The Price of Parenthood: Childcare Costs and Fertility *

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Abstract

Across the developed world, fertility rates have been declining beyond replacement level. The U.S. rate has fallen to a historic low, leading to concerns over a shrinking workforce and aging population. Potential parents cite financial constraints as a barrier to having any or more children. One of the most substantial and early costs for parents is childcare. In this paper I study how the cost of childcare affect mothers' decision to have children, and when to have them. I study state-level regulations that effectively increase the cost of childcare and find that an increase in the cost of childcare reduces birth rates. The estimates suggest that a $10 increase in the 2010 weekly price of childcare leads to a 3.7% decrease in the birth rate, or 2 births per 1000 women. I find larger declines in birthrates to women aged 30 and above, which I show could be explained by reductions in second and third births. I also find evidence of mothers delaying their first birth in response to higher childcare prices.

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1 Introduction

Developed countries across the world are experiencing a fertility crisis, as fertility rates decline further below replacement level (2.1 births per woman) The U.S. total fertility rate has been falling since 2007, down to 1.7 births per woman in 2022 (World Bank, 2024). Low fertility rates cause consternation amongst policymakers as, without increased immigration, they can precipitate a shrinking future workforce and aging population. Both of these factors can contribute to slower economic growth and place pressure on social services.

Low birth rates are likely driven by a number of factors, yet would-be parents cite financial reasons as a top factor inhibiting them from starting or expanding their family (Institute for Family Studies, 2022). A large cost that parents face in the early years of child-rearing is childcare. 37% of parents cite cost as the top barrier to finding childcare (National Center for Education Statistics, 2020). Childcare costs represent a substantial financial burden; U.S. families spend 9% to 16% of their median income on full-time care for one child alone (U.S. Department of Labor, 2024). Low-income mothers and families are particularly burdened; 70% of families in the bottom income quintile pay more than the child care affordability benchmark[1]. Given these high costs, many parents rely on informal childcare. 32% of children aged 0 to 4 are cared for by a non-parent relative (U.S. Census Bureau, 2022), who may still be working. Alternatively, the mother (typically) reduces their working hours or drops out of the labour market to care for the child(ren) themselves. Thus the accessibility and affordability of childcare is also an important factor when considering female labour force participation. Yet evidence on the relationship between childcare costs and fertility remains limited.

In this paper, I study whether the cost of formal childcare affects mothers' decision to have children, how many to have, and when to have them. I explore this question in the U.S. context between the years of 2010 and 2022, using Vital Statistics birth records data and county-level data on childcare

[1] The U.S. Department of Health and Human Services defines the child care affordability benchmark as less than 7% of family income (Center for American Progress, 2023).

prices. I use a two-stage least squares approach that relies on hand-collected data on childcare facility regulations to instrument for childcare prices charged by childcare centres. My results show that family formation is sensitive to formal childcare prices. I find that a $10 increase in the weekly price of formal childcare leads to a 3.7% decrease in the birthrate (in 2010 prices). This is equivalent to 2 births per 1000 women. Analysis of birthrates by age reveal interesting heterogeneity; older women, aged 30 and above, are more price responsive than younger women. I explore potential mechanisms that can explain this age gradient and show that second and third births are more impacted by price changes than first births. I also document that older parents spend more on formal childcare in general, and so the absence of a significant effect on younger mothers may be explained by use of informal or parental care.

This paper builds on several strands of the literature. Broadly, I contribute to the literature studying how financial barriers and incentives affect fertility. Child subsidies (Cohen et al., 2013; Milligan, 2005), cash transfers (González, 2013; Ang, 2015), paid maternity leave (Raute, 2019), housing credits (van Doornik et al., 2024), and tax incentives (Laroque and Salanié, 2014; Whittington et al., 1990) have been found to have pro-natal effects. Welfare reforms have been found to have null to small effects on childbearing (Kearney, 2004; Rosenzweig, 1999; Joyce et al., 2002; Moffitt, 1998), except for a reform that reduced welfare for immigrants (Amuedo-Dorantes et al., 2016). Furthermore, Kearney and Wilson (2018); Dettling and Kearney (2014) show that economic conditions and families' assets causally impact U.S. birthrates. Yet there is less work examining childcare costs and policies, partially as finding exogenous variation in costs is challenging.

This paper is the first to study the causal relationship between childcare prices and fertility, to the best of my knowledge. To do so, I use a new dataset containing the geographical distribution of childcare prices. I also utilise a different empirical approach than what has been taken in the literature; I use an instrumental variables strategy with a novel instrument based on childcare regulations.

This paper is also the first, to the best of my knowledge, to study the causal effect of childcare costs in the U.S. context. Early work by Blau and Robins (1989) suggests that childcare costs are birthrate reducing in the U.S., but most empirical evidence on childcare policies and fertility comes from the European context, where public provision of childcare is more common and spending on policies to support families is higher. The introduction of universal childcare in Germany led to an expansion in fertility, for second and third births in particular (Bauernschuster et al., 2016). A reform that capped childcare costs increased first births in Sweden, with stronger effects for low-income families (Mörk et al., 2013). Rindfuss et al. (2010) study the increased availability of childcare spaces in Norway, estimating that this would encourage higher levels of childbearing.

However, the conclusions and magnitudes from these papers may not carry across to the U.S., where childcare is chiefly delivered through the private market, and the responsibility for paying for childcare is placed on parents (Davis and Sojourner, 2021). The U.S. spends 0.33% of GDP on early care and education for 0 to 5 year olds relative to 1.3% or more in France, Norway and Sweden and the OECD average of 0.74% (OECD, 2019)[2]. Evidence from the marketisation of childcare in the U.S., though, suggests that the relationship between childcare costs and fertility rates holds. The marketisation of childcare and immigrant inflows has allowed educated women to remain in the labour force and work longer hours (Cortes and Tessada, 2011). A few authors explore the fertility responses (Furtado, 2016; Furtado and Hock, 2010; Bar et al., 2018; Hazan and Zoabi, 2015), finding that immigrant inflows are associated with an increased likelihood of having a child and that changes in the relative cost of childcare can explain highly educated women's ability to have more children and increase their working hours. To this empirical literature, I bring novel evidence on how childcare price elastic potential mothers and parents are with respect to childbearing in a setting where access to high quality, affordable

[2]Public expenditure on early childhood education and care defined as all public spending towards formal day-care services and pre-primary education services. Data adjusted for cross-national differences in school starting age.

childcare is limited for most.

2 Background

In the U.S., there is limited public involvement in the provision of childcare. The childcare market is mostly made up of small private businesses (both profit and non-profit) (Tekin, 2021) and can be divided into formal and informal markets. Formal childcare settings include day care centres, preschool, nurseries and family child care homes.

Centre based care options are usually provided by businesses, places of worship, or community-based organisations. Centre-based childcare is typically split up into classrooms by child age (infants, toddlers, preschool, school-age) with teaching staff member(s) overseeing the children (Brown and Herbst, 2022). High-quality, centre based care has been found to have positive effects on children's education, future earnings (Bailey et al., 2021; Garces et al., 2002) and health (Carneiro and Ginja, 2014). However, there is a low supply of high-quality care and it is often the most expensive option for parents. In family child care homes, the childcare takes place in the provider's home and children are typically in mixed age groups. Often, the provider also cares for their own children alongside the other children.

Formal childcare facilities are licensed and regulated by state and federal governments to ensure that they meet minimum health and safety requirements. These requirements span a range of domains, including building safety, sanitation, health, background checks, and staff qualifications, training, and supervision. They are designed to support child safety, well-being and development. Family child care homes tend to face less stringent regulations than child care centres.

Informal childcare is care that is unlicensed and unregulated, and provided in the child or caregiver's home by nannies, babysitters, au-pairs, family members or friends. Informal care can often be cheaper, particularly if there are multiple children being cared for at the same time, and a more flexible option for mothers and families.

Public funding for childcare is targeted at low-income families and comes chiefly from the federal government. The main childcare assistance programme is the Child Care and Development Fund (CCDF), a subsidy scheme for low-income households. Eligibility is based on income and child age (less than 13). Furthermore, households must need the childcare to work or engage in work-related activities (Tekin, 2021). In 2022, 1.4 million children were served by the CCDF (Administration for Children and Families, Office of Child Care, 2022a). 96% of these children were funded through vouchers (Administration for Children and Families, Office of Child Care, 2022c), which parents can use to purchase private childcare from their choice of provider (formal and informal). Of families with income that were served by the CCDF, 31% paid no additional copayment for their childcare (Administration for Children and Families, Office of Child Care, 2022b). Government funding for childcare is also directed towards the Temporary Assistance to Needy (TANF) and Head Start programmes for low-income families. Head Start is the only federal public provider of childcare, and serves a small proportion of the population. Head Start associated programmes (Head Start, American Indian and Alaska Native Head Start, and Migrant and Seasonal Head Start) served 778,420 children under five in 2023 (Administration for Children and Families, 2023), or 4% of the U.S. under five population (U.S. Census Bureau, 2025b). Parents who pay for childcare to work or search for work are eligible to claim a tax credit of up to $1,050 for one child, or $2,100 for two or more children (under 13) [3]. Parents can also save money for childcare services in a Dependent Care Flexible Spending Account (DCFSA), a pre-tax benefit account that can be used for spending on before and after school care, babysitting, nannies, formal childcare, and summer day camps.

Data from the Early Childhood Program Participation (ECPP) component of the National Household Education Surveys (NHES) in 2019 shows that

[3] The percent of childcare expenses that is eligible for the tax credit varies by household income and subject to a maximum that depends on the number of children. Households with gross income of up to $15,000 can claim 35% of $3,000 (one child), or $6,000 (two or more children). Households with gross income of $43,001 and over can claim 20% of these same maximum amounts.

53% of children under 3 participate in some form of non-parental care or programme arrangement, for an average (mean) of 16 hours a week. Amongst these children, for their primary form of care, 37% went to a centre based programme, 13% received care from a relative, 40% were in a family child care home, and 6% received other non-relative care (e.g. friends or nannies).

3 Data and sample construction

3.1 Data

My source of data on fertility is the restricted use National Vital Statistics System (NVSS) birth records data. The NVSS contains information on the universe of births in the U.S. I use these data to conduct individual and county-level analysis. The NVSS has county identifiers, so I combine these data with Census population counts to calculate county-level birth rates for the years 2010 to 2022 inclusive. I exclude 2020 due to the global COVID-19 pandemic. Childcare facilities were closed or had reduced capacity during the pandemic, and stay-at-home orders may have affected fertility decisions. In addition, the data has detailed demographic information on the mother (e.g. marital status, age, race, ethnicity, and birth history), which I use in individual level analysis. Fertility decisions take place at the time of conception, rather than at birth. I calculate the estimated date of conception by subtracting the mother's gestation length in weeks from the midpoint of the month of birth. My main outcomes is the log of county-level birthrates (per 1000) to women aged 20 to 49. I also present results for birth rates disaggregated by age bands, parity (first, second, and third birthrates), and race and ethnicity. Using the individual level birth records data I can explore whether potential mothers delay births or increase time between births (in order to save money) in response to higher costs of childcare. The individual level outcomes are age at first child, time between the first and second child, and time between the second and third child.

The childcare price data is from the National Database of Childcare Prices (NDCP), which is reported at the county-level. The NDCP is collated by the

U.S. Department of Labor (DOL) Women's Bureau (WB) and sourced from historic market surveys conducted by U.S. states. States have collected data on childcare market prices since 1998, as a requirement by the Administration for Children and Families (ACF) at the U.S. Department of Health and Human Servies. The ACF needs these data to calculate state reimbursement rates for the CCDF grants, and in order for states to receive this funding they must provide information on the prices charged at childcare facilities across the counties in their state. Thus it is in states' interest to collect these data. The ACF demands that states conduct the surveys every three years (this figure was 2 years until 2016), but some states provide annual data. The market surveys focus on the regulated, formal childcare market, and data is most complete for childcare centres. Despite the requirement to collect these data, and the incentives to do so, there are missing data at the county, year, and child-age level. Furthermore, states varied in their approach to collecting these data. For example, not all states collected the price data by all ages. As a result of these inconsistencies and missingness, the DOL WB has imputed data for missing years, counties, and ages. I discuss how I handle the imputed data in the following subsection. I use the median price of full-time centre based care, aggregated for 0 to 2 year olds inclusive. I focus on prices for children under 3 as these are the initial costs that prospective parents would face.

My empirical strategy relies on state level regulations that shift the cost of providing childcare. A quality public dataset that tracks the regulations placed on formal childcare facilities for all years does not exist, so I hand collected the maximum group size (the maximum number of children allowed in a room) and child-staff ratio (the ratio of children per staff member) for each U.S. state for each year from 2010 to 2022. I sourced these data from the text of the regulations as well as policy documents found online [4]. I describe the instrument in detail in Section 4.

I supplement these data with the American Community Survey (5-year) to capture information on county-level socioeconomic and demographic characteristics. For exploring mechanisms, I rely on data from the U.S. Bureau

[4] Thank you to Kyle Gillard for research assistance in verifying these hand-collected data.

of Labor Statistics Consumer Expenditure Surveys (CES). The CES provides detailed information on categories of expenditures for individual survey respondents, as well as demographic characteristics of these respondents. I use the 2010 and 2022 surveys, as these years bookend my study period. In these data I can observe spending on childcare centres by respondent age. Specifically, I define spending on childcare centres as any spending tagged with the uniform commercial code of "670310" for day care centres, nursery, and preschools.

3.2 Sample construction

The birth records sample consists of women aged 20 to 49 who gave birth between 2010 and 2019, 2021 or 2022 inclusive. I then create a county-level sample for analysing birth rates, and individual level samples to analyse birth timing decisions.

In order to accurately measure when birthing decisions are made and the prices facing potential mothers, I must use the non-imputed childcare price data. I restrict my sample to state-years for which the NDCP data is not imputed on the following criteria: year, geography, and child age. First, I exclude imputed years of data from my sample as they will not reflect the actual prices facing mothers in those years. This is particularly important given that my empirical approach relies on childcare regulatory changes over time. Second, I drop observations where the county-level prices are imputed, to ensure that I am capturing the local area prices facing potential mothers. A subset of states only provided the price data at the state level. The majority of the childcare price data is at the county level, and there is sufficient geographical variation in prices within a state to conduct county-level analysis. Third, I exclude observations that impute data based on child age. To impute missing prices for age groups, the DOL WB assigned the price for a different age group. As I focus on childcare prior to age 3, I don't want imputed prices that reflect older ages (particularly school age) to be in my analytical sample.

This exercise leaves me with data on births and birthrates for 30 states [5], 1,415 unique counties, and 7,491 county-years for the main county level

[5] Alaska, Alabama, Arizona, California, Connecticut, Delaware, Florida, Idaho, Illinois,

analysis. For the individual level analysis, I create separate samples of first, second and third time mothers to analyse birth spacing decisions for these subgroups. I have 4,185,177 first time mothers, 3,488,330 second time mothers, and 1,904,051 third time mothers.

3.3 Descriptive statistics

Table 1 shows summary statistics for my sample of counties. The sample counties have lower earnings and more unemployment than the whole U.S. The mean earnings in the sample is $29,531, and the median is $28,265. In 2022, the sample median earnings was $38,087. The median for the whole U.S. in 2022 was $47,960 (U.S. Census Bureau, 2023). The unemployment rate for the whole U.S. in 2022 was 3.6 percent of the labour force (U.S. Bureau of Labor Statistics, 2023). In the sample counties, this figure is 6.6 percent. The sample is also more White and less Black, Asian, and Hispanic than the wider U.S. population. Across the whole U.S., in 2022, 75% of the population identified as White, 14% identified as Black, 6% identified as Asian, and 19% identified as Hispanic (U.S. Census Bureau, 2025a). The sample mean share of Whites is 85%, for Black individuals the share is 7%, for Asians the share is 2% and for Hispanics, 11%.

The mean childcare price for full-time care at a childcare centre for 0 to 2 year olds in Table 1 is adjusted for inflation using base year 2010 and winsorised at 99th percentile, as this is what is used for the later analysis. The unadjusted mean childcare price in 2022 was $200, and the median $188. For 2010, these figures were $143 for the mean and $137 for the median.

Kansas, Kentucky, Louisiana, Massachusetts, Maryland, Maine, Minnesota, Nevada, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Vermont, Washington, Wisconsin

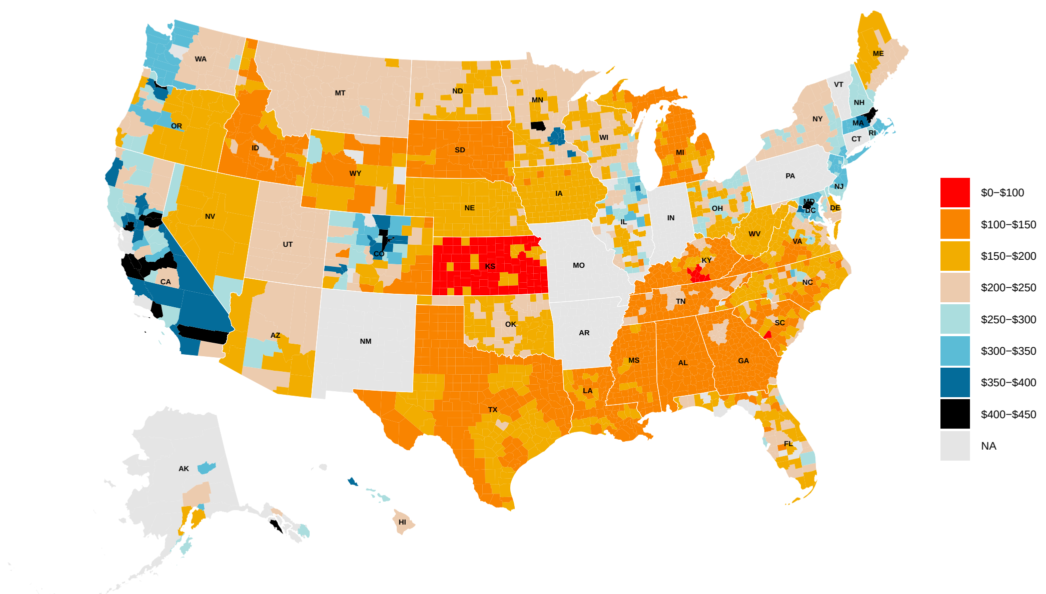
Table 1. Descriptive statistics

Statistic	Mean	St. Dev.
Female population	30,807	94,162
Births	1,687	5,251
Max. group size	16.10	7.55
Childcare price	146.66	49.19
Earnings	29,531	6,387
Unemployment rate	6.57	2.82
Male-Female ratio	1.07	0.17
Female LFP (%)	70.74	6.88
White (%)	85.19	12.72
Black (%)	7.20	10.80
Asian (%)	1.53	2.60
Hispanic (%)	11.17	15.40

Notes: N=7,491. Data: American Community Survey 5-year estimates, Census, NDCP, hand collected data, for 2010-2019, 2021-2022. This table shows summary statistics for sample counties. "Female population" is the number of women aged 20 to 49. "Births" is the number of births to women aged 20 to 49. "Max. group size" is the maximum group size average for 0-2 year olds. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Earnings" is median earnings for the population aged 16 and above. "Unemployment rate" is the unemployment rate of the population aged 16 and above. "Male-Female ratio" is the ratio of men to women aged 20 to 49 years old. "Female LFP (%)" is the labour force participation rate of the female population aged 20 to 64 years old. "White (%)" is the percent of the population that identifies as White. "Black (%)" is the percent of the population that identifies as Black. "Asian (%)" is the percent of the population that identifies as Asian. "Hispanic (%)" is the percent of the population that identifies as Hispanic or Latino regardless of race.

Figure 1 shows the geographical distribution of childcare prices for full-time centre based care for children under 3 across the U.S. in 2022. There is substantial variation in prices, with parents living on the East and West coasts facing much higher prices. Prices have increased and become more dispersed over time, as shown in the distribution of prices plotted in Appendix Figures E1 and E2.

Figure 1. Avg. weekly price of full-time centre based childcare for 0-2 years, 2022



Notes: Data: NDCP for 2022, including the imputed data. This map shows the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds by U.S. county.

4 Empirical strategy

I evaluate the causal effect of childcare prices on birth outcomes using a two-stage least squares (2SLS) approach. A naive Ordinary Least Squares (OLS) regression of birth outcomes on childcare prices could suffer from statistical endogeneity. One source of such endogeneity is simultaneity. Childcare prices are determined in equilibrium, thus price changes can reflect either a supply or demand response (or both). A lower birth rate would lead to reduced demand for childcare and could lead to lower prices, and/or a shock to the cost of childcare could increase prices and reduce the birth rate. Measurement error may also arise. In particular, noisy measurement of childcare prices. As discussed in Section 3, the NDCP dataset is constructed from state surveys of childcare facilities. We can imagine that this is an imperfect process, with limitations on collecting fully accurate information. To overcome these issues, I instrument childcare prices with regulations placed on formal childcare facilities.

Regulations placed on childcare facilities affect the cost of providing childcare. Increasing health and safety requirements, setting stricter child-staff ratios and limiting the number of children allowed in a room can all raise the cost of running a childcare centre. In the main analysis, I instrument the price of childcare in a county with the state mandated maximum number of children permitted in a room, the maximum group size, in a given year. To test the robustness of my results, I use both the state mandated maximum group size and child-staff ratio as instruments. These regulations apply to all formal childcare centres and I use the average group size and child-staff ratio for children less than 3 years old. When the mandated maximum group size is reduced, the childcare facility has to decrease the number of children they can cater for, which can lead the childcare price to rise. When the child-staff ratio increases, fewer children per staff member are permitted, which can also lead the price to increase. This is the intuition behind the instruments.

4.1 Specification

The empirical model for analysing effects on birth rates is described by the following equation:

$$ln(Birthrate)_{ct} = \zeta + \beta \cdot CostofChildcare_{ct} + \eta \cdot X_{ct} + \gamma_{1t} + \delta_{1c} + \epsilon_{ct} \quad (1)$$

$$CostofChildcare_{ct} = \alpha + \mu \cdot Z_{ct} + \kappa \cdot X_{ct} + \gamma_{2t} + \delta_{2c} + \varepsilon_{ct} \quad (2)$$

The subscript c denotes county and t denotes year. Z_{ct} is the state level maximum group size in place for childcare centres, or both this maximum group size and the child-staff ratio, averaged for 0 to 2 year olds. I control for time varying county-level characteristics X_{ct}, which includes median earnings, the unemployment rate, female labour force participation, the male-female ratio, the house price index, and the racial and ethnic composition (Black, White, Asian and Hispanic) of the county. I control for county fixed effects δ_c and time fixed effects γ_t to account for time-invariant differences across counties and time trends. I cluster standard errors at the state-year level [6]. The coefficient of interest is β, which captures the local average treatment effect (LATE). The LATE is the causal effect of the cost of childcare on birthrates in counties where the regulations led to a change in prices for formal childcare, weighted by the change in prices.

The empirical model for analysing effects on individual mother i birth timing outcomes is given by:

$$Y_{ict} = \zeta + \cdot\beta CostofChildcare_{ct} + \eta \cdot X_{ict} + \gamma_{1t} + \delta_{1c} + \epsilon_{ct} \quad (3)$$

$$CostofChildcare_{ct} = \alpha + \mu \cdot Z_{ct} + \kappa \cdot X_{ict} + \gamma_{2t} + \delta_{2c} + \varepsilon_{ict} \quad (4)$$

Y_{ict} is either age at first birth (in years), time between the first and second birth (in months), or time between the second and third birth (in months). Z_{ct} is as before. I control for the same county level characteristics as in Equations

[6] Appendix Table D5 shows that my results are robust to clustering at the state level, but doing so makes the number of clusters small given that I do not have all 50 states in my sample.

2 and 1 [7]. In addition, I control for the following additional individual level characteristics: race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic), marital status, and month of birth. Again, I include county (δ_c) and time (γ_t) fixed effects and cluster standard errors at the state-year level. The coefficient of interest β captures the local average treatment effect. Here, the LATE is the causal effect of the cost of childcare on birth timing outcomes amongst mothers living in counties where the regulations led to a change in prices for formal childcare, weighted by the change in prices.

This approach exploits variation in the presence and strength of childcare facility regulations across time and states. In my data, I observe regulatory changes in three states: Delaware (2011), Nevada (2015), and Vermont (2016). For the main analysis with the maximum group size as the instrument, I exploit regulatory changes in Nevada and Vermont. For the robustness analysis with both instruments, I exploit changes in Nevada, Vermont, and Delaware. Across my study period there were four more states (Arizona, Virginia, Louisiana, Utah) that made changes to the mandated maximum group size or child-staff ratio for children under 3, but due to missing data in the NDCP (as described Section 3) I only observe pre- and post- price data in these three states.

4.2 Identification

To interpret the coefficient β as the local average treatment effect of childcare prices on birth outcomes, several assumptions must be satisfied. The key identifying assumptions for 2SLS are relevance and the exclusion restriction. The instrument is relevant if it is highly correlated with the endogenous regressor, childcare prices, in our empirical specification. In Appendix Table D1, I show evidence of a strong first stage; the F statistic is 21 for the main analytical sample.

The exclusion restriction is satisfied if the childcare regulations impact birth outcomes only through the price of childcare, and not via other channels. It is not possible to directly test this assumption, but we can consider potential

[7] In the individual level analysis I do not control for racial and ethnic composition at the county level. Instead I control for these variables at the individual level.

violations. One may be concerned that changes in the regulations on childcare centres affect prices of family childcare and informal care. Rising prices of centre-based care may lead parents to substitute to other forms of care, with subsequent effects on prices. In this paper, I view the price of centre based childcare as a proxy for the price of childcare more broadly. The NDCP data indicates that childcare centre prices are representative of the formal care market. In Appendix Figure E3 I show that centre and family based care prices in the NDCP are highly and statistically significantly correlated. Yet a limitation of these data is that I cannot see prices of informal care, and a publicly available dataset of informal childcare prices does not exist. This data constraint limits my ability to directly test the informal care channel. That said, I can assess this channel indirectly. If there were spillover effects onto the informal and family care markets, we would still expect to observe effects on birth rates amongst groups that rely less on centre based childcare. However, in Section 5, I show evidence of no statistically significant effects on younger mothers, and I show that these mothers consume less centre based care. These data are consistent with the identifying assumption that the childcare facility regulations affect birthrates chiefly through the formal care channel, rather than shifts in the informal care market.

The instrument must also address conditional independence. The childcare facility regulations must be uncorrelated with birthrates and individual birth timing outcomes, conditional on covariates. Including county fixed effects accounts for time-invariant local factors (e.g. cultural norms), and time fixed effects accounts for national level shocks or trends. To further strengthen the credibility of conditional independence, I also include a rich set of control variables that could affect family formation. I control for socioeconomic factors such as earnings and the unemployment rate, racial and ethnic composition, and house prices. These control variables help address systematic differences across counties that may be correlated with the regulations and birthrates. Moreover, given declining rates of fertility in the U.S., one might be concerned that states may relax these regulations to encourage fertility. However, reporting and discussion of the regulations highlights the key goal of these regulations: to protect child health and safety and encourage learning (See Appendix Figure E4). Mandated group size and child-staff ratio requirements support child safety as they ensure staff can adequately supervise and care for the children they are responsible for, reducing the risk of injuries or accidents. The requirements also support child development. Rooms with sufficient space and without overcrowding can promote increased child-staff interaction and safe child-to-child interaction for enhanced learning and development. Additionally, two of the three regulatory changes that I observe increase the stringency of the mandates on childcare providers (e.g. introducing a maximum group size requirement).

In the presence of heterogeneous treatment effects, to interpret the instrumental variables (IV) estimates as the LATE, we also require the monotonicity assumption. In this setting, the monotonicity assumption demands that a decrease in the maximum group size weakly increases or weakly decreases childcare prices for all counties. Given that a decrease in the maximum group size will reduce profits for childcare providers, I expect such a change to increase childcare prices for all. It seems implausible that the regulations would have the opposite effect. To assess this assumption, in Appendix Figure E5, I plot the cumulative distribution functions (CDF) of the birthrates for counties in treated and untreated, or not yet treated, states. The CDFs do not cross, which shows stochastic dominance; the birthrates for counties without regulatory changes are stochastically larger than those for counties with regulations.

Given that I have a small number of "treated" states - states which experience changes in the regulations in my sample - one may worry that there is effect heterogeneity and that the LATE does not closely approximate the Average Treatment Effect. The LATE that I estimate is the weighted causal effect on women in counties in the treated states. In Section 6, I show that my results are not sensitive to dropping states one at a time, which provides some assurance that effect size heterogeneity is not a substantial issue. One may also question whether the treated and control states were on different paths. In Appendix Figures E6, E7, and E8, I plot the event study estimates of the effect of the introduction of childcare facility regulations and birthrates for women aged 30 to 34 (a group driving my results) for each of the three treated states [8]. For Nevada and Delaware, the regulations introduced were more stringent on childcare centres, and in these two states we see no evidence of pre-trends and reductions in birthrates. In Vermont, the state relaxed the group size requirement for 18 month olds, so we may expect to see reductions in birthrates. The estimates are noisy, but point in this direction. Overall, these event studies provide some reassurance that counties in control states in combination with covariates are providing a suitable control for counties in treated states.

5 Results

5.1 Birthrate results

Table 2 shows the OLS, IV and reduced form estimates of the effects of childcare prices on birthrates, broken down by age bands. Column 1 shows the main outcome: the log birthrate for women aged 20 to 49. Columns 2 to 7 show log birthrates by five year age bands. The IV results are estimated with the maximum group size as the instrument. The results estimated using both instruments, shown in Appendix Table D2, are consistent in coefficient size and significance.

The OLS estimates are imprecise and close to null in absolute terms. Both reverse causality and measurement error, discussed in Section 4, could bias the OLS estimates towards zero. The IV estimates show a statistically significant reduction in birthrates. A \$10 increase in the weekly price of childcare (the mean is \$147) leads to a 3.7% decrease in the birthrate for women aged 20 to 49. Relative to the mean birthrate of 57 births per 1000 women, this amounts to 2 births per 1000. We see that this reduction in birthrates is more pronounced amongst women aged 30 and above; a \$10 price increase has a 3.7 percentage point larger effect on birthrates for women aged 30 to 34 than

[8] Note that this is not exactly the same approach as the reduced form analysis I present in Section 5, where I use the continuous variables of the maximum group size (e.g. 15) and child-staff ratio (e.g. 0.25) rather than a binary indicator for presence of a policy.

birthrates for women aged 20 to 24. This difference increases with age. Table 3 shows the effects of childcare prices on birthrates for women aged 20 to 49 decomposed by race and ethnicity. Birthrates for White, Black and Hispanic women reduce in response to increased childcare prices. The estimates differ in absolute value, but are not statistically significant from each other.

The reduced form estimates show that changes in the maximum group size regulations on their own lead to statistically significant effects on birthrates. An increase in the maximum group size average for 0 to 2 year olds by 10 children, which would allow childcare centres to reduce prices, increases birthrates by 3.9%. Again, the regulations are associated with larger effects for older mothers and birthrates for White, Black, and Hispanic women are responsive to prices.

Table 2. Effects of childcare prices on birthrates, by age

	20-49	20-24	25-29	30-34	35-39	40-44	45-49
OLS							
Childcare price	0.00	-0.01	-0.01	-0.01	0.00	-0.01	0.03*
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
R^2	0.976	0.977	0.968	0.957	0.957	0.894	0.693
IV							
Childcare price	-0.37***	-0.08	-0.07	-0.45***	-0.56***	-0.53***	-0.97***
	(0.06)	(0.10)	(0.12)	(0.04)	(0.06)	(0.09)	(0.13)
R^2	0.938	0.977	0.967	0.910	0.906	0.860	0.546
Reduced Form							
Maximum Group Size	0.39***	0.10	0.08	0.46***	0.54***	0.49***	0.72***
	(0.11)	(0.12)	(0.13)	(0.12)	(0.11)	(0.07)	(0.05)
R^2	0.976	0.977	0.968	0.957	0.957	0.894	0.693
Mean	57.38	97.60	122.46	90.02	37.72	7.45	0.43

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of birthrates per 1000 women. Coefficients and standard errors multiplied by 100. "20-49" is the log of the county-level birthrate per 1000 women aged 20 to 49, "20-19" the log of the birthrate per 1000 women aged 20-19, and so on. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to that age band. Standard errors, clustered at the state-year level, in parentheses.

Table 3. Effects of childcare prices on birthrates, by race and ethnicity

	White, 20-49	Black, 20-49	Hispanic, 20-49
OLS			
Childcare price	-0.01	0.01	0.01
	(0.02)	(0.04)	(0.02)
R^2	0.960	0.892	0.952
IV			
Childcare price	-0.52**	-0.25*	-0.55***
	(0.22)	(0.12)	(0.12)
R^2	0.883	0.884	0.901
Reduced Form			
Maximum Group Size	0.46***	0.25**	0.66***
	(0.12)	(0.11)	(0.10)
R^2	0.960	0.892	0.952
Mean	54.30	50.27	70.99

* p < 0.1, ** p< 0.05, *** p < 0.01.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of birthrates per 1000 women, by race and ethnicity. Coefficients and standard errors multiplied by 100. "White, 20-49" is the log of the county-level birthrate per 1000 white women aged 20 to 49. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to that race-age group. Standard errors, clustered at the state-year level, in parentheses.

5.2 Birth timing results

Next, I explore whether birth timing responds to changes in childcare prices using the individual level sample of births. Table 4 displays the OLS, IV, and reduced form results for mother's age at first birth and spacing between births. I caveat this analysis by noting that these estimates also reflect compositional change in the sample of mothers. Mothers who choose to not have a first, second, or third child in response to price increases may differ in unobservable characteristics to those who remain in the sample, and so these estimates should be viewed as descriptive and suggestive of behavioural responses.

I find that a rise in childcare prices is associated with mothers shifting their first birth into the future. The IV estimates reveal that a \$10 increase in the weekly price of centre based care is associated with age at first birth rising by 0.165 years, or roughly 2 months. I find suggestive evidence of an increase in time between the first and second birth, but this estimate is not statistically significant at the 5% level or when including additional individual controls. There is a negative statistically significant effect on time between the second and third birth, which is the opposite direction to the prediction that higher childcare prices may lead parents to delay births. This effect, however, could be explained by sample changes. It may be the result of mothers who would have had larger intervals between births deciding to not have a third birth at all. In addition, the mothers who do choose to have a third birth may be more likely to have shorter birth intervals and also live in high price areas.

The reduced form estimates also show a statistically significant effect of maximum group size regulations on age at first birth and spacing between the first and second birth. An increase in the maximum group size by 10 children is associated with a decrease in the age of first time mothers of 0.182 years (about 2 months), and a decrease in the first birth interval by 0.459 months. We see an effect in the opposite direction for the interval between the second and third birth; the discussion in the previous paragraph on sample compositional change applies here too.

Table 4. Effects of childcare prices on birth spacing outcomes

	Age at 1st birth		Birth spacing (1-2)		Birth spacing (2-3)	
OLS						
Childcare price	-0.02	-0.02	0.06	0.05	0.18	0.15
	(0.04)	(0.04)	(0.12)	(0.12)	(0.21)	(0.21)
R^2	0.124	0.223	0.028	0.039	0.022	0.024
IV						
Childcare price	0.83**	1.65***	4.84*	3.93	-4.82**	-5.35**
	(0.36)	(0.21)	(2.59)	(2.55)	(1.77)	(1.82)
R^2	0.124	0.221	0.028	0.039	0.022	0.023
Reduced Form						
Maximum Group Size	-0.91*	-1.82***	-5.65***	-4.59***	5.94***	6.60***
	(0.48)	(0.44)	(0.67)	(0.86)	(1.78)	(1.61)
R^2	0.124	0.223	0.028	0.039	0.022	0.024
Mean	27.62	27.62	50.62	50.62	52.88	52.88
Controls	Cty	Cty&Ind	Cty	Cty&Ind	Cty	Cty&Ind
N	4,185,177	4,185,177	3,488,330	3,488,330	1,904,051	1,904,051

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Data: NVSS birth records, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on birth spacing outcomes. Coefficients and standard errors multiplied by 100. "Age at 1st birth" is the age at which the mother has their first child in years. "Birth spacing (1-2)" is the number of months between the first and second birth. "Birth spacing (2-3)" is the number of months between the second and third birth. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. "Cty" controls include county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, the mother's race and ethnicity, and county and year fixed effects. "Cty&Ind" controls also include the mother's date of birth and marital status. Standard errors, clustered at the state-year level, in parentheses.

5.3 Mechanisms

The finding that birthrates for older women, aged 30 and above, are more responsive to changes in the price of childcare than those for younger women may seem counterintuitive at first glance. We may expect younger women and their partners to be more financially constrained than their older counterparts. Older women have had more time to build up financial resources. Yet older women will typically have spent more time in the labour market, and so their opportunity cost of having a child at an older age may be high, as they consider lost wages and career progression. This consideration could apply to all births, but higher parity births may be more price responsive. High costs of childrearing, such as childcare, may discourage women from having a second or higher order birth. This theory aligns with the main results presented above, as older women are more likely to be having their second or third child than younger women. Another factor that could explain the age gradient is that older women may be more likely to use formal care, such as childcare centres. Younger mothers may rely more on informal care, perhaps by parents or relatives, or may be more likely to drop out of the labour market to care for the child themselves. This could explain why we do not see much of a birthrate response to childcare price increases for younger women. I test these potential mechanisms by first analysing birthrates by first, second and third births, and then examining use of childcare centres through consumer expenditure data.

5.3.1 Birthrates by parity

Table 5 present the OLS, IV and reduced form estimates for the effect of childcare prices on birthrates for the first birth, by age bands. Tables 6 and 7 show similar estimates for the second and third birthrates, respectively. The IV point estimates indicate that older women are more price responsive than younger women across the first, second, and third births. We also see that for the same increase in childcare prices, second and third birthrates fall by more than first birthrates. Specifically, for a $10 increase in the weekly price of childcare, there is a fall in first birthrates for women aged 20 to 49 by

1.6%. This is a decline of 0.3 births per 1000 relative to the mean. For second birthrates, this figure is 16.6% (2.9 births per 1000) and for third birthrates, 15.1% (1.5 births per 1000). We see a similar pattern in the reduced form results.

Table 5. Effects of childcare prices on first birthrates, by age

	20-49	20-24	25-29	30-34	35-39	40-44	45-49
OLS							
Childcare price	-0.02	-0.02	-0.03	-0.02	-0.04**	-0.04*	-0.02*
	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
R^2	0.941	0.950	0.900	0.931	0.911	0.859	0.720
IV							
Childcare price	-0.16**	0.01	0.17	-0.27***	-0.52***	0.55	-0.64**
	(0.06)	(0.10)	(0.12)	(0.06)	(0.09)	(0.62)	(0.21)
R^2	0.934	0.950	0.892	0.925	0.895	0.829	0.537
Reduced Form							
Maximum Group Size	0.17***	-0.01	-0.18	0.28***	0.51***	-0.51***	0.47***
	(0.05)	(0.11)	(0.12)	(0.09)	(0.11)	(0.05)	(0.13)
R^2	0.941	0.950	0.900	0.931	0.911	0.859	0.720
Mean	18.62	48.15	39.66	19.92	6.40	1.16	0.09

* p < 0.1, ** p< 0.05, *** p < 0.01.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of first birthrates per 1000 women. Coefficients and standard errors multiplied by 100. "20-49" is the log of the county-level first birthrate per 1000 women aged 20 to 49, "20-19" the log of the first birthrate per 1000 women aged 20-19, and so on. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by total births to that age band. Standard errors, clustered at the state-year level, in parentheses.

Table 6. Effects of childcare prices on second birthrates, by age

	20-49	20-24	25-29	30-34	35-39	40-44	45-49
OLS							
Childcare price	-0.08	-0.12	-0.11	-0.08	-0.07	-0.03	0.03
	(0.13)	(0.14)	(0.15)	(0.16)	(0.13)	(0.07)	(0.03)
R^2	0.558	0.697	0.596	0.576	0.713	0.774	0.652
IV							
Childcare price	-1.66*	-2.01	-1.77	-1.48	-1.50*	-0.98**	-0.22***
	(0.91)	(1.17)	(1.19)	(1.12)	(0.82)	(0.33)	(0.06)
R^2	0.387	0.589	0.480	0.475	0.608	0.703	0.605
Reduced Form							
Maximum Group Size	1.74	2.26	1.92	1.52	1.46	0.91*	0.17***
	(1.11)	(1.44)	(1.43)	(1.28)	(0.96)	(0.47)	(0.03)
R^2	0.558	0.697	0.595	0.576	0.713	0.774	0.651
Mean	17.30	30.26	39.07	26.99	9.42	1.47	0.06

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of second birthrates per 1000 women. Coefficients and standard errors multiplied by 100. “20-49” is the log of the county-level second birthrate per 1000 women aged 20 to 49, “20-19” the log of the second birthrate per 1000 women aged 20-19, and so on. “Childcare price” is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. “Maximum Group Size” is the state-level maximum group size average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by total births to that age band. Standard errors, clustered at the state-year level, in parentheses.

Table 7. Effects of childcare prices on third birthrates, by age

	20-49	20-24	25-29	30-34	35-39	40-44	45-49
OLS							
Childcare price	-0.07	-0.08	-0.08	-0.10	-0.05	-0.04	0.00
	(0.11)	(0.11)	(0.13)	(0.14)	(0.11)	(0.06)	(0.01)
R^2	0.655	0.770	0.680	0.608	0.626	0.660	0.461
IV							
Childcare price	-1.51*	-1.00	-1.77	-1.80*	-1.39*	-1.07***	-0.47***
	(0.74)	(0.93)	(1.02)	(0.95)	(0.72)	(0.34)	(0.10)
R^2	0.495	0.740	0.558	0.437	0.479	0.519	0.168
Reduced Form							
Maximum Group Size	1.59	1.13	1.93	1.85	1.36	1.00**	0.35***
	(0.92)	(1.10)	(1.24)	(1.15)	(0.86)	(0.39)	(0.09)
R^2	0.654	0.769	0.680	0.607	0.626	0.660	0.461
Mean	10.16	10.86	22.73	19.63	8.20	1.37	0.05

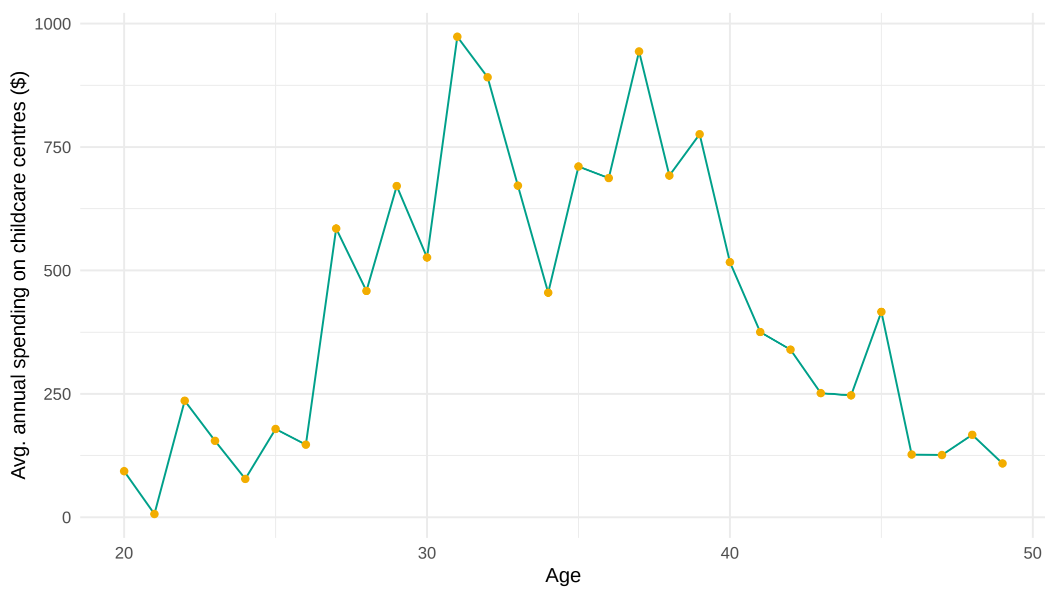
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of third birthrates per 1000 women. Coefficients and standard errors multiplied by 100. “20-49” is the log of the county-level third birthrate per 1000 women aged 20 to 49, “20-19” the log of the third birthrate per 1000 women aged 20-19, and so on. “Childcare price” is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. “Maximum Group Size” is the state-level maximum group size average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by total births to that age band. Standard errors, clustered at the state-year level, in parentheses.

5.3.2 Spending on childcare

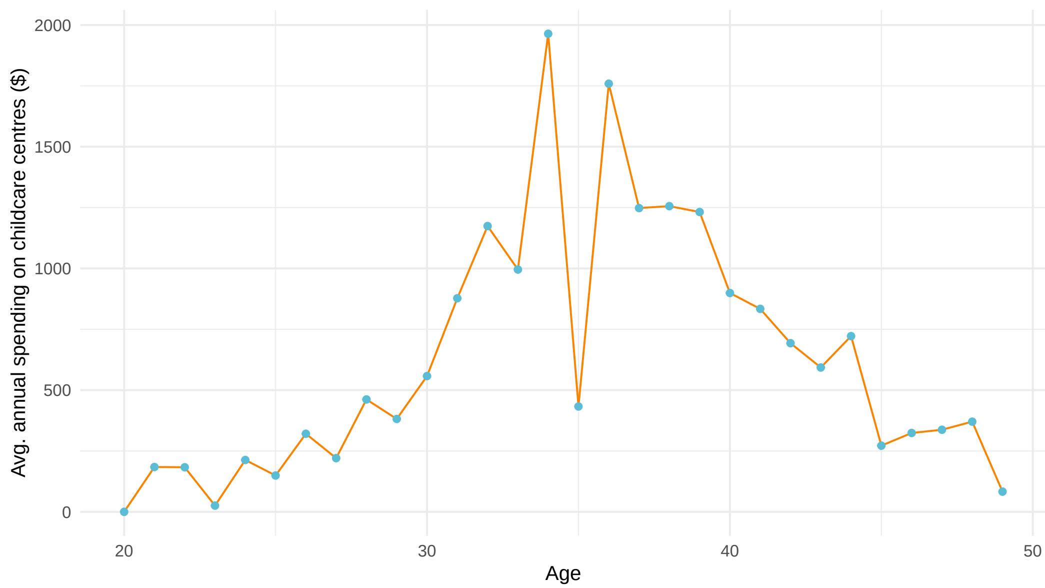
I explore whether older mothers tend to use more formal childcare by examining spending on childcare centres by age using the CES data. Figure 2 shows the average annual spending on childcare centres in 2010 by age, and Figure 3 shows the same plot for 2022. We observe a noticeable pattern by age; spending on childcare centres remains low for parents in their early to mid twenties, rises sharply for those in their thirties, before falling for those in their forties. This age trend is seen in both 2010 and 2022, but there is a more pronounced increase in spending for parents in their thirties in the latter period. These figures lend support to the notion that birthrates for mothers aged 30 and above are more reactive to changes in childcare centre prices than birthrates for younger mothers because older mothers are more likely to use formal care in the first place.

Figure 2. Avg. annual spending on childcare centres in 2010, by age



Note: Data: Consumer Expenditure Survey for 2010. This figure shows the average annual spending on childcare centres by age of the respondent. Childcare centres defined as day care centres, nurseries, and preschools.

Figure 3. Avg. annual spending on childcare centres in 2022, by age



Note: Data: Consumer Expenditure Survey for 2022. This figure shows the average annual spending on childcare centres by age of the respondent. Childcare centres defined as day care centres, nurseries, and preschools.

6 Robustness

I explore the robustness of my findings to various alternative approaches and specifications. First, my IV and reduced form results are robust in effect size and significance to the inclusion of both instruments, rather than just the maximum group size instrument (see Appendix Table D2). Next, in Appendix Table D3, I repeat the IV analysis of the effects of childcare prices on birthrates for women aged 20 to 49 on subsamples of states, dropping one state at a time. This exercise demonstrates that my results are not driven by any one state; they are consistent and statistically significant at the 5 percent level across all subsamples. Appendix Table D4 illustrates that my main results are robust to different levels of winsorising of childcare prices, and not winsorising at all. My main approach winsorises childcare prices at the 99% level as there are notable outliers, as shown in Figure E2. The IV estimates are slightly larger when I don't winsorise prices, but once the influence of the outliers is reduced, there is little difference in coefficient values from winsorising at the 95th, 98th, or 99th percentile. Appendix Table D5 shows that my results withhold a more stringent approach to clustering. My primary approach is to cluster standard errors at the state-year level, given concerns for the bias that can result from having too few clusters (clustering at the state level delivers 30 clusters). The IV and reduced form estimates remain significant at the 5 percent level or lower if I cluster standard errors at the state level. Finally, the first stage is not sensitive to alternative handling of states with no maximum group size regulations. Some states have no maximum group size restrictions in place, including states which experience changes in the regulations across the study period. In order to retain county observations in these states in my analytical sample, I set these missing values to 30 in my baseline specification. This number seems reasonable given that the maximum value in my data is 22. Appendix Table D6 demonstrates that the strength of the first stage is not sensitive to setting these missing values to alternative numbers, and neither are the main IV estimates (see Appendix Table D7).

7 Conclusion

Low and falling fertility rates across the developed world are generating concern about future economic growth and the financial viability of social support systems. Policymakers looking to boost birthrates are considering a wide range of policies. Prior work has shown that financial support for families has been shown to have positive effects on family formation (González, 2013; Ang, 2015; van Doornik et al., 2024; Cohen et al., 2013; Milligan, 2005). In this paper I explore how the cost of childcare, a large and early cost facing potential parents, affects the decision to have children. I investigate this question in the U.S. setting between 2010 to 2022. The results of my analysis suggest that higher prices for formal care reduce birthrates. I also find suggestive evidence that mothers respond on a second margin: by delaying their first birth. Heterogeneity analysis reveals varying effects by age; births to women aged 30 and above are more price responsive than those to younger women. I show that this age gradient in my results could be explained by existing mothers choosing to forgo their second or third child, as I find larger point estimates for higher parity birthrates. A second factor may also be at play: that older parents are more likely to use formal childcare in the first place. I provide supportive evidence to this theory by showing that spending on childcare centres is higher amongst older parents.

A limitation of my analysis is that I am only able to analyse the formal market for childcare, as the NDCP does not capture prices in the informal market and other public data does not exist. When prospective parents consider the cost of childcare, they may search for prices of both formal and informal care. There may be a substitution to informal care when prices in formal childcare centres rise. By showing a lack of significant effects amongst younger mothers, who are less likely to use centre based care, I provide some reassurance that my results capture the direct channel of childcare centres. Further, I expect that prices of formal care are likely to be more readily accessible to parents at the time of conception.

I caution against extrapolating these findings outside the U.S., as childcare markets and policies vary substantially across countries. The dominance of the private childcare market in the U.S. allows me to cleanly study this question with the data I have. However, in countries with greater public involvement in the provision of childcare we would imagine there may be spillover effects on public childcare when prices in the private market shift.

The decline in U.S. fertility rates is seen across demographic groups and cannot be solely explained by women delaying children to later years. Total fertility rates, which measure births over women's lifetime, are also falling (Kearney and Levine, 2022). Current cohorts of women will need to have more births after age 30 than previous cohorts to match total fertility rates of cohorts prior to 2007 (Kearney and Levine, 2021). Considering my findings against this broader context, reductions in birthrates, particularly declines in second and higher order birthrates, paint a poor outlook for returning to replacement level birthrates. Thus preventing rising childcare costs and considering more financial support for childcare in the U.S. are avenues worth exploring for policymakers looking to address low fertility rates.

A Appendix Tables

Appendix Table D1. First stage

	Childcare price	
Maximum Group Size	-1.05***	-0.01
	(0.23)	(0.17)
Child-Staff Ratio		741.89***
		(2.90)
Mean	146.66	146.53
F-stat	21.12	32800.12
N	7,491	8,090

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Data: NDCP childcare prices, hand-collected regulation data, for 2009-2019, 2021-2022. This table shows the first stage of childcare prices on the maximum group size and child-staff ratio, with the single instrument in the first column (2010-2019, 2021-2022) and both instruments in the second columnn (2009-2019, 2021-2022). "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. "Child-Staff Ratio" is the state-level child-staff ratio average for 0 to 2 year olds. "F-stat" is the F statistic for the first stage. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to women aged 20 to 49. Standard errors, clustered at the state-year level, in parentheses.

Appendix Table D2. Effects of childcare prices on birthrates, by age (both instruments)

	20-49	20-24	25-29	30-34	35-39	40-44	45-49
OLS							
Childcare price	-0.00	-0.02	-0.01	-0.02	-0.00	0.00	0.02*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.974	0.975	0.965	0.954	0.956	0.891	0.687
IV							
Childcare price	-0.39***	-0.12***	-0.07	-0.46***	-0.55***	-0.59***	-1.09***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
R^2	0.928	0.974	0.964	0.901	0.903	0.845	0.490
Reduced Form							
Maximum Group Size	0.15***	0.30***	0.33***	0.18***	0.14***	-0.64***	-0.19
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Child-Staff Ratio	-178.93*	146.47	201.58*	-213.59**	-295.61**	-836.03***	-699.92***
	(0.99)	(1.28)	(1.02)	(0.77)	(1.16)	(0.81)	(1.20)
R^2	0.974	0.975	0.965	0.954	0.956	0.892	0.687
Mean	57.28	99.24	122.46	89.65	37.35	7.40	0.43

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Notes: N=8,090. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2009-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of birthrates per 1000 women. Coefficients and standard errors multiplied by 100. "20-49" is the log of the county-level birthrate per 1000 women aged 20 to 49, "20-19" the log of the birthrate per 1000 women aged 20-19, and so on. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. "Child-Staff Ratio" is the state-level child-staff ratio average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to that age band. Standard errors, clustered at the state-year level, in parentheses.

Appendix Table D3. Robustness of IV estimates of the effect of childcare prices on birthrates to leave-one-state-out analysis

Dropped State	Coefficient	Standard Error	P-value
All states	-0.37	0.06	0.00
AK	-0.37	0.06	0.00
AL	-0.37	0.06	0.00
AZ	-0.42	0.04	0.00
CA	-0.44	0.14	0.01
CT	-0.36	0.05	0.00
DE	-0.37	0.06	0.00
FL	-0.22	0.10	0.05
ID	-0.37	0.06	0.00
IL	-0.28	0.06	0.00
KS	-0.37	0.06	0.00
KY	-0.38	0.06	0.00
LA	-0.38	0.06	0.00
MA	-0.39	0.05	0.00
MD	-0.37	0.06	0.00
ME	-0.37	0.06	0.00
MN	-0.37	0.07	0.00
NE	-0.37	0.06	0.00
NV	-0.20	0.07	0.01
OH	-0.37	0.05	0.00
OR	-0.36	0.06	0.00
PA	-0.37	0.06	0.00
SC	-0.37	0.06	0.00
SD	-0.38	0.06	0.00
TN	-0.37	0.05	0.00
TX	-0.55	0.13	0.00
UT	-0.37	0.05	0.00
VA	-0.37	0.05	0.00
VT	-0.37	0.06	0.00
WA	-0.40	0.12	0.01
WI	-0.41	0.03	0.00

Notes: Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated IV effects of childcare prices on the log of the birthrate per 1000 women aged 20 to 49 for the full sample of states ("All states"), and for subsamples where I drop one state at a time. Coefficients and standard errors multiplied by 100. The childcare price is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at 99th percentile. The instrumental variable is the state-level maximum group size average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to women aged 20 to 49. Standard errors are clustered at the state-year level.

Appendix Table D4. Robustness of IV estimates of the effects of childcare prices on birthrates to winsorising

	20-49	20-24	25-29	30-34	35-39	40-44	45-49
95 percentile							
Childcare price	-0.37**	-0.09	-0.07	-0.44***	-0.53**	-0.49***	-0.88**
	(0.09)	(0.11)	(0.12)	(0.09)	(0.13)	(0.10)	(0.24)
R^2	0.958	0.977	0.967	0.934	0.935	0.881	0.635
98 percentile							
Childcare price	-0.36***	-0.08	-0.07	-0.44***	-0.54***	-0.51***	-0.96***
	(0.07)	(0.10)	(0.12)	(0.05)	(0.08)	(0.08)	(0.17)
R^2	0.944	0.977	0.967	0.917	0.913	0.865	0.563
99 percentile							
Childcare price	-0.37***	-0.08	-0.07	-0.45***	-0.56***	-0.53***	-0.97***
	(0.06)	(0.10)	(0.12)	(0.04)	(0.06)	(0.09)	(0.13)
R^2	0.938	0.977	0.967	0.910	0.906	0.860	0.546
No winsorising							
Childcare price	-0.43***	-0.09	-0.08	-0.52***	-0.64***	-0.60***	-1.27
	(0.07)	(0.11)	(0.13)	(0.05)	(0.10)	(0.13)	(1.40)
R^2	0.921	0.977	0.967	0.888	0.878	0.841	0.398

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of birthrates per 1000 women for different levels of winsorising of prices. Coefficients and standard errors multiplied by 100. "20-49" is the log of the county-level birthrate per 1000 women aged 20 to 49, "20-19" the birthrate per 1000 women aged 20-19, and so on. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010, winsorised at the 95th percentile, 98th percentile, and 99th percentile and with no winsorising. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to that age band. Standard errors, clustered at the state-year level, in parentheses.

Appendix Table D5. Robustness of estimates to clustering standard errors at state level

	20-49	20-24	25-29	30-34	35-39	40-44	45-49
IV							
Childcare price	-0.37**	-0.08	-0.07	-0.45***	-0.56**	-0.53**	-0.97**
	(0.15)	(0.12)	(0.14)	(0.15)	(0.21)	(0.24)	(0.45)
R^2	0.938	0.977	0.967	0.910	0.906	0.860	0.546
Reduced Form							
Maximum Group Size	0.39***	0.10	0.08	0.46***	0.54***	0.49***	0.72***
	(0.11)	(0.15)	(0.16)	(0.11)	(0.13)	(0.11)	(0.13)
R^2	0.976	0.977	0.968	0.957	0.957	0.894	0.693
Mean	57.38	97.60	122.46	90.02	37.72	7.45	0.43

* $p < 0.1$, ** $p< 0.05$, *** $p < 0.01$.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated effects of childcare prices on the log of birthrates per 1000 women. Coefficients and standard errors multiplied by 100. "20-49" is the log of the county-level birthrate per 1000 women aged 20 to 49, "20-19" the birthrate per 1000 women aged 20-19, and so on. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to that age band. Standard errors, clustered at the state level, in parentheses.

Appendix Table D6. Robustness of first stage to missing values

	Childcare price		
	NA = 25	NA = 30	NA = 35
Maximum Group Size	-1.49***	-1.05***	-0.81***
	(0.32)	(0.23)	(0.18)
Mean	146.66	146.66	146.66
F-stat	21.31	21.12	20.73

* $p < 0.1$, ** $p< 0.05$, *** $p < 0.01$.

Notes: N=7,491. Data: NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the first stage of childcare prices on the maximum group size. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010 and winsorised at the 99th percentile. "Maximum Group Size" is the state-level maximum group size average for 0 to 2 year olds. "NA=25" sets the maximum group size to 25 for states with no regulation, "NA=30" sets the maximum group size to 30 (baseline specification), and "NA=35" sets the maximum group size to 35. "F-stat" is the F statistic for the first stage. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to that age band. Standard errors, clustered at the state-year level, in parentheses.

Appendix Table D7. Robustness of IV estimates to missing values

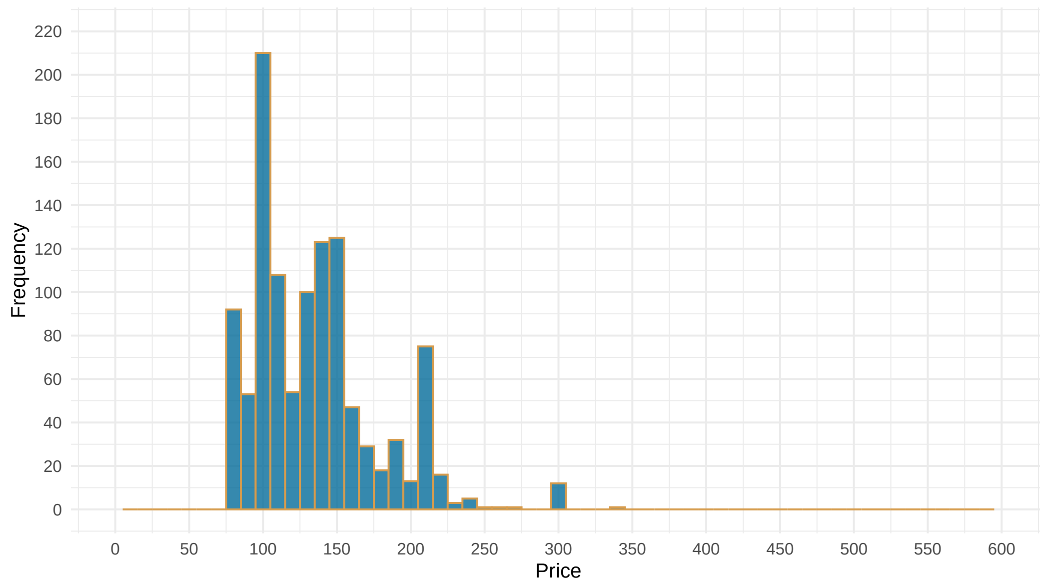
	20-49	20-24	25-29	30-34	35-39	40-44	45-49
NA = 25							
Childcare price	-0.37***	-0.08	-0.07	-0.45***	-0.56***	-0.53***	-0.97***
	(0.06)	(0.11)	(0.12)	(0.04)	(0.06)	(0.09)	(0.14)
R^2	0.938	0.977	0.967	0.909	0.905	0.859	0.546
NA = 30							
Childcare price	-0.37***	-0.08	-0.07	-0.45***	-0.56***	-0.53***	-0.97***
	(0.06)	(0.10)	(0.12)	(0.04)	(0.06)	(0.09)	(0.13)
R^2	0.938	0.977	0.967	0.910	0.906	0.860	0.546
NA = 35							
Childcare price	-0.37***	-0.09	-0.07	-0.45***	-0.55***	-0.52***	-0.97***
	(0.06)	(0.10)	(0.12)	(0.04)	(0.06)	(0.09)	(0.13)
R^2	0.938	0.977	0.967	0.910	0.906	0.860	0.546

* p < 0.1, ** p< 0.05, *** p < 0.01.

Notes: N=7,491. Data: NVSS birth records, SEER county population counts, NDCP childcare prices, hand-collected maximum group size data, for 2010-2019, 2021-2022. This table shows the estimated instrumental variable effects of childcare prices on the log of birthrates per 1000 women for three different approaches to treating states with no maximum group size restrictions. Coefficients and standard errors multiplied by 100. "20-49" is the log of the county-level birthrate per 1000 women aged 20 to 49, "20-19" the birthrate per 1000 women aged 20-19, and so on. "Childcare price" is the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds, adjusted for inflation using base year 2010, winsorised at the 99th percentile. "NA=25" sets the maximum group size to 25 for states with no regulation, "NA=30" sets the maximum group size to 30 (baseline specification), and "NA=35" sets the maximum group size to 35. All models control for county median earnings, the unemployment rate, female labour force participation, the male-female ratio, a housing price index, racial and ethnic composition, and county and year fixed effects. Estimates weighted by births to that age band. Standard errors, clustered at the state-year level, in parentheses.

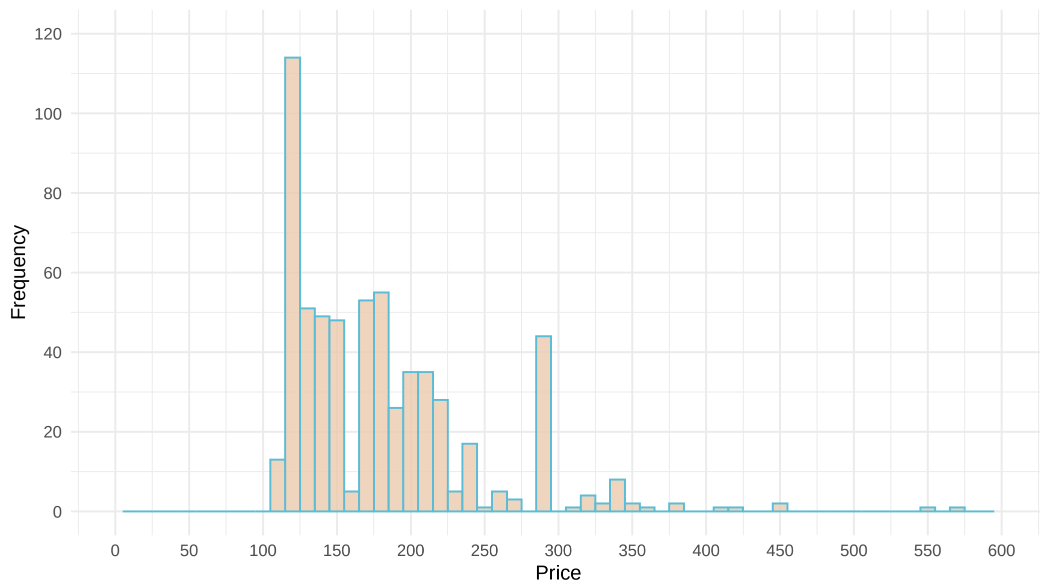
B Appendix Figures

Appendix Figure E1. Distribution of avg. weekly price of full-time centre childcare for 0-2 years, 2010



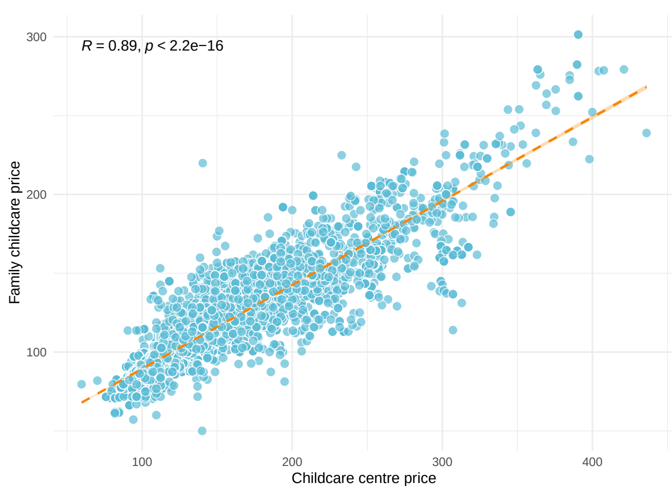
Notes: Data: NDCP for 2010. This plot shows the distribution of the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds.

Appendix Figure E2. Distribution of avg. weekly price of full-time centre childcare for 0-2 years, 2022



Notes: Data: NDCP for 2022. This plot shows the distribution of the median weekly price for full-time care at a childcare centre averaged for 0 to 2 year olds.

Appendix Figure E3. Scatterplot of centre based childcare and family childcare prices



N=11,789. Data: NDCP childcare prices. This figure shows a scatterplot of the median weekly price for full-time care averaged for 0 to 2 year olds, adjusted for inflation using base year 2010, at childcare centres and at family childcare homes. R is the Pearson correlation coefficient and p is the two-sided p-value from testing the null hypothesis that $R = 0$.

Appendix Figure E4. Newspaper article on childcare regulations in Nevada

LAS VEGAS SUN

Day care concerns: Staffing standards in Nevada below national averages

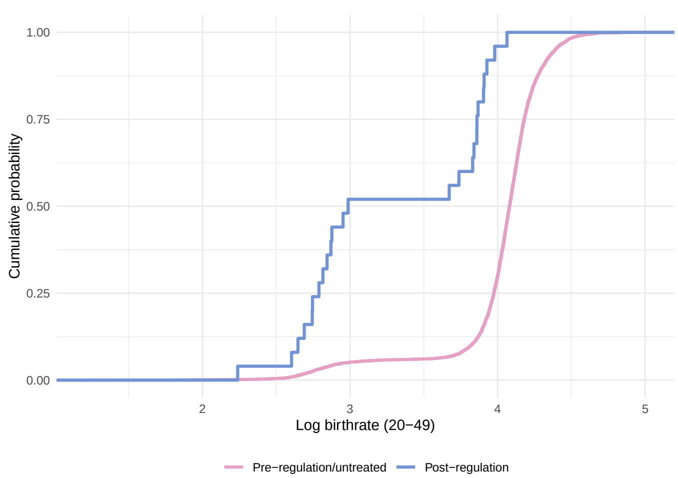
Thursday, May 15, 2003 | 11:24 a.m.

Nevada doesn't do as much as most other states to ensure that children are safe at day care centers, studies and experts say.

When it comes to child care staffing ratios, Nevada has some of the loosest regulations in the nation.

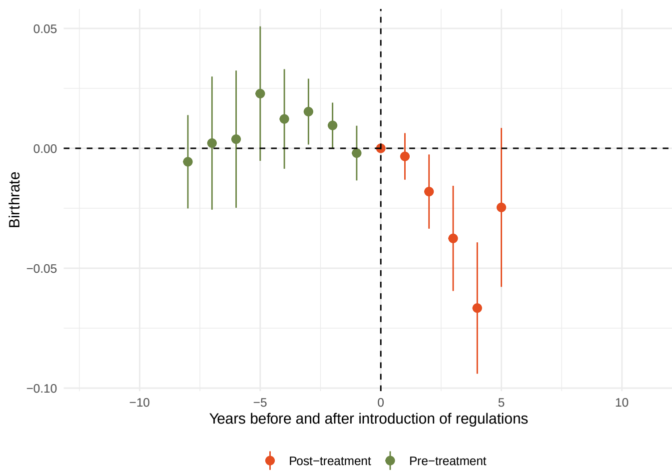
Nevada also ranks low in the number of licensed child care centers and in children served by government-subsidized child care, according to national comparisons. A state study last summer found that there were at least 6,000 children on waiting lists for child care.

Appendix Figure E5. Testing monotonicity



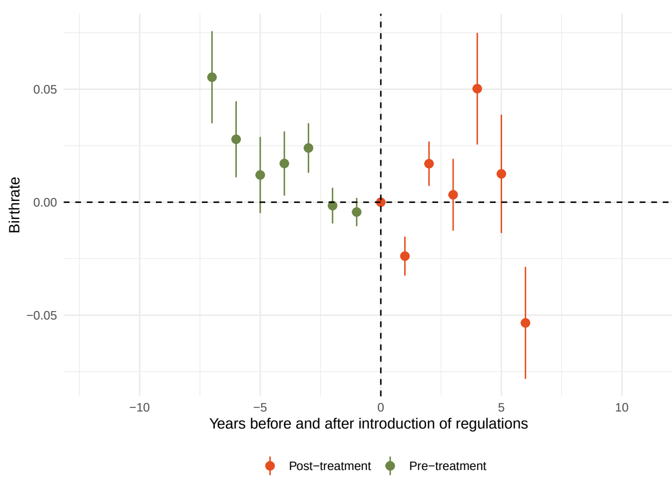
N=7,491. Data: NVSS birth records, SEER county population counts, hand-collected maximum group size data, for 2010-2019, 2021-2022. This figure shows the cumulative distribution functions for county-years after state-level childcare facility regulatory changes, and county-years before or without state-level childcare facility regulatory changes. The x-axis is log birthrate for women aged 20 to 49. The y-axis is the cumulative probability.

Appendix Figure E6. Event study plot of childcare facility regulations on birthrates, Nevada



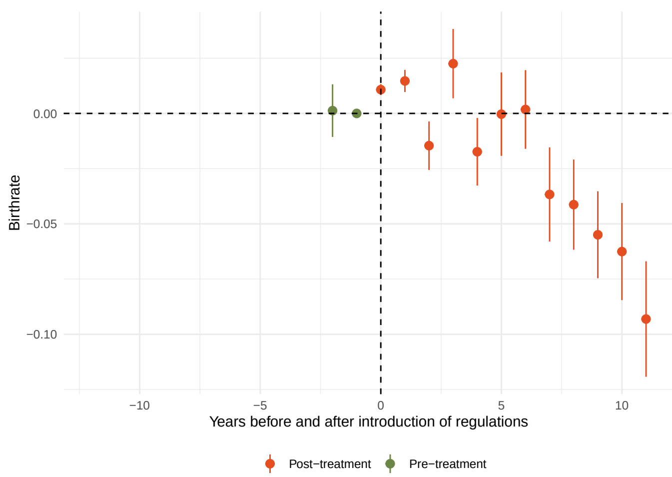
N=14,805. This figure shows an event study plot of effects of the introduction of childcare centre regulations in Nevada relative to control states on birthrates. The dotted vertical line is the year of treatment. The x-axis is relative time to the introduction of the regulations. The y-axis is the log birthrates for women aged 30 to 34. In 2017 NV introduced group size requirements for the first time and increased child-staff ratios for 18 month and 3 year olds. The reference year is $t = 0$ as the regulations were introduced in September.

Appendix Figure E7. Event study plot of childcare facility regulations on birthrates, Vermont



N=14,794. This figure shows an event study plot of effects of the introduction of childcare centre regulations in Vermont relative to control states on birthrates. The dotted vertical line is the year of treatment. The x-axis is relative time to the introduction of the regulations. The y-axis is the log birthrates for women aged 30 to 34. In 2016 VT relaxed group size requirements for 18 month olds. The reference year is $t = 0$ as the regulations were introduced in September.

Appendix Figure E8. Event study plot of childcare facility regulations on birthrates, Delaware



N=14,668. This figure shows an event study plot of effects of the introduction of childcare centre regulations in Delaware relative to control states on birthrates. The dotted vertical line is the year of treatment. The x-axis is relative time to the introduction of the regulations. The y-axis is the log birthrates for women aged 30 to 34. In 2011 DE introduced group size requirements for the first time. The reference year is $t = -1$ as the regulations were introduced in January.

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