Universal Daycare and Mother's Working Lifetime[*]

Sarah Sander[1,2]

[1]University of Copenhagen and CEBI

[2]University College London - Institute of Education

March 31, 2021

Abstract

This paper examines the effects of universal daycare on mothers' labor force participation, full-time employment, and earnings over the working lifetime. I exploit differential access to daycare caused by a roll-out of daycare centers across Denmark in combination with rich administrative data. Daycare availability has persistent effects on labor force participation and increases long-run earnings. Reduced fertility and parental separation are potential mediators behind the participation effects. For higher-educated mothers, participation effects diminish over time, whereas earnings effects prevail in the long run. These results suggest that labor market attachment during child-rearing years has important long-run economic consequences.

JEL codes: J13, J14, J16, J22

Keywords: grandchildren, female labor supply, gender, inequality, retirement

1 Introduction

Policymakers across the world have initiated different strategies—such as parental leave, job protection and subsidized daycare for children of preschool age—to facilitate the labor force participation of mothers during their child-rearing years. While there is little evidence that extended parental leave has positive effects on mother's labor market outcomes, child care policies aimed at making it easier for mothers to work is more promising (Olivetti and Petrongolo, 2017). Most OECD countries offer universal access to subsidized daycare, however, the lack of access to affordable daycare continues to be a widely debated topic including in the United States. On the one hand, proponents of subsidized daycare argue that accessible and affordable care is a crucial component to promote female labor force participation. On the other hand, critics argue that, a private market for childcare is preferable, as it does not distort the allocation of resources (Kottelenberg and Lehrer, 2017).

Subsidizing daycare increases a mothers' effective wage rate and can as a result affect maternal labor supply through both an income and substitution effect (Gelbach, 2002; Cattan, 2016). On the intensive margin, the effect of subsidized daycare is ambiguous. While increasing the effective wage rate leads to higher real income, it also makes not working (leisure) relatively more expensive. On the extensive margin, one would expect non-negative effects, although some crowding out of other informal care may occur (Cattan, 2016). Accordingly, the empirical evidence is inconclusive, with results varying between no or small effects (e.g., Havnes and Mogstad, 2011) and positive employment effects (e.g., Lefebvre and Merrigan, 2008). While the evidence base largely consists of papers evaluating the short-run effects, daycare access have the potential to enable mothers to obtain a higher attachment to the labor market while having children of pre-school age, which can translate into higher accumulation of experience and higher earnings opportunities in the long run (Adda et al., 2017). Thus, daycare access can affect mothers beyond the years in which, they have children of pre-school age (Lefebvre et al., 2009). These dynamic effects of daycare availability may be even higher for women who prior to childbirth have invested in their human capital accu-

mulation through post-secondary education, as building experience and on the job training are paramount early in the career.

This paper analyzes the causal effects of daycare access on women's labor market participation and earnings through 34 years after the birth of their first child. In order to identify casual effects, I utilize the Danish transition from targeted to universal care following a reform in the mid-1960s, which led to an increase in the availability of daycare centers. I exploit time and regional variations in access to daycare to estimate the long-run effects on mothers' labor market outcomes, and I provide evidence that daycare implementation is uncorrelated with pre-reform local employment trends.

The results document that access to universal daycare has lasting effects on maternal employment and earnings through more than 30 years after the birth of the first child. The effects are larger for mothers without post-secondary education. For mothers without post-secondary education, access to high-quality daycare raised female labor market participation by five percent 17 years after the birth of the first child, whereas the corresponding effect for mothers with post-secondary education is less than one percent. Furthermore, while employment effects are insignificant after 23 years, daycare access has a positive and substantial impact on earnings 30 years after childbirth for mothers with post-secondary education. This points out that accumulated labor market experience during the child-rearing years has lasting and economically important consequences throughout the working life. The results are robust to a series of sensitivity checks. First, I show that mothers are not selectively moving to places with daycare availability. Second, I show that the results are not driven by daycare centers opening in or around the larger cities. Third, the results are robust to allowing the most populous area within each municipality to roll-out daycare at a different speed than less populous areas. Moreover, a set of placebo estimates suggest that the results are not driven by systematic differences in trends between areas with and without daycare availability.

Only a few other studies evaluate the medium- and long-run effects of universal daycare on

mothers' labor market outcomes.[1] Lefebvre et al. (2009) and Haeck et al. (2015) evaluate the introduction of a low-fee intervention in Canada by comparing mothers in Quebec to mothers in the rest of Canada and mothers who had age eligible children with mothers who did not have age eligible children using a DDD design. Lefebvre et al. (2009) find that the reform increased labor force participation by seven percentage point seven years after implementation, which is driven by less educated mothers. Haeck et al. (2015) find positive employment effects 11 years after the daycare program was introduced. In addition, they find stronger effects for mothers who was affected by the reform from the beginning of their motherhood suggesting that reducing human capital depreciation is important. Using a reform implemented in Spain in the early 1990s, Nollenberger and Rodriguez-Planas (2011) investigates how daycare for three-year-olds affects maternal employment up to when the child is seven. They find that the reform increases maternal employment by ten percent and no effect on fertility. Herbst (2017) evaluates a temporary wartime daycare program in the United States and finds positive effects on maternal employment 17 years after implementation, although the program was not intended to permanently increase female labor supply.

This paper makes several substantial contributions to the literature. First, this is the first paper that is able to follow mothers throughout the majority of their working life. Being able to follow mothers throughout their entire working lifetime allows this paper to provide a more complete picture of the benefits of daycare policies, which move some mothers into employment when they have children of pre-school age. Second, the paper makes an

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[1]The short run evidence is more vast and include Havnes and Mogstad (2011) who analyze a staged expansion of subsidized childcare in Norway during the 1970s, when maternal employment was about 25 percent, and find that subsidized childcare increased married mothers' participation only by 1.1 percentage point because public childcare crowded out informal care. Analyzing a later reform in Norway, which combined price reductions and increased availability, Hardoy and Schøne (2015) find a 5 percent increase in the participation rate of mothers at a time when maternal participation was 79 percent. Carta and Rizzica (2018) exploit an eligibility cutoff for mothers with children aged two in a regression discontinuity design. They use data from Italy and find that daycare increases mothers' labor force participation by 7.1 percentage points, which corresponds to a 12.5 percent increase from a baseline participation rate of 57 percent. For the Netherlands, Bettendorf et al. (2015) find a modest increase in mothers' labor force participation of 3.6 percent and a 6.2 percent increase in hours worked using a reform that cut the childcare fee by 50 percent. For the United States, Cascio (2009) and Fitzpatrick (2012) only find significant positive employment effects for single mothers. Reviews on how subsidized daycare affects maternal employment are given by Blau and Currie (2006) and Morrissey (2016).

important contribution by shedding light on a number of essential factors at play. Thus by combining the rich Danish administrative data, I am able to establish that daycare availability affects completed fertility and parental separation. Specifically, I find that mothers with daycare access have fewer additional children, wait longer before they get a second child, and are more likely to live apart from the first-born child's father 16 years after childbirth.

The rest of the paper continues as follows: Section 2 outlines the pre-reform settings and the mid-1960s universal daycare reform in Denmark. Section 3 presents the unique daycare panel and the rich individual data used in this paper. Section 4 explains how the transition to universal daycare is used to identify the effects on maternal employment and earnings. Finally, the results are presented in Section 5, and Section 6 concludes.

2   Background

Although subsidized childcare in Denmark dates back to 1919, daycare with universal access was first implemented in 1965.[2] A series of laws was implemented between 1919 and 1951 to improve the quality and availability of childcare. However, the Danish childcare system remained targeted at children from low-income families because only institutions in which two-thirds of the children came from families in which both parents had to work to make a living got the maximum subsidy. Through the 1960s and 70s, women increasingly entered the labor market, and many mothers could no longer care for their own children during work hours. By 1963, the number of children on waiting lists for childcare was twice as large as the number of children enrolled (Horsten, 1963; Korremann, 1977). Consequently, the Danish parliament transformed the existing targeted care system into a universal daycare system in 1965 (See Lunn (1971) for Act no. 193, 1964). The reform mandated four main changes that both affected the number of daycare slots and the quality of care in the daycare institutions.

First, as the daycare institutions became available to children from all socioeconomic

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[2]The first childcare institutions were run by philanthropists with an aim to teach children from poor households to be disciplined, clean, and obedient. These institutions was considered a charity and thereby discouraged working class families from using them (Ploug, 2012).

backgrounds, the focus of the institutions changed from being a place where children could stay during work hours to institutions with a focus on child development. Second, after the reform, building costs were fully publicly funded, and operating costs were split between the state, the municipality, and the parents, with parents paying 30 percent of the operating costs. Third, the reform untied subsidies to institutions, regardless of the proportion of children from low-income families (Lunn, 1971). Thus, after the reform, there was universal access to daycare for all children, irrespective of their socioeconomic background. Fourth, the municipalities were now given the responsibility to provide sufficient daycare institutions. For the purposes of this paper, the last two elements of the reform are especially important in the sense that daycare became an important instrument for municipalities to facilitate female labor supply, regardless of one's socioeconomic background.

In Denmark, the late 1950s were characterized by an economic upturn and the 1960s-70s by a rapid expansion of the welfare state. Consequently, the share of publicly employed workers increased by 2.5 percentage points from 1948 to 1960, whereas the share increased by 13 percentage points from 1960 to 1975 (Statistics Denmark, 2008). Figure 1 shows the development of the number of daycare institutions for children aged three through six (solid line, left axis) and the female share of the labor force (diamonds, right axis) from 1920 through 1990. The dashed vertical line marks the change from targeted to universal daycare in 1966. The figure shows that the number of daycare institutions increased slowly until 1965. The reform did not reach its full potential before 1966 because the government prohibited local daycare authorities from funding construction during 1960-66. Thus from 1956 to 1966, the number of institutions increased from 569 to 843, whereas from 1966 to 1994, the number of institutions increased by more than a factor four, to 4,000 institutions.

The geographical variation in the openings of daycare institutions is illustrated in Figure 2. The figure shows a map of the Danish municipalities (local daycare authorities) and the daycare availability within the municipalities. The municipalities had the responsibility of providing sufficient non-parental childcare, and the black lines on the map indicate the mu-

Figure 1: Number of daycare institutions and female labor supply
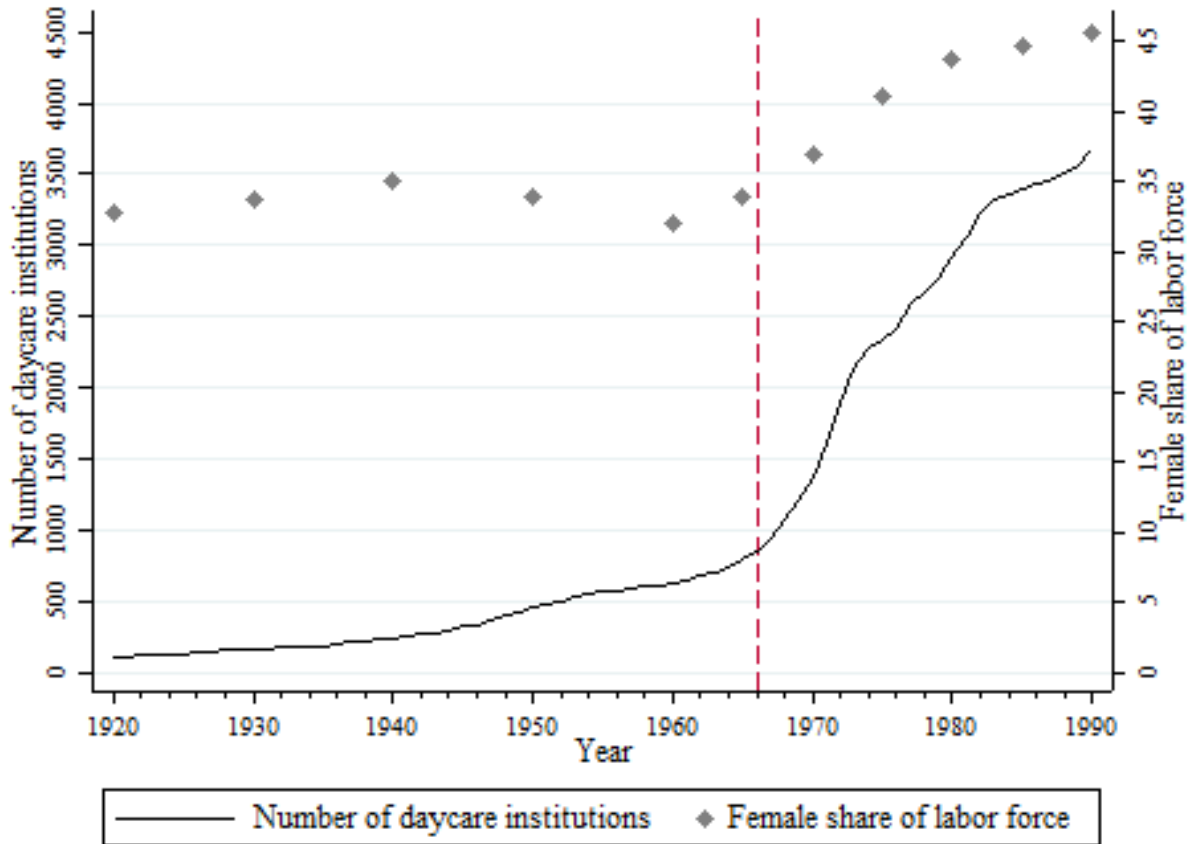
nicipality borders. The lightest red color on the map indicate neighborhoods where daycare was available prior to 1964, and the darkest red color indicates neighborhoods where daycare became available after 1980. Importantly, the map shows that daycare became available gradually across Denmark, but also that the larger cities such, as Copenhagen and Aarhus, had at least one childcare institution before the universal daycare reform was implemented.[3] In Section 5.5, I show that the results are robust to the exclusion of the largest cities and the exclusion of the suburbs.

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[3]Although it would be interesting to examine the effect of targeted versus universal childcare, it is not possible as there is no data on maternal employment for the targeted childcare period.

Figure 2: Daycare roll-out

■	(1980,1990]
■	(1978,1980]
■	(1976,1978]
■	(1974,1976]
■	(1972,1974]
■	(1970,1972]
■	(1968,1970]
■	(1966,1968]
■	(1964,1966]
■	[1900,1964]
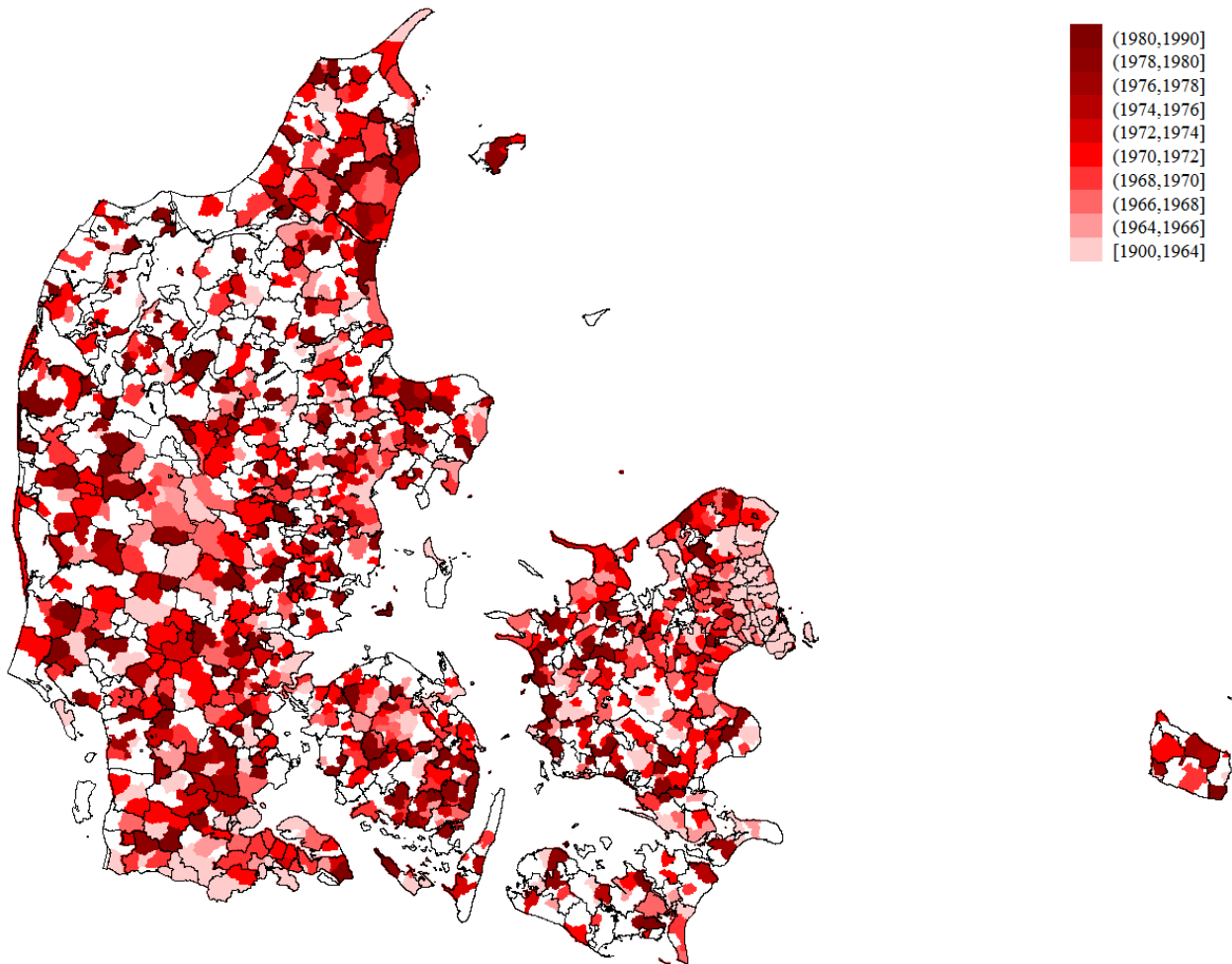
NOTE— The figure maps the variation in daycare availability within municipalities and across time. The lightest red color indicates neighborhoods where the first daycare institution opened prior to 1964, whereas the darkest red color indicates neighborhoods where the first daycare institution opened between 1980 and 1990. The black lines indicate the municipality borders (1970-2007) but also smaller islands, which are not independent municipalities. The map is constructed using data from the Danish Geodata Agency.

The universal daycare reform not only affected the care options for children aged three through six, but also opened up for non-parental care for children younger than three. However, daycare for children younger than three (nurseries) expanded more slowly than daycare for children aged three through six. Figure A.1 shows the number of places for the two age groups and indicates that the take-up in nurseries occurred during the 1980s and 90s. All employed women were entitled to 14 weeks of paid birth-related leave from 1960 (Borchorst, 2003).[4] Thus, during this time, there was limited support for mothers with children younger than three.

Figure 1 also reveals an increase in the female share of the labor force during this period. From 1920 through 1965, the female share of the labor force varied between 30 and 35 percent, whereas it increased to 46 percent in 1990. These numbers reflect not only an increase in the female participation rate but also a decrease in the participation rate of men. In 1960, 94 percent of all men aged 15-69 participated in the labor market, whereas only 44 percent of all women aged 15-69 had a job. By 1990, the participation rate among men had dropped to 84 percent, whereas the female participation rate had increased to 73 percent. The overall participation rate for both men and women aged 15-69 increased from 68 percent in 1960 to 79 percent in 1990 (Statistics Denmark, 2008).

3   Data

I combine administrative registers from Statistics Denmark, 1970 census tract data, and information on daycare availability digitized from historical records. The Danish registers contain a unique identifier for each individual and a link between children and parents, which makes it possible to combine data from several registers and families. Through the personal

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[4]The first law on birth-related leave was implemented in 1901 and gave women working at factories four weeks of leave after birth. Birth-related leave was gradually expanded to women working in others sectors, and in 1960 a law was passed that gave all women with a job eight weeks of paid leave before birth and 14 weeks of paid leave after birth. Women out of the labor force gradually also became entitled to some economic support following childbirth. In 1984, the birth-related leave period was extended to 20 weeks, with the option that the father could take the last six weeks of leave (Borchorst, 2003).

identifier in the registers, I match demographic characteristics, educational attainment, labor market participation rates, earnings, and work hours of each of the mothers to the age of their first child. The data includes all women in the 1970 census tract (i.e., all women resident in Denmark in 1970) who have their first child between 1964 and 1975. From this sample, I drop women with an immigrant background (2.2 percent) and women who move out of Denmark or pass away before their first child turns 16 (0.6 percent). The final sample consists of 370,602 mothers.

I use daycare yearbooks to collect information about daycare institutions from 1964 through 1975 (National Board of Social Services, 1968-72; Tvenstrup, 1975). From 1976, I find information about daycare institutions in the administrative registers. Together, these sources give a panel of neighborhoods with daycare availability from 1964 through 1990. I define mothers with daycare access as a match between the neighborhood of daycare in the years after the birth of the first child and the mothers neighborhood of residence in 1970 from the national census tract.[5] This approach is also used in Bingley et al. (2020). However, this match between neighborhood of daycare and the mother's neighborhood of residence in the 1970 census is problematic if parents select into a given neighborhood based on daycare availability. Another approach used in the literature is to match daycare availability based on the child's place of birth (e.g., Havnes and Mogstad, 2011). This is not possible in this setting because the birth registration variable in the Danish registers is inconsistently measured during the period I consider and has a data break in 1978. More specifically, the birth registration was changed in 1978 to reflect the mother's neighborhood of residence at the time of birth and not the actual place of birth. The authorities changed the registration practice because the number of children born in hospitals increased dramatically during the 1960s and 70s, causing the annual number of births in neighborhoods with a hospital to increase disproportionately. To validate that parents are not selecting into neighborhoods with

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[5]The census tract reports neighborhood and municipality of residence November 4th, 1970. A neighborhood(parish) is a smaller administrative unit than a municipality. There are 2,033 neighborhoods nested in 277 municipalities in the data set.

daycare availability, I calculate the distance between the birth place of the mother and her address in the 1970 census tract and examine whether mothers who move a longer distance are more likely to live in a neighborhood with daycare. Additionally, I show that the results are robust to the exclusion of mothers who had their first child prior to 1970 in Section 5.5.

From the registers, I collect information about earnings from 1980 through 2015. Earnings are registered annually by the tax authorities. I adjust all earnings to 2016 U.S.-prices and convert earnings to log points. An advantage of the earnings measure is that it excludes income from unemployment insurance and other social benefits. Thus, labor market earnings are only available for those who have a paid job, and consequently, log earnings are undefined for those without a job. The estimates on log earnings are therefore conditional on employment.

I use three measures of employment in this paper. These are constructed on the basis of annual information about mandatory pension contributions to the Supplementary Pension Fund Register (in Danish: ATP). The ATP was introduced in 1964, and contributions to ATP vary with hours worked. Persons working between 10 and 19 hours a week pay one-third of the full ATP contribution, persons working between 20 and 29 hours a week pay two-thirds of the full ATP contribution, and persons working 30 hours or more a week pay the full ATP contribution. The ATP contributions are available on a yearly basis; thus, a one-third ATP contribution can correspond to a person working 10 hours a week throughout the year or full-time for one-third of the year. During this period, the unemployed, the self-employed, and persons out of the labor force were not part of the ATP (Hansen and Lassen, 2011). I use the ATP to construct a measure of average weekly hours worked throughout the year. Additionally, I construct a dummy for participation in a given year prior to 1980 if any contributions where made within that year. After 1980, I code the participation as one if the mother had any positive earnings within that year. Coding participation based on positive earnings has the advantage of including mothers who work less than 10 hours a week; Figure C.1 shows that the results are not sensitive to the different definitions of participation. Full-

time employment is defined as making ATP contributions of the full amount and corresponds to a minimum of 30 hours of work a week throughout the year.[6]

The education registers contain information about the educational attainment of all individuals in Denmark on a yearly basis, and I use the registers from 1980. Information about educational attainment is reported directly from the educational institutions to Statistics Denmark. For individuals who achieved their education prior to 1980, the registers contain information about educational attainment and the date of achievement from the census data. I use this data to define each mother's educational attainment prior to the birth of her first child, because daycare availability might affect educational attainment. The majority (82 percent) of the mothers in the sample did not achieve more education after 1970; thus, for those who have their first child after 1970, I can easily define their pre-child educational attainment. However, for those who have their first child before 1970 (50 percent of the sample), I assume the mother's education had been obtained prior to the birth of her first child if the length of her education plus the normal starting age for obtaining that level of education is less than her age at the birth of her first child. Alternatively, I define their educational attainment as the mandatory level of education (0.02 percent). I define 2 groups of educational attainment of an equal size. Low-educated mothers I define as mothers with no post-secondary education and higher-educated mothers I define as mothers with some post-secondary schooling (i.e., vocational training, college, or university). Additionally, I use the education registers to construct a dummy outcome variable, which takes the value one if the mother attains more education after the birth of her first child.

All regressions include an indicator of urban neighborhood, defined as a market town. Market towns were larger cities with a greater degree of historical and economic status. Thus, by including an indicator for such urban areas, I control for differences in job and earnings opportunities.

The Danish administrative data contains information about complete fertility histories.

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[6]Because work hours are not observed for those working less than 10 and above 30 hours a week, I do not include the wage rate as an outcomes.

Thereby, I am able to examine whether there are any mediators in play through fertility decisions. The sample includes mothers who have their first child between 1964 and 1975; therefore, I examine the effects of daycare on total fertility on the intensive margin. Specifically, I define four fertility outcomes: number of children, a dummy for more than one child, a dummy for more than two children, and a dummy for more than three children. Additionally, the personal identifiers linking parents and children in the registers allows me to calculate the spacing between children. I use cohabitation information to examine whether daycare affects the probability of the mother living together with the child's father in the year the first born child turns 16.

Table 1 presents summary statistics for mothers' characteristics and time invariant outcomes. Column (1) reports means and standards deviation for the full sample, and Columns (2) and (3) report means and standard deviations for sub-samples, depending on access to daycare. On average, mothers in the sample are 23.7 years old at first child and have 10.8 years of education. Specifically, 50 percent of the mothers in the sample have no post-secondary education. The mean year of birth of the mothers in the sample is 1945; thus, the low educational level and age at first birth are not surprising. Daycare availability is correlated with fewer children, larger spacing between children, more parents living apart when the first child is 16, additional educational attainment after first childbirth, and more years in the labor market after the birth of the first child. Summary statistics of the four fertility outcomes are presented in Table B.1 separately for those with and without daycare access measured at the time of birth of the first child. The pattern is the same; daycare availability is correlated with fewer children.

Table B.2 shows the summary statistics of the participation rate, full-time employment, and hours of work separately for each year through 6 years after the first childbirth and for mothers with and without daycare access in the given year. Overall, Table B.2 reveals that the participation rates and hours of work are lowest in year 1 (i.e., during the full calendar year after the year the first child was born), but they are increasing over the years, and

Table 1: Summary statistics

	(1) All	(2) Daycare year 4	(3)
		No	Yes
Mother's age at first birth	23.70	23.46	23.77
	(4.35)	(4.55)	(4.29)
Year of birth	1945.57	1944.94	1945.77
	(5.42)	(5.80)	(5.27)
Years of education	10.78	10.11	10.99
	(2.94)	(2.99)	(2.89)
Basic schooling	0.50	0.59	0.47
	(0.50)	(0.49)	(0.50)
Urban neighborhood	0.22	0.06	0.27
	(0.41)	(0.25)	(0.44)
Missing father id	0.01	0.01	0.01
	(0.11)	(0.09)	(0.12)
Number of children	2.20	2.35	2.15
	(0.85)	(0.91)	(0.82)
Years between first and next child	3.76	3.55	3.83
	(2.44)	(2.29)	(2.49)
Not living with child's father	0.20	0.15	0.22
	(0.40)	(0.36)	(0.41)
Additional education after birth of first child	0.12	0.10	0.13
	(0.33)	(0.31)	(0.34)
Lenght of working life (years) after first child	25.19	22.97	25.89
	(10.26)	(10.94)	(9.93)
Observations	370602	89284	281318

NOTE— The table shows the means and standard deviations of the background variables of mothers who had their first child between 1964 and 1975 and the means and standard deviations of some of the dependent variables. Length of working life is a sum of the participation dummies through 34 years after the birth of the first child.

daycare is correlated with higher levels of participation, full-time employment, and hours worked. The means of the long-run outcomes are presented in Table B.3. The participation rate increases over the first 16 years after the first childbirth, then it flattens at 81 percent, and 23 years after the first childbirth, the participation rate begins to decrease, such that the participation rate is 66 percent 34 years after the first childbirth. The full-time employment rate is highest 29 years after the first birth, during which time 46 percent of the mothers in the sample work full-time. The weekly hours of work is highest 21-23 years after the first childbirth, and the earnings are highest 29 years after the first childbirth. All the outcomes follow a concave pattern over the years after first childbirth.

Essential to the identification of causal effects in this study is that the openings of daycare institutions did not happen in neighborhoods where female labor force participation was already high or was anyway increasing. Figure 3 (a) shows the average female participation rate for women aged 20 through 45 for neighborhoods that opened a daycare institution from six years prior through 12 years after daycare implementation. Importantly, Figure 3 (a) reveals that the female participation rate was stable around 56 percent prior to the implementation of daycare. After the first opening of a daycare institution the average female participation rate increased gradually, reaching a level around 70 percent nine years after daycare implementation. Figure 3 (b) shows event time estimates of maternal labor force participation relative to the first daycare opening along side event time estimates of maternal labor force participation relative to a placebo daycare opening. The event time estimates of the placebo openings are all insignificant, while the event estimates of the real openings are insignificant for all pre-event years and significant after the opening, which suggest that the results are not driven by systematic differences in trends between areas with and without daycare availability.

Figure 3: Daycare implementation and female participation rate

(a) Average female labor force participation

(b) Event study of mothers' participation rate
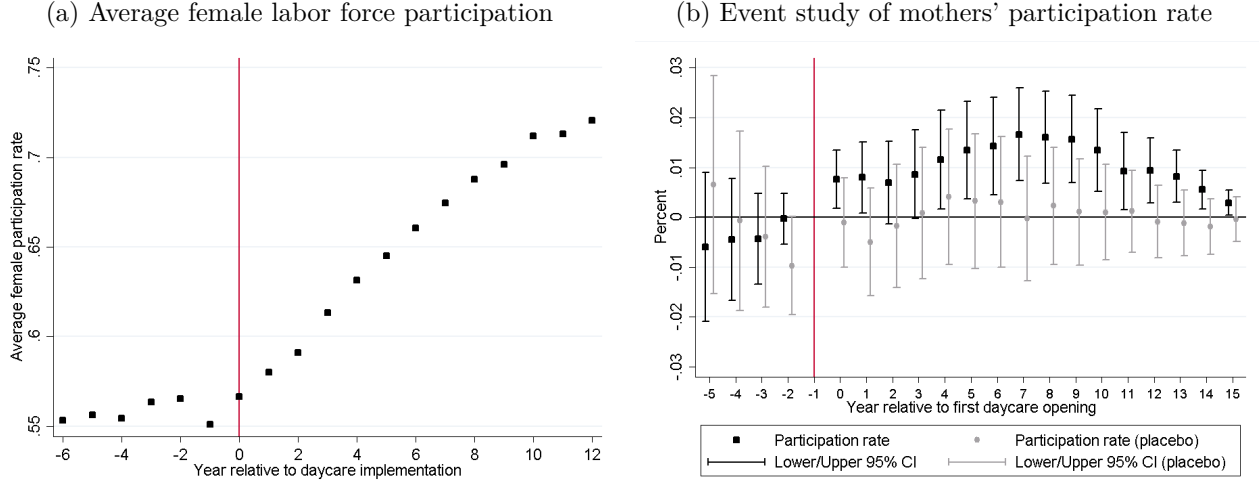
NOTE— The figure shows the average female participation rate for women aged 20-45 for neighborhoods that implemented a daycare institution plotted over years relative to the year of daycare implementation in panel (a). The averages are weighted by the female population size in each neighborhood-year cell. Panel (b) shows an event study of maternal labor force participation where the event time is year of daycare implementation together with an event study of maternal labor force participation of a placebo daycare implementation.

4 Empirical Strategies

I follow two strategies in the empirical analysis. The first strategy is based on a difference-in-differences approach comparing the outcome of mothers with differential access to daycare in a given municipality. I begin with the contemporaneous effects of daycare availability:

$$Y_{inmt} = \alpha DC_{nmt} + X'_{inm}\beta + \tau_i + \gamma_t + \mu_m + \varepsilon_{inmt} \tag{1}$$

where Y_{inmt} is the outcome for mother i in neighborhood n in municipality m at time t, and DC_{nmt} is an indicator taking the value one if municipality m has implemented daycare in neighborhood n at time t and zero otherwise. X'_{inm} is a vector of observed characteristics, such as age at first birth, month of birth of the first child, and an indicator of living in an urban neighborhood. τ_i indicates the birth year of the mother and controls for life-cycle events. γ_t is a full set of year dummies indicating the year the mother gives birth to her first child. In Equation (1), the outcome variables are measured zero through six years after the

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first child is born; thus, γ_t is a non-linear time trend controlling for macro shocks. I add a full set of dummies for the first child's month of birth in the analysis of contemporaneous effects because mothers who have their first child in the same year but in a different month (e.g., January and December) will have different participation rates in the year during which they have their first child. μ_m refers to a full set of municipality fixed effects (intercepts for local daycare authorities). The error term ε is allowed to be heteroskedastic and to cluster at the municipality level. I estimate Equation (1) for a set of contemporaneous labor market outcomes: participation, full-time employment, and hours worked.

To evaluate the long-run effects of daycare availability on mothers' labor force participation and earnings, I estimate the following equation:

$$Y_{inmt+b} = \alpha DC_{nmt,t=4} + X'_{inm}\beta + \tau_i + \gamma_t + \mu_m + \epsilon_{inmt} \tag{2}$$

Equation (2) follows the same setup as Equation (1), with two exceptions. First, Y is measured b years after year t. Specifically, I evaluate mothers' labor market outcomes on a yearly basis from when her first born child is four through 34. Second, I use daycare availability in the year the mother's first born child turns four as the explanatory variable in all regressions of Equation (2)[7].

The models identify the effects of daycare availability on mothers' employment status using the difference in the timing of daycare availability between neighborhoods within the municipality and across time. Whereas the year of first birth dummies control non-linearly for a general time trend, job opportunities might be better in larger neighborhoods. Consequently, I test whether the results are robust to including an extra set of non-linear time trends for the largest (in terms of population) neighborhood within the municipality in Section 5.5. I continue the empirical analysis by investigating the effects of daycare availability

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[7]Appendix table B.4 shows the correlations of daycare availability across years after first childbirth. The correlations between daycare availability when the first born child is three through six are high, e.g. for mothers who had access to daycare when their first born child was 4, 87 percent also had access when the child was three.

on mothers' earnings following the setup of Equation (2). The earnings analysis is limited to the long run, because the first records of earnings are from 1980.

Equations (1) and (2) produce reduced-form effects for all mothers with a daycare in the neighborhood when their child is aged zero through six and four, respectively. Thus, the estimates of α are Intention-To-Treat (ITT) effects, and by estimating ITT effects, I avoid the issue that at the individual level, enrollment in non-parental childcare is most likely endogenous.[8]

The key identifying assumption in this setup is that trends in labor market outcomes for mothers without access to daycare would have been the same as those for mothers with access to daycare in the absence of daycare availability. This assumption is inherently untestable and impeded by the fact that getting a child has consequences for women's labor force participation from the time the child is born. Therefore, I continue the analysis by providing indirect evidence of the parallel trend assumption, employing an event study strategy using the year before the birth of the first child as event time zero.

I begin the event study analysis by comparing mothers and fathers labor market outcomes around the birth of their first child using the following approach:

$$Y_{im\tau}^p = \sum_{j \neq -1} \Theta_j^p \cdot \mathbf{I}[j = \tau] + \omega_i^p + \gamma_t^p + \mu_m^p + v_{im\tau}^p \tag{3}$$

Where $Y_{im\tau}^p$ is the labor market participation of individual i in municipality m at event time τ, and p indicates whether the parent is a mother or a father. In addition to a full set of event time dummies, I include age dummies (ω_i^p), year dummies (γ_t^p), and municipality fixed effects μ_m^p. The error term $v_{im\tau}^p$ is allowed to be heteroskedastic and to cluster at the municipality level. By allowing for a full set of age dummies, I control for underlying life cycle trends, which eases the comparison of mothers to fathers, since women on average are younger than men when they have their first child. Similarly, by including a full set of year dummies, I control non-linearly for factors such as business cycles and wage inflation. Because there is

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[8]I do not observe individual daycare attendance during this period.

variation in how old parents are when they have their first child, there is variation in event times conditional on calendar year and parents' age, which makes it possible to identify all three sets of dummies.

I base the event study analysis on a balanced panel of parents observed each year between five years prior to the birth of their first child and 20 years after, indicated by the event time τ spanning from -5 to 20. I omit the event time $\tau = -1$, and consequently the event time estimates Θ_τ^p measure the impact of having a child relative to the year just before the first child was born. If the estimated event time coefficients on labor force participation are negative for $\tau >= 0$, it suggests that some parents opt out of the labor market after the birth of their first child. Similarly, if $\Theta_\tau^m \neq \Theta_\tau^f$ for $\tau >= 0$, it suggests that mothers and fathers are differentially affected by having a child.

To investigate whether daycare availability moderates the impact of children on mothers' labor market outcomes, I estimate event time coefficients separately for mothers with differential access to daycare:

$$Y_{im\tau}^{DC} = \sum_{j \neq -1} \Theta_j^{DC} \cdot \mathbf{I}[j = \tau] + \gamma_t^{DC} + \omega_i^{DC} + \mu_m^{DC} + v_{im\tau}^{DC} \tag{4}$$

Equation (4) follows the exact setup of Equation (3), but I estimate Equation (4) separately for mothers with no daycare access, some daycare access, and full daycare access.[9] For the parallel trend assumption to hold, I should find that $\forall j < 0 \, \hat{\Theta}_j^{DC} \approx 0$. Systematically negative event time coefficients prior to the birth of the first child for mothers with some or full daycare access would indicate that the daycare availability variable is spuriously capturing a secular trend in maternal labor force participation. In a similar vein, systematically positive event time coefficients prior to the birth of the first child for mothers with some or full daycare

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[9]Mothers with no daycare access are defined as mothers who live in a neighborhood where there is no daycare during the first six years after the birth of her first child. Mothers with some daycare access are defined as mothers with access to daycare at least one of the first six years after the birth of her first child. Finally, mothers with full daycare access are defined as mothers with access to daycare in all the first six years after the birth of her first child. Appendix Table B.4 shows the correlation of daycare access across years after first childbirth.

access would indicate that the daycare institutions opened in neighborhoods with higher levels of maternal employment.

5 Results

In this section, I present the empirical results based on the methods outlined in the previous section. I start by providing evidence on the contemporaneous effects of access to universal daycare on maternal labor force participation, full-time employment, and hours worked in Section 5.1, whereas Section 5.2 presents the long-run effects of daycare availability. In Section 5.3, I continue the empirical analysis by providing evidence from the event study approach. Finally, Section 5.4 examines the effects of daycare on fertility, education, and parental separation as potential mediators for mothers' labor force participation effects, and Section 5.5 presents a series of robustness and specification checks.

5.1 Contemporaneous effects of daycare availability

Table 2 shows the reduced form estimates of equation (1). Specifically, Table 2 shows the effect of daycare availability in year t on mothers' labor force participation in year t separately for values of t from zero through six, where t indicates the number of years after the birth of the first child. Each row indicates the year (t) in which daycare availability and the mothers' labor force participation are measured and each column presents a different model specification. Column (1) shows the relations between daycare availability and mothers' labor force participation, disregarding any further controls. The point estimates are positive and statistically significant for all years. In Column (2) I add a full set of year dummies and in Column (3) I also include municipality fixed effects. The point estimates in Column (3) suggest that daycare availability has a positive effect on participation for all years apart from year zero, which is the year the first child is born. Specifically, mothers with daycare access in the year their first child turns one (two) are 1.2 (2.2) percentage points more likely to

Table 2: The contemporaneous effects of daycare on mothers' labor market participation zero through six years after the birth of the first child

	(1)	(2)	(3)	(4)
Year 0	0.147***	0.068***	0.000	-0.007*
	(0.012)	(0.010)	(0.004)	(0.004)
Year 1	0.138***	0.064***	0.012***	0.005
	(0.012)	(0.007)	(0.004)	(0.003)
Year 2	0.124***	0.073***	0.022***	0.015***
	(0.011)	(0.007)	(0.004)	(0.003)
Year 3	0.146***	0.105***	0.060***	0.053***
	(0.007)	(0.008)	(0.005)	(0.004)
Year 4	0.145***	0.111***	0.063***	0.057***
	(0.008)	(0.008)	(0.005)	(0.004)
Year 5	0.139***	0.112***	0.063***	0.057***
	(0.007)	(0.008)	(0.005)	(0.004)
Year 6	0.134***	0.111***	0.062***	0.056***
	(0.008)	(0.008)	(0.005)	(0.004)
Observations	370602	370602	370602	370602
Year dummies	No	Yes	Yes	Yes
Municipal FE	No	No	Yes	Yes
Covariates	No	No	No	Yes

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Each cell shows point estimates from separate regressions, each row indicates the year in which daycare availability and the outcome variable are measured, and each column represents a model specification. Column (1) only includes the explanatory variable. Columns (2)-(4) include a full set of year of first childbirth dummies, and Columns (3)-(4) include municipality fixed effects. Additionally, covariates are added in Column (4). The included covariates are a full set of dummies for mother's age at first birth, mother's year of birth, month of birth of the first child, and an indicator of urban area.

work than mothers without daycare access. For years three through six, the point estimates are higher, indicating e.g. that mothers with daycare access three years after first childbirth are 6.0 percentage points more likely to work three years after first childbirth.

The results of the full model are shown in Column (4). Specifically, I add covariates to the model in Column (4) to control non-linearly for mother's age at first birth, mother's year of birth, and month of birth of the first child. Additionally, I control for differences in job opportunities by including a dummy for living in an urban area. Overall, the results are robust to the inclusion of covariates. The point estimates are close to zero or not statistically different from zero the first couple of years after the birth of the first child. Mothers with

daycare access are 1.5 percentage points more likely to work in the year their first child turns two compared to mothers without access to daycare. The point estimates in Column (4) are above 5 percentage points for years three through six. To get a sense of the magnitude, I relate the point estimates to the sample means reported in Table B.2. This exercise suggests that mothers with daycare access are 9.1, 9.7, 9.3, and 9.0 percent more likely to participate in the labor market in the year their first born child turns three, four, five, and six, respectively.

Table 3 shows the effects of daycare availability on mothers' full-time employment status separately for zero through six years after the birth of the first child. Overall the parameter estimates on full-time employment are smaller than those for any employment in Table 2; however, during the period I consider in this paper, the percentage of mothers working full-time was low. Table B.2 shows that 59 percent of the mothers in the sample participate in the labor market in the year their first born child turns four, whereas only 17 percent work full-time in that year. Relating the point estimates in Table 3 to the mean values in Table B.2, the results suggest that mothers with daycare access are 5.3 percent more likely to be full-time employed in the year they have their first child than to mothers without access to daycare. Similarly, mothers with daycare access are 3.8 percent more likely to work full-time the year their first born child turns one. Mothers with daycare access are 9.4 percent more likely to be full-time employed in the year their first child turns three. Effect sizes remain at this level through years four to six, with effect sizes of 11.2 percent, 10.5 percent, and 11.7 percent in the year the first child turns four, five, and six, respectively.

Table 4 shows the effects of daycare availability on mothers' hours of work separately for zero through six years after the birth of their first child. In line with the results on participation and full-time employment, the results for hours worked are small or not statistically significant in the first couple of years. When the first born child turns three the point estimates are significantly different from zero at conventional significance level, and they increase as the child gets older. Mothers with daycare access work 0.27 hours more per week (1.8 percent) than mothers without daycare access in the year their first child turns four.

Table 3: The contemporaneous effects of daycare on mothers' full-time employment zero through six years after the birth of the first child

	(1)	(2)	(3)	(4)
Year 0	0.084***	0.031***	0.011**	0.008***
	(0.006)	(0.006)	(0.004)	(0.003)
Year 1	0.059***	0.027***	0.007*	0.006**
	(0.006)	(0.006)	(0.004)	(0.003)
Year 2	0.052***	0.031***	0.007*	0.005*
	(0.006)	(0.005)	(0.004)	(0.003)
Year 3	0.058***	0.042***	0.019***	0.016***
	(0.004)	(0.004)	(0.003)	(0.003)
Year 4	0.061***	0.048***	0.021***	0.019***
	(0.004)	(0.004)	(0.004)	(0.003)
Year 5	0.064***	0.051***	0.022***	0.019***
	(0.004)	(0.004)	(0.003)	(0.003)
Year 6	0.065***	0.053***	0.023***	0.021***
	(0.005)	(0.005)	(0.003)	(0.003)
Observations	370602	370602	370602	370602
Year dummies	No	Yes	Yes	Yes
Municipal FE	No	No	Yes	Yes
Covariates	No	No	No	Yes

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Each cell shows point estimates from separate regressions, each row indicates the year in which daycare availability and the outcome variable are measured, and each column represents a model specification. Column (1) only includes the explanatory variable. Columns (2)-(4) include a full set of year of first childbirth dummies, and Columns (3)-(4) include municipality fixed effects. Additionally, covariates are added in Column (4). The included covariates are a full set of dummies for mother's age at first birth, mother's year of birth, month of birth of the first child, and an indicator of urban area.

Overall, daycare availability increases mothers' participation rate, full-time employment, and hours worked in the short run. The results in this section suggest that daycare availability affects mothers labor market attachment on both the intensive and extensive margin. The results further suggest that mothers primarily respond to daycare availability when their first child has turned three and not during the first couple of years after they become a mother. This may seem in contrast to the results of Simonsen (2010), who finds that mothers react to both daycare price changes and availability during the first year after childbirth. However, Simonsen (2010) use more recent data from 2001. The lack of statistically significant point estimates during the first couple of years after the birth of the first child in this paper suggests

Table 4: The contemporaneous effects of daycare on mothers' hours of work zero through six years after the birth of the first child

	(1)	(2)	(3)	(4)
Year 0	1.309***	0.460***	0.015	0.049
	(0.151)	(0.158)	(0.102)	(0.079)
Year 1	0.655***	0.209*	0.076	0.126*
	(0.116)	(0.122)	(0.084)	(0.065)
Year 2	0.490***	0.201*	0.005	0.059
	(0.122)	(0.117)	(0.091)	(0.079)
Year 3	0.611***	0.403***	0.221***	0.174**
	(0.111)	(0.119)	(0.083)	(0.071)
Year 4	0.737***	0.569***	0.331***	0.271***
	(0.105)	(0.110)	(0.090)	(0.083)
Year 5	0.879***	0.709***	0.372***	0.307***
	(0.107)	(0.113)	(0.076)	(0.067)
Year 6	0.944***	0.795***	0.419***	0.351***
	(0.111)	(0.118)	(0.077)	(0.070)
Observations	370602	370602	370602	370602
Year dummies	No	Yes	Yes	Yes
Municipal FE	No	No	Yes	Yes
Covariates	No	No	No	Yes

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Each cell shows point estimates from separate regressions, each row indicates the year in which daycare availability and the outcome variable are measured, and each column represents a model specification. Column (1) only includes the explanatory variable. Columns (2)-(4) include a full set of year of first childbirth dummies, and Columns (3)-(4) include municipality fixed effects. Additionally, covariates are added in Column (4). The included covariates are a full set of dummies for mother's age at first birth, mother's year of birth, month of birth of the first child, and an indicator of urban area.

that the relevant margin has changed from mothers with children aged three through six in the 1960s-70s to mothers with children younger than two in recent times. This could reflect different cultural norms or that mothers have more than one child before they return to work during the period I consider in this paper. The mothers in the sample on average have 2.3 children, and I investigate whether daycare access affects fertility in Section 5.4.

5.2 Long-run effects of daycare availability

I now turn to the estimation of Equation (2), where for each year from four through 34 years after the first childbirth, I estimate the effect of daycare availability in year four on mothers'

employment and labor market earnings. To ease comparison of the estimates over years and across outcomes, I plot the effect sizes in percent rather than percentage points by scaling the point estimates with the mean of the dependent variable in the corresponding year. The means of the dependent variables are presented in Table B.3.

Figure 4 shows the effects of daycare in year four on (a) participation rate, (b) full-time employment, (c) log earnings, and (d) hours of work per week. Mothers with daycare access are 9.7 percent more likely to participate in the labor market during the year their first child turns four. The effect sizes fall gradually as the first child ages e.g., when their first child is 14, mothers with daycare access are 5.7 percent more likely to participate in the labor market, and when their first child is 22, mothers with daycare access are 3.1 percent more likely to participate in the labor market. Daycare access has persistent effects on the participation rate of mothers 34 years after the birth of their first child. Mothers who had access to daycare are 1.2 percent more likely to participate in the labor market 34 years after they have their first child.

Figure 4 (b) shows the effects on full-time employment, and the pattern of decreasing effect sizes aligns with that of the participation rate. Mothers with daycare access are 11 percent more likely to be full-time employed in the year their first born child turns four, 8.2 percent more like to be full-time employed when their first child is 14, and 4.4 percent more likely to be full-time employed when their first child is 34.

Daycare availability when the first child is four also has persistent positive effects on earnings through 34 years after the birth of the first child, although the earnings estimates are noisier ranging between 3 and 6 percent. Mothers with daycare access when the first born child is four on average earn 5.3 percent more in the year the first child turns 16 and 4.2 percent more in the year the first child turns 34 than mothers who did not have access to daycare when the child was four. On average, the mothers in the sample are 23.7 years old when they have their first child, which corresponds to an average age of 57.7 years in the last year I evaluate the long-run effects of daycare availability.

Thus, the results show that daycare availability during the child-rearing years has life-long consequences on both labor market participation and earnings. As highlighted by Lefebvre et al. (2009), the existence of effects after the child(ren)'s pre-school years is closely related to human capital. Participation in the labor market during child-rearing years yields lower levels of depreciation of human capital attained through education and in previous jobs, in addition to new human capital attained through the current job.

The results presented in Figure 4 are in line with the results in Herbst (2017); he finds that a $1 increase in the wartime daycare program increases mothers' full-time employment by 0.099 percentage points, up from a full-time employment rate of 12 percent for mothers in the treatment group. This corresponds to an 8 percent increase in full-time employment resulting from a $10 increase in daycare spending. Herbst (2017) uses census data in his analysis; consequently, he is only able to evaluate the impact of the temporary daycare program every tenth year. Thus, 17 years after the abolition of the program, he finds that a $10 increase in daycare spending implies that 6 percent of the mothers are more likely to work full-time. He also finds small but positive effects on earnings. Along the same lines, Lefebvre et al. (2009); Haeck et al. (2015) find that the introduction of universal daycare in Quebec affects mothers' labor market attachment beyond the years during which they have children of pre-school age.

Figure 4: The short- and long-run effects of daycare availability when the first child is four on mothers' participation rate, full-time employment, earnings, and hours of work

(a) Participation rate

(b) Full-time employment

(c) Log earnings

(d) Hours of work
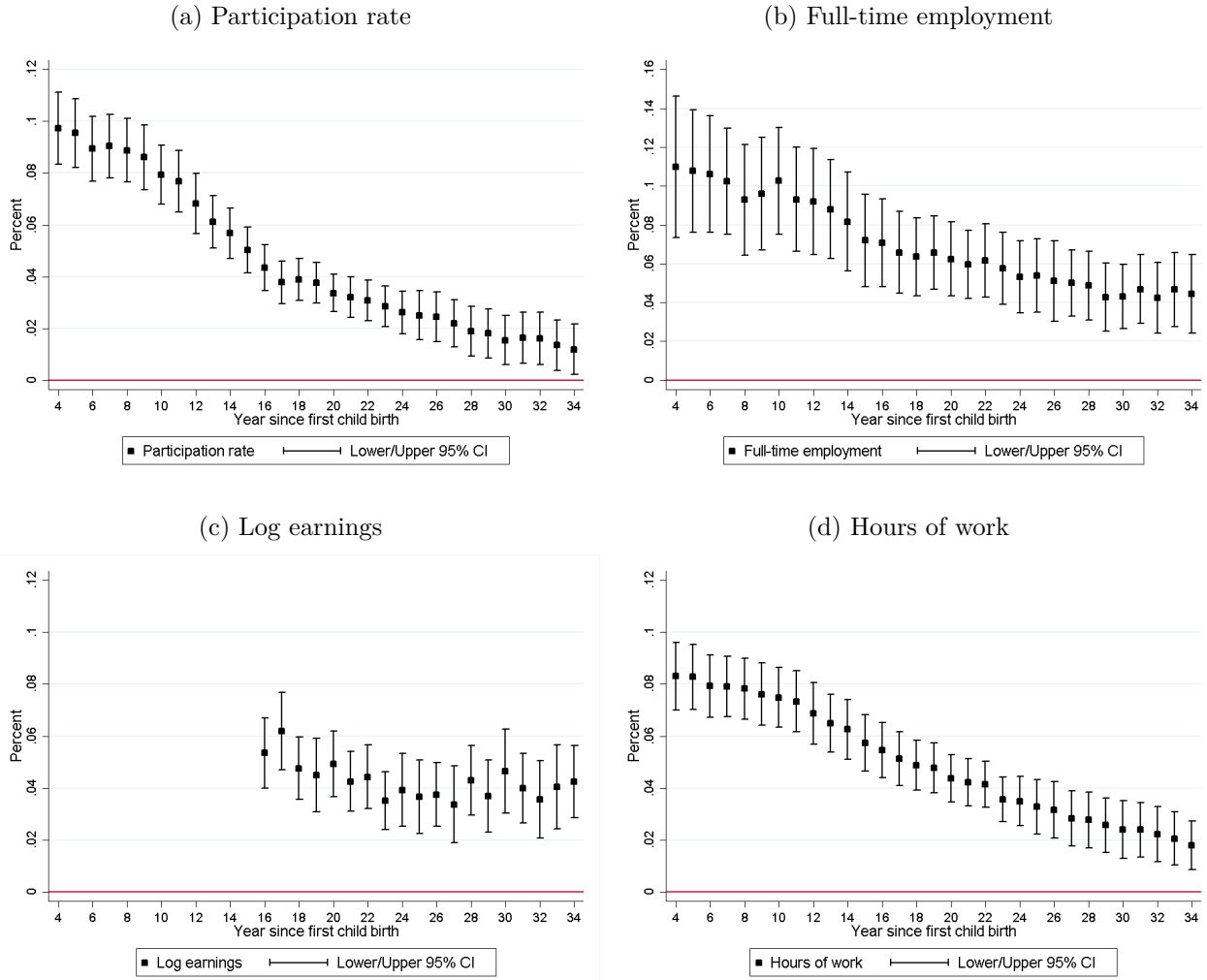
NOTE— The figure shows the effects of daycare in the year the first born child turns four on (a) the participation rate four through 34 years after the first childbirth relative to the sample mean, (b) full-time employment four through 34 years after the first childbirth relative to the sample mean, (c) log earnings (conditional on employment) 16 through 34 years after the first childbirth, and (d) hours of work per week four through 34 years after the first childbirth relative to the sample mean. Table B.3 shows the mean of the outcome variables. Each square corresponds to a point estimate from a separate estimation divided by the mean of the dependent variable in the corresponding year. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

5.2.1 Heterogeneous effects by mothers' education

Mothers who have invested (time and foregone labor market earnings) in education will likely have different incentives to enter and participate in the labor force. Additionally, lower-educated mothers might face different barriers to enter the labor market. For example, Baum (2002) finds that daycare costs are a larger employment barrier for low-income mothers. To examine such differences, I stratify the sample with respect to the mothers' education. Figure 5 shows the effects of daycare in year four on (a) participation rate, (b) full-time employment, (c) log earnings, and (d) hours of work per week separately for low- and higher-educated mothers. There are long-run positive effects on participation for both groups of mothers; however, the effect sizes are smaller for higher-educated mothers. Specifically, for higher-educated mothers, the effect of daycare availability on participation is 3.9 percent 10 years after the birth of the first child, less than 1 percent 17 years after the birth of the first child, and no longer significantly different from zero when the first born child turns 23. For low-educated mothers, the effect of daycare availability on participation remains significantly different from zero through 32 years after the birth of the first child. For low-educated mothers, the effect of daycare availability on participation is 10.1 percent 10 years after the birth of their first child, 5.1 percent 17 years after the birth of their first child, and 1.5 percent 32 years after the birth of their first child. Whereas low-educated mothers on average have their first child when they are 22.7, higher-educated mothers are on average two years older (cf. Table B.5). This difference in age at first childbirth between low- and higher-educated mothers can to some extend explain why the effects on the participation rate are longer lived for low-educated mothers.

The effects of daycare on full-time employment and hours of work follow the same pattern as the results for the participation rate. The effects are much larger for low-educated mothers than for higher-educated mothers, which is in line with the results in Lefebvre et al. (2009). There are especially larger differences in full-time employment. For example, when their first child is 6, low-educated mothers are 14.5 percent more likely to work full-time, whereas

higher-educated mothers are 3.9 percent more likely to work full-time. The effects on full-time employment remain larger for low-educated mothers; however, by the time the first born child turns 32, the effect sizes are closer, with 3.8 for low- and 1.7 for higher-educated mothers, although the effects for higher-educated mothers are not significantly different from zero. Figure 5 (d) shows the effects of daycare on hours of work, and the effect sizes are 8.7 percent for low- and 3.9 percent for higher-educated mothers 10 years after the birth of their first child.

There are substantial differences in the effect sizes between low- and higher-educated mothers for the three different employment outcomes. However, the effects of daycare on earnings are more similar between low- and higher-educated mothers. Low-educated mothers with access to daycare earn 6.5 percent more 17 years after the birth of their first child than low-educated mothers without daycare access, whereas higher-educated mothers with daycare access earn 3.7 percent more 17 years after the birth of their first child. Thirty years after the birth of their first child, low-educated mothers with daycare access earn 4.5 percent more and higher-educated mothers earn 2.5 percent more than mothers without daycare access. For higher-educated mothers, the effects of daycare access on earnings are not statistically significant for 25-27 years and 31-34 years after the birth of their first child. On the other hand, the effects remain significantly positive for low-educated mothers through 34 years after the birth of their first child.

In summary, the effects of daycare on maternal employment are primarily driven by low-educated mothers, whereas the employment effects are smaller and less persistent for higher-educated mothers, indicating that the lack of daycare availability is a larger employment barrier for low-educated women during their child-rearing years than for higher-educated women. The effects on earnings for low- and higher-educated mothers are more closely aligned than the employment effects. However, for higher-educated mothers, the effects of daycare on earnings are longer lived than the effects on employment, suggesting that job attachment during child-rearing years is especially important for higher-educated mothers in

Figure 5: Heterogeneous effects of daycare availability when the first child is four on mothers'
participation rate, full-time employment, earnings, and hours of work by mothers' education
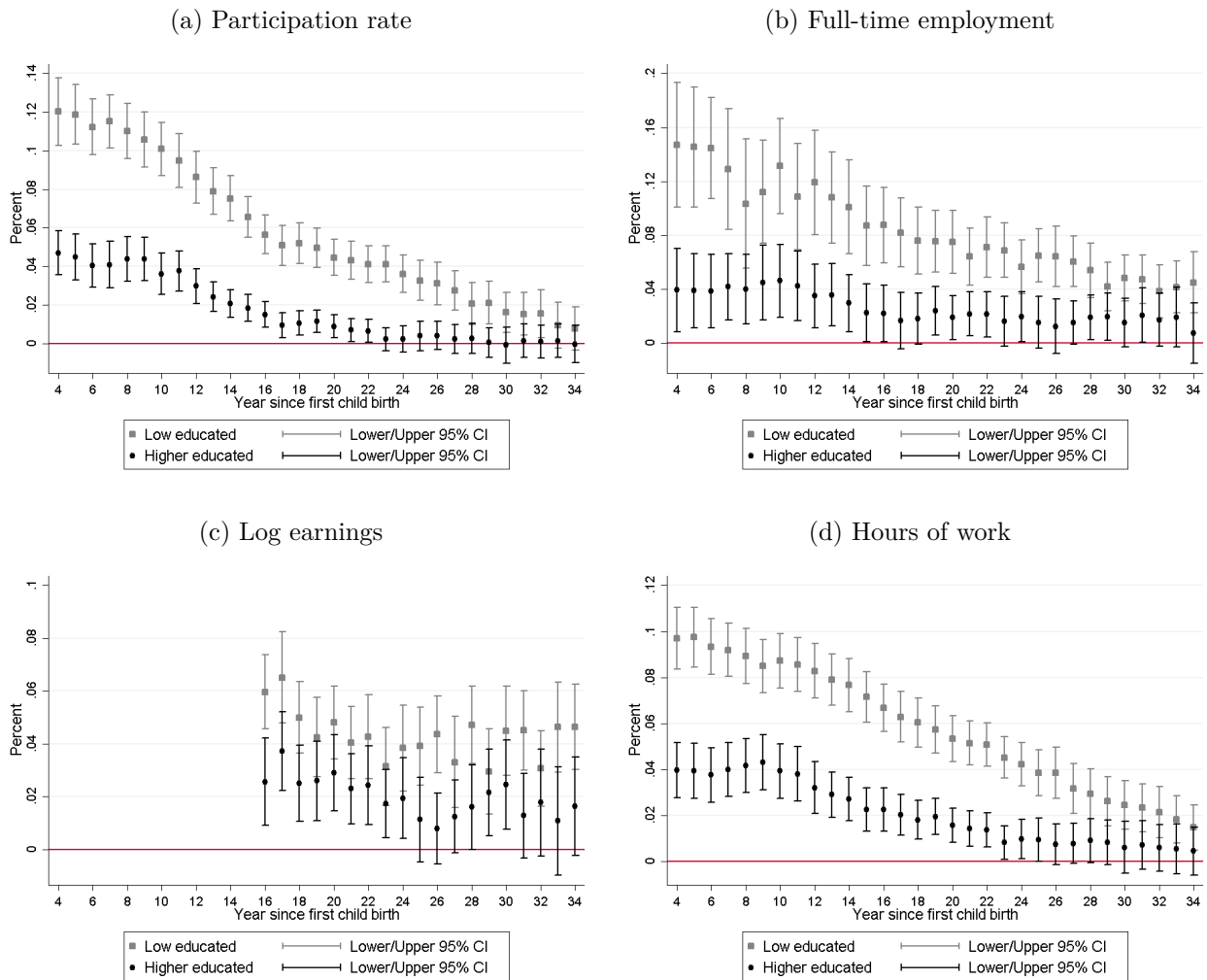
(a) Participation rate

(b) Full-time employment

(c) Log earnings

(d) Hours of work

NOTE— The figure shows the effects of daycare in the year the first born child turns four on (a) the participation rate four through 34 years after the first childbirth relative to the sample mean for low- and higher-educated mothers, (b) full-time employment four through 34 years after the first childbirth relative to the sample mean for low- and higher-educated mothers, (c) log earnings (conditional on employment) 16 through 34 years after the first childbirth, and (d) hours of work per week four through 34 years after the first childbirth relative to the sample mean for low- and higher-educated mothers. Each square corresponds to a point estimate from a separate estimation. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

terms of economic output.

5.3 Event study analysis

Prior research shows that women's participation rate drops after childbirth, whereas men's participation is unaffected. Using Danish data, Kleven et al. (2019) find a family gap in earnings of 20 percent; they attribute the gap to three different margins: labor force participation, hours worked, and wage rates. Specifically, Kleven et al. (2019) find a 13 percent drop in the participation rate of mothers who have their first child between 1985 and 2003.

For parents who have their first child between 1969 and 1975, I have data on their labor force participation five years prior to the year they become parents through 20 years after. I use this data to investigate whether daycare availability moderates the drop in labor force participation women experience after the birth of their first child. Figure 6 shows the event time coefficients estimated separately for three groups of parents. The first group is parents with access to daycare in all years after the birth of their first child, the second group is parents with access to daycare in some of the years, and the third group is parents with no access to daycare through the first six years after the birth of their first child. The event time coefficients are plotted separately for mothers (a) and fathers (b).

For all three groups of mothers, the event time coefficients are close to zero prior to the birth of their first child, supporting the identifying assumption, that the daycare institutions did not open in neighborhoods where female labor force participation was already increasing. From event time zero to seven, Figure 6 shows a gradual drop for all three groups of mothers; however, for mothers with daycare access in all years, the drop is smaller than for the two other groups of mothers. The gradual drop likely reflects additional childbirth, but given the size of the drop, it is also probable that some women drop out of the labor force when they have children. For the group of mothers who had daycare access in all pre-school years, the participation rate remains around 30 percentage points lower than the participation rate in the year prior to the birth of their first child from the time the child is seven to 20 years old. Although this is a considerable drop, it is a smaller drop than that exhibited by mothers who did not have access to daycare during the first years after they had their first child. The

Figure 6: Event study of parents' labor force participation

(a) Mothers with diff. daycare access   (b) Fathers with diff. daycare access
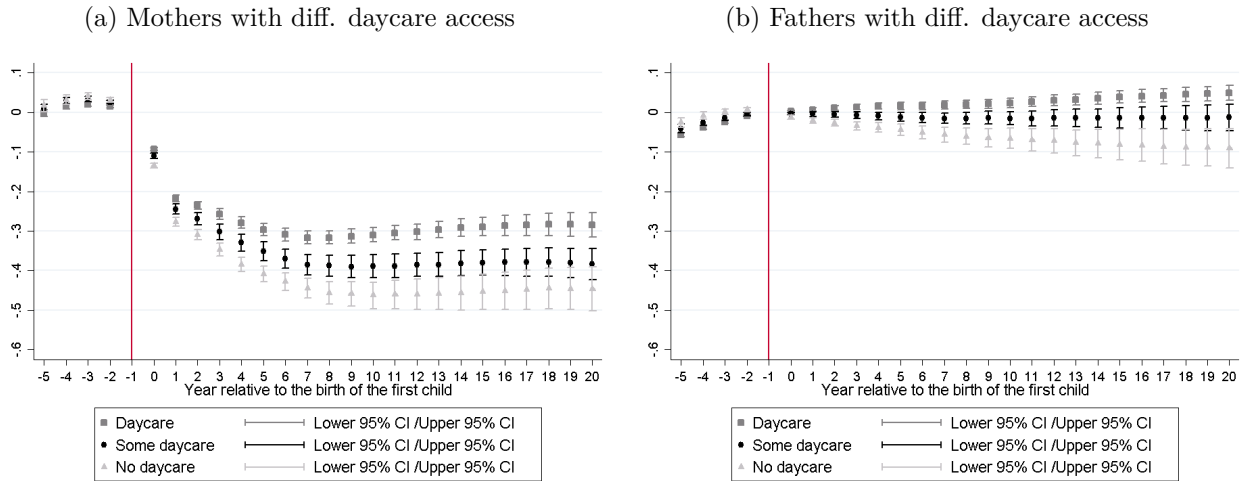
NOTE— The graph shows event time coefficients estimated separately for three groups of mothers (a) and fathers (b). The three groups are defined as parents with access to daycare in all years after the birth of their first child, parents with access to daycare in some years, and parents with no access to daycare through the first child's first six years. Estimations are based on a balanced sample of mothers and fathers who have their first child between 1969 and 1975 and are observed in the data during the entire period between five years prior and 20 years after they have their first child.

participation rate of mothers without access to daycare during the pre-school years of their first child drops to a level 45 percentage points lower than the participation rate in the year prior to the first childbirth. For fathers, the event time coefficients are much closer to zero, although fathers with daycare access in all years display a positive trend in participation rates, whereas fathers without daycare access display a negative trend compared to the year before the birth of the first child.[10]

5.4   Daycare effects on fertility and parental separation

The results presented in the previous sections indicate that mothers with access to daycare after the birth of their first child are more likely to participate in the labor market. To investigate one possible mediator for this result, I examine whether daycare availability affects fertility decisions. From a theoretical perspective, daycare availability can affect fertility

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[10]The ATP is not a perfect measure for labor force participation because it does not include self-employed (e.g., farmers).

through both an income effect and a substitution effect. Daycare increases a mother's earnings opportunity, which increases the demand for children if children are not an inferior good, and at the same time, it raises the opportunity cost of children (Becker, 2009).[11]

I estimate the effect of daycare availability on the number of children and indicators for more than one, two, or three children. Because the sample consists of women who have their first child between 1964 and 1975, I consider fertility responses to daycare on the intensive margin. I construct two summary measures of daycare availability as explanatory variables. The first is an indicator for daycare availability for children up to age two, and the second is an indicator for daycare availability for children between age three and six. Among the mothers who had daycare available for children between age three and six, 53 percent also had daycare for children up to age two available. To avoid issues with reverse causality, I measure both types of daycare availability in the year the mother has her first child.

Table 5 presents the results for the four fertility outcomes. Daycare availability for children between age three and six negatively affects the number of children, whereas there is no effect of daycare availability for children up to age two or of having access to both types of daycare. One-third of the mothers had access to daycare for children up to age two; however, the enrollment in this type of childcare was lower than for children between age three and six (see Figure A.1). Thereby, it is not surprising that any fertility effects load onto the dummy for daycare access for children between age three and six. Access to daycare for children between age three and six reduces the number of children by 0.036 compared to mothers without access to daycare. Mothers in this sample on average have 2.2 children; thereby, the result indicates that daycare access reduces the number of children by 1.6 percent.

Table 5 also shows the effects of daycare access on the probability of having more than one, two, or three children. For all three fertility outcome dummies, there is no statistically significant effect of access to daycare for children up to age two, negative effects of access to daycare for children between age three and six, and no additional effect of having access to

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[11]See also Gauthier (2007) for a review of the literature investigating the impact of different family policies on fertility.

Table 5: The effects of daycare on mothers' subsequent fertility decisions

	(1) # children	(2) More than 1	(3) More than 2	(4) More than 3
DC for 0-2 year olds	-0.020	-0.006	-0.012	-0.001
	(0.029)	(0.013)	(0.014)	(0.004)
DC for 3-6 year olds	-0.049***	-0.013***	-0.024***	-0.009***
	(0.005)	(0.002)	(0.003)	(0.002)
Interaction term	0.027	0.000	0.019	0.005
	(0.033)	(0.014)	(0.016)	(0.005)
Observations	370602	370602	370602	370602
Year dummies	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Each column presents estimates from separate regressions, where the outcome variable is number of children, a dummy for more than one child, a dummy for more than two children, and a dummy for more than three children, respectively. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

both types of daycare. Daycare for children between age three and six reduces the probability of having more than one child by 1.3 percentage points (1.6 percent), the probability of having more than two children by 1.8 percentage points (6.0 percent), and the probability of having more than three children by 0.5 percentage points (7.1 percent). Overall, daycare availability has negative effects on total fertility, and the effects are larger for mothers on the margin of having more than two or three children. The negative effects on fertility are in contrast to previous empirical findings from quasi-experimental variations in daycare access or costs. Bauernschuster et al. (2016) examines how the introduction of daycare for children aged three affects fertility in Germany, and they find that daycare increases fertility. However, Bauernschuster et al. (2016) examine a period during which the total fertility in Germany was low, with 1.4 children per women; in contrast, the mothers in this sample on average have 2.2 children. In a similar vein, Rindfuss et al. (2010) find a positive impact of daycare availability on fertility in Norway during the 1970s, when total fertility was 1.85. Mörk et al. (2013) examine the effects of childcare costs on fertility in Sweden and find limited effects of changes in the childcare costs on fertility behavior. Combining the labor force participation

and fertility effects in this paper suggests that daycare increases the opportunity cost of children.

Although daycare availability reduces the number of children, it can potentially encourage mothers to have their children over a shorter period of time in order to return to the labor market faster. On the other hand, daycare availability can encourage mothers to have longer intervals between childbirth in order to attain longer job spells and more job-specific human capital. Consequently, I examine whether daycare availability affects the spacing between children for mothers with more than one child. The results are presented in Table 6. The outcome variables are number of years to the next child and five indicator variables taking the value one if the mother has her second child within one through five years after the first child. The explanatory variables are an indicator for daycare for children up to age two and an indicator for daycare for children between age three and six, both measured in the year the mother has her first child. Again, only the indicator for daycare for children between age three and six is statistically significant indicating that mothers with daycare access wait 0.137 years more to have their next child than mothers without daycare access. The results for the dummy outcomes are in line with the result of the number of years to next child. Mothers with daycare access are 2.2 percentage points less likely to have their next child within two years. Thus, daycare availability increases spacing between children, allowing mothers to work longer spells between childbirth.

Table 6: The effects of daycare on spacing between first and second child

	(1) # years	(2) ≤ 1 year	(3) ≤ 2 years	(4) ≤ 3 years	(5) ≤ 4 years	(6) ≤ 5 years
DC for 0-2 year olds	0.058	0.001	0.003	-0.000	-0.005	-0.006
	(0.083)	(0.011)	(0.008)	(0.020)	(0.015)	(0.013)
DC for 3-6 year olds	0.137***	-0.004**	-0.022***	-0.028***	-0.023***	-0.017***
	(0.017)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Interaction term	-0.026	-0.000	-0.003	-0.005	-0.001	0.001
	(0.086)	(0.011)	(0.008)	(0.021)	(0.015)	(0.013)
Observations	305504	305504	305504	305504	305504	305504
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Municipal FE	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Each panel presents estimates from separate regressions, with different outcomes in each column. The outcomes are number of years to the next child, a dummy for one year or less, a dummy for two years or less, and so forth. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

As mothers entered the labor market and started to generate income they became less economically dependent on the child's father. Thus, greater female labor force participation may correlate with higher divorce rates. However, the causality between female labor force participation and divorce rates can run in both directions. On one the hand, married women might work more because they anticipate a divorce. On the other hand, women who work more might be more likely to divorce because their opportunity cost of marriage is higher (Becker et al., 1977; Johnson and Skinner, 1986). Consequently, I continue the analysis by investigating whether daycare availability has any effect on parental separation. I define separations based on the mother's and father's address in the year during which the first child turns 16, which is the first year I can observe address information for the parents from the earliest cohort.[12] Table 7 shows the effect of daycare availability on household separation at child age 16. In Panel A, the explanatory variables are daycare availability for children up to age two, daycare availability for children between age three and six, and the interaction term between the two daycare availability measures, which are all measured in the year of

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[12]I do not observe if the parents are married before they have children nor do I observe if they have ever lived together.

Table 7: The effects of daycare on parents not living together at child age 16 and additional educational achievement after the birth of the first child

	(1) Separation	(2) More education
Panel A		
DC for 0-2 year olds	-0.000	0.001
	(0.013)	(0.015)
DC for 3-6 year olds	0.013***	0.002
	(0.003)	(0.002)
Interaction term	0.010	0.003
	(0.013)	(0.016)
Panel B		
Daycare year 4	0.020***	0.001
	(0.003)	(0.002)
Observations	365949	370602
Year dummies	Yes	Yes
Municipal FE	Yes	Yes
Covariates	Yes	Yes

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Each panel presents estimates from separate regressions. In Column (1) the outcome variable is a dummy taking the value one if the parents do not live together when the first born child turns 16. In Column (2) the outcome variable is a dummy taking the value one if the mother achieves more education after the birth of her first child. In Panel A, daycare availability is measured prior to the birth of the first child, and in Panel B, daycare availability is measured in the year the first born child turns four. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

the first childbirth. In Panel B, the explanatory variable is daycare availability in the year the first born child turns four. Using daycare availability in the year the child turns four as the explanatory variable, Column (1) of Table 7 shows that mothers who had access to daycare are 2 percentage points more likely to live apart from the child's father in the year the child turns 16 compared to mothers who did not have access to daycare when the child was four.

As a final mediator, I investigate whether daycare availability has any effects on additional educational achievement after the birth of the first child. The summary statistics in Table 1 show that 12 percent of the mothers in the sample continue their education after they have their first child; however, Column (2) of Table 7 shows that daycare availability does not affect additional education attainment after first childbirth. In summary, the results show

that daycare availability, fertility, and female labor supply are associated.

5.5   Robustness and sensitivity checks

In this section, I present the results from a series of robustness and sensitivity checks. Specifically, I examine whether the results are driven by selective movement, the pre-1970 child cohorts, urbanicity, and differential time evolvement. First, the results in this paper would be biased if parents choose to live in a neighborhood based on daycare availability. To validate that parents are not selecting into neighborhoods with daycare availability, I calculate the distance between the birth place of the mother and her address in the 1970 census tract and examine whether mothers moving a greater distance are more likely to live in a neighborhood with daycare. I exploit information about the latitude and longitude of the neighborhood the mother is born in and the neighborhood in which she resides in 1970 to calculate the distance the mother moves. Variations of the distance measure are used as explanatory variables in regressions where daycare availability in year four is the dependent variable.

Table 8 shows the relationship between distance moved and daycare availability. The estimates in Column (1) are from regressions in which no other explanatory variables are included, whereas the estimates in Column (4) are from regressions with the full set of covariates and fixed effects. In Panel A, distance in terms of 100 km is the main explanatory variable, and the estimate in Column (1) suggests that mothers who move 100 km away from their birth place are 0.032 percentage points more likely to reside in a neighborhood with daycare access in 1970. Including the full conditioning set reduces the estimate, such that mothers who move 100 km are 0.004 percentage points more likely to live in a neighborhood with daycare access in 1970. Denmark is a small country, measuring only about 455 km from the most eastern point to the most western point. On average, mothers move 49 km away from their birth place, but there is a large variation in the distance mothers move (e.g., 12 percent of the mothers do not move away from their birth place (cf. Table8, Panel D)). In Panel B, both distance and squared distance are included as explanatory variables, and

	(1) Daycare	(2) Daycare	(3) Daycare	(4) Daycare
Panel A				
Distance	0.03238***	0.03651***	0.00400**	0.00435***
	(0.00553)	(0.00592)	(0.00170)	(0.00133)
Panel B				
Distance	0.00382	0.01786	0.00414	0.00739
	(0.03430)	(0.03331)	(0.00635)	(0.00514)
Squared distance	0.01347	0.00878	-0.00007	-0.00143
	(0.01478)	(0.01409)	(0.00250)	(0.00209)
Panel C				
IHST distance	0.00474	0.00785**	-0.00116	0.00062
	(0.00295)	(0.00304)	(0.00112)	(0.00086)
Observations	328330	328330	328330	328330
Year dummies	No	Yes	Yes	Yes
Municipal FE	No	No	Yes	Yes
Covariates	No	No	No	Yes
Panel D				
Means of the distance measures:	Distance (100km)	Squared distance	IHST distance	Zero distance
	0.49	0.69	3.34	0.12
	(0.67)	(1.52)	(1.87)	(0.32)

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Column (1) only includes the explanatory variable(s). Columns (2)-(4) include a full set of year of first childbirth dummies and Columns (3)-(4) include municipality fixed effects. Additionally, covariates are added in Column (4). The included covariates are a full set of dummies for mother's age at first birth, mother's year of birth, month of birth of the first child, and an indicator of urban area. There is no information about the birth place for 11.4 percent of the mothers in the sample.

there is no longer any significant relationship between the distance the mothers move away from their birth place and daycare availability. In Panel C, I convert the distance to log values using the Inverse Hyperbolic Sine Transformation (IHST) in order to keep those with a distance of zero. The results of the IHST distance are not statistically significant, which suggests that mothers are not selectively moving a longer distance in order to have access to daycare. In summary, selective migration does not seem to be an issue.

Second, in another set of robustness checks, I exclude mothers who have their first child prior to 1970. The assignment of daycare availability is based on the year the mothers have their first child and the mothers' address in 1970. Thus, for mothers who have their first

Table 9: Robust to the exclusion of the pre-1970 cohort

	(1) Participation	(2) Full time	(3) Hours of work
Year 0	0.006	0.010***	0.180
	(0.003)	(0.004)	(0.132)
Year 1	0.013***	0.008*	0.376**
	(0.005)	(0.005)	(0.164)
Year 2	0.015***	0.006	0.393**
	(0.005)	(0.004)	(0.167)
Year 3	0.041***	0.017***	1.158***
	(0.006)	(0.004)	(0.167)
Year 4	0.042***	0.020***	1.246***
	(0.005)	(0.004)	(0.155)
Year 5	0.036***	0.019***	1.143***
	(0.005)	(0.004)	(0.138)
Year 6	0.036***	0.020***	1.062***
	(0.004)	(0.004)	(0.139)
Observations	173360	173360	173360

NOTE— * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the municipality level in parentheses. Each cell shows point estimates from separate regressions, each row indicates the year in which daycare availability and the outcome variable are measured. Column (1) shows the contemporaneous effects of daycare availability on mothers' labor force participation. Column (2) shows the contemporaneous effects of daycare availability on mothers' full-time employment. Column (3) shows the contemporaneous effects of daycare availability on mothers' hours of work. All regressions include municipality fixed effects, a full set of dummies for year of first childbirth, mother's age at first birth, mother's year of birth, month of birth of her first child, and an indicator of urban area.

child prior to 1970, their address is not predetermined. However, Table 9 shows that the results are robust to the exclusion of mothers who have their first child prior to 1970 for the three contemporaneous outcomes.

I further test whether exclusion of these mothers affects the long-run estimates; Figure 7 shows the effect sizes from Figure 4 along the corresponding effect sizes from a robustness analysis excluding mothers, who have their first child prior to 1970. The results are qualitatively robust to the exclusion of the pre-1970 cohort, although the effect sizes are smaller for the participation rate. For the three other dependent variables, the main effects are close to the effects based on a sub-sample of mothers who have their first child after 1970.

Third, I consider whether the results are sensitive to differences between rural and urban areas. Denmark experienced an economic upturn during the late 1950s, but production

was concentrated in the city areas. Consequently, job opportunities were more numerous in the cities, and the larger cities already had daycare prior to the universal daycare reform. Figure 2 shows a map of the roll-out, and it is evident that the capital Copenhagen, the second largest city, Aarhus, and the third largest city, Odense, all had daycare before the universal daycare reform. I test whether the results are driven by daycare access and better job opportunities in the larger cities by re-estimating the effects while excluding the three largest municipalities. Figure 8 shows that the results are robust to the exclusion of the three largest municipalities in Denmark.

During the 1960s and 70s, the suburbs of Copenhagen and Aarhus expanded, and it is also evident from the map in Figure 2 that a daycare institution opened in many of these areas. I test whether the results are robust to the exclusion of the suburbs of the two largest cities. Specifically, I exclude the neighboring municipalities and re-estimate the effects. Figure 9 shows that the exclusion of the suburbs of the two largest cities does not change the results.

As a final set of checks, I test whether the results are robust to differential time evolvement. In the main specification I allow for flexible time trends by including a full set of year dummies for the year the mother has her first child. In figure 10 I examine if the results are sensitive to the inclusion of an additional set of time dummies by giving mothers living in the most populous neighborhood within the municipality a separate set of time dummies. Figure 10 shows that the inclusion of these time dummies does not alter the result that daycare availability during child-rearing years has lasting effects on labor market participation and earnings more than 30 years after the birth of the first child.

Figure 7: Robust to the exclusion of the pre-1970 cohort
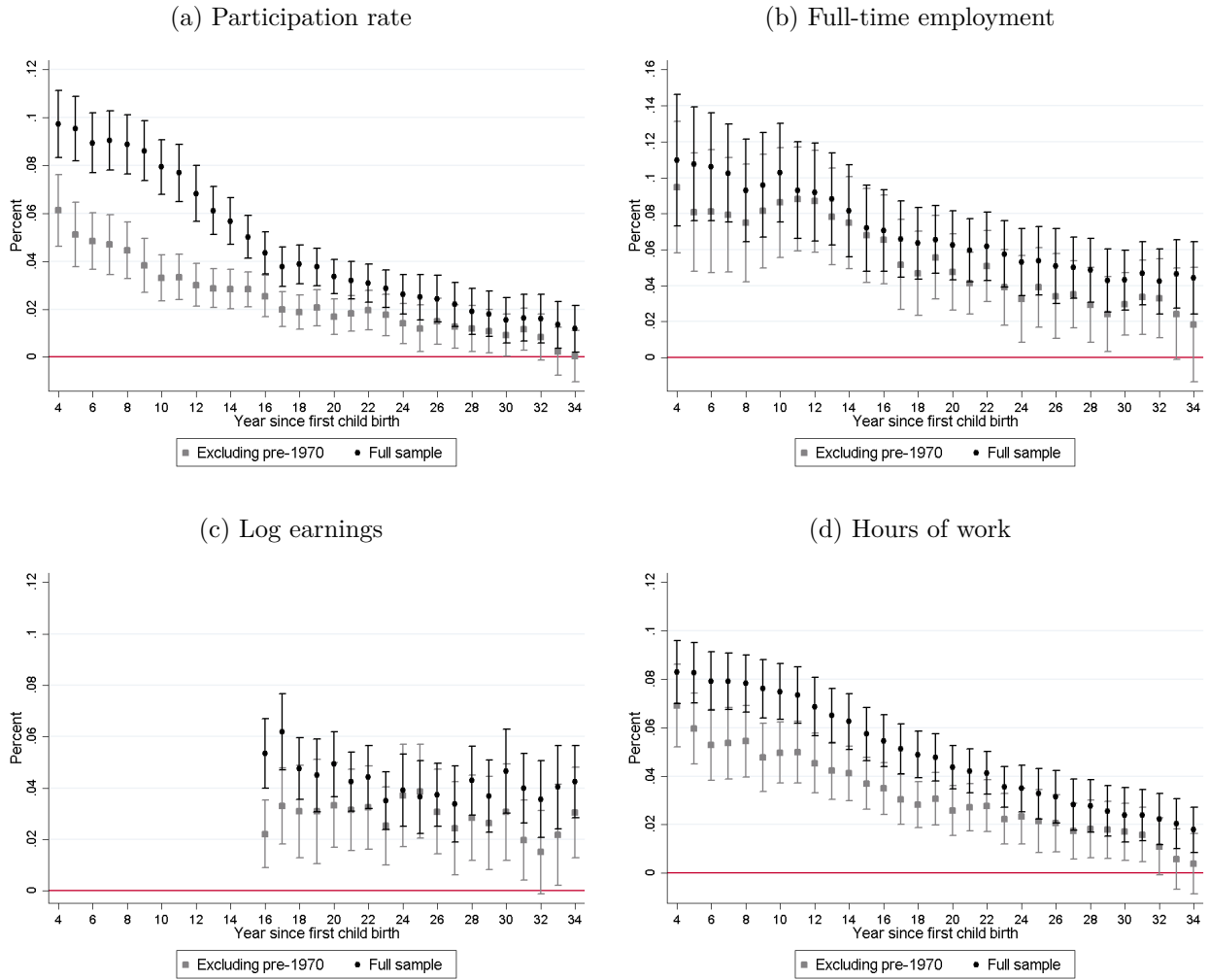
(a) Participation rate

(b) Full-time employment

(c) Log earnings

(d) Hours of work

NOTE— The figure shows the effects of daycare in the year the first born child turns four on (a) the participation rate, (b) full-time employment, (c) log earnings (conditional on employment), and (d) hours of work per week for the full sample and for a subsample excluding the mothers who had their first child before 1970. Each square corresponds to a point estimate from a separate estimation. The point estimates in (a), (b), and (d) are scaled by the sample means for the full sample and for the subsample, respectively. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

Figure 8: Robust to the exclusion of the three largest cities
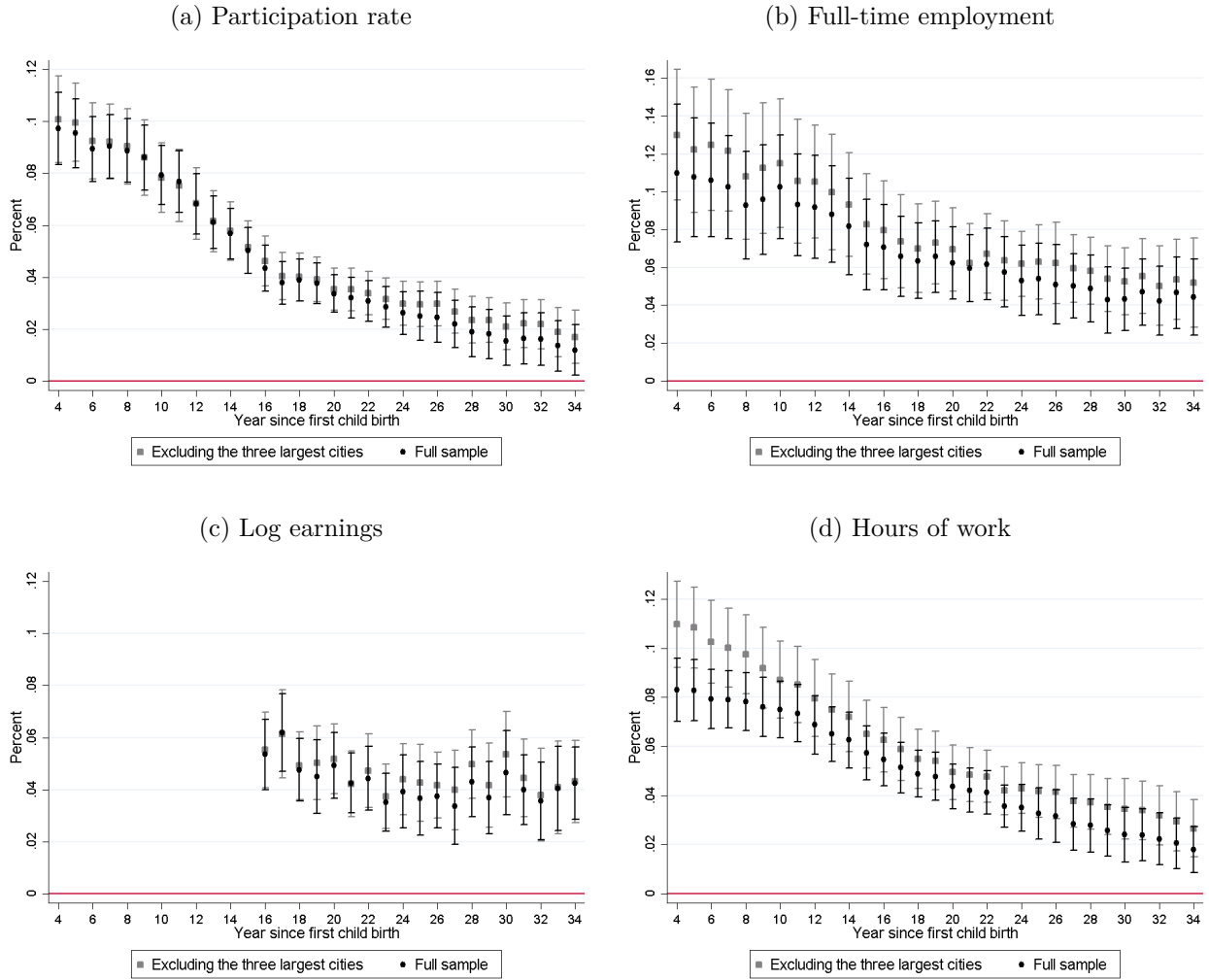
(a) Participation rate

(b) Full-time employment

(c) Log earnings
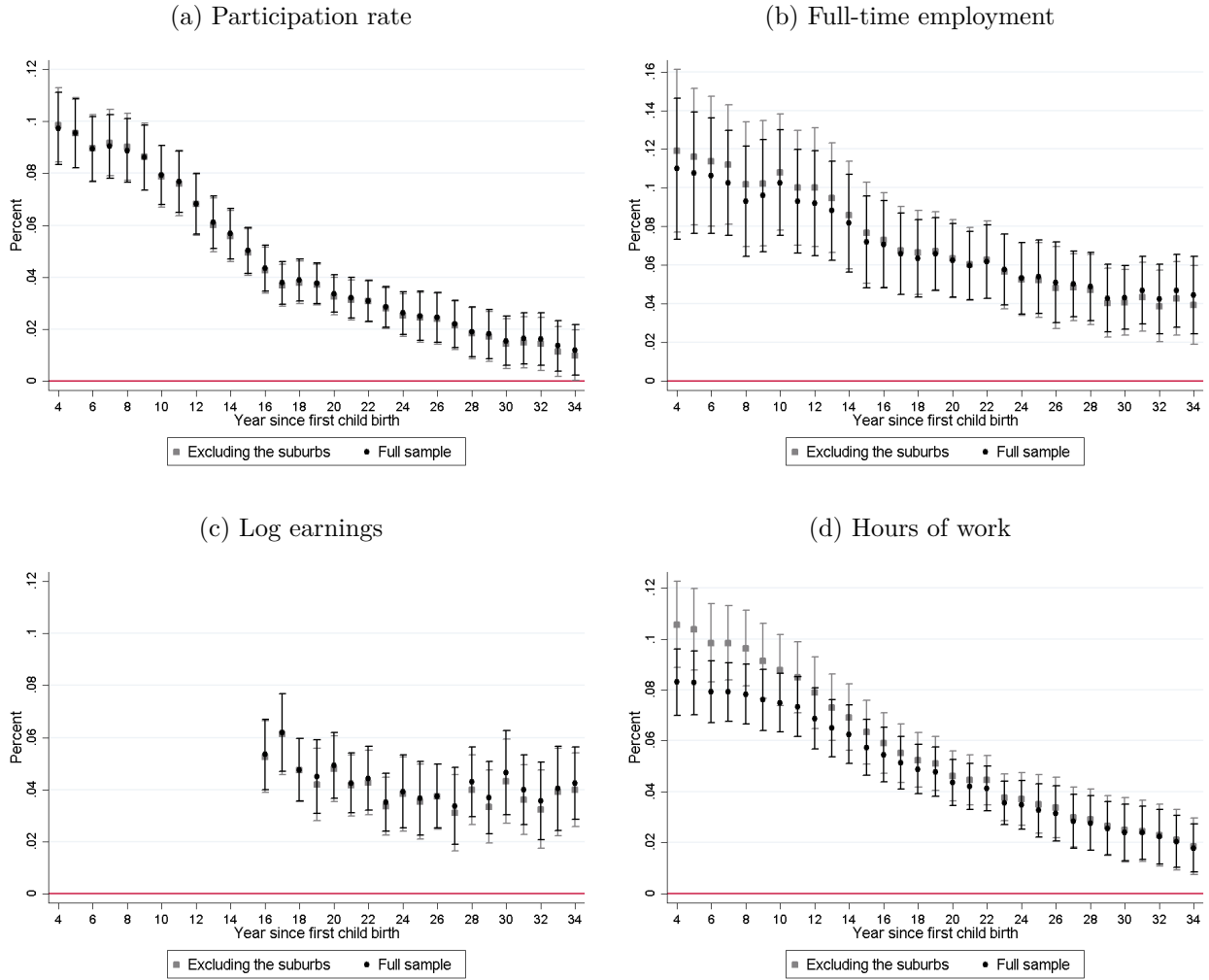

(d) Hours of work

NOTE— The figure shows the effects of daycare in the year the first born child turns four on (a) the participation rate, (b) full-time employment, (c) log earnings (conditional on employment), and (d) hours of work per week for the full sample and for a subsample excluding the three largest cities (Copenhagen, Frederiksberg, Aarhus, and Odense municipality). Each square corresponds to a point estimate from a separate estimation. The point estimates in (a), (b), and (d) are scaled by the sample means for the full sample and for the subsample, respectively. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

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Figure 9: Robust to the exclusion of suburbs

(a) Participation rate

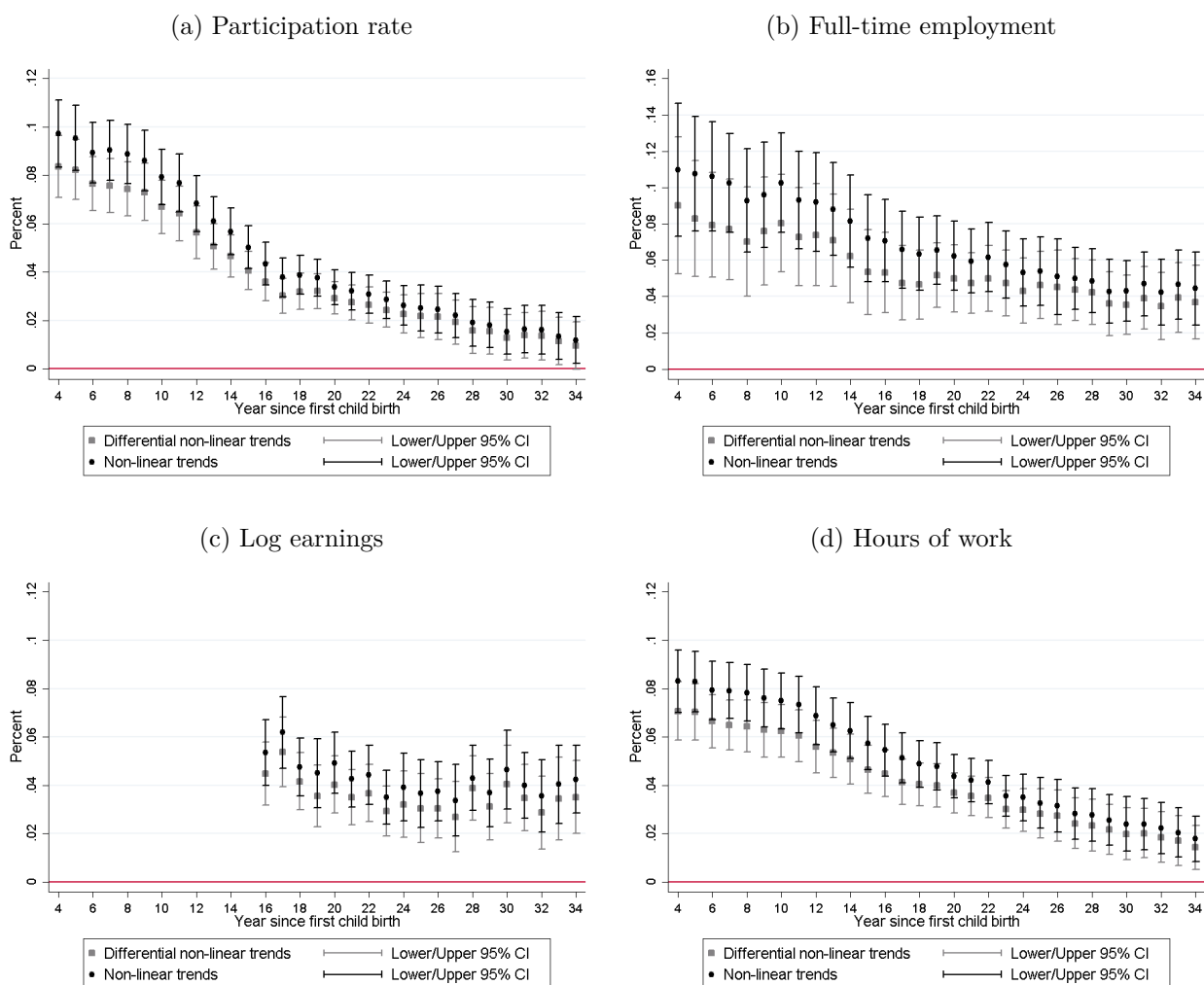(b) Full-time employment

(c) Log earnings

(d) Hours of work

NOTE— The figure shows the effects of daycare in the year the first born child turns four on (a) the participation rate, (b) full-time employment, (c) log earnings (conditional on employment), and (d) hours of work per week for the full sample and for a subsample excluding the suburbs of the two largest municipalities; Copenhagen and Aarhus. Each square corresponds to a point estimate from a separate estimation. The point estimates in (a), (b), and (d) are scaled by the sample means for the full sample and for the subsample, respectively. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.

Figure 10: Robust to differential non-linear time evolvement

(a) Participation rate

(b) Full-time employment

(c) Log earnings

(d) Hours of work

NOTE— The figure shows the effects of daycare in the year the first born child turns four on (a) the participation rate, (b) full-time employment, (c) log earnings (conditional on employment), and (d) hours of work per week separately for the main specification with non-linear time dummies and for a specification allowing for differential non-linear time dummies. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth (time dummies), and the year she has her first child. Additionally, all regressions include municipality fixed effects.

6 Conclusion

This paper analyzes the short- and long-run effects of subsidized daycare availability on mothers' employment and earnings through 34 years after the birth of their first child using the Danish roll-out of universal daycare. The results show that the relevant margin of daycare provision during the mid-1960s and 70s was daycare for children between age three and six. The results further show that daycare access in the year the first born child turns four has lasting effects on labor force participation, full-time employment, hours worked, and labor market earnings. The daycare effects are larger the younger the child; however, the effects remain positive 34 years after the birth of the first child.

The rich administrative data allows me to investigate the effects of the roll-out of universal daycare separately for low- and higher-educated mothers. The effects of daycare on maternal employment are primarily driven by low-educated mothers, whereas the employment effects are smaller and less persistent for higher-educated mothers, indicating that the lack of daycare availability is a larger employment barrier for low-educated women when they have children than for higher-educated women. The earnings estimates for low- and higher-educated mothers are more closely aligned than the employment effects. However, for higher-educated mothers, the effects of daycare on earnings are longer lived than the effects on employment, suggesting that job attachment during child-rearing years is especially important for higher-educated mothers.

Although access to daycare during the child-rearing years has a positive impact on labor market outcomes in the long-run, daycare access also negatively affects total fertility and increases the spacing between the first and the second child. Furthermore, daycare availability during child-rearing years increases the probability of living apart from the first born child's father 16 years after the birth of the child.

The results of this paper suggest that subsidized daycare can increase mothers' employment beyond the preschool years and that access to daycare can be an important policy tool for economic output. This suggests that increased labor market attachment during the

child-rearing years has important economic consequences in the long run.

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A Appendix

B Number of daycare places

Figure A.1: Number of places in daycare institutions for children aged 0-2, 3-6, and 0-6
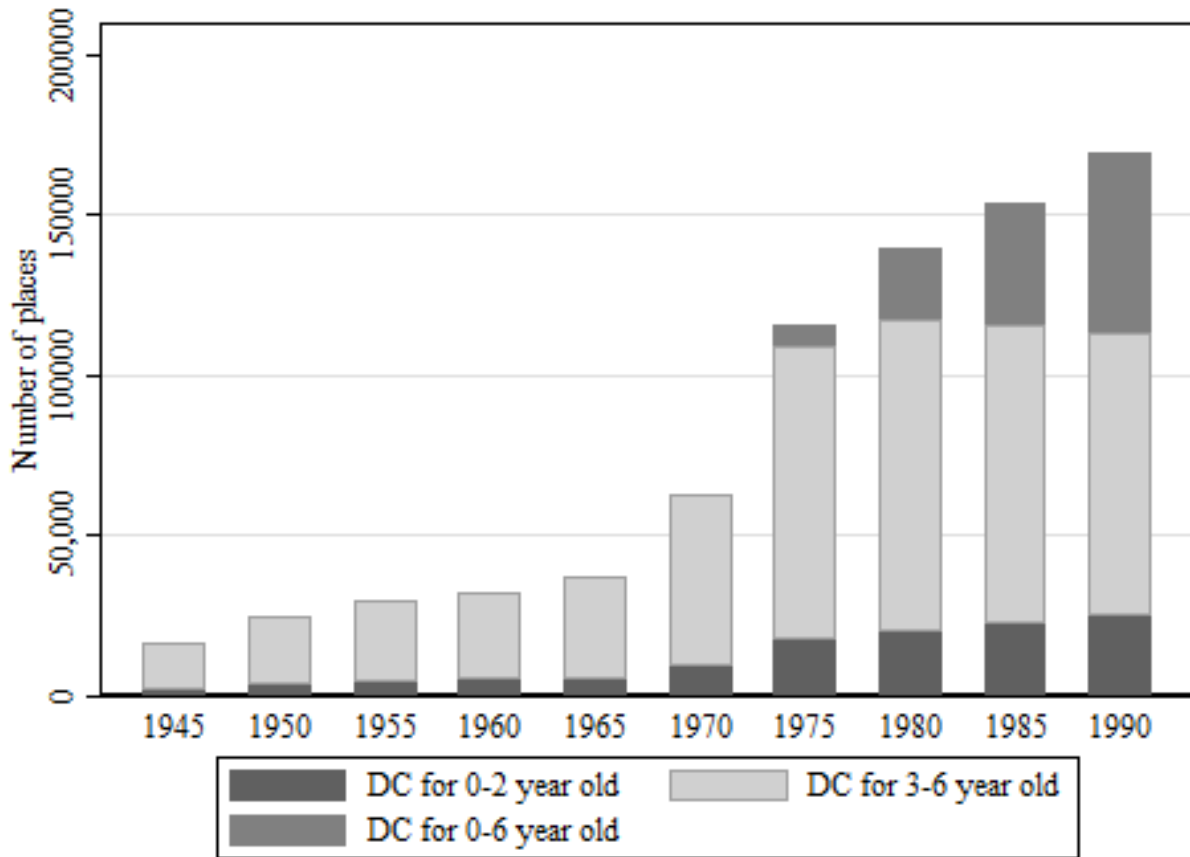
NOTE— The figure shows the number of places in daycare institutions for children up to age two, children between age three and six, and children up to age six. Daycare for children up to age six (integrated institutions) was implemented in 1975.

C   Additional descriptive statistics

Table B.1: Summary statistics of fertility and separation outcomes

	(1) All	(2) Daycare, year 0-2 No	(3) Yes	(4) Daycare, year 3-6 No	(5) Yes
Panel A					
Number of children	2.20	2.25	2.09	2.30	2.12
	(0.85)	(0.87)	(0.79)	(0.89)	(0.81)
More than 1 child	0.82	0.84	0.80	0.85	0.81
	(0.38)	(0.37)	(0.40)	(0.36)	(0.39)
More than 2 children	0.29	0.32	0.23	0.35	0.25
	(0.45)	(0.47)	(0.42)	(0.48)	(0.43)
More than 3 children	0.06	0.07	0.04	0.08	0.05
	(0.24)	(0.26)	(0.21)	(0.27)	(0.22)
Panel B					
Parents not living together, year 16	0.20	0.18	0.23	0.18	0.22
	(0.40)	(0.39)	(0.42)	(0.38)	(0.41)
Observations	370602	254550	116052	154662	215940

NOTE— Panel A shows the means and standard deviations of the four fertility outcomes for all mothers in the sample and separately for mothers with and without daycare access for children up to age two and for children between age three and six measured in the year of birth of their first child. Panel B shows the mean and standard deviation of the dummy for parents not living together when the first child is 16. The number of observations are for the full sample although the separation outcome is undefined for 1.26 percent of the sample because of missing father id.

Table B.2: Summary statistics of participation rate, full-time employment, and hours worked 0 through 6 years after first childbirth.

| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | | No Daycare | | Daycare | |
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Year 0						
Participation	0.67	(0.47)	0.62	(0.49)	0.77	(0.42)
Full-time employment	0.15	(0.35)	0.12	(0.33)	0.20	(0.40)
Hours worked	16.34	(13.47)	14.92	(13.43)	19.47	(13.03)
Observations	370602		254550		116052	
Year 1						
Participation	0.56	(0.50)	0.51	(0.50)	0.65	(0.48)
Full-time employment	0.16	(0.37)	0.14	(0.35)	0.20	(0.40)
Hours worked	14.00	(14.07)	12.64	(13.90)	16.48	(14.03)
Observations	370602		239086		131516	
Year 2						
Participation	0.57	(0.49)	0.53	(0.50)	0.65	(0.48)
Full-time employment	0.17	(0.38)	0.15	(0.36)	0.20	(0.40)
Hours worked	14.54	(14.10)	13.18	(14.00)	16.61	(14.00)
Observations	370602		223720		146882	
Year 3						
Participation	0.58	(0.49)	0.47	(0.50)	0.62	(0.49)
Full-time employment	0.17	(0.38)	0.13	(0.33)	0.18	(0.39)
Hours worked	14.68	(14.06)	11.71	(13.73)	15.71	(14.03)
Observations	370602		95679		274923	
Year 4						
Participation	0.59	(0.49)	0.48	(0.50)	0.63	(0.48)
Full-time employment	0.17	(0.38)	0.12	(0.33)	0.19	(0.39)
Hours worked	15.00	(14.06)	11.91	(13.72)	15.98	(14.02)
Observations	370602		89284		281318	
Year 5						
Participation	0.61	(0.49)	0.50	(0.50)	0.64	(0.48)
Full-time employment	0.18	(0.38)	0.13	(0.33)	0.19	(0.39)
Hours worked	15.46	(14.08)	12.34	(13.78)	16.37	(14.04)
Observations	370602		83855		286747	
Year 6						
Participation	0.62	(0.49)	0.51	(0.50)	0.65	(0.48)
Full-time employment	0.18	(0.38)	0.13	(0.34)	0.19	(0.40)
Hours worked	15.78	(14.08)	12.68	(13.81)	16.62	(14.03)
Observations	370602		78754		291848	

NOTE— The table shows the means and standard deviations of the participation rate, full-time employment, and hours worked zero through six years after the first childbirth for all mothers in the sample and separately for mothers with and without daycare in the year the outcomes are measured

Table B.3: Mean of the outcome variables zero through 34 years after first childbirth

	(1) Participation	(2) Full-time	(3) Hours of work	(4) Earnings
Year 0	0.67	0.15	16.34	
Year 1	0.56	0.16	14.00	
Year 2	0.57	0.17	14.54	
Year 3	0.58	0.17	14.68	
Year 4	0.59	0.17	15.00	
Year 5	0.61	0.18	15.46	
Year 6	0.62	0.18	15.78	
Year 7	0.63	0.18	16.09	
Year 8	0.65	0.19	16.62	
Year 9	0.67	0.20	17.32	
Year 10	0.70	0.21	18.07	
Year 11	0.72	0.22	18.86	
Year 12	0.75	0.24	19.69	
Year 13	0.77	0.25	20.49	
Year 14	0.78	0.27	21.16	
Year 15	0.80	0.29	21.69	
Year 16	0.81	0.30	22.21	26330
Year 17	0.81	0.32	22.54	27078
Year 18	0.81	0.34	22.87	27770
Year 19	0.81	0.36	23.14	28347
Year 20	0.81	0.37	23.34	28809
Year 21	0.81	0.39	23.50	29268
Year 22	0.81	0.40	23.53	29613
Year 23	0.80	0.41	23.50	29886
Year 24	0.79	0.42	23.43	30008
Year 25	0.79	0.43	23.33	30043
Year 26	0.78	0.44	23.21	30081
Year 27	0.77	0.45	23.04	30010
Year 28	0.76	0.45	22.82	29854
Year 29	0.75	0.46	22.52	29608
Year 30	0.73	0.45	22.08	29281
Year 31	0.72	0.42	21.60	28915
Year 32	0.70	0.39	21.08	28481
Year 33	0.68	0.35	20.45	27877
Year 34	0.66	0.30	19.64	27013

NOTE— The table shows the means of the outcomes used in the analysis of long-run effects. The participation rate and full-time employment are dummy variables. The means of hours worked include those who work zero hours a week. The earnings are adjusted to 2016 USD and those with zero earnings are included in the mean values.

Table B.4: Correlation of daycare availability across years after first childbirth

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Year 0	1						
Year 1	0.916***	1					
Year 2	0.844***	0.922***	1				
Year 3	0.410***	0.446***	0.483***	1			
Year 4	0.358***	0.389***	0.421***	0.871***	1		
Year 5	0.342***	0.373***	0.402***	0.829***	0.951***	1	
Year 6	0.328***	0.357***	0.386***	0.793***	0.908***	0.954***	1

NOTE— $*$ $p < 0.10$, $**$ $p < 0.05$, $***$ $p < 0.01$. The table shows the correlations of daycare availability across years after the birth of the first child. The correlations are high across all years, but highest between the years 0-2 and 3-6 (e.g., for those with daycare availability in year 1, 91.6 percent had daycare access in year 0, while for those with daycare access year 6, only 32.8 percent had access in year 0). Year 0 corresponds to the year the mother gives birth to her first child, year 1 corresponds to the year the mothers first born child turns one and so forth.

Table B.5: Summary statistics separately for low- and higher-educated mothers

	(1) All	(2) Low	(3) High
Mother's age at first birth	23.70	22.76	24.65
	(4.35)	(4.67)	(3.78)
Year of birth	1945.57	1946.35	1944.79
	(5.42)	(5.93)	(4.72)
Years of education	10.78	8.22	13.37
	(2.94)	(1.53)	(1.28)
Urban neighborhood	0.22	0.22	0.22
	(0.41)	(0.41)	(0.42)
Missing father id	0.01	0.02	0.01
	(0.11)	(0.12)	(0.10)
Number of children	2.20	2.28	2.12
	(0.85)	(0.93)	(0.75)
Years between first and next child	3.76	3.80	3.73
	(2.44)	(2.62)	(2.26)
Not living with child's father	0.20	0.24	0.16
	(0.40)	(0.43)	(0.37)
Additional education after birth of first child	0.12	0.20	0.04
	(0.33)	(0.40)	(0.21)
Lenght of working life (years) after first child	25.19	23.12	27.27
	(10.26)	(10.59)	(9.47)
Observations	370602	186127	184475

NOTE— The table shows the means and standard deviations of the same variables as in table 1 separately for low- and higher-educated mothers. Higher-educated mothers are defined as mothers with post-secondary education.

D   Different participation definitions

Figure C.1: The effects of daycare on alternative definition of the participation rate
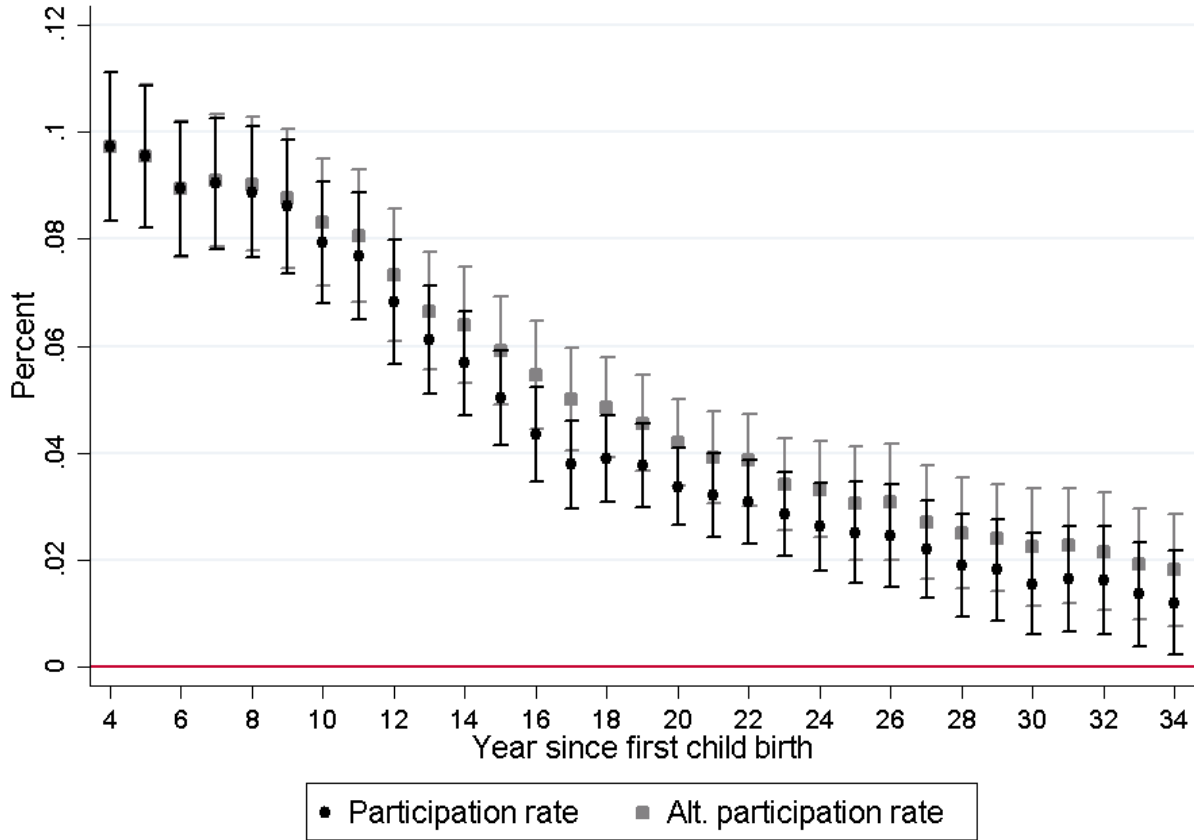
NOTE— The figure shows the effects of daycare in the year the first born child turns four on two different definitions of the participation rate. The black dots are the estimates presented in figure 4 based on a dummy for positive earnings in years from 1980 or contributions to the ATP in the years prior to 1980. The gray squares are estimates based on a dummy for contributions to the ATP for all of the years. The point estimates are scaled by the means of the dependent variable in the corresponding year. All regressions include an indicator of urban area and a full sets of dummies for mother's age at first birth, mother's year of birth, and the year she has her first child. Additionally, all regressions include municipality fixed effects.