately 75 percent of the Austrian population.

[17] The sickness funds offer pregnant women a comprehensive mother-child care program that was introduced in 1974. This program comprises five basic prenatal health exams for the expectant mother and her unborn baby. Pregnant women receive these services free of charge. A strong financial incentive to participate in this program is provided, as the eligibility for several family (birth) benefits is tied in with the utilization of these prenatal medical examinations.

[18] The lack of quality rankings for Austrian hospitals indicates weak competition among clinics. As a consequence, potential quality differences between hospitals that offer CDs do not trigger much attention.

birth to a further child in period $t+p$ with $p \subseteq \{1,2,3,4,5,6\}$. Our structural equation is defined as,

$$F_{i(t+p)} = \beta \cdot CD_{i(t=0)} + \gamma \cdot \mathbf{X}_{i(t=0)} + \epsilon_{it}, \tag{1}$$

where $\mathbf{X}_{i(t=0)}$ denotes a set of covariates comprising information on the mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province of residence.[19] Finally, ϵ_{it} denotes the error term. To study a mother's post-birth labor supply, we define a binary indicator $E_{i(t+p)}$, equal to one if mother i is employed in period $t+p$, and estimate a structural equation equivalent to (1).

A probit estimation of equation (1) is likely to provide biased estimates for β, because the utilization of CD cannot be expected to be exogenous. The cause for a medically-indicated CD — for instance, mother's health condition or complications during birth or pregnancy — may also influence subsequent maternal behavior regarding fertility and labor supply. For demand-determined CDs, it is *a priori* unclear whether (and if yes, how) maternal preferences for a CD are related to subsequent fertility behavior. To overcome the potential endogeneity problem, we suggest two alternative IVs. Both exploit variation in the likelihood of a (non-medically or semi-medically) supply-determined CD across weekdays as discussed above.

2.5.1 Leisure-day IV

First, we define a binary indicator $leisure_{i(t=0)}$ equal to one if the first birth took place on a Saturday, a Sunday, or a public holiday. In estimating

$$CD_{i(t=0)} = \tau^l \cdot leisure_{i(t=0)} + \gamma^l \cdot \mathbf{X}_{i(t=0)} + \varepsilon^l_{it}, \tag{2}$$

we expect to obtain a negative τ^l since obstetricians are less likely to initiate (non-medically or semi-medically) supply-determined CDs on these days due to capacity constraints. The identifying assumption of this approach is that $leisure_{i(t=0)}$ is not correlated with ϵ_{it}.[20] First, it is very reassuring that mothers who give birth on different weekdays are observationally identical in terms of birth outcomes and their socio-economic characteristics (measured at parity one). Table 3 compares mother and child characteristics for different birth days (leisure day, pre-leisure day, other day). We do not see any difference across columns in the sex ratio, the gestational length or the birth weight. Only the CD rate varies across groups. The comparison of means for mother's age, occupation, educational attainment, family status, religious denomination, and province of residence does not show important differences across columns either. Finally, mother's pre-treatment employment rates are essentially identical across groups. In sum, this suggest that our IV looks as if randomly assigned.

[19] We checked the sensitivity of our estimation results to the exclusion of the gestational length and the birth weight, since these two variables are potentially affected by the mode of delivery. Our results are robust to excluding these covariates (see Section 3.4).

[20] Note, given that our estimation sample only comprises births with a gestational age of 39 weeks or higher, we are confident to largely abstract from planned CDs, which are supposed to be performed in gestational week 38 or earlier.

Exclusion restriction We see one potential concern here. Ideally, we would like to be able to assume that the quality of medical care on weekends and public holidays is comparable to the quality provided on weekdays.[21] However, a reduced number of physicians at duty may result in lower quality of care. There are several arguments to be noted here. First, we believe that the organizational structure of Austrian hospitals — they must always provide sufficient resources to perform a surgery, such as an emergency CD — guarantees a constant quality across weekdays. However, we cannot substantiate this argument with empirical evidence. Second, a quality difference *per se* does not impose a threat to our identification, as long as it does not affect subsequent maternal behavior. Third, since mothers typically stay a couple of days in hospital after birth, they receive, irrespective of the weekday of birth, on average the same quality of postnatal care.[22] Finally, any bias would provide us with a more conservative estimate. If the quality of care would indeed be lower on weekends, then one would assume that women giving birth on weekends are the ones who reduced their fertility. In contrast, we put forward that CDs (which are *less* likely on the weekend) lead to lower fertility.

2.5.2 Pre-leisure-day IV

Our second IV allows us to abstract from the latter complications. We define a binary indicator $preleisure_{i(t=0)}$ equal to one if the first birth took place on a Friday or any other workday preceding a public holiday. In the resulting estimation

$$CD_{i(t=0)} = \tau^p \cdot preleisure_{i(t=0)} + \gamma^p \cdot \mathbf{X}_{i(t=0)} + \varepsilon^p_{it}, \quad (3)$$

we expect a positive τ^p, since obstetricians have a preference for leisure on weekends and public holidays. Put differently, we expect physicians to be more inclined to initiate a (non-medically or semi-medically) supply-determined CD, when the weekend or public holiday arrives, in order to leave the hospital on time. An alternative interpretation is that obstetricians carry out more (non-medically or semi-medically) supply-determined CD on these days to avoid a potential CD on capacity-constrained weekends/public holidays. In this specification, we include $leisure_{i(t=0)}$ as a covariate in equations (1) and (3). This means, identification comes only from $preleisure_{i(t=0)}$.

The credibility of this IV strategy is supported by two facts: First, women who give birth on a Friday or any other workday preceding a public holiday, are observationally identical to all other women. This can be seen in Table 3 by a comparing column (3) with columns (1) and (2). Second, we can safely assume that a constant quality of medical care is provided on pre-leisure days, since staffing is identical to workdays preceding a workday. In sum, there is no obvious reason why $preleisure_{i(t=0)}$ should be correlated with ϵ_{it}.

[21] There is a number of papers in medical science highlighting that patients, who were admitted to the hospital on a weekend, have worse health outcomes (see, for instance, Bell and Redelmeier, 2001). The source of this so-called 'weekend effect' is, however, unclear. The literature discusses health-care system factors (such as lower weekend staffing and availability of clinical services), but also patient factors (for instance, patients admitted on weekends could be more complex). For instance, Dobkin (2003) shows that after correcting for patients' observable characteristics, differences in outcomes vanish. Notably, there is little evidence for a weekend effect for births. For instance, Gould et al. (2003) report that after adjusting only for birth weight, any weekend effect in infant mortality vanishes.

[22] For instance, let us assume an average hospital stay of five days. The hospital stay of women comprises, depending on the weekday of admission, either 3/5 (Wed., Thu., Fri., Sat.), 4/5 (Tue., Sun.) or 5/5 (Mon.) working days. For women admitted on the weekend this share is on average 3.5/5, and for women admitted during the week the share is on average 3.6/5. Thus, the only source of concern is the quality on the exact day of birth.

2.5.3 Method of estimation

Since our treatment variable and all our outcome variables are binary, we use a *bivariate probit model* (BPM) to estimate equations (1), (2) and (3), respectively. In contrast to the linear IV model, the BPM explicitly accounts for the binary structure of the dependent variables (Chiburis et al., 2012). It assumes that the outcome and treatment variable are each determined by latent linear index models with jointly normal error terms, and allows us to report *average marginal treatment effects* for β. To check the robustness of our results, we will also discuss *local average treatment effects* based on a *two-stage least square* (2SLS) procedure.

3 Estimation results

This section presents our main empirical findings. We start by summarizing the estimated effect of the weekday of birth on the likelihood of a CD (Section 3.1). Then, we present the estimated effect of a CD on subsequent fertility. Here, we try to distinguish between a quantum and a tempo effect (Section 3.2). The effects of a CD at parity one on maternal labor market outcomes are presented in Section 3.3. Finally, in the robustness section (3.4), we (i) provide regression results for foreign mothers, (ii) present 2SLS estimation results, and (iii) exclude potentially endogenous covariates.

3.1 The effect of the weekday of birth on the likelihood of a CD

Table 4 provides the results of our BPM based on the two alternative IV approaches. Panel A focuses on the leisure IV and summarizes output from the joint estimation of eqs. (1) and (2). Panel B covers the pre-leisure IV and lists output from the joint estimation of eqs. (1) and (3). The different columns refer to a series of separate estimations and show the estimated effect of a CD at parity one on the likelihood of a second birth one to six years after the first birth. This and all other tables report estimated average marginal effects with standard errors in parentheses below.

First, we focus on the estimated effects of the weekday (i.e., leisure and pre-leisure days) on the likelihood of a CD. The second row of Panel A shows that the likelihood of a CD is 4.8 percentage points lower on the weekend or on a public holiday as compared to a working day. This effect is equivalent to a reduction of about 21 percent. We attribute the reduction to the obstetricians' reduced possibilities to induce non-medically and/or semi-medically indicated CDs on these days, when hospitals face tighter capacity constraints. The second row of Panel B shows that the likelihood of a CD is higher on Fridays or other working days preceding a public holiday. The estimated effect amounts to 0.78 percentage point or about 3.5 percent. We attribute this increase to the obstetricians' demand for leisure as the weekend or a public holiday arises. This preference of doctors increases their incentive to induce non-medically and/or semi-medically indicated CDs on these days, which allows them to leave their shift on time.

The leisure IV has comparable more power than the pre-leisure IV. The former IV has a t-statistic of 30.02 and the latter one amounts to 3.96. These t-values correspond with F-statistics of 901.0 and 15.7. For BPM no study appears to exist that provides threshold values that these statistics should exceed for weak identification not to be considered a problem. To still be able to assess the strength of our IVs, we estimate eqs. (2) and (3) with a linear probability model. Thus, we estimate the first stages of a 2SLS estimation, for which critical values are provided by Stock and Yogo (2005). In our case (with one endogenous variable and one IV), the critical F-value is 16.38. For the leisure IV, we obtain a Cragg-Donald Wald F statistic of 893.13, and for the pre-leisure IV of 16.47. Thus, both IVs are considered sufficiently strong.

Covariates The estimated marginal effects of the covariates are in line with previous studies and consistent across specifications. Table A.1 in the Web Appendix provides full estimation output for the specification of column (VI) in Panel A of Table 4. The estimated birth year fixed effects reflect the increasing trend in CDs over time. In the year 2007, a CD is *ceteris paribus* almost 10 percentage points more likely as compared to the year 1995. Notably, the estimated effect of giving birth on the weekend or on a public holiday (leisure IV) is almost half of the size of this secular time trend. The most important maternal characteristic is maternal age at birth. As compared to the group of the youngest mothers, an increase in the mother's age is associated with an increase in the probability of a CD by 2.3 and 17.0 percentage points for the second and tenth age decile, respectively. The mother's educational attainment, her occupation, family status, and religious denomination also have predictive power. For instance, the relationship between educational attainment and the likelihood of a CD follows a U-shaped pattern. Up to the level of "Post-secondary college", an increase in educational attainment is associated with a reduced likelihood of a CD (minus 4 percentage points). Beyond this level, we find a slightly positive impact of further education. The effect of the birth weight and gestational age both follow a clear U-shaped pattern. Thus, very low and very high birth weights have the highest likelihood of a CD. The same holds true for gestational age. Finally, CDs are less likely for girls than for boys (minus 2.1 percentage points).

3.2 The effect of a CD on subsequent fertility behavior

For both IVs, we observe that a CD at parity one has a negative effect on the likelihood of giving birth to another child starting three years after the first birth (see the first rows of Panel A and B in Table 4). The estimated effects are remarkably similar for the two alternative IVs. The quantitative effects can easily be compared across IVs and over years in the graphical representation of the estimated marginal effects provided in Figure 3. As compared to a vaginal delivery, a CD reduces the likelihood of a second birth three years after by 10.3 and 10.8 percentage points, respectively. The estimated effects are highly statistically significant and persist over the whole period under consideration. Six years after the first birth, the likelihood of having a second child is reduced by 14.4 and 15.6 percentage points. This effect is equivalent to a 28 percent decrease.[23]

We also estimate a naïve probit model. The results suggest that a CD at parity one is associated with a decrease in the likelihood of a second birth by only 5.3 percentage points three years after the first birth (see Table A.2 in the Web Appendix for full estimation output). The effect increases only slightly (in absolute terms) over the period of four to six years after first birth. Thus, the naïve probit model provides qualitatively equivalent results (as compared to the BPM), however, the estimates are substantially downward biased in absolute terms. This illustrates how important

[23] The outcome equation for the pre-leisure IV provides a falsification check of the leisure IV since it is included as a covariate. We do not find a significant direct effect of the leisure IV on fertility. The estimated marginal effect of -0.002 is economically and statistically insignificant (standard error: 0.003). This clearly supports the exclusion restriction assumption for the leisure IV.

it is to account for endogeneity in CD. A more formal way to assess the endogeneity of CD is given by the parameter ρ (see last rows of Panels A and B of Table 4). The estimated correlations between the error terms of the two equations are highly statistically significant for the period three to six years after the first birth. Their sign suggests that unobservable factors that are positively related to a CD are also positively related to the likelihood of a second birth.

There is still concern that we cannot test whether (and if yes, how many) planned CDs remain in our estimation sample of births with a gestational length of 39 weeks or more. Some obstetricians may not follow the guidelines that recommend planned CD before gestational week 39. In a worst case scenario, two circumstances may occur at the same time. First, a significant number of planned CDs is still included in our sample. Second, planned CD mothers have unobserved characteristics that are correlated with subsequent fertility and labor market behavior. Our leisure IV estimates would be biased under these assumptions. In contrast, pre-leisure IV estimates can be expected to be unbiased even under this scenario, since we control for leisure days and only exploit variation across working days. Here, we only need the much weaker assumption that planned CDs are equally likely across working days. To make this more explicit, we present a BPM model, that uses only observations of births on working days, in Table A.3 in the Web Appendix. Put differently, we exclude all births on leisure days. The estimated treatment effects of this specification do not differ substantially from those presented in Table 4.

The further analysis of fertility discussed below is based on the leisure IV, and the estimation results are summarized by graphs. The Web Appendix includes full estimation output for the leisure and the pre-leisure IV. Throughout our analysis, we obtain equivalent results for both IVs.

3.2.1 Treatment effect heterogeneity

To explore potential treatment effect heterogeneity, we examine several sample splits. It turns out that the estimated treatment effects are very stable across different subsamples. For instance, Figure 4 summarizes the estimated marginal effects for mothers with low and high educational attainment, respectively. The former group comprises mothers with compulsory schooling and apprenticeship training, the latter includes those with at least lower secondary schooling. The only notable difference in the estimated effects across the two groups is two years after the first birth. At this point in time, we observe a statistically significant effect for mothers with low educational attainment, and no effect for mothers with high educational attainment. Thereafter, we observe very comparable estimates for these two groups.

3.2.2 Tempo versus quantum effect

Since the vast majority of mothers in our estimation sample is still in child-bearing age six years after their first birth (see Figure A.2 in the Web Appendix), we cannot unequivocally conclude whether the estimated impact is a so-called *quantum* or only a *tempo effect*. Put differently, it is possible that treated women only delay childbearing. If this is the case, we would expect shrinking treatment effects beyond the sixth year after first birth, reflecting additional births by treated mothers, which compensate for reductions in earlier periods (tempo effect). Alternatively, a CD at parity one could reduce life cycle fertility (quantum effect). In this case, the treatment effects can be expected to stay constant (or at least significantly negative) beyond the sixth year until the end of treated women's reproductive years.

To provide evidence whether the estimated effects capture a quantum or a tempo effect, we conduct two additional estimation analyses. First, we estimate our model for the subgroup of mothers, who we can observe at least up to 10 years after their first birth. In doing so, we exploit the idea that the likelihood of a second child decreases as the age of the first child increases. Second, we impose in addition an age restriction on mothers and focus on a sub-group, who were close to the end of their reproductive years. If the estimated effects hold in the sample of mothers close to the end of their reproductive years, this would support the interpretation of a quantum effect.

Longer horizon The purple (dark) bars in Figure 5 summarize the estimated marginal effects for the subsample of mothers who gave birth before 2005. This subgroup has the advantage that we can observe their subsequent fertility up to at least 10 years after first birth. The blue (light) bars replicate the baseline estimates for the full sample of births until the year 2007. This comparison reveals two important findings: First, the two set of estimates are very comparable in the first six years after birth. Second, the effects for the seventh to the tenth year after birth hardly change as compared to the estimate for the sixth year. The stability of the estimated treatment effects over the period of ten years after first birth supports the interpretation of a quantum effect.

Longer horizon for older mothers The green (light) bars in Figure 6 summarize the estimated marginal effects of a CD on the likelihood of a second birth for the subsample of mothers who are 30 years of age or older at first birth. These women are, depending on their age at first birth, between 40 and 55 years old after ten years. The purple (dark) bars replicate the estimates for all mothers who gave birth before 2005, irrespective of their age at first birth. We observe only minor differences in the estimated effects for average-aged mothers and older mothers. Ten years after the first birth, the fertility effect is minus 17 percentage points for average-aged mothers and about minus 19 percentage points for older mothers.[24] We interpret this as strong evidence in favor of a quantum effect of a CD at first birth and reject the hypothesis that the estimated fertility effects of a CD only represent a postponement of subsequent births (tempo effect).

3.2.3 Third birth

A final analysis with respect to fertility focuses on the potential impact of a CD at parity one on the probability of having a third child. For this purpose, we restrict again the sample to mothers who we observe at least for ten years after their first birth. In this analysis, we disregard the timing and mode of any second birth, since these are 'bad controls'. We simply estimate the effect of a CD at first birth on the likelihood of having a third child in subsequent years based on the BPM described above. The estimated marginal effects are summarized by the green (dark) bars in Figure 7. We find a significant and negative impact starting five years after the first birth. It is fully plausible that the onset of the effect on a third child is delayed as compared to the effect on a second child (see purple (light) bars). The estimated effect in the fifth year amounts to minus 2.6 percentage points, and increases (in absolute terms) over time up to minus 6.2 percentage points in the tenth year after first birth. The latter effect is equivalent to a reduction of almost 54 percent. Thus, the estimated treatment effect is (measured in percent) about twice as large as the one on

[24] Notably, the first stage of the leisure IV is somewhat stronger for older women (as compared to average-aged women). In the former case, a birth on the weekend or public holiday is 5.6 percentage points less likely a CD, in the latter by 4.3 percentage points (see Tables A.6 and A.7 in the Web Appendix).

the probability of a second child. This result provides additional evidence for a permanent and negative impact of CD at parity one on subsequent fertility.[25]

3.3 The effect of a CD on subsequent labor market behavior

Given the permanent negative impact of a CD at parity one on subsequent fertility, it seems plausible that treated mothers also adjust their labor market behavior. Since a lower number of children corresponds with lower child-care responsibilities, one would expect an increase in maternal labor supply.

To test this supposition, we estimate a BPM for maternal employment. Table 5 summarizes the estimation results based on the two alternative IV approaches (compare Panels A and B). The dependent variable $E_{i(t+p)}$ is equal to one if the mother is employed p years after the first birth.[26] The different columns refer to a series of separate estimations and show the estimated marginal effect of a CD at parity one on the likelihood of maternal employment one to six years after the first birth. To identify the mother's employment status, we verify whether she is employed on the cutoff dates 12, 24, 36, ... months after birth. We find a statistically significant positive effect on the likelihood of maternal employment, starting 3 years after the first birth. The timing of this effect is plausible, since the onset of the fertility and the labor supply effect coincide. In this particular year after the first birth, treated mothers are 12 percentage points more likely employed. Given an average employment rate of about 51 percent, the estimated treatment effect corresponds to an increase of 23 percent. Thus, the quantitative effect of a CD at parity one on fertility and labor market behavior are comparable. Four years after birth, the effect on labor market behavior peaks at more than 13 percentage points (see Panel A), and declines thereafter. Six years after the first birth, treated mothers are still about 6 percentage points (or about 10 percent) more likely employed. This pattern, which is very comparable across both IV approaches, makes perfect sense, since part of the untreated mothers will return to the labor market as their 'additional' child grows older.

The statistically significant negative impact of CD on employment in the first year after birth may point to direct negative health effects after the surgery. Mothers may suffer from serious physical or mental health problems as a consequence of the CD which does not allow them to return to the labor market quickly. Note, however, only a rather small share of women (22 percent) is employed in the first year after birth. This is a result of the Austrian parental leave system which provides paid parental leave up to two years after birth. The estimated effect is less pronounced in the leisure IV specification. Figure 8 provides a graphical representation of employment effects.

In a next step we aim to answer the question how much additional labor income is generated due to the positive effect of a CD at parity one on maternal labor supply. For this purpose, we consider the first six years after birth. One way to approximate the change in labor income is given by simply combining our estimated effect on the employment probability (from Table 5) with the average income. This simple calculation gives an effect of about Euro 7,132 or 14 percent. Clearly,

[25] For the probability of a fourth child, we find statistically insignificant negative effects. However, only a small share of women has more than three children (after 6 years: 0.39 percent; after 10 years: 1.56 percent).

[26] More precisely, we check whether the mother has any employment spell in the calender month 12, 24, 36, ... months after birth. If yes, we categorize her as employed, and as non-employed, otherwise.

there are more sophisticated procedures.[27] A tractable solution is imputing wages of zero for all non-employed women (Neal and Johnson, 1996) and to estimate a Tobit Type 1 model. In our specific case, we face the challenge of a Tobit Type 1 model with a binary endogenous regressor. We implement our IV estimation via a control function approach using a Tobit specification for wage. This procedure provides us with a comparable earnings gain of about 11 percent. Details are available upon request.

The further analysis of maternal labor supply is also based on the leisure IV. The Web Appendix includes full estimation output for the leisure and the pre-leisure IV. We obtain equivalent results for both IVs.

3.3.1 Treatment effect heterogeneity

Unlike to the case of fertility, we find that the labor market response to a CD is not homogenous across all groups. Figure 9 summarizes the estimated effects for mothers with low and high educational attainment, respectively. The baseline employment in the first six years after the birth is about 3 percentage points lower for lower educated mothers, as compared to higher educated ones. The estimated treatment effects suggest that only women with higher educational attainment (i.e., those who have at least lower secondary schooling) increase their labor supply. For mothers with lower educational attainment, we find positive coefficients in the third to the fifth year after birth. However, these are not statistically significant at conventional levels. The first stage is sufficiently strong for both groups; however, marginally more pronounced for higher educated mothers. The treatment effect heterogeneity in the second stage is surprising, given that we found a reduction in fertility for both groups. Thus, among low educated mothers, post-treatment labor market behavior does not differ substantially despite the significant difference in average family size. This finding is the net effect of two separate potential explanations (which cannot be disentangled): untreated women do not reduce their labor supply (despite having on average more children), and/or treated women do not increase their labor supply (despite having on average fewer children). Given that low educated mothers do not significantly change their labor supply after CD, we restrict the following analyses (part-time versus full-time employment and a longer time horizon) to mothers with high educational attainment.

3.3.2 Intensive margin

The set of estimations discussed above informs us about labor supply responses at the extensive margin. It would further be interesting to analyze adjustments at the intensive margin. While our data do not include information on the (contracted) working hours, we can use the pre-treatment earnings as a natural reference point to define a proxy variable for the adjustment along the intensive margin. To keep things conceptually easy, we assume that all employed women were in full-time employment before their first birth. This seems to be a plausible assumption for young women without children. We call mothers full-time employed in the post-treatment period

[27] For instance, one could also employ a self-contained estimation analysis, with the wage rate as an outcome variable. Such an analysis, however, gives rise to the classical problem in applied labor economics that the wage rate is censored for non-employed women. The econometric literature provides methods for the joint estimation of a structural model of the participation decision and the wage determination. A credible implementation of such a model, however, requires an additional exclusion restriction and is beyond the scope of this add-on exercise.

if they earn at least 75 percent of their pre-treatment salary.[28] If their post-treatment salary is less than 75 percent of their pre-treatment salary, we call them part-time employed. According to this definition, the share of highly-educated part-time employed mothers (among highly-educated employed mothers) is about 41 percent one year after first birth and declines steadily over time to about 34 percent six years after the first birth. Figure 10 summarizes estimates for part-time and full-time employment of highly-educated mothers. The estimates reveal that our employment effects are driven by an increase in full-time employment. We find positive effects of CD on full-time employment 2 to 4 years after the first birth. The quantitative impact reaches a statistically significant maximum of 14.2 percentage points in year 3 (leisure IV specification). The effects on part-time employment are small and in all cases statistically insignificant. Given that the main fertility effect happens to occur in years 3 and 4 — i.e. the majority of the second births among untreated women — it is very plausible to see the most pronounced labor market responses in this period.

3.3.3 Longer horizon

To investigate employment effects beyond the sixth year after birth, we confine the analysis to highly-educated women who gave birth before 2004. This allows us to follow their labor market behavior up to at least ten years after first birth. Figure 11 summarizes estimated treatment effects of the respective BPMs and contrasts these with the baseline estimates for highly-educated mothers. This new set of results confirms a trend, which was already adumbrated by our baseline specification: The positive employment effect of a CD at parity one peaks after three years, decreases thereafter, and turns statistically insignificant in subsequent years. This pattern is in line with the fertility effects and the availability of child-care institutions in Austria. On average, the 'additional second child' born to untreated mothers turns three in the sixth to seventh year after first birth. Starting from this age, public child-care facilities are widely available. Austria has a well-structured *Kindergarten* network that provides heavily subsidized day care for children between three and six years of age. In contrast, there is a perpetual shortage of day nurseries (*Kinderkrippen*) that offer day care for children below the age of three. Thus, we interpret the fading out of the employment effect as the return of untreated women to the labor market when their second child starts with *Kindergarten*.

3.4 Sensitivity analysis

We check the sensitivity of our estimation results to a number of variations with respect to the the sample used, the method of inference, and the covariates included. We briefly report on these sensitivity checks below. Detailed estimation output based on the leisure IV is provided in the Web Appendix.

Estimation sample To avoid potential measurement error in our outcome variables, we have excluded foreign mothers from our main estimation sample used above. For comparison reasons, we present equivalent results for the sample of foreign mothers. The estimated effect of the leisure IV on the likelihood of a CD is very comparable for foreign and Austrian mothers. The resulting effect of a CD at parity one on subsequent fertility is, however, less pronounced for foreign mothers

[28] We exclude all mothers, who were not employed in the year before birth, from this analysis. These are 45,482 women or 16 percent.

(see Tables A.14 in the Web Appendix). The negative treatment effects turn statistically significant only after five years. In this year, the estimated effect amounts to minus 13.8 percentage points. In the following year, it decreases to minus 9.2 percentage points, but remains highly significant. For maternal employment, we find stronger differences as we do not obtain a statistically significant effect of a CD for foreign mothers (see Table A.15 in the Web Appendix). The estimated effects are negative, but remain statistically insignificant in all six periods after first birth. Thus, while treated foreign mothers reduce fertility, they do not increase their labor supply (relative to untreated foreign mothers with higher fertility). Given that foreign mothers are on average less educated as compared to Austrian mothers, this result is in line with our finding for the treatment effect heterogeneity along the dimension of educational attainment (discussed in in Section 3.3.1). In sum, we find less significant results for foreign mothers. This is consistent with measurement error problems in the dependent variables.

Methods of estimation The advantage of the BPM is that it explicitly accounts for the binary nature of the treatment and the outcome variable. However, it imposes functional assumptions on the error terms (i. e. ϵ and ε are assumed to be jointly normally distributed with zero means, the variances of the error terms being one, and their covariance being ρ). For comparison, we re-estimated our models also with a linear IV model that ignores the binary structure of outcome and treatment variables. This 2SLS estimation works well for the leisure IV. The estimated local average treatment effects on fertility and maternal labor supply (see Table A.16 and A.17 in the Web Appendix, respectively) are very comparable to the average treatment effects obtained by the BPM. For instance, the 2SLS suggests that a CD (due to delivery on a leisure day) reduces the probability of having another child six years after birth by 11.3 percentage points. The 2SLS estimates also confirm the positive effect on maternal employment. A CD at parity one increases maternal employment significantly three to four years after first birth. The quantitative effect peaks in the third year (at 10.3 percentage points) and decreases thereafter.[29]

Covariates In our baseline specification, we control for gestational length and birth weight. These two variables are potentially affected by the mode of delivery. This is in particular true for planned CDs. Fortunately, our results are not sensitive to the exclusion of these two covariates. The estimated treatment effects basically do not change (see Tables A.18 and A.19 in the Web Appendix). Based on the leisure IV specification, the highly significant treatment effects on fertility (maternal employment) are slightly lower (higher) in the period three to five years after the first birth as compared to the baseline results. These results corroborate our presupposition that our estimation sample does not comprise a significant number of planned CDs.

4 Conclusions

About 28 percent of all births in OECD member countries were delivered by Cesarean in 2013. However, Molina et al. (2015) recommend that this share should not exceed 19 percent to optimize maternal and neonatal outcomes.[30] Thus, at least 32 percent of all CDs could be avoided. A

[29]Based on the pre-leisure IV, the 2SLS model does not replicate the significant effects on fertility or maternal employment. It seems that the ignorance of the binary structure of the outcome and treatment variables only works if the IV is really strong (as in the case of the leisure IV).

[30]The recommendation (10 to 15 percent) by the *World Health Organization* is even lower (World Health Organization, 2015).

reduction of CD rates to the recommended level would decrease health-care costs substantially. Our analysis shows that further welfare gains would be achieved in increased fertility.

Our IV estimation results imply that mothers who have a non-medically indicated CD at parity one are 17 and 6 percentage points less likely to give birth to a second and third child, respectively. This corresponds to an estimated reduction in lifetime fertility of 0.23 children, or 17 percent. A reduction in the average CD rate from 28 percent to a recommended level of 19 percent would increase the fertility rate by 0.016 children per woman. This would increase the average total fertility rate in the OECD area by one percent. Our analyses suggest that such fertility gains, would be accompanied by moderate reductions in female labor supply.

There is profound public effort in all high-income countries to foster fertility. In 2014, OECD member countries spent 2.6 percent of GDP on average on families (OECD Public Social Expenditure Database, category: public social spending on the family). Many of these countries implement specific policies to increase fertility, such as fully subsidized assisted reproduction. Our analysis shows that one sensible policy to increase fertility is to reduce CD rates to a normal level. To achieve this goal, the supply and the demand side should be addressed. Health-care market regulation need to reduce monetary supply-side incentives for CDs. The reimbursement of obstetric care in DRG[31]-based hospital funding systems should be changed in favor of vaginal births. To reduce the demand for CDs to a healthy level, public health campaigns should be implemented.

A clear limitation of our analysis is that we cannot reveal the causal mechanism. It remains unclear why CD mothers reduce their fertility. Future research is needed to determine whether it is a physiological or a psychological mechanism. On top of that, more design-based approaches are needed to study the effects of a CD on children. Our results highlight that any analysis of medium or long-term child outcomes has to account for the fact that treated children tend to come from smaller families.

[31]Diagnosis related groups

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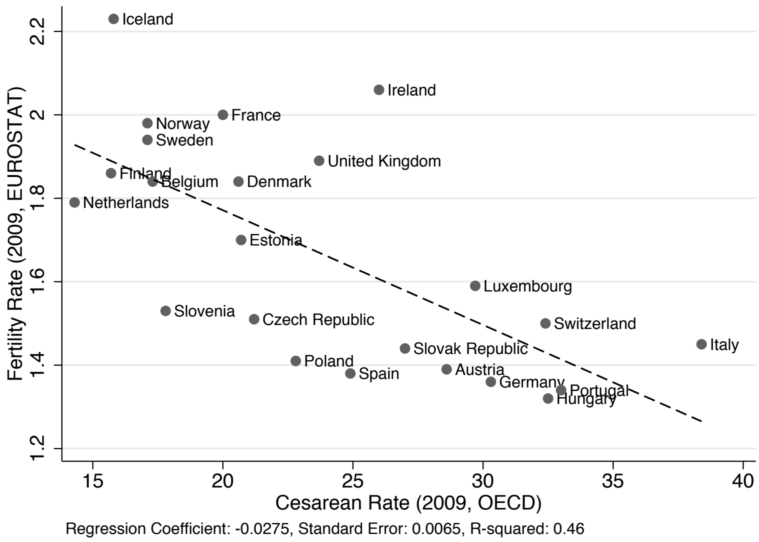
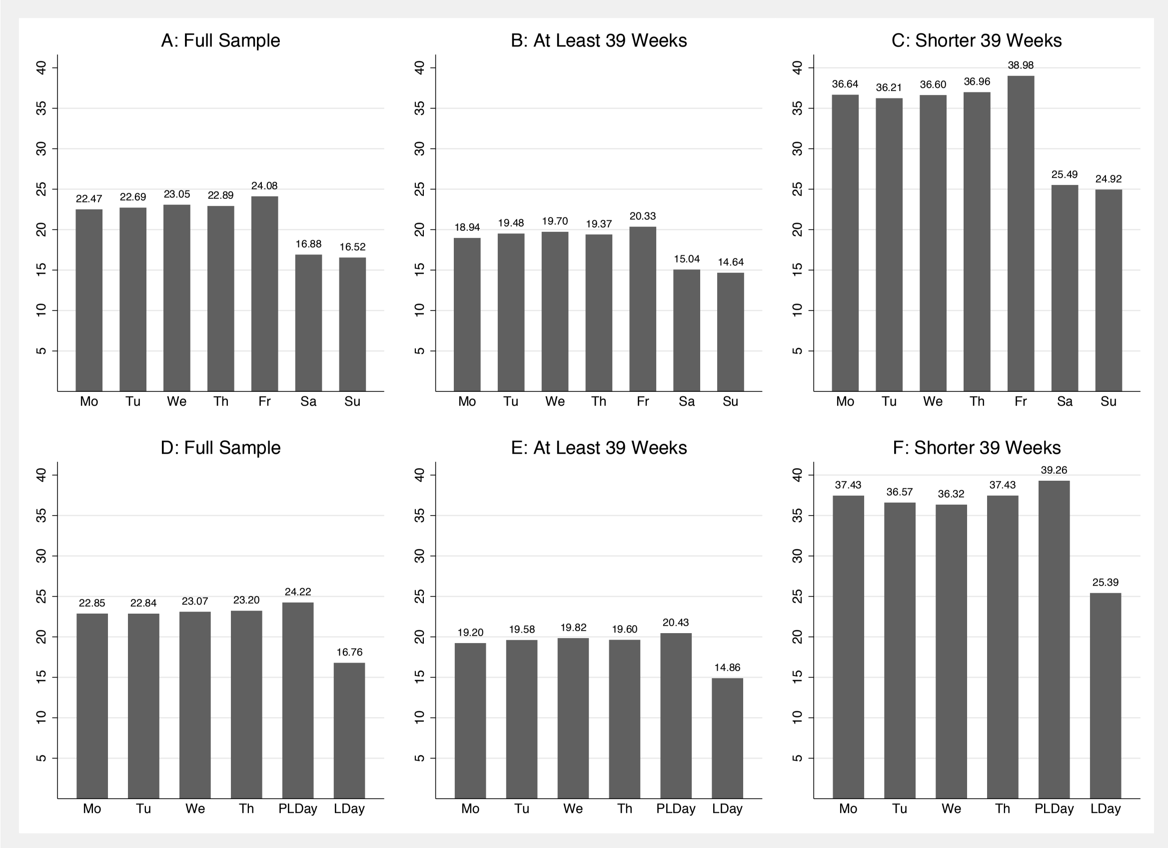
5 Tables and figures (to be placed in article)

Figure 1 – CD and fertility in Europe



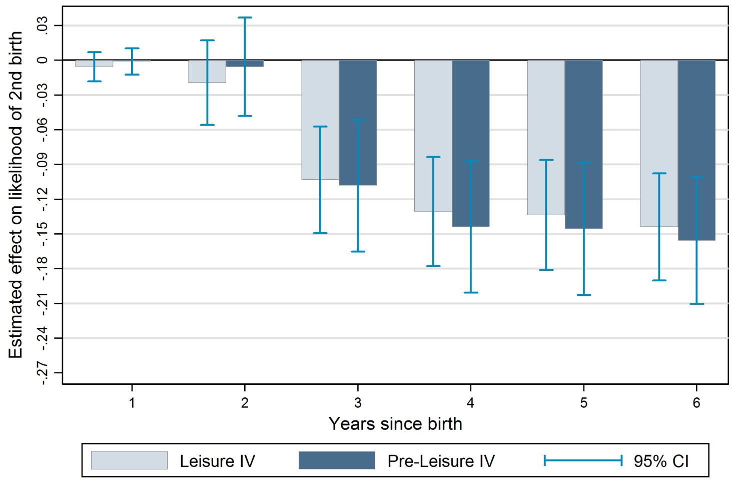
Notes: This figure depicts the cross-country correlation between CD rates and fertility rates for the sample of European countries for which OECD data on CDs is available.

Figure 2 – CD rates per weekday



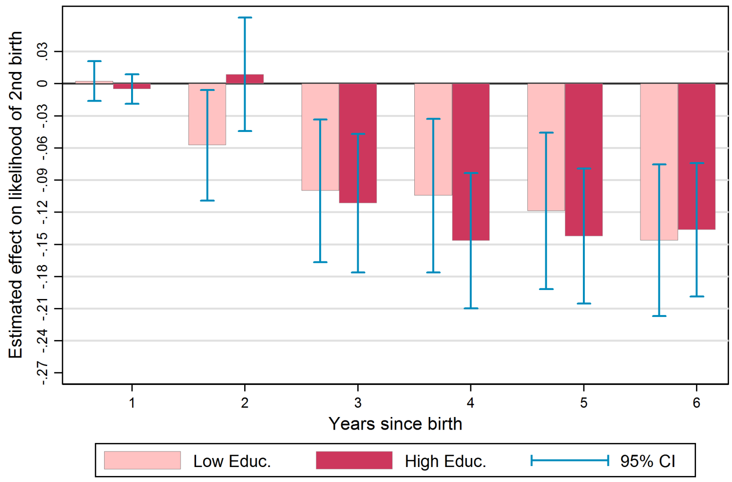
Notes: This figure depicts CD rates in percent over weekdays (A, B, C) and type of days (D, E, F) for the full sample (A, D), the sample of deliveries at week 39 or later (B, E), and deliveries before week 39 (C, F), respectively.

Figure 3 – Effect of a CD at parity one on the likelihood of a 2nd birth



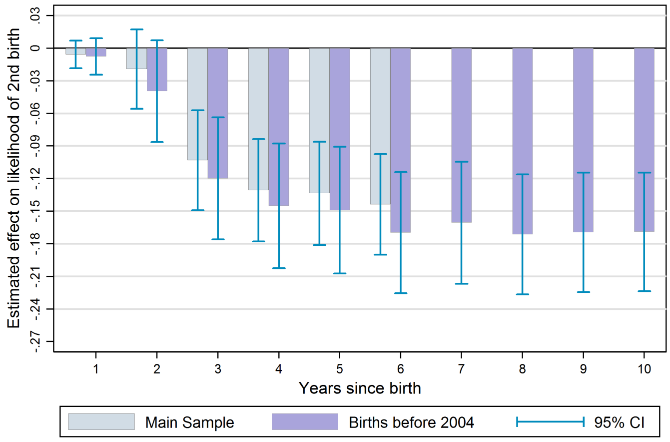
Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of a second birth based on a series of bivariate probit models that use two alternative IVs. The estimates are equivalent to those summarized in Table 4. See notes to this table for further information.

Figure 4 – Effect of a CD on fertility by mother's educational attainment



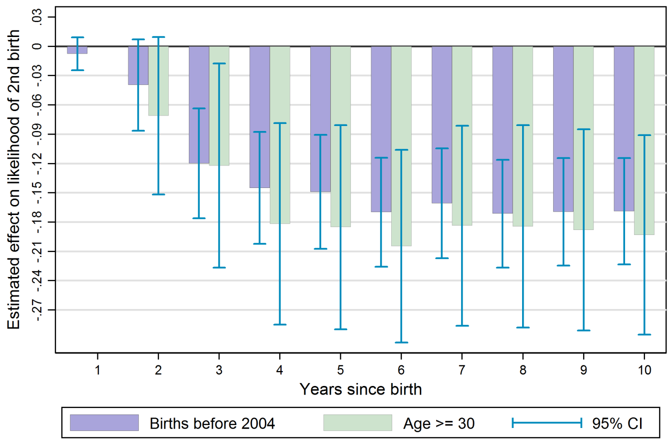
Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of a second birth for mothers with high and low educational attainment. The estimates are based on a series of bivariate probit models that use the leisure IV. High education includes mothers with secondary schooling at least, low education refers to mothers with compulsory schooling and apprenticeship training. The estimates are equivalent to those summarized in Tables A.4 and A.5 in the Web Appendix. See notes to these tables for further information.

Figure 5 – Effect of a CD on fertility up to 10 years after first birth



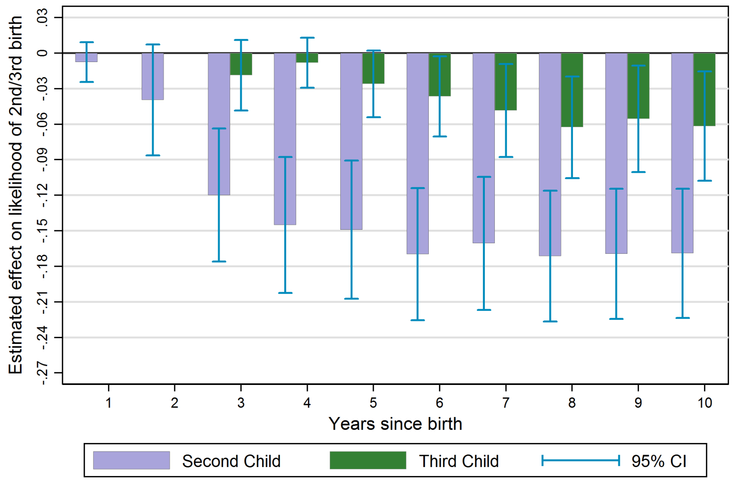
Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of a second birth for the full sample of births from 1995-2007 (Main Sample) and a subsample of births from 1995-2004 that we can observe up to at least 10 years (Births before 2004). The estimates are based on a series of bivariate probit models that use the leisure IV. Full estimation output for the 1995-2003 subsample can be found in Table A.6 in the Web Appendix. See notes to this table for further information.

Figure 6 – Effect of a CD on fertility by average-aged and older mothers



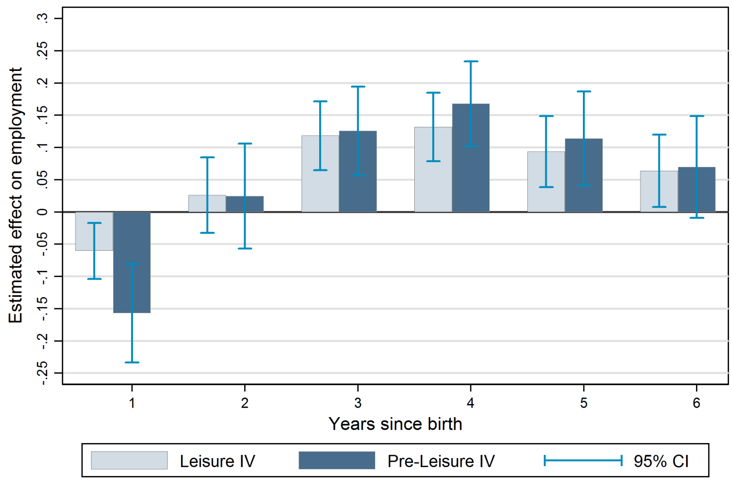
Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of a second birth for the sample of births from 1995-2003 (Births before 2004) and, for the same time period, a subsample of older mothers who are at least 30 years old at first birth (Age>= 30). The estimates are based on a series of bivariate probit models that use the leisure IV. Full estimation output for the subsample of older mothers can be found in Table A.7 in the Web Appendix. See notes to this table for further information.

Figure 7 – Effect of a CD at parity one on the likelihood of a 3rd birth



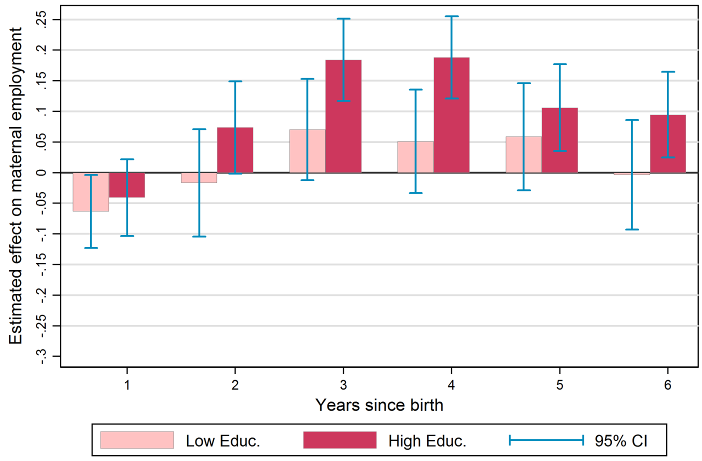
Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of a second and third child including births from 1995-2003. The estimates are based on a series of bivariate probit models that use the leisure IV. Full estimation output for the likelihood of a third child can be found in Table A.8 in the Web Appendix. See notes to this table for further information.

Figure 8 – Effect of a CD at parity one on mother's employment



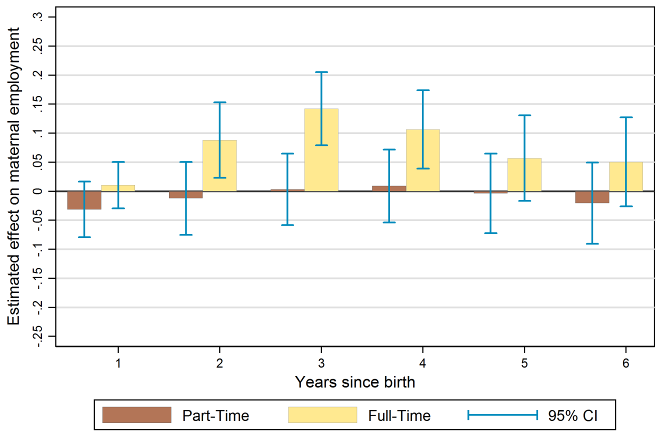
Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of maternal employment based on a series of bivariate probit models that use two alternative IVs. The estimates are equivalent to those summarized in Table 5. See notes to this table for further information.

Figure 9 – Effect of a CD on employment by mother's educational attainment



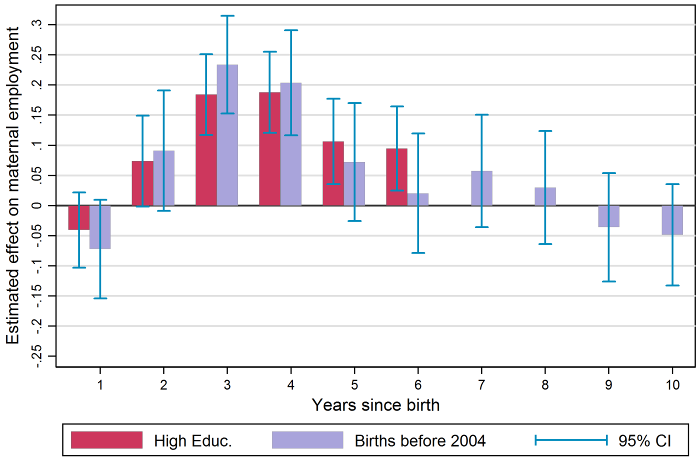
Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of maternal employment for mothers with high and low educational attainment. The estimates are based on a series of bivariate probit models that use the leisure IV. High education includes mothers with secondary schooling at least, low education refers to mothers with compulsory schooling and apprenticeship training. The estimates are equivalent to those summarized in Table A.9 and A.10 in the Web Appendix. See notes to these tables for further information.

Figure 10 – Effect of a CD on full-time and part-time employment of highly-educated mothers



Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of full-time and part-time maternal employment of highly-educated mothers. The estimates are based on a series of bivariate probit models that use the leisure IV. A mother is employed full-time (part-time) after treatment if she earns more (less) than 75 % of her pre-treatment salary. Full estimation output for this set of estimations can be found in Tables A.11 and A.12 in the Web Appendix. See notes to these tables for further information.

Figure 11 – Effect of a CD on employment of highly-educated mothers up to 10 years after first birth



Notes: This graph depicts the estimated marginal effects of a CD at parity one on the likelihood of employment of highly-educated mothers including all births from 1995-2007 (High Education) and a subsample of births from 1995-2003 that we can observe up to at least 10 years (Births before 2004). The estimates are based on a series of bivariate probit models that use the leisure IV. Full estimation output for the 1995-2003 subsample can be found in Table A.13 in the Web Appendix. See notes to this table for further information.

Table 1 – Mother and child characteristics by treatment status

	(1) Vaginal Birth		(2) CD		
	Mean	SD	Mean	SD	
Girl	50.2		46.2		* * *
Birth weight	335.6	(40.2)	337.1	(47.6)	* * *
Gestation length	40.3	(0.9)	40.3	(1.0)	* * *
Mother's age	26.4	(4.9)	28.1	(5.4)	* * *
Mother's occupation					* * *
Self-employed	1.7		2.5		
Farming	0.6		0.6		
White collar	71.5		72.4		
Blue collar	15.6		14.6		
Missing	8.0		7.0		
Unknown	2.7		2.9		
Mother's education					* * *
Compulsory school	10.3		9.8		
Apprenticeship	38.9		36.7		
Interm. tech. and voc. school	19.0		18.6		
Academic secondary school	17.1		17.1		
Post-secondary college	5.0		5.1		
University	6.7		9.5		
Unknown	3.0		3.2		
Family status					* * *
Single	51.6		48.3		
Married	46.4		48.6		
Widowed	0.1		0.1		
Divorced	1.9		3.0		
Mother's religion					* * *
Roman Catholic	85.1		83.2		
Protestant	4.2		4.4		
Old Catholic	0.1		0.1		
Jewish	0.0		0.0		
Muslim	1.3		1.0		
Other	0.7		0.7		
Unknown	8.6		10.5		
Province of residence					* * *
Burgenland	2.7		3.5		
Carinthia	7.4		6.8		
Lower Austria	18.3		19.3		
Upper Austria	18.6		16.0		
Salzburg	7.1		5.4		
Styria	15.0		18.7		
Tyrol	9.6		9.3		
Vorarlberg	5.0		3.8		
Vienna	16.3		17.1		
Number of observations	231,025		51,806		

Notes: This table depicts descriptive statistics measured at the time of birth for mothers with vaginal delivery (column (1)) and CD mothers (column (2)). Birth weight is measured in dekagrams, gestation length in weeks, mother's age in years. All other figures indicate percentages. Standard deviations in parentheses. Differences between groups are tested by means of 2-independent-sample t tests for birth weight, gestation length, and mother's age. Chi-square tests are employed for the categorical variables girl, mother's occupation, mother's education, family status, mother's religion, and province of residence. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table 2 – Outcome variables by treatment status

	(1) Vaginal Birth Mean	(2) CD Mean	
Second child			
Year 1	0.6	0.4	***
Year 2	15.9	11.6	***
Year 3	34.4	28.0	***
Year 4	44.2	36.8	***
Year 5	50.3	42.4	***
Year 6	54.4	46.1	***
Third child			
Year 1	0.0	0.0	
Year 2	0.1	0.1	
Year 3	0.6	0.5	***
Year 4	2.2	1.4	***
Year 5	4.4	3.1	***
Year 6	6.4	4.5	***
Employment			
Year -4	67.5	73.5	***
Year -3	75.9	79.8	***
Year -2	82.5	84.7	***
Year -1	86.6	87.6	***
Year 0	7.1	8.4	***
Year 1	20.9	23.7	***
Year 2	44.1	47.7	***
Year 3	50.2	55.2	***
Year 4	54.0	58.7	***
Year 5	59.5	63.6	***
Year 6	64.5	68.2	***
Number of observations	231,025	51,806	

Notes: This table depicts outcome variables before and after birth for mothers with vaginal delivery (column (1)) and CD mothers (column (2)). The figures indicate percentages. Standard deviations in parentheses. Differences between groups are tested by means of chi-square tests. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table 3 – Mother and child characteristics for different birth days

	(1) Leisure Day		(2) Pre-leisure Day		(3) Other Day	
	Mean	SD	Mean	SD	Mean	SD
Cesarean	14.9		20.4		19.6	
Girl	49.3		49.4		49.5	
Birth weight	336.1	(41.3)	335.5	(42.0)	335.9	(41.8)
Gestation length	40.3	(0.9)	40.3	(0.9)	40.3	(0.9)
Mother's age	26.7	(5.0)	26.7	(5.1)	26.7	(5.1)
Mother's occupation						
Self-employed	1.8		1.9		1.9	
Farming	0.5		0.5		0.6	
White collar	71.8		71.8		71.5	
Blue collar	15.3		15.2		15.5	
Missing	7.9		7.7		7.8	
Unknown	2.8		2.8		2.8	
Mother's education						
Compulsory School	10.2		10.1		10.2	
Apprenticeship	38.3		38.2		38.7	
Interm. tech. and voc. School	19.0		19.1		18.8	
Academic secondary school	17.2		17.4		17.0	
Post-secondary college	5.0		5.1		5.0	
University	7.3		7.0		7.3	
Unknown	3.0		3.1		3.0	
Family status						
Single	51.1		51.2		50.9	
Married	46.8		46.7		46.9	
Widowed	0.1		0.1		0.1	
Divorced	2.0		2.1		2.1	
Mother's religion						
Roman Catholic	84.6		84.8		84.9	
Protestant	4.4		4.3		4.1	
Old Catholic	0.1		0.1		0.1	
Jewish	0.0		0.0		0.0	
Muslim	1.2		1.2		1.2	
Other	0.7		0.8		0.7	
Unknown	9.0		8.8		8.9	
Province of residence						
Burgenland	2.8		2.8		2.9	
Carinthia	7.2		7.2		7.3	
Lower Austria	18.6		18.5		18.4	
Upper Austria	18.2		18.0		18.1	
Salzburg	6.9		6.8		6.8	
Styria	15.6		15.7		15.8	
Tyrol	9.2		9.8		9.6	
Vorarlberg	4.8		4.9		4.8	
Vienna	16.6		16.3		16.4	
Employment						
Year -4	68.3		68.7		68.6	
Year -3	76.6		76.9		76.6	
Year -2	83.0		83.1		82.8	
Year -1	86.8		86.9		86.7	
Number of observations	83,281		46,571		152,979	

Notes: This table depicts mother and child characteristics across different types of birth days. Birth weight is measured in dekagrams, gestation length in weeks. All other figures indicate percentages. Employment rates refer to years before birth. Standard deviations in parentheses.

Table 4 – Biprobit estimation results: the effect of a CD at parity one on the likelihood of a second birth

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0056	−0.0193	−0.1031***	−0.1307***	−0.1335***	−0.1439***
	(0.0065)	(0.0186)	(0.0235)	(0.0240)	(0.0242)	(0.0236)
Eq. (2): $leisure_{i(t=0)}$	−0.0482***	−0.0482***	−0.0482***	−0.0482***	−0.0482***	−0.0481***
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1273	−0.0372	0.0829**	0.1105***	0.1142***	0.1322***
	(0.2005)	(0.0457)	(0.0390)	(0.0375)	(0.0374)	(0.0368)
PANEL B: PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0010	−0.0056	−0.1082***	−0.1439***	−0.1456***	−0.1557***
	(0.0058)	(0.0217)	(0.0291)	(0.0290)	(0.0291)	(0.0279)
Eq. (3): $preleisure_{i(t=0)}$	0.0078***	0.0078***	0.0078***	0.0077***	0.0077***	0.0077***
	(0.0020)	(0.0020)	(0.0019)	(0.0019)	(0.0019)	(0.0019)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	−0.0239	−0.0705	0.0913*	0.1312***	0.1328***	0.1506***
	(0.1979)	(0.0526)	(0.0483)	(0.0455)	(0.0451)	(0.0437)
Mean of dependent variable	0.006	0.151	0.332	0.429	0.489	0.529
Number of observations	282,831	282,831	282,831	282,831	282,831	282,831

Notes: This table summarizes bivariate probit estimation results for the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table 5 – Biprobit estimation results: the effect of a CD at parity one on the likelihood of maternal employment

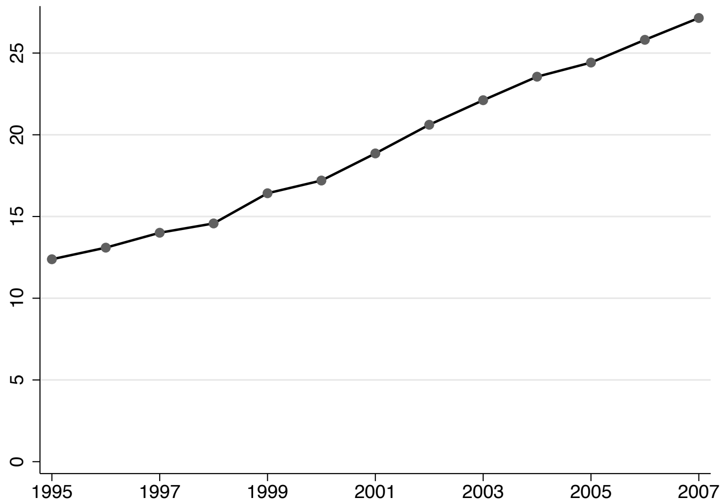
	(I) $E_{i(t+1)}$	(II) $E_{i(t+2)}$	(III) $E_{i(t+3)}$	(IV) $E_{i(t+4)}$	(V) $E_{i(t+5)}$	(VI) $E_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0604***	0.0260	0.1183***	0.1320***	0.0937***	0.0639**
	(0.0221)	(0.0299)	(0.0272)	(0.0271)	(0.0280)	(0.0287)
Eq. (2): $leisure_{i(t=0)}$	−0.0480***	−0.0482***	−0.0481***	−0.0480***	−0.0481***	−0.0482***
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1430***	−0.0069	−0.1258***	−0.1536***	−0.1120***	−0.0774*
	(0.0463)	(0.0446)	(0.0406)	(0.0410)	(0.0430)	(0.0458)
PANEL B: PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.1569***	0.0247	0.1257***	0.1679***	0.1141***	0.0697*
	(0.0389)	(0.0415)	(0.0351)	(0.0336)	(0.0372)	(0.0402)
Eq. (3): $preleisure_{i(t=0)}$	0.0083***	0.0078***	0.0077***	0.0078***	0.0077***	0.0077***
	(0.0019)	(0.0020)	(0.0019)	(0.0019)	(0.0019)	(0.0020)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.3457***	−0.0051	−0.1369***	−0.2081***	−0.1434**	−0.0866
	(0.0819)	(0.0618)	(0.0524)	(0.0516)	(0.0574)	(0.0642)
Mean of dependent variable	0.214	0.448	0.511	0.549	0.602	0.652
Number of observations	282,831	282,831	282,831	282,831	282,831	282,831

Notes: This table summarizes bivariate probit estimation results for the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of maternal employment 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Web Appendix

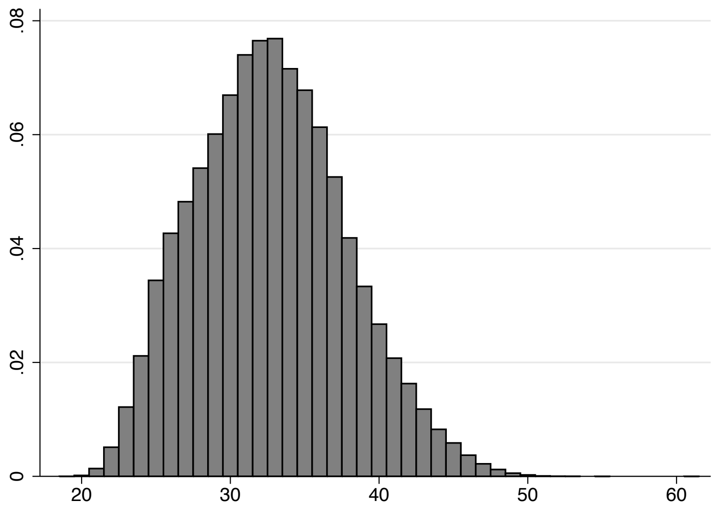
This Web Appendix (not for publication) provides additional material discussed in the unpublished manuscript '*Cutting Fertility? The Effect of Cesarean Deliveries on Subsequent Fertility and Maternal Labor Supply*' by Martin Halla, Harald Mayr, Gerald J. Pruckner, and Pilar García-Gómez.

Figure A.1 – CD Rate in Austria, 1995-2007



Notes This figure depicts CD rates in Austria in percent from 1995-2007 (the time period under study).

Figure A.2 – Distribution of mother's age six years after first birth



Notes: This figure depicts the age distribution of mothers in main sample six years after their first birth.

Table A.1 – Biprobit estimation results for fertility: all covariates, equations (1) and (2)

	Equation (2)		Equation (1)	
Eq. (2): $leisure_{i(t=0)}$	−0.0481***	(0.0016)		
Eq. (1): $CD_{i(t=0)}$			−0.1439***	(0.0236)
Girl	−0.0214***	(0.0014)	−0.0037**	(0.0019)
Birth year, base group 1995				
1996	0.0012	(0.0036)	0.0043	(0.0042)
1997	0.0128***	(0.0036)	0.0040	(0.0043)
1998	0.0150***	(0.0037)	0.0075*	(0.0043)
1999	0.0340***	(0.0036)	0.0070	(0.0044)
2000	0.0362***	(0.0036)	0.0237***	(0.0045)
2001	0.0431***	(0.0037)	0.0438***	(0.0045)
2002	0.0563***	(0.0036)	0.0444***	(0.0046)
2003	0.0615***	(0.0037)	0.0639***	(0.0046)
2004	0.0758***	(0.0036)	0.0691***	(0.0048)
2005	0.0849***	(0.0037)	0.0836***	(0.0049)
2006	0.0871***	(0.0037)	0.0889***	(0.0049)
2007	0.0959***	(0.0037)	0.0943***	(0.0051)
Birth month, base group January				
February	−0.0003	(0.0035)	0.0070	(0.0044)
March	−0.0032	(0.0035)	0.0140***	(0.0043)
April	0.0023	(0.0035)	0.0112**	(0.0044)
May	0.0039	(0.0035)	0.0151***	(0.0044)
June	0.0016	(0.0035)	0.0117***	(0.0044)
July	0.0021	(0.0034)	0.0116***	(0.0043)
August	0.0042	(0.0034)	0.0152***	(0.0043)
September	0.0033	(0.0034)	0.0119***	(0.0043)
October	0.0040	(0.0034)	0.0130***	(0.0043)
November	0.0066*	(0.0035)	0.0136***	(0.0044)
December	0.0104***	(0.0035)	0.0090**	(0.0044)
Pregnancy duration decile, base group 2				
Decile 3	−0.0048	(0.0056)	0.0019	(0.0076)
Decile 4	−0.0326***	(0.0057)	−0.0160**	(0.0077)
Decile 5	−0.0619***	(0.0057)	−0.0017	(0.0078)
Decile 6	−0.0623***	(0.0058)	0.0023	(0.0078)
Decile 7	−0.0609***	(0.0059)	−0.0322***	(0.0080)
Decile 8	−0.0567***	(0.0057)	0.0004	(0.0078)
Decile 9	−0.0565***	(0.0059)	−0.0217***	(0.0080)
Decile 10	−0.0088	(0.0057)	−0.0098	(0.0077)
Birth weight decile, base group 1				
Decile 2	−0.0566***	(0.0041)	0.0084	(0.0057)
Decile 3	−0.0767***	(0.0040)	0.0156***	(0.0058)
Decile 4	−0.0831***	(0.0040)	0.0209***	(0.0058)
Decile 5	−0.0918***	(0.0040)	0.0180***	(0.0059)
Decile 6	−0.0910***	(0.0040)	0.0261***	(0.0058)
Decile 7	−0.0892***	(0.0040)	0.0295***	(0.0058)
Decile 8	−0.0843***	(0.0040)	0.0317***	(0.0059)
Decile 9	−0.0674***	(0.0039)	0.0316***	(0.0057)
Decile 10	−0.0199***	(0.0039)	0.0393***	(0.0054)
Mother's age decile, base group 1				
Decile 2	0.0232***	(0.0036)	0.0243***	(0.0041)

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Table continued

Decile 3	0.0308***	(0.0036)	0.0344***	(0.0042)
Decile 4	0.0408***	(0.0035)	0.0372***	(0.0042)
Decile 5	0.0526***	(0.0036)	0.0257***	(0.0043)
Decile 6	0.0612***	(0.0036)	0.0060	(0.0045)
Decile 7	0.0770***	(0.0036)	−0.0259***	(0.0046)
Decile 8	0.0912***	(0.0036)	−0.0667***	(0.0050)
Decile 9	0.1161***	(0.0036)	−0.1234***	(0.0056)
Decile 10	0.1697***	(0.0036)	−0.2820***	(0.0075)
Mother's education, base group compulsory school				
Apprenticeship	−0.0137***	(0.0027)	0.0116***	(0.0034)
Interm. tech. and voc. school	−0.0237***	(0.0031)	0.0374***	(0.0039)
Academic secondary school	−0.0335***	(0.0032)	0.0618***	(0.0041)
Post-secondary college	−0.0412***	(0.0042)	0.1103***	(0.0055)
University	−0.0241***	(0.0038)	0.1777***	(0.0051)
Unknown	−0.0233***	(0.0064)	0.0427***	(0.0084)
Family status, base group single				
Married	0.0070***	(0.0016)	0.1151***	(0.0020)
Widowed	0.0383	(0.0258)	0.0290	(0.0368)
Divorced	0.0309***	(0.0047)	−0.0246***	(0.0067)
Mother's occupation, base group self-employed				
Farming	−0.0091	(0.0107)	0.2260***	(0.0139)
White collar	−0.0169***	(0.0050)	0.2110***	(0.0072)
Blue collar	−0.0081	(0.0054)	0.2152***	(0.0076)
Missing	−0.0125**	(0.0057)	0.0774***	(0.0079)
Unknown	−0.0162**	(0.0079)	0.2030***	(0.0108)
Mother's religion, base group Roman Catholic				
Protestant	0.0065*	(0.0035)	−0.0158***	(0.0045)
Old Catholic	0.0448**	(0.0208)	−0.1125***	(0.0285)
Jewish	−0.0014	(0.0335)	0.0644	(0.0420)
Muslim	−0.0153**	(0.0069)	0.0320***	(0.0085)
Other	0.0132	(0.0085)	0.0361***	(0.0107)
Unknown	0.0038	(0.0025)	−0.0789***	(0.0033)
Province of residence, base group Burgenland				
Carinthia	−0.0401***	(0.0048)	0.0083	(0.0063)
Lower Austria	−0.0258***	(0.0043)	0.0422***	(0.0057)
Upper Austria	−0.0528***	(0.0044)	0.0652***	(0.0059)
Salzburg	−0.0732***	(0.0049)	0.0798***	(0.0067)
Styria	0.0018	(0.0044)	0.0253***	(0.0058)
Tyrol	−0.0409***	(0.0046)	0.0774***	(0.0062)
Vorarlberg	−0.0821***	(0.0053)	0.1255***	(0.0072)
Vienna	−0.0391***	(0.0044)	−0.0384***	(0.0059)
Mean of dependent variable	0.183		0.529	
N	282,831		282,831	

Notes: This table summarizes bivariate probit estimation results for fertility six years after first birth based on the leisure IV and including all covariates. Estimations provide the effect of a CD at parity one on the likelihood of a second birth (Equation (1)) and the effect of the leisure instrument on the likelihood of a CD at parity one (Equation (2)). The coefficients indicate average marginal effects. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.2 – Probit estimation results for fertility

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
Eq. (1): $CD_{i(t=0)}$	−0.0017***	−0.0343***	−0.0530***	−0.0592***	−0.0589***	−0.0580***
	(0.0004)	(0.0018)	(0.0023)	(0.0024)	(0.0024)	(0.0024)
Girl	−0.0003	−0.0022	−0.0036**	−0.0042**	−0.0033*	−0.0019
	(0.0003)	(0.0013)	(0.0018)	(0.0018)	(0.0018)	(0.0018)
Birth year, base group 1995	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Birth month, base group January	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Pregnancy duration decile, base group 2	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Birth weight decile, base group 1	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Mother's age decile, base group 1						
Decile 2	−0.0016***	0.0096***	0.0262***	0.0300***	0.0263***	0.0230***
	(0.0005)	(0.0031)	(0.0041)	(0.0042)	(0.0042)	(0.0041)
Decile 3	−0.0027***	0.0105***	0.0450***	0.0513***	0.0423***	0.0326***
	(0.0006)	(0.0032)	(0.0041)	(0.0043)	(0.0043)	(0.0043)
Decile 4	−0.0042***	0.0071**	0.0494***	0.0562***	0.0481***	0.0347***
	(0.0006)	(0.0031)	(0.0040)	(0.0042)	(0.0042)	(0.0042)
Decile 5	−0.0045***	0.0019	0.0445***	0.0480***	0.0377***	0.0221***
	(0.0006)	(0.0031)	(0.0041)	(0.0043)	(0.0043)	(0.0043)
Decile 6	−0.0046***	−0.0045	0.0335***	0.0344***	0.0193***	0.0015
	(0.0006)	(0.0032)	(0.0042)	(0.0043)	(0.0043)	(0.0043)
Decile 7	−0.0058***	−0.0172***	0.0097**	0.0059	−0.0130***	−0.0322***
	(0.0007)	(0.0032)	(0.0042)	(0.0043)	(0.0043)	(0.0043)
Decile 8	−0.0066***	−0.0274***	−0.0132***	−0.0260***	−0.0495***	−0.0748***
	(0.0007)	(0.0033)	(0.0043)	(0.0044)	(0.0044)	(0.0044)
Decile 9	−0.0062***	−0.0449***	−0.0454***	−0.0701***	−0.1031***	−0.1346***
	(0.0007)	(0.0034)	(0.0044)	(0.0045)	(0.0045)	(0.0045)
Decile 10	−0.0060***	−0.0859***	−0.1571***	−0.2102***	−0.2605***	−0.3013***
	(0.0008)	(0.0036)	(0.0046)	(0.0047)	(0.0047)	(0.0046)

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Table continued

Mother's education, base group compulsory school						
Apprenticeship	−0.0016***	−0.0070***	0.0081**	0.0088**	0.0119***	0.0128***
	(0.0004)	(0.0025)	(0.0033)	(0.0034)	(0.0034)	(0.0034)
Interm. tech. and voc. school	−0.0017***	0.0019	0.0200***	0.0269***	0.0352***	0.0398***
	(0.0005)	(0.0029)	(0.0038)	(0.0039)	(0.0039)	(0.0039)
Academic secondary school	−0.0026***	0.0106***	0.0429***	0.0524***	0.0611***	0.0652***
	(0.0006)	(0.0030)	(0.0039)	(0.0040)	(0.0040)	(0.0040)
Post-secondary college	−0.0038***	0.0172***	0.0722***	0.0937***	0.1103***	0.1151***
	(0.0010)	(0.0039)	(0.0051)	(0.0053)	(0.0053)	(0.0053)
University	−0.0031***	0.0522***	0.1234***	0.1529***	0.1734***	0.1817***
	(0.0009)	(0.0036)	(0.0047)	(0.0049)	(0.0050)	(0.0049)
Unknown	−0.0012	0.0073	0.0272***	0.0362***	0.0500***	0.0450***
	(0.0013)	(0.0066)	(0.0083)	(0.0085)	(0.0085)	(0.0084)
Family status, base group single	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Mother's occupation, base group self-employed	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Mother's religion, base group Roman Catholic	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Province of residence, base group Burgenland	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Mean of dependent variable	0.006	0.151	0.332	0.429	0.489	0.529
Number of observations	282,521	282,831	282,831	282,831	282,831	282,831

Notes: This table summarizes probit estimation results for fertility. Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 6 years after the first birth. The coefficients indicate average marginal effects. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.3 – Biprobit estimation results: the effect of a CD at parity one on the likelihood of a second birth (leisure days excluded)

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	0.0031	−0.0310	−0.1192***	−0.1622***	−0.1758***	−0.1810***
	(0.0066)	(0.0268)	(0.0354)	(0.0351)	(0.0344)	(0.0332)
Eq. (3): $preleisure_{i(t=0)}$	0.0079***	0.0080***	0.0080***	0.0079***	0.0078***	0.0078***
	(0.0021)	(0.0020)	(0.0020)	(0.0020)	(0.0020)	(0.0020)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	−0.1417	−0.0074	0.1094*	0.1603***	0.1806***	0.1911***
	(0.1947)	(0.0670)	(0.0599)	(0.0564)	(0.0549)	(0.0534)
Mean of dependent variable	0.006	0.150	0.331	0.427	0.487	0.527
Number of observations	199,550	199,550	199,550	199,550	199,550	199,550

Notes: This table summarizes bivariate probit estimation results for the preleisure IV (joint estimation of Eq. (1) and (3)) when all births on leisure days are excluded. Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 6 years after the first birth (Eq. (1)). The second row includes the effects of the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.4 – Biprobit estimation results: fertility for mothers with low educational attainment

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	0.0024	−0.0574**	−0.0999***	−0.1044***	−0.1186***	−0.1461***
	(0.0095)	(0.0263)	(0.0340)	(0.0366)	(0.0373)	(0.0361)
Eq. (2): $leisure_{i(t=0)}$	−0.0445***	−0.0445***	−0.0445***	−0.0444***	−0.0444***	−0.0443***
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
$\rho : Corr(\varepsilon_{it}^{p}, \epsilon_{it})$	−0.1373	0.0556	0.0789	0.0722	0.0922	0.1356**
	(0.2279)	(0.0666)	(0.0568)	(0.0561)	(0.0564)	(0.0552)
PANEL B: PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	0.0045	−0.0611*	−0.1277***	−0.1445***	−0.1590***	−0.1957***
	(0.0099)	(0.0316)	(0.0402)	(0.0421)	(0.0422)	(0.0385)
Eq. (3): $preleisure_{i(t=0)}$	0.0094***	0.0094***	0.0095***	0.0094***	0.0094***	0.0095***
	(0.0028)	(0.0028)	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$\rho : Corr(\varepsilon_{it}^{p}, \epsilon_{it})$	−0.1833	0.0649	0.1254*	0.1340**	0.1535**	0.2120***
	(0.2156)	(0.0800)	(0.0679)	(0.0657)	(0.0649)	(0.0603)
Mean of dependent variable	0.008	0.147	0.316	0.410	0.471	0.514
Number of observations	137,720	137,720	137,720	137,720	137,720	137,720

Notes: This table summarizes bivariate probit estimation results for mothers with low educational attainment based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. Low education includes mothers with compulsory schooling and apprenticeship training. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.5 – Biprobit estimation results: fertility for mothers with high educational attainment

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
Panel A: Leisure IV						
Eq. (1): $CD_{i(t=0)}$	−0.0049	0.0088	−0.1115***	−0.1466***	−0.1422***	−0.1364***
	(0.0070)	(0.0270)	(0.0330)	(0.0322)	(0.0321)	(0.0317)
Eq. (2): $leisure_{i(t=0)}$	−0.0517***	−0.0516***	−0.0518***	−0.0517***	−0.0517***	−0.0518***
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1841	−0.1021	0.0950*	0.1341***	0.1282**	0.1211**
	(0.2671)	(0.0640)	(0.0545)	(0.0512)	(0.0508)	(0.0505)
Panel B: Preleisure IV						
Eq. (1): $CD_{i(t=0)}$	−0.0015	0.0393	−0.0890**	−0.1313***	−0.1299***	−0.1091***
	(0.0064)	(0.0302)	(0.0421)	(0.0408)	(0.0404)	(0.0410)
Eq. (3): $preleisure_{i(t=0)}$	0.0071**	0.0070**	0.0071**	0.0070**	0.0070**	0.0070**
	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.0424	−0.1729**	0.0583	0.1101*	0.1088*	0.0781
	(0.2948)	(0.0693)	(0.0688)	(0.0642)	(0.0634)	(0.0645)
Mean of dependent variable	0.004	0.156	0.351	0.451	0.510	0.547
Number of observations	136,523	136,523	136,523	136,523	136,523	136,523

Notes: This table summarizes bivariate probit estimation results for mothers with high educational attainment based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. High education includes mothers with secondary schooling at least. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.6 – Biprobit estimation results: fertility for mothers observable at least 10 years

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$	(VII) $F_{i(t+7)}$	(VIII) $F_{i(t+8)}$	(IX) $F_{i(t+9)}$	(X) $F_{i(t+10)}$
PANEL A: LEISURE IV										
Eq. (1): $CD_{i(t=0)}$	−0.0076	−0.0396*	−0.1198***	−0.1450***	−0.1491***	−0.1698***	−0.1607***	−0.1714***	−0.1695***	−0.1690***
	(0.0086)	(0.0239)	(0.0287)	(0.0293)	(0.0298)	(0.0285)	(0.0287)	(0.0282)	(0.0280)	(0.0278)
Eq. (2): $leisure_{i(t=0)}$	−0.0428***	−0.0428***	−0.0428***	−0.0427***	−0.0428***	−0.0428***	−0.0428***	−0.0428***	−0.0428***	−0.0429***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1623	0.0015	0.1083**	0.1338***	0.1397***	0.1726***	0.1623***	0.1795***	0.1798***	0.1815***
	(0.2367)	(0.0560)	(0.0471)	(0.0452)	(0.0454)	(0.0439)	(0.0444)	(0.0443)	(0.0444)	(0.0444)
PANEL B: PRELEISURE IV										
Eq. (1): $CD_{i(t=0)}$	−0.0056	−0.0396	−0.1272***	−0.1581***	−0.1581***	−0.1745***	−0.1647***	−0.1723***	−0.1728***	−0.1676***
	(0.0113)	(0.0283)	(0.0340)	(0.0340)	(0.0346)	(0.0329)	(0.0332)	(0.0327)	(0.0323)	(0.0324)
Eq. (3): $preleisure_{i(t=0)}$	0.0097***	0.0097***	0.0097***	0.0094***	0.0094***	0.0094***	0.0094***	0.0094***	0.0094***	0.0094***
	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1060	0.0014	0.1204**	0.1539***	0.1534***	0.1799***	0.1684***	0.1808***	0.1850***	0.1792***
	(0.3375)	(0.0662)	(0.0559)	(0.0527)	(0.0529)	(0.0507)	(0.0514)	(0.0514)	(0.0512)	(0.0518)
Mean of dependent variable	0.006	0.161	0.332	0.424	0.483	0.523	0.552	0.572	0.586	0.597
Number of observations	204,392	204,392	204,392	204,392	204,392	204,392	204,392	204,392	204,392	204,392

Notes: This table summarizes bivariate probit estimation results for mothers who we observe up to at least 10 years after first birth based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(X) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 10 years after the first birth (Eq. (1)). The second row includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.7 – Biprobit estimation results: fertility for mothers at least 30 at first birth and observable at least 10 years

	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$	(VII) $F_{i(t+7)}$	(VIII) $F_{i(t+8)}$	(IX) $F_{i(t+9)}$	(X) $F_{i(t+10)}$
PANEL A: LEISURE IV									
Eq. (1): $CD_{i(t=0)}$	−0.0712*	−0.1221**	−0.1819***	−0.1852***	−0.2048***	−0.1838***	−0.1844***	−0.1881***	−0.1932***
	(0.0412)	(0.0534)	(0.0527)	(0.0534)	(0.0504)	(0.0522)	(0.0529)	(0.0526)	(0.0521)
Eq. (2): $leisure_{i(t=0)}$	−0.0558***	−0.0558***	−0.0557***	−0.0558***	−0.0558***	−0.0558***	−0.0558***	−0.0558***	−0.0558***
	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1203	0.1338	0.2116**	0.2120**	0.2403***	0.2020**	0.2008**	0.2070**	0.2153**
	(0.1173)	(0.1003)	(0.0937)	(0.0926)	(0.0877)	(0.0891)	(0.0901)	(0.0897)	(0.0892)
PANEL B: PRELEISURE IV									
Eq. (1): $CD_{i(t=0)}$	−0.1418*	−0.1986***	−0.2512***	−0.2472***	−0.2496***	−0.2314***	−0.2241***	−0.2316***	−0.2284***
	(0.0850)	(0.0770)	(0.0660)	(0.0643)	(0.0602)	(0.0625)	(0.0650)	(0.0631)	(0.0639)
Eq. (3): $preleisure_{i(t=0)}$	0.0090*	0.0091*	0.0087*	0.0092*	0.0091*	0.0094*	0.0090*	0.0091*	0.0090*
	(0.0050)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.3152	0.2795*	0.3375***	0.3218***	0.3195***	0.2845***	0.2693**	0.2823**	0.2763**
	(0.2248)	(0.1490)	(0.1229)	(0.1168)	(0.1084)	(0.1103)	(0.1139)	(0.1112)	(0.1123)
Mean of dependent variable	0.128	0.276	0.347	0.386	0.409	0.423	0.432	0.437	0.440
Number of observations	53,665	53,665	53,665	53,665	53,665	53,665	53,665	53,665	53,665

Notes: This table summarizes bivariate probit estimation results for older mothers based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(X) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 10 years after the first birth (Eq. (1)). The second row includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. Mothers are included in the sample if they are at least 30 years old at first birth and can be observed up to at least 10 subsequent years. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.8 – Biprobit estimation results: the effect of a CD at parity one on the likelihood of a third birth

	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$	(VII) $F_{i(t+7)}$	(VIII) $F_{i(t+8)}$	(IX) $F_{i(t+9)}$	(X) $F_{i(t+10)}$
PANEL A: LEISURE IV								
Eq. (1): $CD_{i(t=0)}$	−0.0187	−0.0081	−0.0260*	−0.0366**	−0.0486**	−0.0627***	−0.0554**	−0.0616***
	(0.0152)	(0.0108)	(0.0143)	(0.0172)	(0.0200)	(0.0219)	(0.0230)	(0.0235)
Eq. (2): $leisure_{i(t=0)}$	−0.0428***	−0.0428***	−0.0428***	−0.0428***	−0.0428***	−0.0428***	−0.0428***	−0.0427***
	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)	(0.0018)
$\rho : Corr(\varepsilon_{it}^{p}, \epsilon_{it})$	0.3988*	0.0112	0.0975	0.1038	0.1239	0.1528**	0.1049	0.1111
	(0.2192)	(0.1187)	(0.0904)	(0.0815)	(0.0793)	(0.0759)	(0.0733)	(0.0702)
PANEL B: PRELEISURE IV								
Eq. (1): $CD_{i(t=0)}$	0.0050	−0.0082	−0.0363*	−0.0514**	−0.0599**	−0.0742**	−0.0837**	−0.1062***
	(0.0079)	(0.0133)	(0.0215)	(0.0257)	(0.0294)	(0.0321)	(0.0340)	(0.0352)
Eq. (3): $preleisure_{i(t=0)}$	0.0096***	0.0097***	0.0097***	0.0097***	0.0097***	0.0098***	0.0097***	0.0097***
	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)
$\rho : Corr(\varepsilon_{it}^{p}, \epsilon_{it})$	−0.1930	0.0124	0.1611	0.1726	0.1684	0.1926*	0.1943*	0.2427**
	(0.1896)	(0.1462)	(0.1306)	(0.1176)	(0.1145)	(0.1100)	(0.1065)	(0.1021)
Mean of dependent variable	0.006	0.021	0.041	0.060	0.075	0.091	0.104	0.115
Number of observations	204,392	204,392	204,392	204,392	204,392	204,392	204,392	204,392

Notes: This table summarizes bivariate probit estimation results based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (III)-(X) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 3 to 10 years after the first birth (Eq. (1)). The second row includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. Mothers are included in the sample if they can be observed up to at least 10 subsequent years. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.9 – Biprobit estimation results: employment for mothers with low educational attainment

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0633**	−0.0169	0.0706*	0.0510	0.0589	−0.0035
	(0.0303)	(0.0447)	(0.0422)	(0.0431)	(0.0446)	(0.0456)
Eq. (2): $leisure_{i(t=0)}$	−0.0443***	−0.0444***	−0.0444***	−0.0445***	−0.0445***	−0.0445***
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
$\rho : Corr(\varepsilon_{it}^{p}, \epsilon_{it})$	0.1605**	0.0521	−0.0572	−0.0418	−0.0661	0.0202
	(0.0727)	(0.0678)	(0.0614)	(0.0623)	(0.0655)	(0.0683)
PANEL B: PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.1715***	−0.0681	0.0756	0.0490	0.0258	−0.0290
	(0.0561)	(0.0610)	(0.0535)	(0.0555)	(0.0605)	(0.0611)
Eq. (3): $preleisure_{i(t=0)}$	0.0101***	0.0094***	0.0094***	0.0094***	0.0095***	0.0094***
	(0.0027)	(0.0027)	(0.0028)	(0.0028)	(0.0028)	(0.0028)
$\rho : Corr(\varepsilon_{it}^{p}, \epsilon_{it})$	0.4157***	0.1298	−0.0645	−0.0388	−0.0178	0.0581
	(0.1289)	(0.0932)	(0.0779)	(0.0803)	(0.0882)	(0.0910)
Mean of dependent variable	0.165	0.390	0.476	0.513	0.558	0.603
Number of observations	137,720	137,720	137,720	137,720	137,720	137,720

Notes: This table summarizes bivariate probit estimation results for mothers with low educational attainment based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of maternal employment 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. Low education includes mothers with compulsory schooling and apprenticeship training. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.10 – Biprobit estimation results: employment for mothers with high educational attainment

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0406	0.0739*	0.1841***	0.1880***	0.1063***	0.0947***
	(0.0319)	(0.0385)	(0.0342)	(0.0343)	(0.0361)	(0.0357)
Eq. (2): $leisure_{i(t=0)}$	−0.0516***	−0.0517***	−0.0516***	−0.0512***	−0.0516***	−0.0517***
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.0983*	−0.0749	−0.2264***	−0.2351***	−0.1276**	−0.1262**
	(0.0593)	(0.0572)	(0.0535)	(0.0545)	(0.0578)	(0.0610)
PANEL B: PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.1055**	0.1121**	0.1928***	0.2514***	0.1678***	0.1065**
	(0.0489)	(0.0487)	(0.0438)	(0.0392)	(0.0458)	(0.0494)
Eq. (3): $preleisure_{i(t=0)}$	0.0075***	0.0070**	0.0070**	0.0073***	0.0070**	0.0069**
	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.2195**	−0.1318*	−0.2399***	−0.3377***	−0.2269***	−0.1463*
	(0.0921)	(0.0732)	(0.0688)	(0.0651)	(0.0751)	(0.0847)
Mean of dependent variable	0.262	0.505	0.546	0.582	0.645	0.701
Number of observations	136,523	136,523	136,523	136,523	136,523	136,523

Notes: This table summarizes bivariate probit estimation results for mothers with high educational attainment based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of maternal employment 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. High education includes mothers with secondary schooling at least. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.11 – Biprobit results: the effect of a CD at parity one on the likelihood of part-time employment of highly-educated mothers

	(I) $Epart_{i(t+1)}$	(II) $Epart_{i(t+2)}$	(III) $Epart_{i(t+3)}$	(IV) $Epart_{i(t+4)}$	(V) $Epart_{i(t+5)}$	(VI) $Epart_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0312	−0.0123	0.0032	0.0092	−0.0035	−0.0203
	(0.0245)	(0.0320)	(0.0314)	(0.0320)	(0.0349)	(0.0357)
Eq. (2): $leisure_{i(t=0)}$	−0.0530***	−0.0530***	−0.0529***	−0.0529***	−0.0530***	−0.0529***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1484	0.0407	0.0119	−0.0035	0.0049	0.0263
	(0.0962)	(0.0698)	(0.0677)	(0.0694)	(0.0719)	(0.0709)
PANEL B: PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0144	−0.0097	−0.0227	0.0099	0.0380	−0.0314
	(0.0346)	(0.0430)	(0.0447)	(0.0424)	(0.0417)	(0.0517)
Eq. (3): $preleisure_{i(t=0)}$	0.0060*	0.0061**	0.0060*	0.0061*	0.0061*	0.0062**
	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.0821	0.0352	0.0678	−0.0051	−0.0796	0.0482
	(0.1370)	(0.0937)	(0.0971)	(0.0919)	(0.0843)	(0.1030)
Mean of dependent variable	0.081	0.188	0.190	0.187	0.208	0.226
Number of observations	114,210	114,210	114,210	114,210	114,210	114,210

Notes: This table summarizes bivariate probit estimation results for the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of part-time employment of highly-educated mothers 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. A mother is employed part-time after treatment if she earns less than 75 % of her pre-treatment salary. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.12 – Biprobit results: the effect of a CD at parity one on the likelihood of full-time employment of highly-educated mothers

	(I) $Efull_{i(t+1)}$	(II) $Efull_{i(t+2)}$	(III) $Efull_{i(t+3)}$	(IV) $Efull_{i(t+4)}$	(V) $Efull_{i(t+5)}$	(VI) $Efull_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	0.0105	0.0881***	0.1422***	0.1066***	0.0571	0.0507
	(0.0205)	(0.0332)	(0.0323)	(0.0345)	(0.0377)	(0.0391)
Eq. (2): $leisure_{i(t=0)}$	−0.0530***	−0.0529***	−0.0530***	−0.0529***	−0.0530***	−0.0530***
	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	−0.0075	−0.1218**	−0.1871***	−0.1221**	−0.0478	−0.0342
	(0.0670)	(0.0588)	(0.0548)	(0.0560)	(0.0584)	(0.0594)
PANEL B: PRELEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0477	0.0972**	0.1556***	0.1231***	0.0496	0.0541
	(0.0364)	(0.0398)	(0.0371)	(0.0406)	(0.0487)	(0.0506)
Eq. (3): $preleisure_{i(t=0)}$	0.0064**	0.0061**	0.0060*	0.0061**	0.0061*	0.0061**
	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1838	−0.1378**	−0.2096***	−0.1488**	−0.0361	−0.0393
	(0.1189)	(0.0703)	(0.0631)	(0.0660)	(0.0754)	(0.0768)
Mean of dependent variable	0.116	0.290	0.327	0.363	0.408	0.447
Number of observations	114,210	114,210	114,210	114,210	114,210	114,210

Notes: This table summarizes bivariate probit estimation results for the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of full-time employment of highly-educated mothers 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. A mother is employed full-time after treatment if she earns more than 75 % of her pre-treatment salary. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.13 – Biprobit estimation results: employment for highly-educated mothers observable at least 10 years

	(I) $E_{i(t+1)}$	(II) $E_{i(t+2)}$	(III) $E_{i(t+3)}$	(IV) $E_{i(t+4)}$	(V) $E_{i(t+5)}$	(VI) $E_{i(t+6)}$	(VII) $E_{i(t+7)}$	(VIII) $E_{i(t+8)}$	(IX) $E_{i(t+9)}$	(X) $E_{i(t+10)}$
PANEL A: LEISURE IV										
Eq. (1): $CD_{i(t=0)}$	−0.0721*	0.0911*	0.2336***	0.2035***	0.0723	0.0204	0.0577	0.0299	−0.0359	−0.0485
	(0.0418)	(0.0509)	(0.0414)	(0.0445)	(0.0499)	(0.0505)	(0.0476)	(0.0478)	(0.0459)	(0.0430)
Eq. (2): $leisure_{i(t=0)}$	−0.0458***	−0.0459***	−0.0457***	−0.0454***	−0.0458***	−0.0459***	−0.0460***	−0.0459***	−0.0459***	−0.0459***
	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1537**	−0.0991	−0.3037***	−0.2590***	−0.0750	−0.0004	−0.0812	−0.0416	0.0791	0.1116
	(0.0783)	(0.0750)	(0.0655)	(0.0701)	(0.0772)	(0.0821)	(0.0830)	(0.0883)	(0.0885)	(0.0869)
PANEL B: PRELEISURE IV										
Eq. (1): $CD_{i(t=0)}$	−0.1313**	0.1533***	0.2479***	0.2585***	0.1367**	0.0230	0.0343	0.0618	−0.0234	−0.0384
	(0.0616)	(0.0594)	(0.0494)	(0.0496)	(0.0628)	(0.0682)	(0.0643)	(0.0686)	(0.0623)	(0.0559)
Eq. (3): $preleisure_{i(t=0)}$	0.0090***	0.0084**	0.0082**	0.0081**	0.0081**	0.0084**	0.0084**	0.0086***	0.0083**	0.0084**
	(0.0033)	(0.0033)	(0.0032)	(0.0032)	(0.0033)	(0.0033)	(0.0033)	(0.0033)	(0.0033)	(0.0033)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.2655**	−0.1914**	−0.3263***	−0.3469***	−0.1753*	−0.0045	−0.0406	−0.1007	0.0549	0.0910
	(0.1172)	(0.0896)	(0.0790)	(0.0810)	(0.0993)	(0.1108)	(0.1114)	(0.1277)	(0.1205)	(0.1134)
Mean of dependent variable	0.256	0.508	0.542	0.581	0.639	0.692	0.728	0.759	0.784	0.804
Number of observations	94,928	94,928	94,928	94,928	94,928	94,928	94,928	94,928	94,928	94,928

Notes: This table summarizes bivariate probit estimation results for highly-educated mothers who we observe up to at least 10 years after first birth based on the leisure IV (joint estimation of Eq. (1) and (2)) and the preleisure IV (joint estimation of Eq. (1) and (3)). Columns (I)-(X) provide separate estimations for the effect of a CD at parity one on the likelihood of maternal employment 1 to 10 years after the first birth (Eq. (1)). The second row includes the effects of the leisure instrument (Eq. (2)) and the preleisure instrument (Eq. (3)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.14 – Biprobit estimation results: fertility (only foreigners)

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	0.0428**	0.0395	−0.0891	−0.0767	−0.1384***	−0.0915*
	(0.0191)	(0.0347)	(0.0563)	(0.0557)	(0.0514)	(0.0511)
Eq. (2): $leisure_{i(t=0)}$	−0.0372***	−0.0368***	−0.0377***	−0.0376***	−0.0375***	−0.0375***
	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	−0.5129***	−0.1625*	0.1228	0.0897	0.1883**	0.1056
	(0.1033)	(0.0951)	(0.1097)	(0.0950)	(0.0854)	(0.0820)
Mean of dependent variable	0.012	0.119	0.245	0.331	0.394	0.442
Number of observations	75,346	75,346	75,346	75,346	75,346	75,346

Notes: This table summarizes bivariate probit estimation results for foreign mothers based on the leisure IV (joint estimation of Eq. (1) and (2)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.15 – Biprobit estimation results: employment (only foreigners)

	(I) $E_{i(t+1)}$	(II) $E_{i(t+2)}$	(III) $E_{i(t+3)}$	(IV) $E_{i(t+4)}$	(V) $E_{i(t+5)}$	(VI) $E_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0507	−0.0785	0.0001	−0.0199	−0.0355	−0.0629
	(0.0508)	(0.0497)	(0.0574)	(0.0614)	(0.0652)	(0.0687)
Eq. (2): $leisure_{i(t=0)}$	−0.0372***	−0.0371***	−0.0373***	−0.0373***	−0.0373***	−0.0374***
	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1506	0.1457	0.0215	0.0326	0.0520	0.0889
	(0.1346)	(0.0901)	(0.0945)	(0.0982)	(0.1023)	(0.1070)
Mean of dependent variable	0.152	0.320	0.371	0.394	0.425	0.458
Number of observations	75,346	75,346	75,346	75,346	75,346	75,346

Notes: This table summarizes bivariate probit estimation results for foreign mothers based on the leisure IV (joint estimation of Eq. (1) and (2)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of maternal employment 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.16 – 2SLS estimation results: the effect of a CD at parity one on the likelihood of a second birth

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
Eq. (1): $CD_{i(t=0)}$	−0.0099	−0.0480	−0.0943**	−0.1004**	−0.1052**	−0.1131***
	(0.0069)	(0.0313)	(0.0406)	(0.0423)	(0.0426)	(0.0424)
Eq. (2): $leisure_{i(t=0)}$	−0.0468***	−0.0468***	−0.0468***	−0.0468***	−0.0468***	−0.0468***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Mean of dependent variable	0.006	0.151	0.332	0.429	0.489	0.529
Number of observations	282,831	282,831	282,831	282,831	282,831	282,831

Notes: This table summarizes 2SLS estimation results based on the leisure IV (joint estimation of Eq. (1) and (2)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of a second birth 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors (in parentheses) are robust to heteroskedasticity of unknown form. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.17 – 2SLS estimation results: the effect of a CD at parity one on the likelihood of maternal employment

	(I) $E_{i(t+1)}$	(II) $E_{i(t+2)}$	(III) $E_{i(t+3)}$	(IV) $E_{i(t+4)}$	(V) $E_{i(t+5)}$	(VI) $E_{i(t+6)}$
Eq. (1): $CD_{i(t=0)}$	0.0128	0.0248	0.1029**	0.0812*	0.0660	0.0517
	(0.0351)	(0.0428)	(0.0434)	(0.0433)	(0.0425)	(0.0413)
Eq. (2): $leisure_{i(t=0)}$	−0.0468***	−0.0468***	−0.0468***	−0.0468***	−0.0468***	−0.0468***
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Mean of dependent variable	0.214	0.448	0.511	0.549	0.602	0.652
Number of observations	282,831	282,831	282,831	282,831	282,831	282,831

Notes: This table summarizes 2SLS estimation results based on the leisure IV (joint estimation of Eq. (1) and (2)). Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of maternal employment 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) on the likelihood of a CD at parity one. The coefficients indicate average marginal effects. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, gestational length, birth weight, month of birth, year of birth, and the province. Standard errors (in parentheses) are robust to heteroskedasticity of unknown form. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.18 – Biprobit estimation results: fertility (birth weight and gestation length omitted)

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0053	−0.0134	−0.0880***	−0.1255***	−0.1318***	−0.1421***
	(0.0061)	(0.0198)	(0.0252)	(0.0258)	(0.0260)	(0.0254)
Eq. (2): $leisure_{i(t=0)}$	−0.0498***	−0.0497***	−0.0498***	−0.0498***	−0.0497***	−0.0497***
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1204	−0.0517	0.0572	0.1014**	0.1103***	0.1283***
	(0.1921)	(0.0484)	(0.0417)	(0.0402)	(0.0401)	(0.0395)
Mean of dependent variable	0.006	0.151	0.332	0.429	0.489	0.529
Number of observations	282,831	282,831	282,831	282,831	282,831	282,831

Notes: This table summarizes bivariate probit estimation results based on the leisure IV (joint estimation of Eq. (1) and (2)) if the covariates birth weight and gestation length are not included. Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of of a second birth 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) on the likelihood of a CD at parity one. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

Table A.19 – Biprobit estimation results: employment (birth weight and gestation length omitted)

	(I) $F_{i(t+1)}$	(II) $F_{i(t+2)}$	(III) $F_{i(t+3)}$	(IV) $F_{i(t+4)}$	(V) $F_{i(t+5)}$	(VI) $F_{i(t+6)}$
PANEL A: LEISURE IV						
Eq. (1): $CD_{i(t=0)}$	−0.0627***	0.0469	0.1434***	0.1540***	0.1237***	0.1005***
	(0.0231)	(0.0323)	(0.0285)	(0.0284)	(0.0293)	(0.0304)
Eq. (2): $leisure_{i(t=0)}$	−0.0496***	−0.0498***	−0.0496***	−0.0495***	−0.0495***	−0.0496***
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)
$\rho : Corr(\varepsilon^p_{it}, \epsilon_{it})$	0.1472***	−0.0382	−0.1636***	−0.1868***	−0.1581***	−0.1360***
	(0.0484)	(0.0484)	(0.0431)	(0.0434)	(0.0454)	(0.0491)
Mean of dependent variable	0.214	0.448	0.511	0.549	0.602	0.652
Number of observations	282,831	282,831	282,831	282,831	282,831	282,831

Notes: This table summarizes bivariate probit estimation results based on the leisure IV (joint estimation of Eq. (1) and (2)) if the covariates birth weight and gestation length are not included. Columns (I)-(VI) provide separate estimations for the effect of a CD at parity one on the likelihood of maternal employment 1 to 6 years after the first birth (Eq. (1)). The second row of each panel includes the effects of the leisure instrument (Eq. (2)) on the likelihood of a CD at parity one. ρ is the estimated correlation between the error terms in both equations. Each estimation also controls for mother's age, marital status, educational attainment, occupation, religious denomination, the child's sex, month of birth, year of birth, and the province. Standard errors in parentheses. *, **, *** indicate statistical significance at the 10-percent, 5-percent, and 1-percent level.

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Martin Halla, Harald Mayr, Gerald J. Pruckner, Pilar García-Gómez

Cutting fertility? The effect of Cesarean deliveries on subsequent fertility and maternal labor supply

Abstract
The incidence of Cesarean deliveries (CDs) has been on the rise. The procedure's cost and benefits are discussed controversially; in particular, since non-medically indicated cases seem widespread. We study the effect of CDs on subsequent fertility and maternal labor supply. Identification is achieved by exploiting variation in the supply-side's incentives to induce non-medically indicated CDs across weekdays. On weekends and public holidays obstetricians' are less likely to induce CDs (due tighter capacity constraints in hospital). On Fridays and other days preceding a holiday, they face an increased incentive to induce CDs (due to their demand for leisure on non-working days). We use high-quality administrative data from Austria. Women giving birth on different weekdays are pre-treatment observationally identical. Our instrumental variable estimates show that a non-planned CD at parity one decreases life cycle fertility by almost 17 percent. This reduction in fertility translates into a temporary increase in maternal employment.

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