Effect of Child Care Regulations on Child Care Markets: Evidence from Policy Discontinuity at the Border

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Abstract

This study examines the effects of state-level structural regulations, specifically staff-to-child ratios (SCR), on childcare markets, including supply, revenue, payroll per employee, and turnover rates. Utilizing provider-level panel data from Dunn and Bradstreet, we analyze variations across multiple geographic levels, including local markets within 10 miles of state borders, as well as at the county and state levels. The county-level analysis finds no statistically significant effects on the number of childcare establishments, payroll, or turnover, although negative point estimates suggest modest reductions in establishments and employment. The reduction in establishments is most pronounced among medium-sized providers (20-39 employees), particularly in low-income neighborhoods, consistent with prior findings that stricter regulations disproportionately affect center-based providers. Notably, stricter SCR policies in lower-income zones are associated with a statistically significant increase in childcare sector employment. These findings underscore the importance of considering income heterogeneity when assessing the impacts of childcare regulations.

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1 Introduction

Prior to entering kindergarten, most American children spend time regularly with caregivers who are not their parents, often while their parents are working. In 2019, almost 60% of children under age 6 (and not in kindergarten) attended one or more weekly nonparental care arrangements (U.S. Department of Education, National Center for Education Statistics, 2021). These arrangements included preschools and prekindergartens, child care or day care centers, family child care providers (e.g., care provided in a private home) and care by relatives. Given that the average young child spends more than 30 hours per week in nonparental care (among those using nonparental care) (National Survey of Early Care and Education Project Team, 2016), ensuring the health and safety of these children is important to parents and policymakers. Furthermore, given the established short and long-term benefits of high quality early care and education for young children, especially those from disadvantaged backgrounds (Heckman and Masterov, 2007), most states have adopted regulations that set minimum standards for child care facilities and programs.

As noted by Hotz and Xiao (2011), states do not regulate quality directly, but rather focus their regulations on certain structural features of care settings thought to be related to quality and safety, such as staff-child ratios, group sizes and staff educational credentials. Much of the prior literature has focused on staff-child ratios (SCR), given their immediate connection to the cost of providing service as well as its quality. The overall effect of SCR strictness on the number of childcare service establishments balances two potential, countervailing forces. Stricter SCR directly requires more staff per child. This intends to increase service quality and recent evidence suggests that it does (Garcia-Vazquez, 2023). By providing quality assurance and reducing informational asymmetry, stricter SCR might also increase consumer demand, which would increase the number of establishments. On the other hand, increasing staffing is expensive and so stricter SCR would likely raise service costs, pushing the supply curve down. In terms of employment, stricter SCR requires more employees per child (of a given age) served. By the first channel, employment would increase. By the second, derived

demand for ECE employment would fall with the service supply curve.

Relatively few studies have examined the effects of regulations in the child care sector on prices, quantities, or quality. One exception is Hotz and Xiao (2011), who use restricted-access establishment-level panel data on child care centers from 1987, 1992 and 1997 in a model with state, time and establishment fixed effects. Their results show that stricter state regulation of staff-child ratios led to a decrease in the number of child care center establishments, particularly in areas with more poor families. Yet they also found evidence that stricter state regulation improved quality of care proxied by the share of child care centers with national accreditation, particularly in higher income areas.

In this paper we similarly leverage state-level variation in child care regulations to examine the effects on the supply and quality of care. Specifically, we re-examine Hotz and Xiao (2011)'s results using more recent data and three different quasi-experimental designs. In contrast to Hotz and Xiao, we find limited evidence that state SCR regulation affects the quantity of childcare purchased. We use three main designs.

The first design aims to parallel Hotz and Xiao (2011) as closely as possible subject to the constraint of using publicly-available data. Analysis is at the county-year level based on County Business Patterns data on childcare industry establishments, employment, and payroll using a difference-in-differences logic. The goal of this analysis is to compare our results with Hotz and Xiao to shed light on whether any differences in our results reflect differences in methodology, data, or changes in the child care services market over time.

The second design focuses on states where the exact date of the policy change is known and uses a synthetic control group approach. The regulations survey is only conducted every three years, leaving unknown gaps between policy implementation and the outcomes we observe. We are researching the exact policy change dates for certain states. At this point in time, we have only conducted the synthetic control approach for Louisiana. We include this approach and these preliminary results in this draft in order to obtain feedback on the alternative research approaches.

The third and strongest design uses measures of each mainland U.S. childcare provider's exact location from Dun & Bradstreet (D&B) and estimates SCR effects focusing on fine-resolution differences across state borders. If state SCR regulatory strictness binds, childcare supply should mass on the less-strict side of a border as it is displaced from the stricter side. We use a regression discontinuity design in distance from the border to provide evidence on the effect of stricter regulations on the number of establishments, their payroll and number of employees.

2 Methods

Regulations such as staff-child ratio requirements have theoretically ambivalent implications for the amount of child care provided in the market. On the one hand, more stringent staff-child ratio regulation for childcare centers could increase centers' cost of production, driving prices up as these costs are passed along to consumers. If regulation binds, centers will need more staff to produce the same amount of care. As child care becomes less affordable, consumers will shift to other alternatives and the child care market will contract. However, regulations also serve a quality assurance function. Consumers may find it difficult to verify aspects of child care provider quality and safety such as whether the provider is adequately staffed throughout the day. This can lead to market unraveling where bad providers drive out good ones and buyers expect low quality (Akerlof, 1970). Regulation can address this, giving consumers greater confidence in providers and thus supporting child care demand. The net effect of any given regulation depends on the balance between these two effects – if the cost-driven supply reduction channel dominates the quality-driven demand increase channel, quantity will fall, if the quality-driven demand channel dominates, quantity will rise.

A challenge here is that we observe neither service quantities nor prices. Instead we observe establishments, employment, employee earnings, and employee turnover, and revenue. These would be good proxies for service quantities if firms' optimal labor-to-child ratios stayed stable but, obviously, changes in SCR regulation aim to affect these. A policy increase in minimum SCR will tend to push up optimal labor-to-service ratios and push down the

optimal number of children served per staff for each affected type of child.

So, assuming the policy changes binds, a null or negative effect on employment implies a decrease in the number of children served (or a shift in the age composition towards older kids and a decrease in kids served adjusted for age), which means the negative supply effect dominates the positive demand effect in the service market. Or, the regulatory change doesn't bind. On the other hand, a positive effect on employment is less clear as it's consistent with a small decrease, a null, or an increase in the quantity of children served.

First, we begin with panel analysis of county-year data in a two-way fixed effect model with continuous SCR measure as the treatment. This intends to parallel the structure of Hotz and Xiao (2011)'s analysis as closely as possible. However, concerns about endogeneity of treatment, heterogeneous treatment effects, and proportional dose-response push us to alternative identification strategies.

Second, we use a synthetic control (SC) approach to model the effect of state policy changes using state-year data where we know the exact timing of the policy changes (rather than the 3-year window). Currently this is just one state: Lousisiana, though we are working to expand to include additional states. The advantage of the SC approach is the power to reject the null.

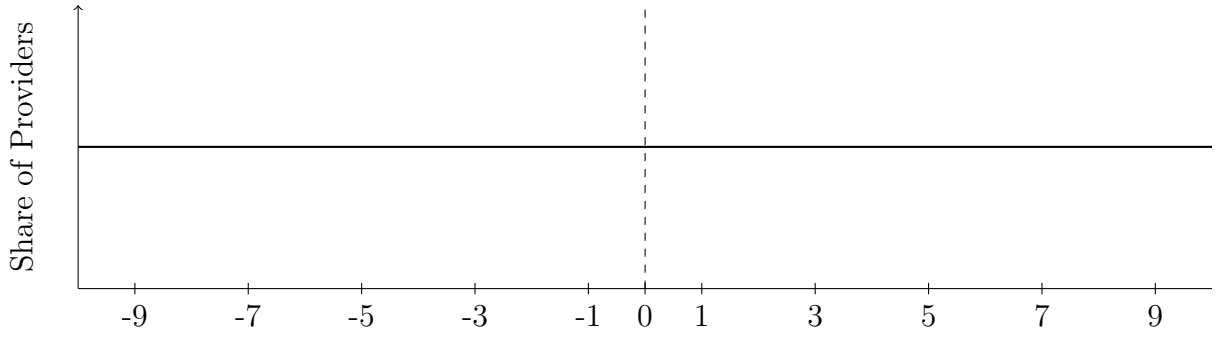
Third, we move to a regression-discontinuity design across state borders. This is similar in spirit to the study of right-to-work effects of Holmes (1998) or minimum wage effects in Dube et al. (2010). The current version focuses on cross-sectional comparison but this could be extended to panel analysis. Given that parents prefer shorter commutes to care providers, they will tend to prefer providers near home or work (or on the way). If the cost channel of stricter SCR regulation dominates, suppliers near a state border will have an incentive to locate on the less-strict side of the border to offer lower-cost care and capture more market share. Evidence of a discontinuity at the border, with more mass of childcare establishments, employment, and revenue displaced from the more- to the less-strict side of the border is evidence of the cost channel dominating.

Figure 1 shows how the spatial distribution of provider establishments or employment around a state border might differ under different scenarios. The sub-figures each represent cases where a pair of bordering states have different CSR strictness in policy. The horizontal axis represents distance to the border with negative numbers indicating distance into the less-strict state and positive ones into the more-strict state. For now, assume that population and jobs are uniformly distributed and that the effects of all policies correlated with SCR are null.[1] The vertical axis represents the share of local childcare establishments or employees located at each distance from the border. Absent the regulatory differences, we would expect to see childcare providers uniformly distributed across the border. If SCR regulation does not affect quantities, the distribution of providers would appear as in sub-figure (a).

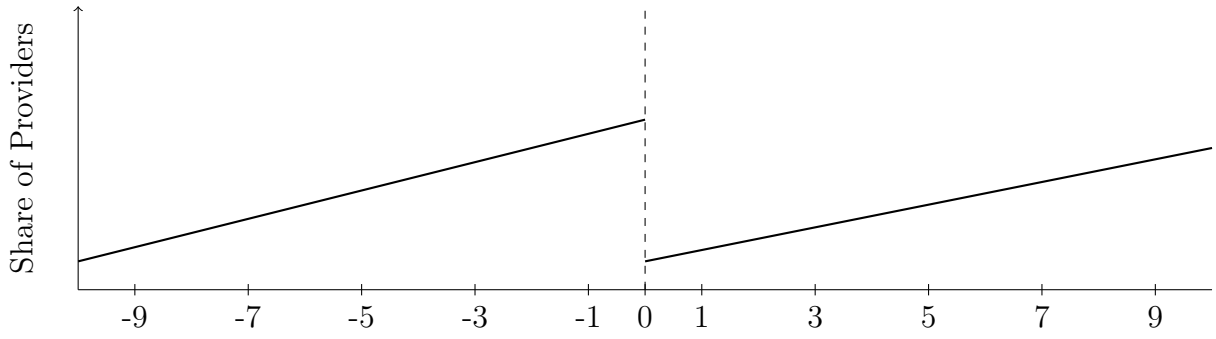
If SCR regulation drives down supply through increased costs more than it drives up demand through increased quality, then we would expect to see a pattern as in sub-figure (b), where some of the supply that would otherwise locate near the strict side of the border can boost profit by crossing the border. Those just near the border gain relatively large benefit in savings on staff compensation by moving a small distance and incur a relatively small cost in terms of losing much demand due to increased distance or lower valued quality. As the length of the move increases, the lost-demand costs increase but the other factors stay constant. So the magnitude of the displaced mass is informative about the size of the combination of the staff cost-savings and lost revenue from reduced quality from lower SCR relative to the demand-loss from increasing customer distance. We will not model this structurally but more displacement suggests some combination of SCR causing bigger staffing costs and less quality gains and that distance matters less to customers.

[1] These are strong conditions that we will work to make credible in the empirical analysis.

Figure 1: Hypothetical spatial distributions of providers near state border by effect of state regulation on supply location and population distribution



(a) Difference in regulation does not affect supply



(b) Difference in regulation drives supply toward less-strict state

Note: distance normalized as positive into the state with the more strict regulation.

2.1 County panel analysis

To identify the effects of a continuous SCR regulation treatment on counts of the number of establishments (total and by size) and employment, we employ linear models incorporating two-way fixed effects. For continuous payroll per employee and turnover rates outcomes, we use linear models. Standard errors are clustered at the county level.

We estimate two versions of these models, one without additional controls and one adding time-varying controls for demand determinants: total population, number of families with any young (under 5) child, the share of families with children that have a married adult couple, the local median income, and the number of jobs in all sectors excluding childcare.

The estimation uses a two-way fixed effects model, incorporating both county and year fixed effects, to explain county-year childcare market related outcome variable as functions of

a state-level policy variable, the staff-child ratio (D_{ct}), while controlling for socio-demographic characteristics and job availability within the county:

$$Y_{ct} = \alpha_1 D_{ct} + \alpha_2 X_{ct} + \gamma_c + \tau_t + \epsilon_{ct} \tag{1}$$

2.2 State level analysis

In order to implement synthetic control method, we aggregated the data from the county-year level to the state-year level. This aggregation was necessary to align the analysis with the timing of policy changes at the state level, enabling a focus on state-wide impacts. For each treated state, we identified the specific year when the policy change occurred, which served as the treatment year.

Using the synthetic control framework, we constructed a "synthetic state" as a weighted combination of control states that did not experience the policy change during the study period. The weights ensure that the synthetic state's pre-treatment characteristics closely matched those of the treated state. The characteristics used for matching included a range of socio-demographic and state-level variables, such as number of population, share of married family with young children, median income and job availability outside of child care sector, to account for factors that could influence the outcome independently of the policy change.

The synthetic control approach is well-suited for this study as there is a small number of treated group (states), as it leverages the information from multiple control pool of states to create a weighted composite that approximates the treated state's counterfactual trajectory.

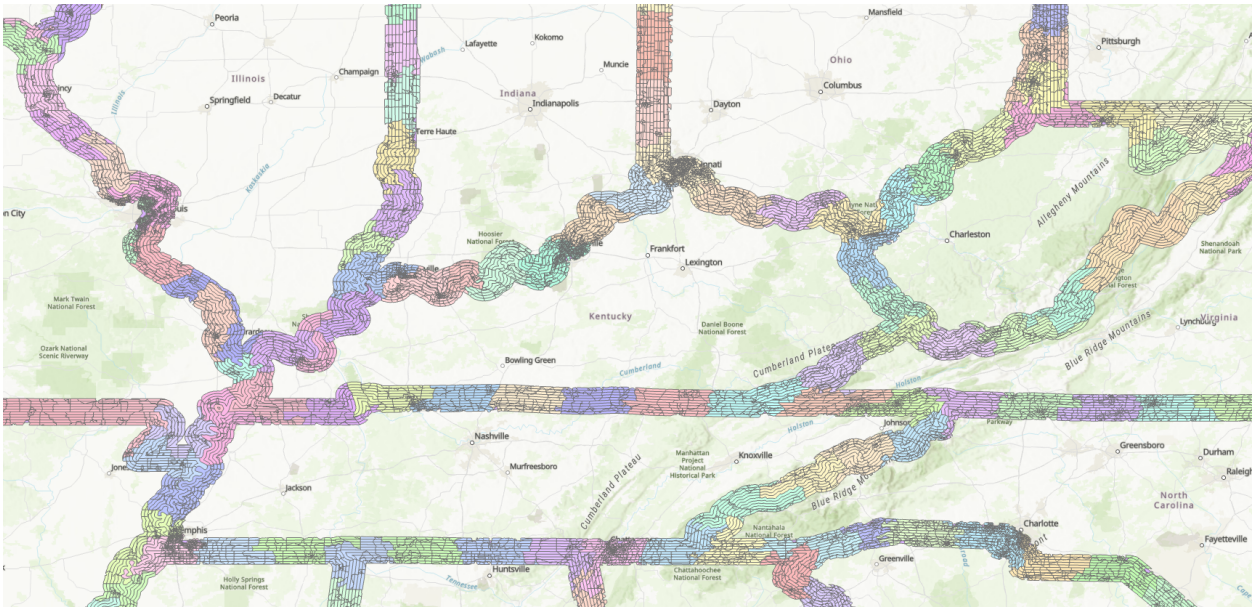
One concern with these two models is that there could be local economic shocks correlated with state changes in SCR. A different design focuses on contrasts across state borders.

2.3 Regression Discontinuity Design at State Borders

Zones indexed by z span a border between two states, creating state-zone combinations indexed by zs. Given zs, let $s'(sz)$ index the other state in the zone, simplified to s'. Each

state-zone is partitioned into 5 subzones based on distance to the border, indexed by zsd. Subzones are defined as being in five distance-to-border ranges (indexed by its distance midpoint), less than 2 miles, 2 to 4 miles, 4 to 6 miles, 6 to 8 miles, and 8 to 10 miles. Let $\tilde{D}_{zsd}$ be the distance-to border index using the range midpoint: 1, 3, 5, 7, or 9. Subzones are observed across multiple years, yielding data at the $zsdt$ level. Figure 2 provides a geographical illustration of the zones used in the analysis. Each colored area represents a zone extending 10 miles in each direction from the state border, with zones further subdivided by distance to the border, as described above.

Figure 2: Illustration of Zone-Level Area Near the State Border with Distance-Based Subzones



Let P_{st} measure policy in any state-year and T_{zst} indicate that state s has more strict regulation than its zone neighbor s' at time t: $T_{zst} = 1$ if $P_{st} > P_{s't}$ and 0 otherwise.

We want to contrast outcomes in the strict regulation side of the border versus the lenient regulation side. So, we normalize distance from the border as increasing going deeper into the stricter regulation state. Define $D_{zsd} = \tilde{D}_{zsd}$ if $T_{zst} = 1$ and $-\tilde{D}_{zsd}$ if $T_{zst} = 0$.[2]

[2] T_{zst} varies over time depending on the level of P_{st} relative to $P_{s't}$. However, less than 3.2 percent of the zone-state observations experience a change in T_{zst} over time.

The RD specification is:

$$Y_{zsdt} = \alpha_1 D_{zsd} + \alpha_2 T_{zs} + \alpha_3 T_{zs} D_{zsd} + X_{zsdt}\delta + \gamma_z + \gamma_t + \epsilon_{zsdt}$$

where T_{zs} is the treatment indicator, which indicates whether the observation is located in the stricter policy environment in terms of the staff-to-child ratio. The interaction term captures the differential slope of the running variable on either side of the cutoff.

3 Data

We conduct analysis are three separate geographic levels – county level, state level, and small zones near state borders. We describe data sources and variable construction that are shared across and specific to the levels.

3.1 Common across levels of analysis

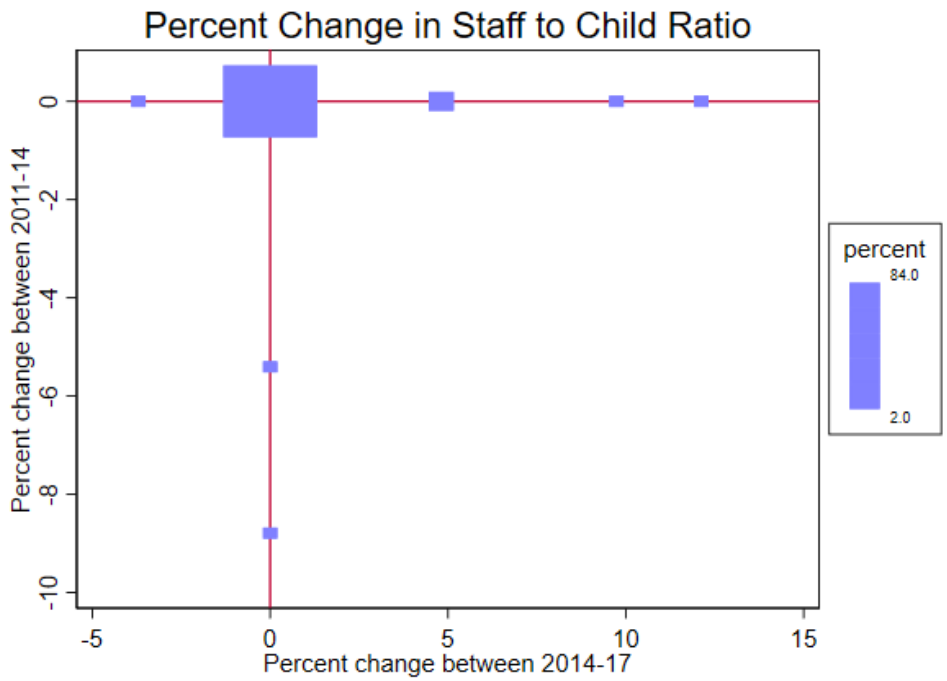
Staff-child ratio (SCR) regulation policy: the National Association for Regulatory Administration (NARA) publishes data on each state's minimum SCR by child age group in 2011, 2014, and 2017 from their Child Care Licensing Programs and Policies Survey.[3] If the minimum is 1 staff per 4 children, the staff-child minimum ratio is 0.25. If there is no minimum, the value is 0, corresponding to a possibly infinite number of children per staff. To build a harmonized summary measure of SCR stringency for each state year that includes information across age groups, we take a weighted average of group SCR using each age group's share of the 66 months of age before average age at kindergarten entry. Across all states in all three calendar years, SCR policies are observed for 5 age points. We assume each age-point policy applies for the following share of early childhood: 6-week SCR gets 12/66 months of weight, 18-month gets 24/66, 3-year gets 12/66, 4-year gets 12/66, and 5-year gets 6/66 months. For each state-year, we use the cross-age-point weighted average of these SCR to a scalar measure SCR policy overall.

[3]In conversation, people who conducted the NARA survey cautioned that the survey methods changed across earlier years but was stable over this period. Abrupt measured policy changes between the 2007 and 2008 waves provide evidence of methodological instability.

Across the 6,504 county-years from 2,168 unique counties in the county-level analysis, this raw SCR variable averages 0.12 (average regulation requires 0.12 staff per child or 8.86 children per staff) with a standard deviation of 0.026, a minimum of 0.0 (in state-years with no SCR regulation) and a maximum of 0.167 in the most-stringent regime (Table 2).

During the study period from 2011 to 2017, there were eight state-year observations with changes in the staff-to-child ratio, as outlined in Table 1. The magnitude of these changes is illustrated in Figure 3, showing that two states experienced a decrease in the staff-to-child ratio ranging from 5% to 9% between 2011 and 2014, while a few states observed an increase in the ratio ranging 4% to 12% between 2014 and 2017.

Figure 3: Variation in the policy variable (Staff to child ratio)



Note: This Figure displays the percent change in the staff-to-child ratio across two periods: 2011 - 2014 (Y-axis) and 2014 - 2017 (X-axis). Positive values on both axes indicate an increase in the ratio, while negative values reflect a decrease. The four quadrants created by the red lines at zero help differentiate trends: the top-right quadrant shows an increase in both periods, the bottom-left shows a decrease in both, and the other two quadrants represent mixed trends (increase in one period, decrease in the other). Most data points, represented by boxes, are clustered around zero, indicating that the staff-to-child ratio remained

relatively stable with minimal changes for most cases. Larger boxes suggest more states have such trends, while smaller boxes reflect less frequent extreme changes. Overall, the graph suggests that overall changes in the staff-to-child ratio were moderate, with more positive shifts than negative or mixed ones.

Table 1: Staff to Child Ratio, By State and Year

	SCR2011	SCR2014	SCR2017	Δ_11_14	Δ_14_17
AK	0.13	0.13	0.13	0.00	0.00
AL	0.10	0.10	0.10	0.00	0.00
AR	0.09	0.09	0.10	0.00	5.26
AZ	0.10	0.10	0.10	0.00	0.00
CA	0.12	0.12	0.12	0.00	0.00
CO	0.12	0.12	0.12	0.00	0.00
CT	0.15	0.15	0.15	0.00	0.00
DC	0.15	0.15	0.15	0.00	4.17
DE	0.12	0.12	0.12	0.00	0.00
FL	0.09	0.09	0.09	0.00	0.00
GA	0.08	0.08	0.08	0.00	0.00
HI	0.10	0.10	0.10	0.00	0.00
IA	0.14	0.14	0.14	0.00	0.00
ID	–	–	–	–	–
IL	0.13	0.13	0.13	0.00	0.00
IN	0.13	0.13	0.13	0.00	0.00
KS	0.13	0.13	0.13	0.00	0.00
KY	0.11	0.11	0.11	0.00	0.00
LA	0.09	0.09	0.10	0.00	9.73
MA	0.14	0.14	0.14	0.00	0.00
MD	0.15	0.15	0.15	0.00	0.00
ME	0.14	0.14	0.14	0.00	0.00
MI	0.14	0.14	0.14	0.00	0.00
MN	0.13	0.13	0.13	0.00	0.00
MO	0.14	0.14	0.14	0.00	0.00
MS	0.09	0.09	0.09	0.00	0.00
MT	0.16	0.16	0.16	0.00	0.00
NC	0.09	0.09	0.09	0.00	0.00
ND	0.16	0.15	0.15	-5.41	0.00
NE	0.13	0.13	0.13	0.00	0.00
NH	0.13	0.12	0.12	-8.79	0.00
NJ	0.12	0.12	0.12	0.00	0.00
NM	0.11	0.11	0.11	0.00	0.00
NV	0.10	0.10	0.11	0.00	5.00
NY	0.16	0.16	0.16	0.00	0.00
OH	0.11	0.11	0.10	0.00	-3.70
OK	0.11	0.11	0.11	0.00	0.00
OR	0.14	0.14	0.14	0.00	0.00
PA	0.14	0.14	0.14	0.00	0.00
RI	0.13	0.13	0.13	0.00	0.00
SC	0.09	0.09	0.09	0.00	0.00
SD	0.14	0.14	0.14	0.00	0.00
TN	0.12	0.12	0.12	0.00	0.00
TX	0.08	0.08	0.08	0.00	0.00
UT	0.11	0.11	0.11	0.00	0.00
VA	0.13	0.13	0.13	0.00	0.00
VT	0.15	0.15	0.17	0.00	12.12
WA	0.12	0.12	0.12	0.00	0.00
WI	0.13	0.13	0.13	0.00	0.00
WV	0.14	0.14	0.14	0.00	0.00
WY	0.13	0.13	0.13	0.00	0.00

3.2 County level analysis

Child care providers: From the U.S. Census County Business Patterns data for each county each year, we pull the following variables for the child care industry (NAICS 624410): numbers of establishments with 1 to 4 employees, with 5 to 9 employees, 10 to 19 employees, 20 to 49 employees, 50 to 99 employees, and more than 100 employees, as well as the total number of establishments, the total number of employees, and the annual payroll per employee. We also measure county-quarter childcare industry employee turnover rate using Census Quarterly Workforce Indicator data. Table 2 reports summary statistics. We use these as outcomes to measure the size of the childcare sector and the effects of changes in state SCR regulation policy. Across county-years, the number of establishments averages 29.0 (SD=82.4), of employees averages 338 (1,031), and payroll per employee averages $11,067 ($8,237).

Population characteristics: Changes in the size and characteristics of the residential population could affect childcare service demand and labor supply. Census American Community Survey (ACS) 5-year estimates with the end year matching the policy year measures county-year residential population, which averages 119,280 (Manson et al., 2020). To control for potential child care service demand by families that live nearby, we use ACS to measure county-year total residential population averaging 119,280 (SD=349,240), the number of families with any child under age 5 years averaging 64.8 (SD=192.4), share of such families that contain a married couple, and median household income. To control for potential demand from work-nearby parents, we measure the number of jobs outside the childcare industry as the difference between the county-year's total employment and its childcare employment.

Table 2: Summary Statistics for County Panel Analysis

Variable	Mean	Std. Dev.	Min.	Max.	N
Payroll per employee (1000s)	13.025	7.389	0	73	6504
N Employees (1000s)	0.403	1.115	0	19.739	6504
N Employees per 100 families	4.113	3.168	0	35.795	6504
Staff turnover rate	0.107	0.072	0	0.875	6504
N Establishments	34.3	89.059	1	1828	6504
N Establishments per 100 families	0.519	0.308	0.031	5.882	6504
N Establishment (1 to 4 Employees)	12.54	38.531	0	896	6504
N Establishment (5 to 9 Employees)	6.644	16.568	0	343	6504
N Establishment (10 to 19 Employees)	8.109	21.117	0	383	6504
N Establishment (20 to 49 Employees)	5.677	15.387	0	242	6504
N Establishment (50 to 99 Employees)	0.494	1.97	0	38	6504
N Establishment (GT 100 Employees)	0.105	0.685	0	16	6504
N Estab per 100 families (1 to 4 Employees)	0.204	0.228	0	4.706	6504
N Estab per 100 families (5 to 9 Employees)	0.106	0.131	0	2.586	6504
N Estab per 100 families (10 to 19 Employees)	0.095	0.096	0	1.338	6504
N Estab per 100 families (20 to 49 Employees)	0.048	0.063	0	0.602	6504
N Estab per 100 families (50 to 99 Employees)	0.004	0.013	0	0.207	6504
N Estab per 100 families (GT 100 Employees)	0.001	0.005	0	0.155	6504
child-staff ratio(raw)	8.864	1.979	0	12	6479
staff-child ratio(raw)	0.115	0.026	0	0.167	6504
County ID	1084.5	625.896	1	2168	6504
State ID	26.925	14.277	1	51	6504
Year	2014	2.45	2011	2017	6504
Data from ACS					
N total population (10000s)	14.028	37.805	0.163	1010.572	6504
N Families with young children (100s)	76.311	208.324	0.51	5216.6	6504
Share Married families with young children	0.695	0.113	0.109	1	6504
Median Income (1000s)	49.004	13.065	19.264	129.588	6504
N Employees out of child care (10000s)	5.31	16.306	0	393.29	6504
Share below poverty	0.159	0.061	0.029	0.479	6504
Share below poverty with young children	0.217	0.112	0	1	6504

Note: The balanced panel analytic dataset includes 2,168 counties, each with more than one observation across three years from 2011 to 2017, yielding a total of 6,504 county-year observations for the analysis. The outcome variables consist of annual payroll per employee, employment counts, and the number of establishments by size, all obtained from County Business Patterns (CBP) data, along with turnover rates sourced from the Census Quarterly Workforce Indicators data. State-level policy variables, such as the staff-to-child ratio, are obtained from NARA. Demographic controls are based on county-level ACS 5-year estimates for the 2011, 2014, and 2017 snapshots.

3.3 State level analysis

We aggregated the data from the county-year level to the state-year level for analysis. The balanced panel dataset comprises 51 states, each with multiple observations across three years between 2011 and 2021, resulting in a total of 561 state-year observations. Instead of relying solely on the staff-to-child ratio from survey data available for three years, we use a specific year of policy change as the treatment variable. To support this approach, we utilize 11 years of data (2011−2021) from the County Business Patterns (CBP) dataset, which provides the outcome variables: annual payroll per employee, employment counts, and the number of establishments.

Table 3: Summary Statistics for State Panel Analysis

Variable	Mean	Std. Dev.	Min.	Max.	N
Payroll per employee (1000s)	19.712	3.765	13.434	37.745	561
N Employees (1000s)	17.671	18.884	1.436	86.129	561
emp_per_fam	5.799	1.975	1.764	14.237	561
N Establishments	1484.012	1604.535	156	8979	561
N Establishments per family	0.508	0.177	0.184	1.16	561
staff-child ratio(raw)	0.149	0.034	0	0.224	561
State ID	26	14.733	1	51	561
Year	2016	3.165	2011	2021	561
Data from ACS					
N total population (10000s)	607.703	693.493	55.209	3898.164	561
N Families with young children (100s)	3282.86	3769.984	261.36	21017.4	561
Share Married families with young children	0.712	0.052	0.572	0.872	561
Median Income (1000s)	54.607	9.200	39.579	81.526	561
N Employees out of child care (10000s)	233.583	258.024	19.049	1481.146	561
Share below poverty	0.139	0.031	0.08	0.227	561
Share below poverty with young children	0.178	0.045	0.089	0.277	561

Note: The balanced panel analytic dataset includes 51 states, each with more than one observation across three years from 2011 to 2021, yielding a total of 561 state-year observations for the analysis. The outcome variables consist of annual payroll per employee, employment counts, and the number of establishments by size, all obtained from County Business Patterns (CBP) data, along with turnover rates sourced from the Census Quarterly Workforce Indicators data. State-level policy variables, such as the staff-to-child ratio, are obtained from NARA. Demographic controls are ACS 5-year estimates.

3.4 State-border small geographic zone-level analysis

Child care providers: we use provider-year data from Dunn and Bradstreet (D&B) for 2011, 2014, and 2017. For each year for each business establishment in the U.S., D&B contains a record with establishment name, physical address, industry, number of employees, and annual revenue. Employees and revenue are reported by the business or, if not, modeled by D&B. We restrict attention to child care establishments (SIC code 8351) and aggregate across providers within zone-state-distance-year to construct measures of total employees in each $zsdt$.

Local population characteristics: child care demand comes from two primary sources, those who live nearby and those who work nearby. We measure the relevant local residential population and local economic activity in order to control for these non-regulatory influences on local childcare establishments and employment.

Many aspects of state policy may differ across borders (right-to-work laws, minimum wage levels...), which can influence local communities and economies. Including controls for local residential population characteristics and local job volume help proxy for mechanisms by which these other policy differences could influence our outcomes of interest, childcare sector establishments and employment.

To measure live-nearby demand, we aggregate Census American Community Survey block-group data (Manson et al., 2020) to the zone-state-distance-year $zsdt$ level to measure the same residential population characteristics.

To measure work-nearby demand, we aggregate Census LEHD Origin-Destination Employment Statistics (LODES) data to measure the total number of jobs in each $zsdt$ across all sectors.

Child care employees and total employees per local family with a young child: a key metric of interest is the ratio of child care industry employees to the total number of families with any child under the age of six, building context for the ECE employment count by adjusting for potential live-nearby demand.

Table 4: Summary Statistics for Regression Discontinuity Design

Variable	Mean	Std. Dev.	Min.	Max.	N
Outcomes from DNB					
N employees	129.608	398.456	0	7021	5775
Sales volume ($10000s)	983.77	13843.567	0	806643.688	5775
N establishments	14.876	42.023	1	748	5775
N employees per 100 families	45.705	150.869	0	4580.152	5775
N establishments per 100 families	6.415	15.057	0.282	500	5775
Sales volume ($10000s) per 100 families	204.53	2305.191	0	131714.844	5775
Policy data from NARA					
Treatment dummy (Higher SCR Zone)	0.468	0.499	0	1	5775
Miles from border	-0.312	6.529	-10	10	5775
Staff child ratio (Raw)	0.12	0.024	0	0.167	5775
ACS data					
N total population (1000s)	16.844	49.847	0.115	993.347	5775
N Families with young children	399.665	1250.917	0.4	25997.5	5775
Share Married families with young children	0.057	0.023	0	0.399	5775
Median Income (1000s)	53.116	25.324	2.499	250.001	5775
Year	2013.815	2.448	2011	2017	5775
Zone ID	188.714	115.367	1	402	5775
Zone-State ID	357.609	217.159	2	750	5775
Zone-State-Mile ID	1239.245	721.560	5	2497	5775

Note: There are a total of 311 zones with at least one childcare provider, resulting in 658 zone-state combinations, and 2,268 zone-state-miles-to-border units (2, 4, 6, 8 and 10 miles) leading to 5,775 zone-state-miles-to-border-unit-year observations that include at least one childcare provider. The unit of analysis is the zone-state-subzone combination, which divides zones based on state borders and distance to border. The outcome variables are the total number of childcare sector employees per family, Sales volume per family, and number of establishments per family, sourced from DNB data. The policy variables at the state level include the staff-to-child ratio (center-based), obtained from NARA. Demographic controls at the zone level are derived from Block-group level ACS data, the 2013-2017 ACS 5-year estimates.

The dataset comprises 311 zones with childcare providers with at least one childcare provider, 658 zone-state pairs (some zones are at the borders of more than 2 states), 2,268 zone-state-distance subzones, and 5,775 total observations across three years. Across units (zone-state-distance-year), the number of the number of childcare establishments averages 14.9 (SD=42.0), employees averages 129.6 (398.5), and total annual industry revenue average per local family with any young children averages $2,045 (SD=$23,052) per Table 4.

4 Results

4.1 County-Level Analysis

The county panel analysis shows overall no effect of changes in SCR regulation on the number of childcare establishments per family with any young children (Table 5). The point estimates are negative but not significant without controls in column (1) and with them in (2). Increasing required staff per child by 0.026 (one standard deviation), like moving from 13 children allowed per staff to 10 allowed, induces 0.016(=0.026*0.645) reduction (3.1% of the outcome mean). But the estimate is not significant at conventional levels. The point estimates here agree with Hotz and Xiao (2011) but the estimate is imprecise. The change in ratio doesn't seem to have affect other outcome variables including payroll per employee and staff turnover rate.

Looking at effects across establishment employment-size categories across models (3)-(14), none of the models including controls are statistically significant, except for establishments with 20 to 39 employees, where one SD increase in the ratio induces -0.026(=-1.126*0.026) reduction in the establishments which is approximately 5% of the total number of establishment per 100 families, which is consistent with findings by Hotz and Xiao (2011) in that greater stringency of regulations reduces number of center-based providers.

Moving past establishments, Table 6 reports estimates related to effects of increases in the strictness of SCR regulation on staffing in terms of number of total childcare employees per family with any young child, payroll per employee, and the staff turnover rate. If SCR increases by a 0.026 (1 SD), number of employees per 100 families are estimates to fall by 0.53 unit (=0.026*20.556) or 12.8% of the outcome mean. Employee earnings are estimated to fall 16% (=2.15/13.025) = $2,149 annually. Staff turnover rate increases by 5% of the outcome mean. But, none of these estimates are statistically significant at conventional levels.

A fall in payroll could be a compensating differential for an improved working condition of higher SCR. It could also just be a squeeze on workers by businesses facing tighter margins

as regulations force increases in staffing quantity per child. We do not see strong evidence of effects on the number of employees per family with any young child (staffing intensity) nor staff turnover rate (proxy for low job quality). Alternatively, providers may be cutting hourly wages and substituting towards workers with worse outside options.

Table 5: County-year level Analysis: Effect of Child-Staff Ratio on Number of Establishment per Family by Employee Size

	Overall		1 to 4		5 to 8		10 to 19		20 to 49		50 to 99		GT 100	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Staff-child ratio(raw)	-0.572	-0.645	1.909	2.198	0.230	0.859	1.294	1.466	-1.362***	-1.216**	-0.111	-0.107	0.006	0.007
	(2.471)	(2.414)	(3.098)	(2.972)	(1.396)	(1.439)	(1.025)	(1.016)	(0.516)	(0.528)	(0.164)	(0.167)	(0.018)	(0.018)
N total population (10000s)		-0.003***		0.002		0.002***		0.002**		0.002**		0.000		-0.000
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.000)		(0.000)
Share Married families with children		0.054		-0.052		0.031		-0.029		-0.009		-0.003		-0.002
		(0.070)		(0.098)		(0.050)		(0.026)		(0.017)		(0.003)		(0.002)
Median Income (1000s)		-0.001		0.001		0.003*		0.001		0.001		0.000		0.000
		(0.002)		(0.002)		(0.001)		(0.001)		(0.000)		(0.000)		(0.000)
N Employees out of child care (10000s)		0.004***		0.005***		0.002***		0.002***		0.003***		0.000**		-0.000
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.000)		(0.000)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.873	0.873	0.713	0.714	0.617	0.619	0.656	0.658	0.712	0.716	0.560	0.561	0.558	0.558
N	6504	6504	6504	6504	6504	6504	6504	6504	6504	6504	6504	6504	6504	6504

A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.; The estimation uses a two-way fixed effects model, incorporating both county and year fixed effects, to explain county-year payroll per employee, the number of establishments per family, and the staff turnover ratio as functions of a state-level policy variable, the staff-child ratio (D_{ct}), while controlling for socio-demographic characteristics and job availability within the county:

$$Y_{ct} = \alpha_1 D_{ct} + \alpha_2 X_{ct} + \gamma_c + \tau_t + \epsilon_{ct} \tag{2}$$

Estimates were obtained using Stata's reghdfe command. In column (10), the coefficient of -1.207 for the staff-child ratio suggests that a one standard deviation increase (0.026) in the child-staff ratio is associated with an approximate decrease of -0.026 (= 0.026 * -1.126) in the number of establishments with $20-49$ employees per 100 families. This decrease represents a 5% reduction in the average level of total establishments.

Table 6: County-year level analysis: Effect of Child-Staff Ratio on Number of Employees per family, Nuber of Establishments per family, Annual Payroll per Employee, and Staff turnover rate

	N Emp per family		N Estab per family		Payroll per employee		Staff turnover rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Staff-child ratio(raw)	-16.505	-20.556	-0.572	-0.645	-75.317	-82.769	0.254	0.205
	(23.587)	(23.547)	(2.471)	(2.414)	(53.834)	(54.754)	(0.712)	(0.709)
N total population (10000s)		-0.058***		-0.003***		-0.133***		-0.000
		(0.015)		(0.001)		(0.033)		(0.000)
Share Married families with young children		-0.339		0.054		-1.189		-0.001
		(0.789)		(0.070)		(1.625)		(0.017)
Median Income (1000s)		-0.022		-0.001		-0.033		-0.000
		(0.018)		(0.002)		(0.044)		(0.001)
N Employees out of child care (10000s)		0.060***		0.004***		-0.025		0.001***
		(0.019)		(0.001)		(0.041)		(0.000)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.792	0.792	0.873	0.873	0.716	0.716	0.621	0.622
N	6504	6504	6504	6504	6504	6504	6504	6504

Note: A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.; The estimation uses a two-way fixed effects model, incorporating both county and year fixed effects, to explain county-year payroll per employee, the number of establishments per family, and the staff turnover ratio as functions of a state-level policy variable, the staff-child ratio (D_{ct}), while controlling for socio-demographic characteristics and job availability within the county:

$$Y_{ct} = \alpha_1 D_{ct} + \alpha_2 X_{ct} + \gamma_c + \tau_t + \epsilon_{ct} \tag{3}$$

Estimates were obtained using Stata's reghdfe command. In column (6), the coefficient of -78.995 for the staff-child ratio indicates that a one standard deviation increase (0.023) in the child-staff ratio is associated with an approximate decrease of -1.817 or $1,817 (=0.023*-78.995), in payroll per employee, representing about 14% of the mean annual payroll per employee ($13,068). However, none of the estimated effects are statistically significant at conventional levels.

Next, we repeat the analysis but splitting the sample of counties into terciles based on each county's average median income across years. Table 7 presents negative coefficients, with larger effects observed in counties within the middle and bottom income tercile. However, none of these estimates are statistically significant. For context, Hotz and Xiao (2011) reported a stronger negative effect on establishment counts in low-income communities. In our analysis, the estimated coefficient of -2.731 for counties in the bottom income tercile suggests a 14% reduction in establishments relative to the outcome mean, though this estimate is not statistically significant at conventional levels.

Table 8 shows that the decrease in the number of larger childcare establishments, in terms of employee count, observed in Table 5, primarily occurs in low-income counties. This suggests that stricter regulations may be driving out center-based establishments in low-income neighborhoods.

Table 7: County-year level analysis: Effect of Child-Staff Ratio on Annual Payroll per Employee, and Number of Employees, By Income tercile

	N Emp per family		N Estab per family		Payroll per employee		Staff turnover rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Top tercile								
Staff-child ratio(raw)	-6.271	-9.201	0.913	0.507	-67.420	-47.653	1.427	1.420
	(25.220)	(25.523)	(3.656)	(3.679)	(54.598)	(54.176)	(1.182)	(1.207)
2nd tercile								
Staff-child ratio(raw)	-22.125	-33.499	0.154	-1.276	-131.538	-151.078	-0.352	-0.383
	(44.115)	(45.830)	(5.328)	(4.840)	(90.768)	(93.082)	(1.102)	(0.989)
Bottom tercile								
Staff-child ratio(raw)	-20.646	-21.360	-3.196	-2.731	-54.458	-65.426	-1.162	-1.179
	(65.222)	(64.696)	(3.154)	(3.145)	(167.479)	(169.384)	(1.085)	(1.079)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The sample was divided into three groups based on the average median income at the county level over the study window. A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.; The estimation uses a two-way fixed effects model, incorporating both county and year fixed effects, to explain county-year payroll per employee, the number of establishments per family, and the staff turnover ratio as functions of a state-level policy variable, the staff-child ratio (D_{ct}), while controlling for socio-demographic characteristics and job availability within the county:

$$Y_{ct} = \alpha_1 D_{ct} + \alpha_2 X_{ct} + \gamma_c + \tau_t + \epsilon_{ct} \tag{4}$$

Estimates were obtained using Stata's reghdfe command. In column (6), the coefficient of -151.078 for the staff-child ratio found in counties within the middle tercile of the median income category indicates that a one standard deviation increase (0.026) in the child-staff ratio is associated with an approximate decrease of 3.928 or $3,928 (=0.026*-151.078), in payroll per employee, representing about 30% of the mean annual payroll per employee ($13,025). The estimate is not statistically significant at a conventional level.

Table 8: County-year level analysis: Effect of Child-Staff Ratio on Number of Establishment per Family by Employee Size, By Income tercile

	Overall		1 to 4		5 to 8		10 to 19		20 to 49		50 to 99		GT 100	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Top tercile														
Staff-child ratio(raw)	0.913	0.507	2.270	2.273	0.532	0.275	1.065	1.028	-0.934	-0.900	-0.001	0.012	0.001	0.020
	(3.656)	(3.679)	(4.186)	(4.303)	(2.270)	(2.342)	(1.699)	(1.638)	(0.745)	(0.771)	(0.230)	(0.235)	(0.018)	(0.023)
2nd tercile														
Staff-child ratio(raw)	0.154	-1.276	4.595	3.465	0.887	1.970	2.359	1.817	-0.671	-0.982	0.150	0.189	-0.018	-0.018
	(5.328)	(4.840)	(7.828)	(6.897)	(2.380)	(2.504)	(1.616)	(1.630)	(1.022)	(1.041)	(0.334)	(0.344)	(0.022)	(0.021)
Bottom tercile														
Staff-child ratio(raw)	-3.196	-2.731	1.435	1.690	0.827	1.189	2.444	2.487	-1.725*	-1.595	-0.659*	-0.683*	0.061	0.057
	(3.154)	(3.145)	(2.949)	(3.011)	(2.060)	(2.115)	(1.824)	(1.840)	(0.994)	(0.996)	(0.346)	(0.350)	(0.066)	(0.064)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The sample was divided into three groups based on the average median income at the county level over the study window. A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.

4.2 Zone-Level Analysis, Within 10 Miles of State Borders

Figure 4 illustrates the discontinuity in the policy variable at the border, along with the outcomes and control variables. A clear jump is observed in the SCR at the border, while the outcome variables do not exhibit any systematic differences in levels around the border. The consistency in the levels of the control variables confirms the balance between the treated and control state-zones.

Table 9 shows the estimated effect of staff to child ration on the number of employees per 100 families, number of child care establishment per 100 families, and total sales volume per 100 families. The preferred RD specification is in even columns, with year and zone-state fixed effects with added controls. The coefficient on the treatment dummy (Treated - higher SCR) in column (2) is -5.741. This indicates that being located on the stricter regulation side of the zone leads to a decrease in the number of child care employees per 100 families by approximately 5.741, relative to the market with less stringent policies. The effect is not statistically significant at a conventional level. Given that the mean value of the number of employees per 100 families is 45.7, we can interpret the treatment effect as $\frac{-5.741}{45.7} \times 100 = 12.5\%$ relative to the sample's average of 45.7. The coefficient on the centered running variable D_{zsd} is close to zero (-0.150) and not statistically significant, suggesting that there is no clear relationship between the outcome variable and the running variable as it increases away from the border (cutoff). The interaction term captures the differential slope of the running variable on either side of the cutoff. The coefficient for the interaction term is small in magnitude and not statistically significant, indicating that the slope of the outcome variable with respect to the running variable D_{zsd} does not differ between treated and untreated units. A similar pattern is observed for other outcome variables; although the coefficients are negative, the overall findings suggest that the SCR policy changes do not have a meaningful impact on these observed outcomes.

Figure 4: Discontinuity at the border

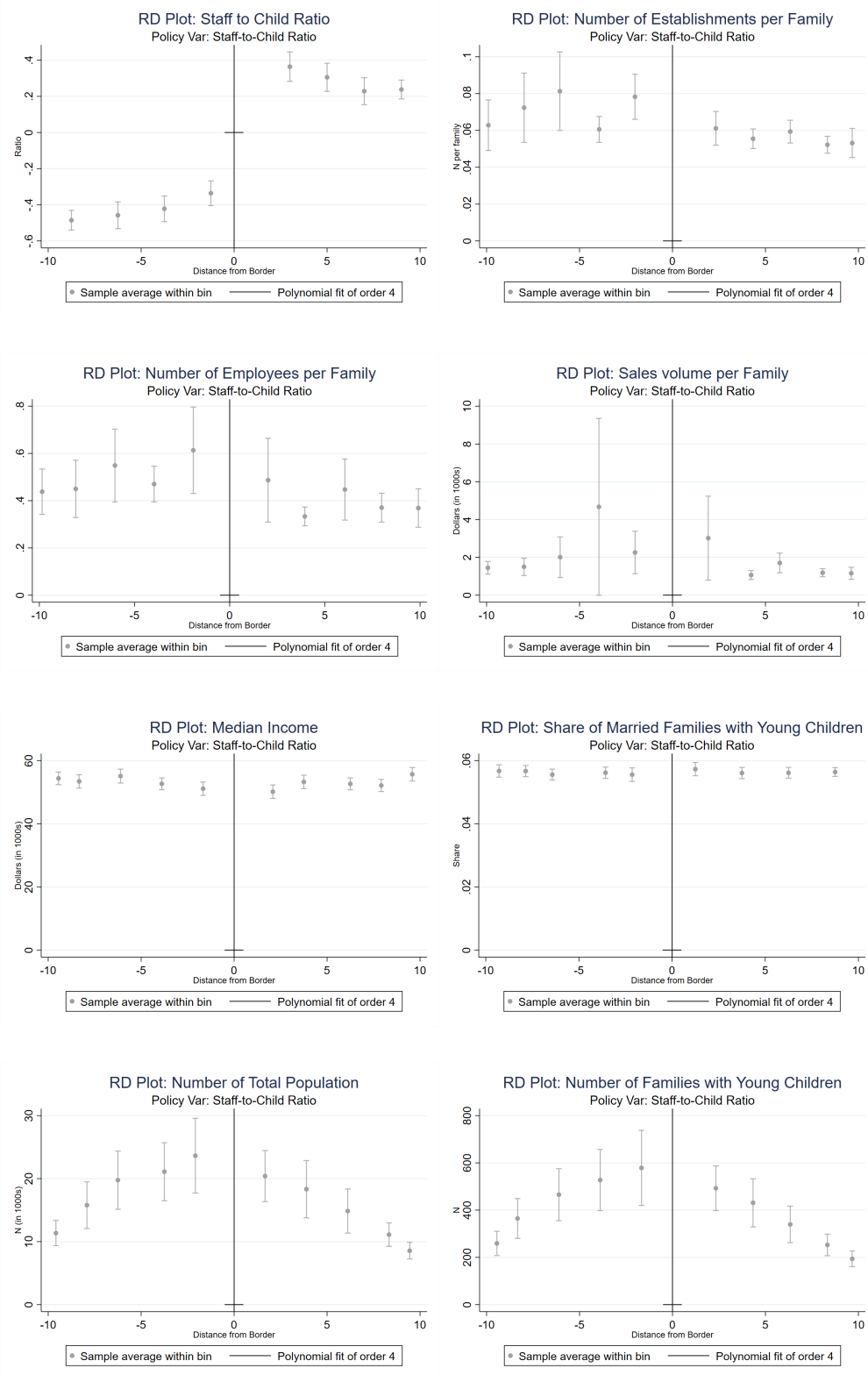


Table 9: Zone-year level RDD analysis: Effect of Child-Staff Ratio on Number of Employees per family, Number of Establishments per family, and Total sales per family

	N Employee/family		N Estab/family		Sales/family	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated (higher SCR)	-5.557	-5.741	0.040	-0.027	-170.507	-234.759
	(5.566)	(5.632)	(0.277)	(0.233)	(158.056)	(244.294)
Miles from border	-0.185	-0.150	0.027	0.049*	42.125	42.908
	(0.454)	(0.577)	(0.029)	(0.029)	(36.521)	(48.286)
Treated (higher SCR) × Miles from border	0.661	0.711	-0.045	-0.045	-37.278	-41.970
	(0.690)	(0.783)	(0.047)	(0.044)	(39.888)	(61.434)
N total population (1000s)		-0.028		0.001		-0.658
		(0.023)		(0.003)		(1.143)
N Families with young children		0.001		-0.000		0.029
		(0.001)		(0.000)		(0.036)
Share Married families with young children		-265.364***		-36.688***		-6916.614
		(56.311)		(4.244)		(4363.685)
Median Income (1000s)		0.016		0.001		3.517
		(0.018)		(0.001)		(3.786)
Demog Controls	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Zone-state FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.264	0.272	0.477	0.513	0.138	0.140
N	5775	5775	5775	5775	5775	5775

Note: A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the sub-zone level.; Each zone represents a local geographic area with shared state boundaries throughout the study period.

The results in Table 10 show effects of SCR on childcare market outcomes across income terciles. there is no clear pattern in the size or direction of the effect on the outcome variables and estimates of interest are not statistically significant. One distinact pattern is that for zones in bottom tercile of income category, he interaction term between treatment and distance from the state border is negative and statistically significant for all outcomes, indicating that farther from the border, treated areas have relatively less establishment, employees and sales volume per 100 families. In contrast, the bottom income tercile displays evidence of a significant positive effect of stricter SCR policies on the number of employees per family. The coefficient for employment in column (4) is 1.897 and significant at 1% level, representing a meaningful increase relative to the sample average, suggesting that stricter regulations may foster employment growth in the child care sector in lower-income regions. Taken together, these findings suggest that while stricter SCR regulations do not broadly impact child care establishments or sales volumes across income groups, they can have meaningful positive effects on child care employment in low-income areas, underscoring the importance of considering income heterogeneity in policy evaluations.

Table 10: Zone-year level analysis: Effect of Child-Staff Ratio on Establishments per Family, Number of Employees per Family, and Sales Volume per Family, By Income tercile

	N Estab/family		N Employee/family		Sales/family	
	(1)	(2)	(3)	(4)	(5)	(6)
Top tercile						
Treated (higher SCR)	2.396	-3.652	0.824*	-0.152	-297.837	-318.922
	(4.506)	(5.686)	(0.499)	(0.282)	(250.947)	(316.565)
Miles from border	-0.528	-1.247	0.001	0.016	28.969	67.803
	(0.632)	(0.901)	(0.063)	(0.046)	(23.138)	(77.166)
Treated×Miles from border	0.935	2.428**	-0.031	0.059	-20.366	-65.006
	(0.858)	(1.089)	(0.081)	(0.063)	(23.189)	(95.385)
2nd tercile						
Treated (higher SCR	-5.010	-3.185	0.441	0.727	30.480	202.933
	(6.323)	(7.719)	(0.477)	(0.683)	(112.721)	(218.158)
Miles from border	1.062	0.186	0.024	0.036	0.669	-34.818
	(0.648)	(0.623)	(0.046)	(0.036)	(6.830)	(24.204)
Treated×Miles from border	-0.487	-0.794	-0.093	-0.175**	33.026	45.637
	(1.173)	(1.148)	(0.077)	(0.070)	(31.089)	(36.350)
Bottom tercile						
Treated (higher SCR)	-5.383	2.886	0.002	1.897***	-8.375	-32.011
	(10.023)	(11.810)	(0.520)	(0.700)	(83.536)	(77.350)
Miles from border	1.967*	1.486	0.064	0.067	10.516	7.630
	(1.152)	(1.161)	(0.056)	(0.048)	(9.129)	(7.582)
Treated×Miles from border	-3.533***	-3.282**	-0.163**	-0.247***	-21.487**	-14.651**
	(1.350)	(1.635)	(0.075)	(0.065)	(10.733)	(7.432)
Demog controls	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: The sample was divided into three groups based on the average median income at the zone level over the study window. A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the sub-zone level.; The table presents estimated effect of change in policy by income level of the local markets. The sample was divided into four groups according to the zone-level average median income. Each zone represents a local geographic area with shared state boundaries throughout the study period.

4.3 State-Level Analysis

The estimation based on state-level data is detailed in the Appendix. Identifying the exact year of policy changes necessitates reviewing state administrative codes or statutes, which is a time-intensive process. For illustration, we present results for Louisiana, where a policy change occurred in 2015. The graphs corroborate the findings from the county-

and zone-level analyses, showing little evidence that stricter regulations significantly impact childcare market outcomes as a whole.

5 Conclusion

This study investigates the impact of changes in staff-to-child ratio (SCR) regulations on childcare market outcomes, focusing on the number of childcare establishments, staffing levels, payroll per employee, and staff turnover. We analyze data from counties, states and zones within 10 miles of state borders, examining the effects of stricter SCR regulations on these outcomes based on different type of methods. We also conduct heterogeneity analysis stratifying the sample into income terciles to explore whether the effects of SCR regulation differ by income level.

The county-level analysis reveals no notable statistically significant effects of SCR regulation changes on the number of childcare establishments, payroll, or staff turnover. While negative point estimates suggest some reductions in establishments (e.g., a 3.1% reduction when increasing the staff-to-child ratio), these effects are not statistically significant. Similarly, no significant impacts are observed on payroll or turnover. The analysis also shows that increasing the staff-to-child ratio by one standard deviation is associated with a decrease in the number of employees per family (12.8% reduction) and a reduction in employee earnings (16%), but these effects are also not statistically significant. When broken down by the size of the providers in terms of employee size, we find that stringent regulation induces reduction in the number of establishments with 20 to 39 employees, which is consistent with findings by Hotz and Xiao (2011) in that greater stringency of regulations reduces number of center-based providers. Our results by income-level shows that these reduction in the center-based providers of larger size tend to take place in low income neighborhood.

At the income level, when counties are divided into terciles based on median income, no significant effects are found, though negative coefficients suggest a slight reduction in establishments in low-income areas. In the zone-level analysis, in lower-income zones, stricter regulations are associated with a significant increase in employment in the childcare sector,

suggesting that stricter SCR policies may have positive effects on childcare employment in these areas. [TBA about the possible mechanism].

The findings suggest that while stricter SCR regulations do not have broad effects on the number of childcare establishments or overall market outcomes, they may have positive effects on employment, while also driving out center-based providers in lower-income areas. This highlights the importance of considering income heterogeneity when evaluating the impact of such policies.

This research will further explore the underlying mechanisms behind these findings, such as whether the positive effects on employment in low-income areas are driven by increased demand for services or by shifts in provider practices.

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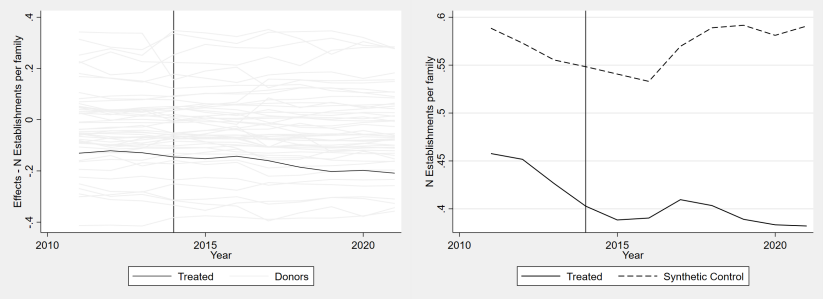
for Education Statistics, 2021. URL https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020075REV. Table 1.

A Appendix

Figure A.1: Synthetic Control Estimation (change in level, number of establishments per family) - Louisiana Policy Change in 2015



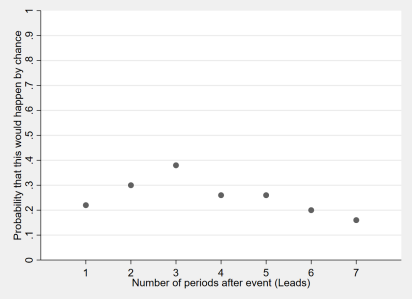
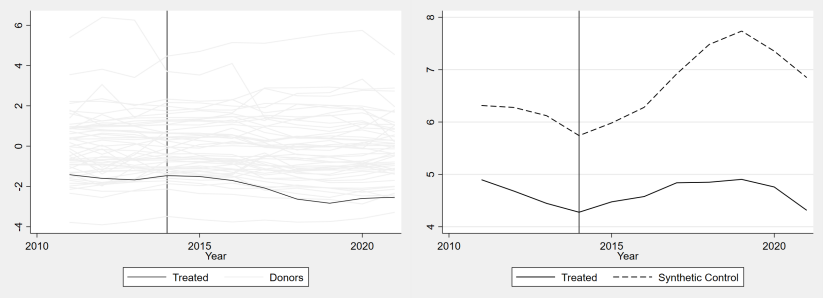


Figure A.2: Synthetic Control Estimation (change in level, number of employees per family) - Louisiana Policy Change in 2015



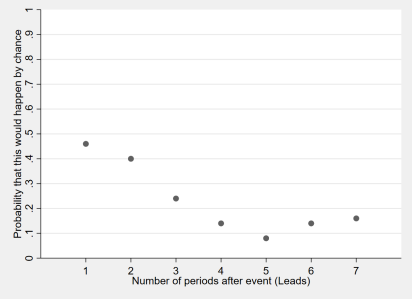
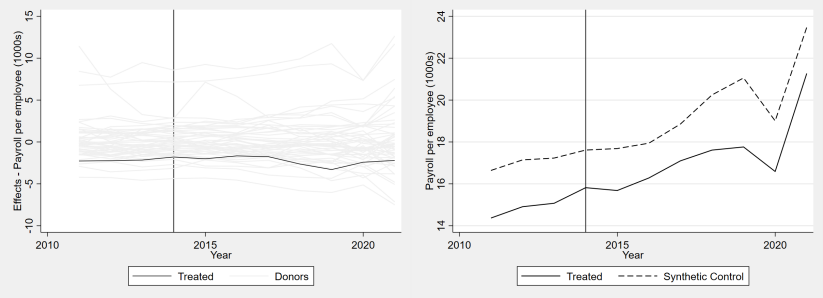
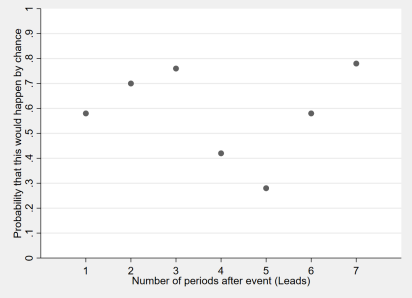


Figure A.3: Synthetic Control Estimation (change in level, annual payroll per employee) - Louisiana Policy Change in 2015





A.1 County-Level Analysis based on yearly data from 2011 to 2017

This section presents data and results derived from a 7-year panel dataset covering 2011 to 2017. By pinpointing the specific year of policy change for each state, additional years can be incorporated into the analysis. The exact year of the child-to-staff ratio for each state is identified through an examination of state legislative documents. The results in this section offer more precise estimates compared to the county-level analysis presented in Section 4.1.

Table A.1: Summary Statistics for County Panel Analysis

Variable	Mean	Std. Dev.	Min.	Max.	N
Payroll per employee (1000s)	13.066	7.277	0	73	15176
N Employees (1000s)	0.399	1.105	0	19.739	15176
N Employees per family	4.042	3.101	0	35.795	15176
Staff turnover rate	0.107	0.071	0	0.875	15176
N Establishments	34.16	88.867	1	1828	15176
N Establishments per family	0.511	0.3	0.028	5.882	15176
N Establishment (1 to 4 Employees)	12.618	38.47	0	896	15176
N Establishment (5 to 9 Employees)	6.729	16.597	0	361	15176
N Establishment (10 to 19 Employees)	8.184	21.007	0	383	15176
N Establishment (20 to 49 Employees)	5.678	15.211	0	242	15176
N Establishment (50 to 99 Employees)	0.521	1.956	0	38	15176
N Establishment (GT 100 Employees)	0.116	0.695	0	16	15176
N Estab per family (1 to 4 Employees)	0.211	0.225	0	4.706	15176
N Estab per family (5 to 9 Employees)	0.114	0.128	0	2.586	15176
N Estab per family (10 to 19 Employees)	0.103	0.097	0	1.338	15176
N Estab per family (20 to 49 Employees)	0.052	0.063	0	0.602	15176
N Estab per family (50 to 99 Employees)	0.004	0.014	0	0.207	15176
N Estab per family (GT 100 Employees)	0.001	0.006	0	0.155	15176
staff-child ratio(raw)	0.056	0.06	0	0.167	15176
County ID	1483.705	864.701	3	2974	15176
State ID	26.925	14.276	1	51	15176
Year	2014	2	2011	2017	15176
Data from ACS					
N total population (10000s)	13.934	37.511	0.163	1010.572	15176
N Families with young children	76.493	208.563	0.51	5216.6	15176
Share Married families with young children	0.695	0.113	0.109	1	15176
Median Income (1000s)	48.268	12.774	19.264	129.588	15176
N Employees out of child care (10000s)	5.317	16.342	0	400.716	15176
Share below poverty	0.159	0.061	0.029	0.479	15176
Sahre below poverty with young children	0.221	0.112	0	1	15176

Note: The balanced panel analytic dataset includes 2,168 counties, each with more than one observation across seven years from 2011 to 2017, yielding a total of 15,176 county-year observations for the analysis. The outcome variables consist of annual payroll per employee, employment counts, and the number of establishments by size, all obtained from County Business Patterns (CBP) data, along with turnover rates sourced from the Census Quarterly Workforce Indicators data. State-level policy variables, such as the staff-to-child ratio, are obtained from NARA. Demographic controls are based on county-level ACS 5-year estimates for the 2011, 2014, and 2017 snapshots.

Table A.2: County-year level Analysis: Effect of Child-Staff Ratio on Number of Establishment per Family by Employee Size

	Overall		1 to 4		5 to 8		10 to 19		20 to 49		50 to 99		GT 100	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Staff-child ratio(raw)	-0.050	-0.051	-0.040	-0.038	-0.003	-0.004	-0.029	-0.028	-0.021*	-0.021*	-0.003	-0.003	0.001	0.001
	(0.040)	(0.040)	(0.046)	(0.046)	(0.032)	(0.032)	(0.027)	(0.027)	(0.012)	(0.012)	(0.004)	(0.004)	(0.001)	(0.001)
N total population (10000s)		-0.004***		0.002***		0.003***		0.002***		0.002***		0.000**		-0.000
		(0.001)		(0.001)		(0.001)		(0.000)		(0.000)		(0.000)		(0.000)
Share Married families with young children		0.013		-0.071		0.030		-0.014		-0.009		-0.000		-0.002
		(0.054)		(0.069)		(0.037)		(0.022)		(0.013)		(0.002)		(0.001)
Median Income (1000s)		-0.002		0.001		0.001		0.001		0.000		-0.000		-0.000
		(0.002)		(0.002)		(0.001)		(0.001)		(0.000)		(0.000)		(0.000)
N Employees out of child care (10000s)		0.005***		0.002***		0.001		0.000		0.001***		0.000**		0.000
		(0.001)		(0.001)		(0.001)		(0.000)		(0.000)		(0.000)		(0.000)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
-squared	0.881	0.881	0.760	0.760	0.652	0.653	0.664	0.664	0.747	0.748	0.625	0.625	0.606	0.606
N	15176	15176	15176	15176	15176	15176	15176	15176	15176	15176	15176	15176	15176	15176

A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.; The estimation uses a two-way fixed effects model, incorporating both county and year fixed effects, to explain county-year payroll per employee, the number of establishments per family, and the staff turnover ratio as functions of a state-level policy variable, the staff-child ratio (D_{ct}), while controlling for socio-demographic characteristics and job availability within the county:

$$Y_{ct} = \alpha_1 D_{ct} + \alpha_2 X_{ct} + \gamma_c + \tau_t + \epsilon_{ct} \tag{A.1}$$

Estimates were obtained using Stata's reghdfe command. In column (10), the coefficient of -1.207 for the staff-child ratio suggests that a one standard deviation increase (0.06) in the child-staff ratio is associated with an approximate decrease of -0.00126 (= 0.06 * -0.021) in the number of establishments with $20-49$ employees per 100 families. This decrease represents a 2.4% reduction in the establishments.

Table A.3: County-year level analysis: Effect of Child-Staff Ratio on Number of Employees per family, Nuber of Establishments per family, Annual Payroll per Employee, and Staff turnover rate

	N Emp per family		N Estab per family		Payroll per employee		Staff turnover rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
staff-child ratio(raw)	-0.238	-0.236	-0.050	-0.051	-1.976	-2.005	-0.001	-0.001
	(0.512)	(0.511)	(0.040)	(0.040)	(1.520)	(1.522)	(0.022)	(0.022)
N total population (10000s)		-0.055***		-0.004***		-0.131***		-0.000
		(0.014)		(0.001)		(0.031)		(0.000)
Share Married families with young children		-0.428		0.013		-0.885		-0.009
		(0.545)		(0.054)		(1.232)		(0.013)
Median Income (1000s)		-0.013		-0.002		0.021		-0.000
		(0.014)		(0.002)		(0.037)		(0.000)
N Employees out of child care (10000s)		0.034**		0.005***		-0.115***		0.001***
		(0.013)		(0.001)		(0.037)		(0.000)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.793	0.794	0.881	0.881	0.681	0.682	0.548	0.548
N	15176	15176	15176	15176	15176	15176	15176	15176

Note: A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.; The estimation uses a two-way fixed effects model, incorporating both county and year fixed effects, to explain county-year payroll per employee, the number of establishments per family, and the staff turnover ratio as functions of a state-level policy variable, the staff-child ratio (D_{ct}), while controlling for socio-demographic characteristics and job availability within the county:

$$Y_{ct} = \alpha_1 D_{ct} + \alpha_2 X_{ct} + \gamma_c + \tau_t + \epsilon_{ct} \tag{A.2}$$

Estimates were obtained using Stata's reghdfe command. In column (6), the coefficient of -2.005 for the staff-child ratio indicates that a one standard deviation increase (0.06) in the child-staff ratio is associated with an approximate decrease of -0.1203 or \$120.3 (=0.06*-2.005), in payroll per employee, representing about 0.9% of the mean annual payroll per employee (\$13,066). However, none of the estimated effects are statistically significant at conventional levels.

Table A.4: County-year level analysis: Effect of Child-Staff Ratio on Annual Payroll per Employee, and Number of Employees, By Income tercile

	N Emp per family		N Estab per family		Payroll per employee		Staff turnover rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Top tercile								
staff-child ratio(raw)	1.323**	1.182*	-0.002	-0.013	-2.234	-2.028	0.064	0.063
	(0.641)	(0.627)	(0.087)	(0.084)	(1.935)	(1.919)	(0.045)	(0.046)
2nd tercile								
staff-child ratio(raw)	-0.436	-0.469	-0.083	-0.082	-0.038	0.005	-0.020	-0.021
	(0.906)	(0.903)	(0.060)	(0.061)	(2.775)	(2.790)	(0.030)	(0.030)
Bottom tercile								
staff-child ratio(raw)	-1.208	-1.165	0.000	-0.005	-3.763	-3.646	-0.051	-0.050
	(1.042)	(1.038)	(0.061)	(0.061)	(3.157)	(3.176)	(0.039)	(0.039)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The sample was divided into three groups based on the average median income at the county level over the study window. A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.; The estimation uses a two-way fixed effects model, incorporating both county and year fixed effects, to explain county-year payroll per employee, the number of establishments per family, and the staff turnover ratio as functions of a state-level policy variable, the staff-child ratio (D_{ct}), while controlling for socio-demographic characteristics and job availability within the county:

$$Y_{ct} = \alpha_1 D_{ct} + \alpha_2 X_{ct} + \gamma_c + \tau_t + \epsilon_{ct} \tag{A.3}$$

Estimates were obtained using Stata's reghdfe command. In column (2), the coefficient of 1.182 for the staff-child ratio found in counties within the top tercile of the median income category indicates that a one standard deviation increase (0.06) in the child-staff ratio is associated with an approximate decrease of 0.07 (=0.06*1.182), in number of employees per family, representing about 1.7% of the average number of employees per family (4.042).

Table A.5: County-year level analysis: Effect of Child-Staff Ratio on Number of Establishment per Family by Employee Size, By Income tercile

	Overall		1 to 4		5 to 8		10 to 19		20 to 49		50 to 99		GT 100	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Top tercile														
Staff-child ratio(raw)	-0.002	-0.013	0.007	0.015	0.075	0.071	-0.043	-0.041	-0.019	-0.017	0.001	0.002	0.001	0.001
	(0.087)	(0.084)	(0.098)	(0.094)	(0.049)	(0.048)	(0.037)	(0.037)	(0.019)	(0.019)	(0.005)	(0.005)	(0.001)	(0.001)
2nd tercile														
Staff-child ratio(raw)	-0.083	-0.082	-0.140**	-0.131**	-0.017	-0.015	-0.099**	-0.096**	-0.028	-0.025	-0.009*	-0.009*	0.001	0.001
	(0.060)	(0.061)	(0.066)	(0.065)	(0.059)	(0.060)	(0.042)	(0.042)	(0.024)	(0.024)	(0.005)	(0.005)	(0.002)	(0.002)
Bottom tercile														
Staff-child ratio(raw)	0.000	-0.005	-0.014	-0.018	-0.119**	-0.120**	0.021	0.021	-0.022	-0.023	0.000	0.000	0.000	0.000
	(0.061)	(0.061)	(0.074)	(0.073)	(0.060)	(0.060)	(0.056)	(0.056)	(0.021)	(0.022)	(0.008)	(0.008)	(0.003)	(0.003)
Demog controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The sample was divided into three groups based on the average median income at the county level over the study window. A larger staff-to-child ratio implies stricter regulations.; * p<.1, ** p<.05, *** p<.01; Robust standard errors are clustered at the county level.