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AEI Economics Working Paper 2024-04

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Abstract

Prices for, and the affordability of childcare has received increased attention since the advent of the COVID-19 pandemic. In addition, concerns have been raised about potential differences in childcare costs and access between rural and urban communities. To address these issues, we combine cross-sectional data from a 2018 survey of childcare prices in counties across eleven states with data on wages, rents, incomes, population and other demographic variables to estimate the determinants of county level prices for infant and pre-kindergarten childcare. Childcare prices for infants and pre-kindergarten four-year-old children are positively correlated with county level population, property rents, wage rates, median family incomes, and shares of adults with bachelor's degrees, which are substantially higher in more heavily populated urban counties. Thus, home and center-based care for infants and pre-kindergarten children is more expensive and, relative to household incomes, less affordable in urban counties than in rural counties.

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Introduction

In 2020, during the COVID-19 pandemic, the price, affordability and availability of childcare received attention in Congress and the press as many childcare facilities closed their doors either temporarily or permanently. In this context, given concerns about employment participation, perhaps especially for single parent families, policy makers have focused on the affordability of and access to childcare in rural areas as compared to urban areas (US Senate Committee on Agriculture, 2021).² Inability to participate in the workforce because of the inability to afford care for children has short and long-term impacts on a parent's and household's income and standard of living. In the short term, there is a potential reduction in the family's current income. Over the long run, because for many young adults on the job training and experience is crucial to the development of work place skills and human capital, future employment and income earning opportunities are diminished, with adverse consequences for both the adults and their children.

Most previous analyses of affordability, defined as the ratio of childcare expenditures to family incomes, have reported mixed results across the rural-urban spectrum but only offered speculative and in some cases competing explanations for the differences they find.³ Here, using cross-sectional data obtained from a 2018 survey of county level average childcare prices for infant and pre-kindergarten (four-year-old) care among eleven states,⁴ conducted by Childcare Aware of America (CCAoA), we address three major issues. The first is whether or not childcare

² For example, relatively recently Henly and Adams (2018), and earlier Maher et al (2008) have suggested that that factors relating to geographic location such as proximity to an urban area or metropolitan/non-metropolitan status may impact the price of childcare through mechanisms relating to market structure and economies of scale.

³ Using data from wave three of the 2008 Survey of Income and Program Participation (SIPP), Laughlin (2013) reported that childcare expenditures, as a share of income, appeared to be lower in rural areas than in urban areas, but that the difference was not statistically significant. Schochet (2019) found the opposite result using 2015 SIPP data but did not report whether or not the differences were statistically significant.

⁴ The eleven states are: Alaska, Delaware, Iowa, Maryland, Massachusetts, Minnesota, Missouri, Nevada, New Hampshire, Oklahoma, and Wisconsin

prices in less populated, more rural counties are higher (as suggested by Henly and Adams, 2018; and Schochet, 2019) or lower than in more heavily populated urban counties. The second is why such differences exist. The third issue is whether, relative to incomes, child care is less or more affordable in rural counties than in urban counties.

Our approach is to estimate reduced form models of the determinants of childcare prices in which prices are a function of variables that are likely to affect both the supply and demand for childcare. We then examine the issue of affordability in more rural and more urban locations using what has become the standard measure of affordability (the ratio of average prices for care to median family incomes) used in many government and other studies of childcare (see for example: Laughlin, 2013; Malik, 2019; Inwood and Stengel, 2020; US Department of the Treasury, 2021).⁵

The CCAoA, using the same data collection approach in each county in the eleven states covered in its survey, reported county level average monthly prices for four types of childcare: infant and four-year-old care in center- and home-based settings. Observations on prices for each of the four different forms of childcare were reported for between 432 and 475 of the 537 counties in the eleven states that provide a much richer data set than those used in previous analyses.⁶ The results presented here indicate that, in contrast to some previous studies, childcare is generally significantly more expensive and less affordable in urban counties than in rural counties. The econometric models of the determinants of infant and pre-kindergarten care prices provide new

⁵ The US Department of Health and Human Services uses an affordability threshold for the price of childcare of seven percent of family income to determine subsidy childcare subsidy levels for low-income families. This metric has been adopted as a threshold to determine whether childcare prices or expenditures are affordable by several studies (See Smith et al., 2020).

⁶ For previous analyses, see Maruffo et al (2003), Davis and Li (2005, 2009), and Davis et al (2009).

insights into why this is the case. Childcare prices are positively linked to wages, rents, and family incomes, which are all higher in urban areas than in rural areas.

For the most part, recent studies of childcare provider costs (implicitly assumed to be the prices paid by households not eligible for subsidies) and affordability in different regions of the country have not used econometric methods. For example, the Center for American Progress has developed an interactive calculator that assumes prespecified relationships between childcare delivery prices or provider costs and variables such as wages and ratios of children to adults to estimate childcare delivery costs in their locations (Workman, 2021). The US Department of Health and Human Services Provider Cost of Quality calculator uses a similar approach for childcare facilities. Both estimate costs based on inputs such as wages, child to adult ratios, and overhead costs (US Department of Health and Human Services, 2022). However, neither of these models utilize data on actual childcare prices, and only estimate costs to the provider at the state level, using assumptions about the roles of variables such as wages and rents. They do not estimate prices paid by the consumer or account for the impacts of demand side variables such as average or median household incomes. The focus has also been on state rather than county costs of care.

Other studies have focused on how regulations on the quality of childcare affect prices but generally only make educated assumptions about which market factors and input costs affect the price of childcare (Artz and Welsch, 2014; Herbst, 2015, Gorry and Thomas, 2017). Herbst

(2015), for example uses only one variable, childcare sector average wages, as a proxy for the cost of childcare.^{7,8}

Four previous studies have estimated reduced form models of childcare prices to empirically evaluate the determinants of childcare prices, but utilize data from much earlier time periods (between 1992 and 2004). These include Marrufo et al (2003), Davis and Li (2005, 2009), and Davis et al (2009).⁹ In contrast to the approach here, which utilizes county level data from eleven states, these studies either use cross-sectional data on state-level average childcare prices (Davis and Li, 2009), or county-level panel data for an individual state (Marrufo et al, 2003; Davis and Li, 2005; Davis et al, 2009). Marrufo et al. (2003) and Davis and Li (2005, 2009) reported that childcare prices were statistically significantly affected by wages, family incomes, population, and childcare subsidy expenditures. All four studies also reported that childcare prices were higher in areas with higher property rents.¹⁰ Davis and Li (2005) reported that, after controlling for wages, rents and other variables, rural counties had lower average childcare prices than urban or metropolitan counties in Minnesota, but similar differences were not found in California (Maruffo et al., 2003) or Oregon (Davis et al., 2009).

⁷The Economic Policy Institute, as part of its Family Budget Calculator, estimates childcare prices at the county level by adjusting state level costs, as reported by CCAoA by metropolitan area fair market rents as reported by the US Department of Housing and Urban Development (Economic Policy Institute, 2020). The findings reported here, and earlier by Davis et al (2009) on the determinants of childcare prices, indicate that this approach is likely inadequate.

⁸ However, among these studies, only Gorry and Thomas (2017) employ a direct measure of childcare prices in econometric models of specific categories of regulation (for example, limits on maximum children-to staff ratios and staff educational requirements) obtained from a CCAoA survey of state-level average prices in 2013.

⁹Marrufo et al (2003) utilize a county-level panel dataset of childcare prices in California from 1992 through 2000. Davis and Li (2005) utilize a county-level panel dataset of childcare prices in Minnesota from 1998 through 2004. Davis et al (2009) utilize a county-level panel dataset of childcare prices in Oregon from 2000 through 2004. Davis and Li (2009) utilize a national state-level cross sectional dataset of childcare prices in 2004.

¹⁰Davis et al. (2009) note that the positive relationship between wages and childcare prices is statistically significant if rents are excluded from the regression models, but not otherwise..

Marrufo et al. (2003), Davis and Li (2005), and Davis et al. (2009) estimated separate models for center and home care for all children under five. Davis and Li (2009) estimated separate models for infants and four-year-olds, but could not distinguish between prices charged by centers and home-based caregivers. In contrast, here prices for all four types of care are evaluated.¹¹

The key results reported in this study are as follows. Prices for infant and pre-kindergarten care in both center and home-based facilities are all positively and statistically significantly related to property rents, wages, family incomes, county population, and the share of adults in the county with a bachelor's degree. In contrast to Marrufo et al. (2003) and Davis and Li (2005), we find no evidence that early childcare prices are affected by the proportion of the population under age five. Further, in contrast to claims that childcare is less affordable in rural areas, the evidence presented here indicates that infant and pre-kindergarten care is more expensive and substantially less affordable in high-population counties.

Data on variables that reflect location specific differences in regulatory requirements and subsidies among the eleven states were not available on a consistent basis. Thus, state fixed effects were included to control for such impacts, as subsidies and regulations are largely determined at the state level. Models that exclude state fixed effects have significantly less explanatory power and standard F tests indicate that state fixed effects are jointly significant determinants of childcare prices, suggesting that differences between states in regulatory environments, along with other unobserved variables, are likely important.¹²

¹¹The four types of formal early childcare for which reduced form models are estimated are center-based care for infants, center-based care for four-year-olds, home-based care for infants, and home-based care for four-year-olds.

¹² For each of the models for which results were reported, F Tests of the joint fixed effects of states were carried out. Uniformly, the joint state fixed effect F tests were significant at the 1% level. For example, F values for model 2 were 29.37 for infant center care, 50.08 for four-year-old center care, 37.50 for infant home care, and 65.38 for four-year-old home care.

Theory

We examine the determinants of childcare prices in four related but different markets: center- and home-based care for infants and for pre-kindergarten (four-year-old) children. The approach is to estimate reduced form models for each market in which prices are a function of exogenous determinants of supply and demand such as income and input prices.

The demand for a specific category of childcare in county i is:

$$D_i = f^D(P_i, \bar{X}_i), \quad (1)$$

where quantity demanded in county i (D_i) is a function of its market price, P_i , and a vector of exogenous variables, \bar{X}_i . The supply function in county i is:

$$S_i = f^S(P_i, \bar{Y}_i), \quad (2)$$

where quantity of a specific type of childcare supplied in county i (S_i) is also a function of its market price (P_i), and a vector of exogenous variables, \bar{Y}_i . Markets are assumed to be competitive and clear. Thus, market price is a function of the vectors of exogenous variables \bar{X}_i and \bar{Y}_i : that is,

$$P_i = f(\bar{X}_i, \bar{Y}_i). \quad (3)$$

where \bar{X}_i includes variables such as family incomes, information about quality, number of children, and demographic indicators and \bar{Y}_i includes variables such as input prices (for example, wages and property rents) as well as indicators of state level policies and regulations that affect the cost of offering care.

Data and empirical model

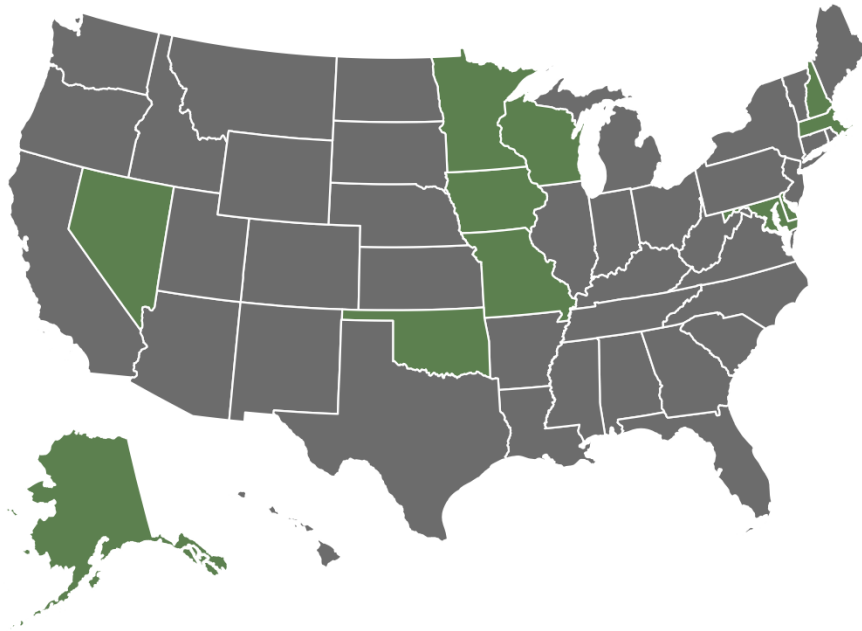
Prices for home and center-based childcare were obtained from the 2018 survey of prices in eleven states for infant and four-year-old care, reported as county-level averages, conducted by Childcare Aware of America (CCAoA, 2019; see Figure 1).¹³ Among the 537 counties¹⁴ in the eleven states, price data were reported for center-based infant care in 432 counties, and for home-based infant care in 471 counties. Prices for four-year-old children were reported for center-based care in 446 counties, and for home-based care in 475 counties. The counties for which data are missing were almost exclusively rural counties with few (less than five) or no childcare facilities (Bureau of Labor Statistics, 2019) which provides support for the proposition that families in some rural counties face “childcare desert” challenges, as argued by Dobbins et al. (2016) and Malik et al. (2020).¹⁵ Variable descriptions and sources are reported in Table 1. Descriptive statistics for all counties in the eleven states are presented in Table 2. For completeness, descriptive statistics for the exogenous variables such as rents and wages in counties with missing price data for each type of care are reported in Appendix A. Similarly, descriptive statistics for those variables in the counties for which price data are available for each respective type of care are presented in Appendix B.

¹³Home care facilities, often abbreviated FCC for “Family Childcare” or “Family Care Center”, are formal childcare facilities that operate legally in the provider’s residential home, which are generally subject to state regulations

¹⁴Counties include county-equivalent jurisdictions such as the independent cities of Baltimore City, Maryland and Carson City, Nevada, and the various boroughs and census areas in Alaska.

¹⁵For each type of childcare, between 88 and 95 percent of counties with missing price data had four or fewer childcare facilities, or missing data on the number of child care facilities operating within the county, as reported by Bureau of Labor Statistics (2018). See Appendix A, Table A1 for statistics describing counties with missing price data.

Figure 1: States included in Child Care Aware of America Dataset ^a



^a The states indicated in this map are: Alaska, Delaware, Iowa, Maryland, Massachusetts, Minnesota, Missouri, Nevada, New Hampshire, Oklahoma, and Wisconsin

Exogenous demand side variables included in the reduced form equations are as follows. County wide median family income accounts for income effects. Total population is a proxy for market size impacts on the demand for care, and also possibly for supply side impacts through complex effects on competition and impacts on childcare delivery costs beyond wages and rents.¹⁶ The share of the population aged 25 and over with a bachelor's degree is also included. A recent study by the Women's Bureau of the US Department of Labor (2023) reported that early childcare prices appeared to be positively correlated with this variable. Beyond impacts on family incomes, bachelor's degree attainment rates may also capture information about the

¹⁶ Population density may drive up the price of space-limited resources such as real estate, but also increase competition and, because of ability for facilities to care for larger numbers of children, allow them to achieve cost reducing economies of size (Henly and Adams, 2018). A range of alternative population measures were also examined. However, these alternative measures were highly correlated with total population, and models in which they were included did not perform better. The other county level population measures included the population under five years old (an estimate of the absolute size of the population needing care used by Davis and Li, 2009), the child to adult ratio (an estimate of the relative size of the population needing care to the population able to provide care, used by Maruffo et al., 2003), and population density (an estimate of geographic concentration of the population).

distribution of incomes, and the likelihood that, in families with two adults, both adults have relatively high paying jobs is greater.

Marrufo et al. (2003) also included the share of the population under five and the employment rate as indicators of demand for care, reporting that both variables had statistically significant positive impacts on center care prices, but only the employment rate had a statistically significant impact on home care prices. The rationale for including the county-wide employment rate is that higher levels of employment may adversely affect the number of adults available to provide informal childcare (including parents or other family members, friends, and neighbors), increasing the demand for formal childcare. In this study, county level employment rates and shares of population under five years old were available from the US Census Bureau American Community Survey (ACS), which reports five-year average values for each variable using data for the period 2014 to 2018. Davis and Li (2009) argued that higher childcare prices increase the opportunity cost of entering the workforce and accepting a job. Thus, there is the potential for simultaneity between these two variables. In models in which Davis and Li included employment measures, the variable was neither statistically nor quantitatively significant.

Table 1. Variable Descriptions

Variable Name	Description	Source
Infant Center Care Price	Average monthly price in 2018 dollars of full time center care for infants	Childcare Aware of America 2019 Report
Four-Year-Old Center Care Price	Average monthly price in 2018 dollars of full time center care for four-year-olds	Childcare Aware of America 2019 Report
Infant Home Care Price	Average monthly price in 2018 dollars of full time family care for infants	Childcare Aware of America 2019 Report
Four-Year-Old Home Care Price	Average monthly price in 2018 dollars of full time family care for four-year-olds	Childcare Aware of America 2019 Report
Average Wage	Average monthly wage in 2018 dollars for all jobs	Quarterly Census of Employment and Wages (QCEW), 2018 Average ^a
Residential Rent	Median monthly residential rental cost in 2018 dollars	American Community Survey (ACS) 2014-2018 Estimates ^b
Family Income	Median monthly family income in 2018 dollars	ACS 2014-2018 Estimates
Population	Total population in hundreds of thousands	ACS 2014-2018 Estimates
Bachelor's Degree	Percent of adults age 25 and up with a bachelor's degree	ACS 2014-2018 Estimates
Employment	Percent of adults age 16 and up that are in the labor force and employed	ACS 2014-2018 Estimates, author's calculations
Share of Population Under Five	Percent of total population under five years in age	ACS 2014-2018 Estimates, author's calculations

^a The Quarterly Census of Employment and Wages (QCEW) is administered by the Bureau of Labor Statistics.

^b The American Community Survey (ACS) is administered by the US Census Bureau.

Table 2. Descriptive Statistics ^a

	Number of Observations	Mean ^b	Standard Deviation	Minimum	Maximum
Infant Center Care Price ^c	432	\$768.29	\$265.72	\$260.00	\$1,975.92
Four-Year-Old Center Care Price ^c	446	\$628.57	\$195.73	\$180.00	\$1,482.17
Infant Home Care Price ^c	471	\$575.95	\$161.43	\$173.33	\$1,245.83
Four-Year-Old Home Care Price ^c	475	\$536.48	\$144.84	\$260.00	\$1,310.83
Average Wage ^c	537	\$3,443.76	\$798.36	\$1,275.81	\$8,551.65
Residential Rent ^c	536	\$747.965	\$210.275	\$443	\$1,765
Family Income ^c	537	\$5,719.77	\$1,264.53	\$3,148.17	\$11,654.67
Population ^d	537	79,890	190,588	981	2,141,574
Bachelor's Degree	537	22.4%	8.7%	9.4%	61.4%
Employment (Share of Population Employed)	537	58.8%	7.2%	35.8%	76.9%
Share of Population Under Five	537	5.9%	1.0%	2.8%	10.3%

^a Values are reported at the county level for the 537 counties in the eleven states for wages, rents, income, employment and population characteristics by the Bureau of Labor Statistics and the Census Bureau. , Price data for center and home based care were obtained from the 2019 Childcare Aware survey.

^b Sample means for each variable are simply averages of county-level observations.

^c Prices, wages, rents, and incomes are reported on a dollars-per-month basis.

^d County population values, as reported by the Census Bureau, are presented in this table. In the regression models, for which results are reported in Tables 3-6, to facilitate the presentation of parameter estimates, the county population variable is rescaled in terms of hundreds of thousands of individual.

Supply side exogenous variables include wages and rental prices. Wages are defined as the average monthly wage paid to all employees in a given county, as reported by the Bureau of Labor Statistics (2019).¹⁷ Average wage rates and median household incomes are positively but not perfectly correlated. The reason is that household income includes non-wage sources of income such as interest, social security, and profits from private businesses and the sale of stocks, and is also linked to the number of income earners in a household. Median levels of the

¹⁷ Average wages in the childcare sector are tested as a determinant of the price of childcare, however there are a large number of NAs in the county-level QCEW childcare sector wage data. Davis and Li (2009) use childcare sector specific wages as a measure of input prices, but express concerns that wages are endogenous to prices (that is, facilities that are able to charge higher prices for other reasons may also pay higher wages). Davis and Li address this by testing wages for all jobs first as a proxy for childcare wages, and then as an instrument childcare wages.

residential rents paid by households in each county are used to represent rental prices, as commercial rent data were not available on a consistent basis at the county level.

Direct measures of regulations and subsidies affecting the childcare sector in each county or state in 2018 could not be constructed on a consistent basis.¹⁸ Thus, state level fixed effects are included in the empirical models to account for differences across states in their impacts, as childcare policies are generally established and carried out at the state level, and other unobserved differences between the states that may affect child care prices.¹⁹

¹⁸ Gorry and Thomas (2017) examined differences in child care prices across states using state level data (but not county level data) associated with state specific differences in regulations on maximum child-to-staff ratios, limits on group sizes, and staff training and education requirements. Such regulatory data were provided by CCAoA in a 2013 survey of child care prices at the state level. They reported that in states with tighter limits on group size and staffing ratios, and more onerous education and training requirements, child care prices tended to be higher. However, they did not account for differences in other state specific childcare policies such as tax credits and subsidies that would also affect child care prices. Further, similar information on regulatory differences across states was not publicly available for the CCAoA 2018 survey of prices at the county level for the eleven states included in that survey.

¹⁹ Regulations such as minimum staff-to-child ratios, maximum group size, and minimum caretaker education or training requirements, are set by states. Federal funds are also provided to individual states through the Childcare Development Block Grant program. These funds can be used for childcare subsidies and tax credits that also vary across states (Lynch, 2022)

Results

Results are reported for three representative econometric models of the determinants of monthly prices for each of the four types of care in Tables 3-6. These include infant (Table 3) and four-year-old (Table 4) care prices in childcare centers, and infant (Table 5) and four-year-old (Table 6) care prices in home-based facilities.²⁰ Results for models that include the employment variable are not reported because of the simultaneity bias concerns identified by Davis and Li (2009). In models in which the employment variable was included, for which results are not reported here but available from the authors, coefficients were consistently negative and, in some cases, statistically significant, in contrast to the results reported by Maruffo et al. This suggests that Davis and Li's concerns about simultaneity bias may be valid.

The three models for which results are reported are as follows. Model 1 includes county specific average wage rates, median household rents, and median family incomes, along with state level fixed effects as explanatory variables. Model 2 also includes county population, and Model 3 further adds the share of the county population that is under five and the share of the population 25 and over with bachelor's degrees.

²⁰ A reviewer suggested that a log-log model specification might be appropriate, given the variation in some of the explanatory variables across counties. Models estimated using log transformations did not outperform the models for which results are presented here, and the interpretation of the results for models in which the dependent and explanatory variables are measured in levels is more straightforward.

Table 3. Infant Center Care Price Models ^a

	1	2	3
(Intercept)	−58.702 (58.953)	132.279* (60.635)	265.923** (68.642)
Wages	0.071** (0.011)	0.043** (0.011)	0.041** (0.010)
Residential Rent	0.436** (0.060)	0.321** (0.059)	0.214** (0.057)
Family Income	0.041** (0.009)	0.048** (0.008)	0.023** (0.008)
Population		25.251** (3.298)	20.378** (3.208)
Bachelor's Degree			7.398** (1.022)
Share of Population Under Five			−2.843 (6.826)
n ^b	432	432	432
R2	0.818	0.841	0.859
R2 Adj.	0.813	0.835	0.854

a. Coefficients significant at the five percent level are indicated by one star (*), and at the one percent level by two stars (**). Standard deviations are reported in parentheses.

b. n denotes number of observations

Table 4. Four-year-old Center Care Price Models^a

	1	2	3
(Intercept)	11.772 (41.140)	124.179** (43.534)	243.053** (50.426)
Wages	0.042** (0.008)	0.022* (0.009)	0.019* (0.008)
Residential Rent	0.275** (0.042)	0.211** (0.042)	0.150** (0.041)
Family Income	0.040** (0.006)	0.044** (0.006)	0.027** (0.006)
Population		15.114** (2.462)	12.204** (2.402)
Bachelor's Degree			4.946** (0.759)
Share of Under Five Population			-5.811 (4.851)
n ^b	446	446	446
R2	0.825	0.839	0.855
R2 Adj.	0.820	0.834	0.850

a. Coefficients significant at the five percent level are indicated by one star (*), and at the one percent level by two stars (**). Standard deviations are reported in parentheses.

b. n denotes number of observations

Table 5. Infant Home Care Price Models ^a

	1	2	3
(Intercept)	151.104** (39.433)	220.841** (41.337)	268.576** (46.753)
Wages	0.042** (0.007)	0.027** (0.008)	0.022** (0.008)
Residential Rent	0.311** (0.037)	0.284** (0.037)	0.258** (0.037)
Family Income	0.021** (0.005)	0.023** (0.005)	0.014* (0.005)
Population		9.808** (2.095)	8.520** (2.101)
Bachelor's Degree			2.521** (0.636)
Share of Under Five Population			-0.912 (4.144)
n	471	471	471
R2	0.835	0.843	0.848
R2 Adj.	0.830	0.838	0.843

a. Coefficients significant at the five percent level are indicated by one star (*), and at the one percent level by two stars (**). Standard deviations are reported in parentheses.

b. n denotes number of observations

Table 6. Four-year-old Home Care Price Models ^a

	1	2	3
(Intercept)	128.321** (32.332)	173.347** (34.460)	227.443** (38.268)
Wages	0.027** (0.006)	0.017** (0.007)	0.012 (0.007)
Residential Rents	0.213** (0.031)	0.194** (0.031)	0.163** (0.031)
Family Income	0.028** (0.004)	0.029** (0.004)	0.018** (0.005)
Population		6.186** (1.775)	4.643** (1.745)
Bachelor's Degree			3.085** (0.536)
Share of Under Five Population			-0.368 (3.470)
Num.Obs.	475	475	475
R2	0.852	0.856	0.866
R2 Adj.	0.848	0.851	0.861

^a Coefficients significant at the five percent level are indicated by one star (*), and at the one percent level by two stars (**). Standard deviations are reported in parentheses.

For all four types of care in all three models, the coefficients on rents, family incomes, population, and bachelor's degree are positive and statistically significant. Coefficients on wages are positive and statistically significant except in Model 3 for four-year-old home care prices (Model 3, Table 6).

The implications of these results are as follows. Using point estimates for each coefficient, a one hundred dollar increase in monthly wages would increase the price of infant care by between \$4.08 (Model 3, Table 3) and \$7.11 (Model 1, Table 3) and the price of care for four-year-olds

by between \$1.90 (Model 3, Table 4) and \$4.18 (Model 1, Table 4).²¹ For home care, a one hundred dollar increase in monthly wages would increase the price of infant care by between \$2.24 (Model 3, Table 5) and \$4.22 (Model 1, Table 5) and the price of care for four-year-old children by between \$1.17 (Model 3, Table 6) and \$2.71 (Model 1, Table 6).

The effects of wages on prices are estimated to be larger for infant care than four-year-old care, and for center-based than home-based care and statistically significant in all but one model (Model 3, Table 6). This finding is consistent with the fact that infant care is more labor intensive than four-year-old care, and that regulatory requirements such as maximum child to caregiver ratios may be more stringent for centers than for home care facilities. When additional demographic variables are included in the regression models (Model 3), estimated coefficients for the wage rate variable are smaller, most likely because wages and population are positively correlated, as suggested by Davis and Li (2009).²²

For center care, a one hundred dollar increase in monthly rents increases the price of infant care by between \$21.42 (Model 3, Table 3) and \$43.58 (Model 1, Table 3) and the price of care for four-year-old children by between \$15.00 (Model 3, Table 4) and \$27.49 (Model 1, Table 4). For home-based care a one hundred dollar increase in monthly rents would increase the price of infant care by between \$25.80 (Model 3, Table 5) and \$31.10 (Model 1, Table 5) and the price of care for four-year-olds by between \$16.30 (Model 3, Table 6) and \$21.28 (Model 1, Table 6).

²¹ Given that the units of measure are dollars, a coefficient of 0.0711 for monthly wages implies that a \$1 increase in wages would increase prices by \$0.071. Thus, a \$100 increase in wages would increase prices by \$7.11. Similarly for the other variables estimated in dollars, the impact of a \$100 increase is to be readily interpreted.

²² In models for which results are not reported here, when the wage rate variable is omitted from the model, coefficient values for household income increase, and vice versa. The Pearson correlation coefficient between median family income and wage rates in our dataset is 0.651, supporting the hypothesis that to some extent the two variables are colinear.

An increase of one hundred dollars in monthly family income would increase center care prices by between \$2.26 (Model 3, Table 3) and \$4.78 (Model 2, Table 3) for infants and by between \$2.68 (Model 3, Table 4) and \$4.44 (Model 2, Table 4) for four-year-olds. For home-based care, a one hundred dollar increase in monthly family incomes would increase the price of infant care by between \$1.36 (Model 3, Table 5) and \$2.28 (Model 2, Table 5) and the price of care for four-year-olds by between \$1.81 (Model 3, Table 6) and \$2.94 (Model 2, Table 6). The coefficient values are larger for center-based than for home-based care, but are relatively similar in infant care models and four-year-old care models for a given type of care.

Models 2 and 3 include total population, a proxy for market size that is expected to have both supply- and demand-side effects. The estimated coefficients for total population are positively and significant for all four categories of childcare ($p < 0.01$). As discussed above, including the population variable generally reduces the values of the estimated coefficients for wages and rents, which are positively correlated with population.

For center care, an increase in population of one hundred thousand would increase the price of infant care by between \$20.37 (Model 3, Table 3) and \$25.25 (Model 2, Table 3), and the price of care for four-year-olds by between \$12.20 (Model 3, Table 4) and \$15.11 (Model 2, Table 4). For home-based care, an increase in population of one hundred thousand people would increase the price of infant care by between \$8.52 (Model 3, Table 5) and \$9.81 (Model 2, Table 5) and the price of care for four-year-olds by between \$4.64 (Model 3, Table 6) and \$6.19 (Model 2, Table 6).

Model 3 also includes two additional variables previous studies have suggested may affect childcare prices. These include the share of the population under five, which in contrast to the

results reported by Marrufo et al. (2003) and Davis et Li (2005), is not statistically significant in any model, a finding also reported by Davis et al. (2009). The other variable, the proportion of the 25 and over population with a bachelor's degree (Women's Bureau, 2023), is positive and statistically significant for all types of care in the models in which it is included in Tables 3-6. The rationale for including this variable is that it accounts for income distribution effects within a county on the demand for childcare as individuals with higher educational qualifications are likely to have higher incomes. Thus, counties with more of those individuals are likely to have more high-income households, other things being equal. For center care, a one percentage point increase in the share of the adult population with a bachelor's degree would increase the price of infant care by \$7.40 (Model 3, Table 3) and the price of care for four-year-olds by \$4.95 (Model 3, Table 4). For home care, a one percent increase in the population share of adults 25 and over with a bachelor's degree would increase the price of both infant care by \$2.52 (Model 3, Table 5), and four-year-old care by \$3.09 (Model 3, Table 6).

As discussed above, household incomes, wages, rents, and the share of adults with bachelors' degrees are generally consistently substantially higher in more urban counties with relatively large populations than in rural counties with much smaller populations. The results presented in Tables 3-6 indicate that each of these variables has substantial positive impacts on both home based and center based childcare prices and costs. Thus, childcare prices are likely to be substantially higher in urban counties than in rural counties.

Affordability

Affordability, widely defined as the ratio of childcare prices – or alternatively family expenditures– to median household incomes, continues to be a major feature of policy debates

about childcare. Other studies have addressed this question, often only qualitatively, and where quantitative estimates have been provided, as discussed above, findings have been mixed (see, for example, Workman, 2021; US Department of Health and Human Services, 2022; Artz and Welsch, 2014; and Herbst, 2015; Gorrry and Thomas, 2017). Here, the issue is addressed in two ways.

First, the CCAoA data on monthly prices are combined with data from the US Census Bureau on median family incomes to construct the standard measure of affordability used by the federal government, the percentage of median family income required for childcare. These county specific estimates of childcare affordability are then plotted against county populations, as shown in Figure 2 for each type of care, where county population size is used as an indicator of relative urbanization.²³ The figures include a simple trend line obtained by regressing the county specific measures of affordability on county population.

All four categories of childcare become more expensive and less affordable as county population increases, not more affordable as some studies have suggested (Henly and Adams, 2018; Schochet, 2019). If home care is generally less available than center care in counties with larger populations, the challenge of affording childcare for families in high-population counties becomes even more severe, as center care is typically more expensive than home care.

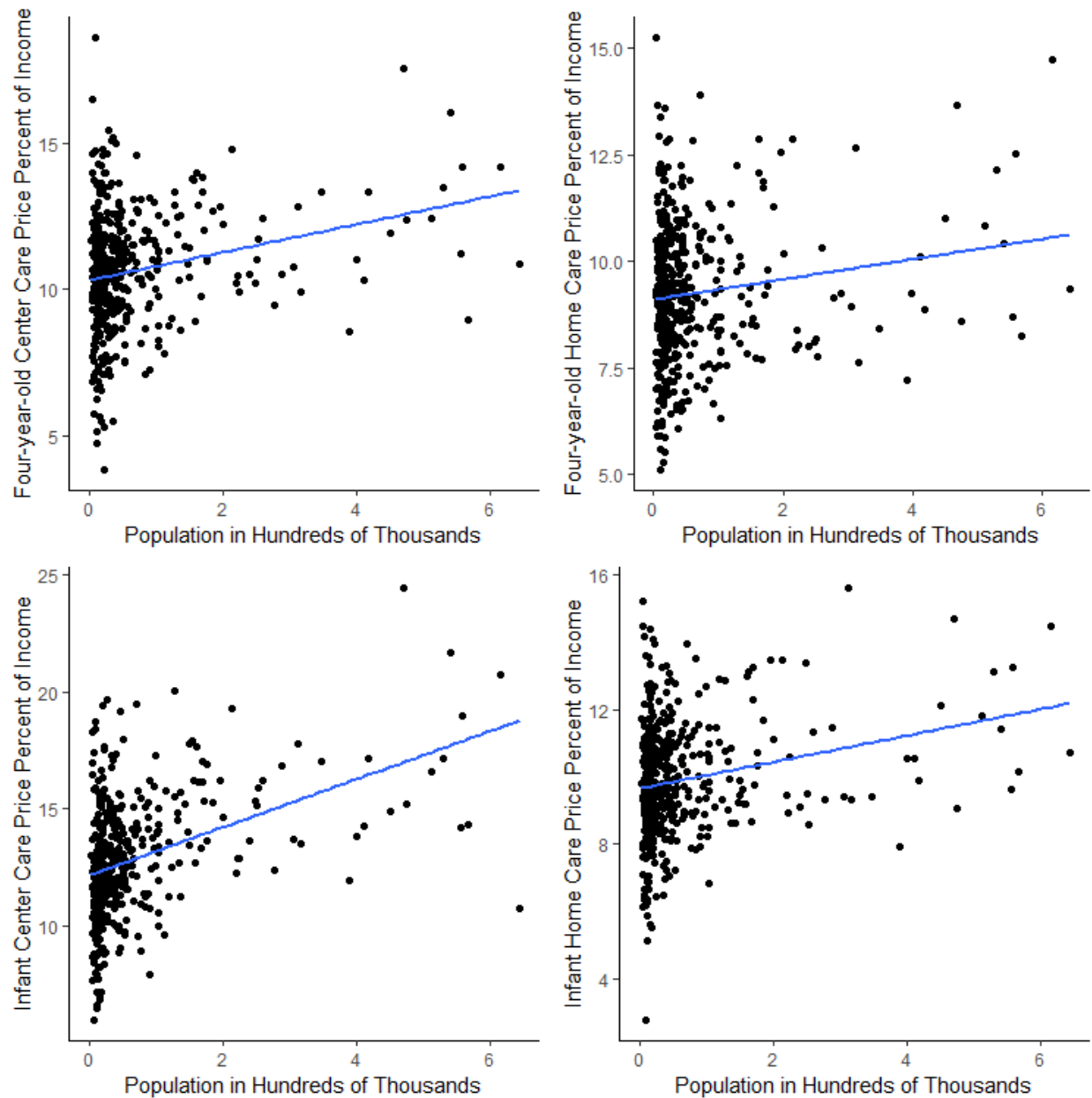
These results are unambiguous, but perhaps not surprising given the econometric evidence presented here on the substantive and compounding impacts on childcare prices of higher wages, higher rents, higher median family incomes, and higher levels of education (as indicated by

²³ Population density, the ratio of the population to land area in a county, is one alternative measure of relative urbanization. Using census tract data within each county to construct other measures of urbanicity is also feasible. When the ratio of monthly childcare prices to median family incomes is plotted against these alternative measures of population density, including population density and median census tract population, similar results are obtained.

shares of adult populations with bachelor's degrees). Values for all of these variables, not just median family incomes, are substantially lower in rural counties and substantially higher in urban counties.

The second approach to examining the extent to which affordability differs among more rural and more urban counties is to carry out a simple illustrative experiment for each type of care using the econometric results presented in Tables 3-6 for Model 3. At the county level, population is positively correlated with household incomes, wages, rents, and other explanatory variables. Thus, prices for each type of care are simulated for representative counties using the parameter estimates for the applicable estimated models to illustrate the extent of potential differences in those prices and the affordability of care in three representative scenarios. In scenario 1, which is indicative of low population, relatively highly rural counties, values for all of the explanatory variables are assumed to be one standard deviation below their sample means (as reported in Appendix B, Tables B1-4). In scenario 2, variable values are set at their sample means; and in scenario 3, variable values are set at one standard deviation above their sample means, representing a relatively urban county. Affordability estimates for each type of care in each of the three illustrative scenarios are reported in Table 7.

Figure 2. Price of Four Categories of Childcare as a Share of Median Family Income by Total County Population^a



^a In Figure 2, the counties for which data are included have populations that lie within three standard deviations of the sample mean for the eleven states to mitigate any outlier affects. Trend lines are represented in blue. When outlier effects are included, the impact of changes in population on affordability becomes larger.

The results are quite striking. In scenario 1, which represents a low income, low population, low rent, low wage rural setting for a county, monthly prices for childcare relative to median family income range from 9.58 percent (four-year-old home care) to 12.13 percent (center infant care). In scenario 2, which represents a county with a sample average population, average rents and wages, and average incomes, monthly prices for childcare relative to median family income range from 11.8 percent (four-year-old home care) to 16.78 percent (center infant care), values that by construction are equal to those for all observations in the CCAoA samples. In scenario 3, a large population, high rent and wages, and high-income urban setting, the affordability measures range from 14.03 percent (four-year-old home care) to 21.43 percent (center infant care), and range from between 50 percent higher to almost double the affordability values in scenario 1.

Table 7. Predicted Monthly Prices of Childcare as Share of Median Family Income

	Scenario 1	Scenario 2	Scenario 3
Infant Center Care	12.13%	16.78%	21.43%
Four-Year-Old Center Care	10.59%	13.77%	16.94%
Infant Home Care	9.93%	12.69%	15.45%
Four-Year-Old Home Care	9.58%	11.80%	14.03%

In summary, across the eleven states for which price data on childcare costs were collected in the CCAoA survey, using conventional measures of affordability (the share of family income that has to be allocated for monthly childcare), childcare, if available, is more affordable in more rural settings than more urban settings. However, among the 537 counties in those eleven states (as reported in Appendix A, Table A2) price data were only available for between 432 and 475

counties because of a lack of information in the other counties, largely because no or very few care formal home and center care facilities were reported to be operating in those counties, almost all of which had low populations and were largely rural. Thus, while care may be relatively affordable in rural counties where it is available, the potential for obtaining access to formal childcare in their own county may pose significant challenges for many rural households with pre-kindergarten children.

Conclusion

The above results indicate that, in contrast to recent suggestions by some commenters, early childcare is both more expensive and substantially less affordable in urban counties with large populations than in rural counties with much smaller populations. These findings hold true for all four categories of care for which price data were available: infant care and four-year-old care in center-based and home-based facilities. Childcare prices and family incomes both increase with population, but the rate of increase is faster for childcare prices.

The econometric analyses of price determination for which results are presented here indicate why this is the case. Childcare becomes less affordable in counties with larger populations because the price of childcare is determined not only by family incomes, but also by rents, wages, and parental education (as reflected by the share of the adult population with bachelor's degrees), all of which increase as counties become more populated and more urban. These findings extend but are also generally consistent with those reported Davis and Li (2005),²⁴ but, in contrast to Marruffo et al (2003) and Davis et al (2009), there was no evidence to support the

²⁴ Maruffo et al. (2003), for California, and Davis et al. (2009) for Minnesota, found that when childcare prices were regressed on county populations, the impact of population on those prices was positive and statistically significant. However, their measures of population were not statistically significant in models that included wages, rents, family incomes, and other variables as explanatory variables.

hypothesis that other demographic variables (for example, the share of the population under five) had significant impacts on childcare prices and costs.

The finding that child care becomes less affordable in more urban counties with larger populations stands in stark contrast to the potentially influential suggestions by Henly and Adams (2018), Schochet (2019), and Inwood (2022) not based on empirical evidence, that childcare might be less affordable for families in rural areas. However, the affordability of, and ease of access to childcare are different stories. As reflected in the data for counties with missing information on childcare prices reported in Appendix A, rural counties with low populations are far more likely to have few or no early childcare facilities than more urban counties with relatively large populations. Thus, while childcare is less affordable in urban areas, challenges with access to both home and center based childcare services may be more extensive in rural areas.

These findings suggest that, at least to some extent, in rural areas public policy should be targeted towards creating access to childcare if a primary objective is to increase workforce participation by adults in low and moderate income households with infants and other children under the age of five. Thus, given concerns about access in rural counties, at the state level policy makers should perhaps consider trade-offs in the use of their limited resources between ensuring availability of care and subsidies to improve affordability of that care.

Finally, however, as has been the case with previous studies, the results presented consistently indicate that, regardless of whether counties are more rural or more urban, childcare costs, as a share of median family incomes, are substantial. They are uniformly much higher for both home and center-based infant and four-year-old care than the federal benchmark for affordability of 7

percent of the median income in the county.²⁵ This is the benchmark used to determine subsidies for lower income households, as defined by the US Department of Health and Human Services. Thus, while states with extensive rural communities may need to allocate resources to expand availability, this should not necessarily be to the exclusion of the use of such funds for subsidies.

²⁵ While higher income families may spend less than 7 percent of their incomes on care by enrolling their children less than full-time, they may additionally pay for informal care during certain hours, or shoulder opportunity costs such as the foregone wages for a non-working parent. Laughlin (2013), for example, reported that families with children under five who pay for any amount for care on average spent 10.5 percent of their incomes on child care.

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Appendix A. Characteristics of Counties with No Reported Price Data

In 2018, state-level organizations associated with Child Care Aware of America surveyed childcare facilities to calculate price data in every county in eleven states. In the final data, several counties did not report price data for one or more of the four categories of early childcare that were studied. This appendix presents descriptive statistics for those counties without reported prices for each childcare category.

Tables A1 and A2 present the number of counties with few or no childcare facilities, and the average number of formal childcare facilities in counties where childcare prices were not reported (Table A1) and counties where childcare prices were reported (Table A2) for each category of care. Data on the number of childcare facilities is from the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages. The BLS only reports a value of zero childcare facilities for one county of the 537 in our dataset. NA values, however, are reported for 41 counties. According to BLS documentation, each facility is surveyed every three years, on a rolling basis, and observations are recorded as “NA” when fewer than half of surveyed facilities respond, or when no businesses were selected to be surveyed in counties with fewer than three eligible businesses.²⁶ The BLS does not differentiate between center- and home-based childcare facilities. On average, there are three or fewer childcare facilities in the counties for which price data is not reported, compared to an average of over 22 facilities in the counties for which we do have price data for each category of childcare that we evaluate. This suggests that the supply of

²⁶ Data is collected through electronic and paper means, with the Annual Refiling Survey (ARS) collecting general business information, and the Multiple Worksite Report collecting further information about employment and wages if businesses are determined to be eligible through the ARS (Bureau of Labor Statistics, 2019).

childcare is very low or non-existent in counties for which we do not have data on average prices.

Table A1. Counties with unreported price data

		Type of Care			
		Infant Center Care	Four Year Old Center Care	Infant Home Care	Four-Year-Old Home Care
Number of Counties by Childcare Establishment Count	NA or 0	32	26	21	20
	1-4	62	54	38	39
	5+	11	11	7	3
	Total	105	91	66	62
Average Number of Establishments ^a		2.6	3.0	3.0	2.5

^a The average number of establishments per county across all eleven states is estimated only using counties for which actual numbers of establishments (including zeros) are reported

Table A2. Counties with reported price data

		Type of Care			
		Infant Center Care	Four Year Old Center Care	Infant Home Care	Four-Year Old Home Care
Number of Counties by Childcare Establishment Count	NA or 0	9	15	20	21
	1-4	159	167	183	182
	5+	264	264	268	272
	Total	432	446	471	475
Average Number of Establishments ^a		24.2	23.8	22.8	22.7

^a The average number of establishments per county across all eleven states is estimated only using counties for which actual numbers of establishments (including zeros) are reported

Table A3 presents descriptive statistics for the counties without reported price data for each category of childcare, for each of the explanatory variables considered in this paper. These values may be compared to the “all counties” values presented in Table 2 in the main text, and the average values from each subset, presented in Table B1 in Appendix B. As may be expected, these are overwhelmingly lower population counties. The average (maximum) population in each subset are 11,500 (35,500) for counties without reported infant center care prices, 11,900 (66,300) for counties without reported four-year-old center care prices, 10,800 (54,500) in counties without reported infant home care prices, and 9,600 (43,700) in counties without reported four-year-old home care prices. Comparing these values to an all-county average population of 79,000 (main text, Table 2), it is evident that these counties are far more rural than the typical county in our dataset. Combining this fact with the information presented above on the number of childcare facilities operating in these counties, it becomes clear that rural families frequently do not have access to formal childcare facilities within their county.

Table A3. Descriptive Statistics for Counties without Reported Prices**Panel A. Infant Center Care Price (N = 105)**

	N	Mean	St. Dev.	Min	Max
Average Wage ^a	105	\$3,088.00	\$840.58	\$2,005.25	\$8,551.65
Median Residential Rent ^a	104	\$659.66	\$155.62	\$443.00	\$1,369.00
Median Family Income ^a	105	\$5,158.57	\$1,040.67	\$3,388.58	\$8,541.67
Population ^b	105	11,534	7,907	981	35,493
Bachelor's Degree	105	18.2%	5.8%	9.4%	43.5%
Employment	105	56.00%	7.6%	39.6%	76.9%
Share Under Five	105	5.8%	1.2%	2.8%	10.3%

Panel B. Four-year-old Center Care Price (N = 91)

	N	Mean	St. Dev.	Min	Max
Average Wage ^a	91	\$3,111.95	\$1,022.29	\$2,005.25	\$8,551.65
Median Residential Rent ^a	90	\$648.34	\$140.54	\$443	\$1,297
Median Family Income ^a	91	\$5,120.99	\$1,018.17	\$3,388.58	\$8,541.67
Population ^b	91	11,872	10,842	981	66,342
Bachelor's Degree	91	18.0%	5.8%	9.4%	43.5%
Employment	91	55.5%	8.0%	39.6%	76.9%
Share Under Five	91	5.7%	1.2%	2.8%	9.6%

Panel C. Infant Home Care Price (N = 66)

	N	Mean	St. Dev.	Min	Max
Average Wage ^a	66	\$3,434.15	\$1,338.56	\$1,275.81	\$8,551.65
Median Residential Rent ^a	65	\$716.15	\$220.74	\$455	\$1,369
Median Family Income ^a	66	\$5,290.26	\$1,355.00	\$3,148.17	\$9,323.83
Population ^b	66	10,775	10,213	981	54,467
Bachelor's Degree	66	18.4%	6.7%	10.5%	43.5%
Employment	66	54.0%	8.7%	35.8%	76.9%
Share Under Five	66	5.8%	1.5%	3.0%	10.3%

Panel D. Four-year-old Home Care Price (N = 62)

	N	Mean	St. Dev.	Min	Max
Average Wage ^a	62	\$3,369.88	\$1,371.16	\$1,275.81	\$8,551.65
Median Residential Rent ^a	61	\$700.84	\$218.06	\$455	\$1,369
Median Family Income ^a	62	\$5,193.87	\$1,308.01	\$3,148.17	\$8,541.67
Population ^b	62	9,569	8,080	981	43,705
Bachelor's Degree	62	17.8%	6.3%	10.5%	43.5%
Employment	62	53.6%	8.9%	35.8%	76.9%
Share Under Five	62	5.8%	1.5%	3.0%	10.3%

^a Child care prices, wages, rents, and incomes are reported on a dollars-per-month basis.

^b Population is presented in real values here. In regression results (Tables 3-6), population is represented in hundreds of thousands.

Appendix B: Model Counties

The data from Childcare Aware of American contains information on prices for different sets of counties, depending on the category of care being offered. Sample means and standard deviations of every variable for each care category are reported in Table B1.

Table B1. Mean Variable Values (Standard Deviations) by Type of Care

	Care Price	Wages	Rents	Incomes	Population	Bachelor's Degree	Share under Five	Sample Size
Infant Center Care	768.29 (265.72)	3,530.23 (764.08)	769.22 (216.25)	5856.17 (1277.46)	0.965 (2.09)	23.44 (9.04)	5.89 (0.88)	432
Four-year-old Center Care	628.57 (195.73)	3,511.46 (727.49)	768.07 (216.32)	5841.94 (1275.97)	0.938 (2.06)	23.31 (8.98)	5.90 (0.91)	446
Infant Home Care	575.95 (161.43)	3,455.11 (692.15)	732.36 (208.65)	5,779.95 (1241.02)	0.896 (2.02)	22.98 (8.86)	5.87 (0.86)	471
Four-year-old Home Care	536.48 (144.84)	3,453.40 (691.36)	754.02 (208.72)	5,788.41 (1243.83)	0.891 (2.01)	23.02 (8.84)	5.88 (0.86)	475

Table 7 in the main text reports affordability ratios, defined as the average price of fulltime childcare divided by the median family income within a county, for each of the four types of childcare in three scenarios. Tables B2-4 (below) present the childcare prices and median family incomes on which the affordability ratios in Table 7 are based. Price values are calculated by adjusting the mean price of each type childcare by one standard deviation of each explanatory variable, multiplied by the coefficients from Model 3 for the respective types of childcare (main text, Tables 3-6). Table B2 reports affordability estimates for scenario 1, in which all explanatory variables are set to one standard deviation below their means. Table B3 reports affordability estimates for scenario 2, in which the explanatory variables are set equal to their means. Table

B4 reports affordability estimates for scenario 3, in which the explanatory variables are set equal to one standard deviation above their means. In each scenario, the county wide median income level used to estimate affordability is also assumed one standard deviation below (scenario 1), equal to (scenario 2), or above (scenario 3) the mean for the full sample of all counties.

Table B2. Scenario 1 – Values One Standard Deviation below the Mean

	Monthly Price of Care	Subset Average Median Monthly Income	Affordability
Infant Center Care	\$555.20	\$4,578.71	12.13%
Four-year-old Center Care	\$483.50	\$4,565.97	10.59%
Infant Home Care	\$450.80	\$4,538.93	9.93%
Four-year-old Home Care	\$435.49	\$4,544.57	9.58%

Table B3. Scenario 2 - Values at Mean

	Monthly Price of Care	Subset Average Median Monthly Income	Affordability
Infant Center Care	\$768.29	\$5,856.17	16.78%
Four-year-old Center Care	\$628.57	\$5,841.94	13.77%
Infant Home Care	\$575.95	\$5,779.95	12.69%
Four-year-old Home Care	\$536.479	\$5,788.41	11.80%

Table B4. Scenario 3 - Values One Standard Deviation above the Mean

	Monthly Price of Care	Subset Average Median Monthly Income	Affordability
Infant Center Care	\$981.38	\$7,133.62	21.43%
Four-year-old Center Care	\$773.64	\$7,117.91	16.94%
Infant Home Care	\$701.102	\$7,020.97	15.45%
Four-year-old Home Care	\$637.47	\$7,032.24	14.03%