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Regional Variation in Child Care Prices: A Cross-State Analysis

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Abstract. A recent study reported that the average annual fees for full-time infant care in a child care center ranged from \$3,803 in Alabama to \$13,480 in Massachusetts. This study analyses this variation in state-level average child care center prices using a standard economic model of supply and demand. We found that a large proportion of the variation in average child care prices can be explained by a small set of variables, including median family income, wages paid to child care workers, and the number of young children in the state. Although the government plays an important role in the child care market, the wide variation in average fees across states mostly reflects what parents can afford to pay. Given the importance of quality child care to current workforce needs and future human capital development, strategies to increase affordability such as child care subsidies and tax credits should be considered along with direct investments in quality improvements.

1. Introduction

For most parents of young children, paying for full-time care in a child care center is expensive. Media reports frequently note that annual full-time center care costs more for a preschool-age child than tuition at some public universities (Schulman, 2000). These costs are high relative to many family budgets, particularly for families with low incomes. A recent study by the National Association of Child Care Resource and Referral Agencies (NACCRRA, 2006) notes that average monthly full-time center fees for two children exceeds the median rent level in 49 states. Yet there is a wide variation in the fees charged for child care in different areas. The NACCRRA (2006) study found that the average annual fees charged for full-time care for an infant in Alabama was \$3,803 while the average in Massachusetts was \$13,480. While average fees are lower for toddlers and preschoolers, the range across states is still large.

The child care market is complex. Child care services in the United States are provided in a variety of different settings, including residential homes (either the child's or the provider's) and non-residential facili-

ties such as child care centers and schools. Many child care providers are private businesses, including both for-profit and not-for-profit organizations. Depending on state regulations, some providers are required to be licensed, though many operate legally without licensure and with minimal regulation. While only a relatively small portion of child care services are provided directly by public entities like K-12 schools, government funding clearly plays a role in the child care market. Government funds Head Start Programs, provides subsidies to help some families pay for child care and, in some states, spends additional money on pre-kindergarten programs.¹ Government also influences the market for child care services through regulations such as maximum child-staff ratios and training requirements. While the government plays an important role in the child care sector, parents pay the majority of the costs of caring for and educating

¹ Federal spending for Head Start programs was \$6 billion in the fiscal year of 2004. Total federal and state spending for child care subsidies through the Child Care and Development Fund (CCDF) was \$9.3 billion in the fiscal year of 2004. In addition, states spent \$2.5 billion on state-funded pre-kindergarten in the 2002-2003 school year. (Source: <http://www.nccic.org>).

children before they reach school age. Studies estimate that parents pay 60% of the costs of child care (with government paying much of the rest) (Mitchell, Stoney and Dichter, 2001). The Cost, Quality and Outcomes (CQO) Study found that parent fees or tuition accounted for the vast majority of revenues in child care centers and as much as 88% of total revenue in for-profit centers (Helburn and Howes, 1996)

The objective of this study is to explain the variation in average child care center prices across states using a standard economic model of supply and demand. In a market system, supply and demand interact to determine the prices of goods and services. Variation in child care prices therefore should be driven by the factors that lead to variations in the supply, demand and quality of child care services in different markets. This study uses regression analysis to investigate the factors associated with differences in average child care center prices across states.² While this approach simplifies many of the complexities of the market, the results improve our understanding of the market for child care services in the United States and underscore the critical connection between affordability and quality.

It is important to recognize that this study is not intended to measure the actual costs of providing care, nor it is a hedonic model of child care prices (which would link prices at individual child care centers with their characteristics). The goal here is simply to investigate the variation in average price across states, because, as seen below, average child care prices vary more across states than average income, rent or housing costs. We find that a large proportion (more than 70%) of the variation in average child care center prices across states can be explained by a small number of state-level variables, including median family income, wages paid to child care workers, and the number of young children in the state.

As a result of this cross-state variation, families face very different prices for child care centers depending on where they live. Higher child care prices do not necessarily lead to less affordability *on average* (if affordability is measured as price of child care as a percentage of income), but higher child care prices increase the burden on the budgets of lower-income families living in the higher-income areas. Previous studies of child care prices have focused primarily on the supply side, that is, the cost factors (such as wages and staff-child ratios) that are associated with child

care prices. This study illustrates the importance of both demand and supply factors in the child care market.

2. Conceptual framework and relevant literature

In the basic economic model of a competitive market with many buyers and sellers of an undifferentiated product and full information, the price of the good or service is determined by the interaction of supply and demand. Factors influencing the demand for a good or service include its price, prices of substitutes and complements, incomes of consumers, size of the population, and tastes and preferences. In terms of the child care market specifically, the demand for center-based child care services is expected to be influenced by factors such as the number of young children needing care, family preferences about types of child care, and family incomes. The availability of substitutes to paid care, such as relatives willing to provide free care and publicly provided programs such as Head Start, may also affect demand. The supply of child care is expected to be influenced by factors such as the availability of labor to the child care field, the wages of that labor, and other costs of providing care such as rent, utilities, insurance, food, etc.

The child care market is clearly more complicated than the simple supply and demand framework outlined above. The child care market operates as a set of submarkets with providers who offer different types of care that vary in terms of services, quality, and price. Parents differ in their preferences for types of care and in their access to free or low-cost alternative care providers such as relatives (Wolfe and Scrivner, 2004). Nonetheless, the conceptual model of a market provides a basic framework for analyzing the price of child care across states. If the provision of child care services exhibits features of a competitive market, the model should accurately predict the relationship between supply and demand factors and the price of child care in different states. As shown below, the estimated model explains much of the cross-state variation in average prices, suggesting that the price of child care does respond to the forces of supply and demand in the market.

Previous studies of the demand for child care have identified a number of relevant factors in the child care market, though most of these studies have focused either on parents' demand for quality of care or on the relationship between mothers' employment and child care choices. Family income has been recognized as an important determinant of demand for child care and child care quality (Blau, 2001; Ficano, 2006; Edwards,

² In this paper we use the term "child care price" to mean the standard amount charged to parents for full-time care of one child over a specified time period. The measure of price available in the NACCRRRA (2006) study is the statewide average monthly fees charged for full-time care for infants and for four-year olds.

Fuller, and Liang, 1996). Other studies have suggested that provision of child care subsidies and tax credits have increased demand for child care and therefore may impact prices (Ficano, 2006; Davis and Li, 2005; Marrufo, O'Brien-Strain and Oliver, 2003). Obviously, demand for child care in a local area is related to the number of children needing care, which reflects both the size of the child population and maternal (or parental) employment (Ficano, 2006; Edwards, Fuller, and Liang, 1996).

From the perspective of child care providers or the suppliers of child care, the largest component of costs for child care services is the cost of labor. The CQO Study estimated labor costs at 70% of total costs (Helburn and Howes, 1996). A more recent study of child care centers in Minnesota determined that on average, labor costs represent 60% of the per hour cost of child care (Policy Studies Inc., 2006). Warner, Ribeiro and Smith (2003) note that it is difficult for child care providers to replace workers with technology as a means of reducing labor costs. Thus, wages paid to child care workers will influence child care prices, and these wages may be higher in areas with higher average wages paid to other workers. Rental or housing costs have also been identified as highly correlated with child care costs (Blau, 2001; Blau and Mocan, 1999; Ficano, 2006).

States' regulations and stringency of enforcement influence child care costs as well as availability and quality (Blau, 2003; Chipty, 1995; Ficano, 2006). For example, states may regulate the number of children per caregiver, group size, and the training and education levels of the caregivers. Allowing fewer children per caregiver or requiring more education and training is likely to raise labor costs for child care centers.

Most parents tend to use child care providers close to where they live or work. Yet even within fairly small geographic areas, child care prices vary widely, reflecting prices for different services (e.g., full or part-time care, or center versus home-base providers) and for different ages of children. Higher prices for child care may reflect higher quality of care. For example, studies have shown that the prices charged to parents are higher on average in centers that are accredited compared to those which are not (NACCRRRA, 2006). The CQO Study found the quality was higher in accredited centers compared to those without accreditation (Helburn and Howes, 1996). Accredited centers generally have teachers with more education and training and so are likely to have higher costs (Smith and Endsley, 1996). Some states recognize the higher quality and higher costs of accredited child care and pay a higher reimbursement rate for care provided in those settings in the child care subsidy program.

Ficano's (2006) study analyzes changes in the supply of formal child care in the U.S. in response to policy changes between 1990 and 2000. She adopts a market framework to examine the factors influencing the supply and demand for labor and estimates reduced form equations for child care supply. She concludes that "market forces affect the child-care market in theoretically predicted ways" (p. 474), and that government spending on child care through tax credits and subsidies has led to increased supply, particularly in poorer and more rural areas. Her study focuses on changes in supply of child care (measured by the number of workers in child care), while the focus of this study is variation in child care prices across states. Despite the difference in focus, both studies demonstrate the role of supply and demand factors in the child care market.

Three studies have examined regional variation of child care prices within a state using a similar econometric approach. The first study of this type (Marrufo, O'Brien-Strain and Oliver, 2003) examined the variation in average child care prices across counties in California between 1991 and 2000. Two subsequent studies applied the California methodology to estimate models using county-level data from Minnesota and Oregon (Davis and Li, 2005; Davis, Li, Weber and Grobe, 2009). The report by Davis et al. (2009) compares the findings from all three states and concludes that similar economic and demographic factors explain much of the variation in child care prices across counties within each state. This study uses a similar approach, applied to state-level data on average child care center prices. Using state-level data allows us to include policy variables (such as licensing requirements for staff-child ratios or the availability of refundable tax credits) that vary across states but do not typically vary across counties within a state.

3. Methods and data

To examine the variation in child care center prices across states, we employ a straightforward regression estimation strategy to identify factors affecting the price of child care through changes in the demand and supply of child care. The cross-sectional model assumes that the market is in equilibrium. This model, though not a general equilibrium exercise, is broadly consistent with individual utility- and profit-optimization behavior and the reduced forms derived from a structural framework. We first outline the theoretical framework followed by a description of the empirical model and data.

In the theoretical model we assume that the demand for child care center services (measured,

perhaps, in hours of center care per week) for each household in the state can be aggregated into a state-wide demand function for center child care (by age of child). The aggregate theoretical demand function in a given state i can be expressed as:

$$D_i = f^d(P_i, I_i, CP_i, G_i, X_i) \tag{1}$$

where D_i is the demand for center child care in state i , which is a function of P_i , the child care price; I_i , household income; CP_i , the number of children; and G_i , government subsidies to demand such as child care subsidies and tax credits, and X_i , which represents taste shifters. (The specific measures used in the empirical model are described below.)

Similarly, let the supply function in the given state i be expressed as:

$$S_i = f^s(P_i, C_i) \tag{2}$$

where S_i is the supply of child care in centers in state i , which is a function of price (P_i) and costs (C_i). As described below, the costs include both direct costs such as wages and rent, and costs related to government regulations such as minimum staff-child ratios.

Given the equalization of market equilibrium quantity of demand and supply, we can then solve for child care price as a function of the determinants of market supply and demand. Assuming that the demand and supply functions can be approximated as linear functions in natural logarithm form, the basic estimating equation takes the following form:

$$\log(P_i) = \beta_0 + \beta_1 \log(I_i) + \beta_2 \log(CP_i) + \beta_3 \log(G_i) + \beta_4 \log(C_i) + \alpha'X + \varepsilon_i \tag{3}$$

where X represents a vector of taste shifters. Assuming standard downward sloping demand and upward sloping supply curves, all the coefficients (β 's) are expected to be positive. Factors leading to an increase in demand for center care are likely to increase the price. For example, demand for child care is likely to increase with the state median income level and the number of children needing care. Factors that increase the cost of providing care or that decrease the availability of center care would be expected to increase the price. The specific measures of each of the demand and supply factors are described next, along with description of the data sources. Variations in model specification that were tested are described below in the results section.

3.1 Data and variables

Table 1 provides basic descriptive statistics for the key variables. The data on child care center fees were published in a study done by the National Association of Child Care Resource and Referral Agencies (NACCRRRA, 2006). The NACCRRRA data were merged with data from a number of other sources identified in appendix Table A-1 to create a new state-level data set. The dependent variable, child care price, is the state average monthly fees in 2004 for full-time care in a child care center, with separate averages for infants and for four year olds.

Table 1. Descriptive statistics for key variables

Variable	N	Mean	Standard Deviation	Minimum	Maximum	Coefficient of Variation
Infant monthly fees	50	\$587	\$187	\$317	\$1,123	0.32
Four year old monthly fees	50	\$477	\$135	\$251	\$802	0.28
Median family income	50	\$63,668	\$10,430	\$47,256	\$88,401	0.16
Number of children	50	1,126,860	1,320,655	87,500	7,438,922	1.17
Employment rate	50	61.5%	4.8%	50.2%	74.0%	0.08
Child care worker wage	50	\$16,439	\$1,992	\$13,330	\$21,920	0.12
Median rent	50	\$651	\$122	\$461	\$914	0.19
Accredited ratio	50	1.8%	1.3%	0.6%	8.1%	0.72
Staff-child ratio regulation	50	8.2%	1.7%	5.0%	12.5%	0.21
Child care subsidies per child	50	\$0.03	\$0.01	\$0.01	\$0.06	0.33
Refundable state child care tax credit	50	0.26	0.44	0.00	1.00	1.70

Note: For variable definitions and sources, see Appendix.

NACCRRRA “asked Child Care Resource and Referral Networks in each state to report average annual fees for center-based care for an infant and a 4-year-old child” (NACCRRRA, 2006, p.iii). The actual methodology used to estimate an “average” price differed across the states (see the report’s appendix for more detail). Despite this variation in methods, the NACCRRRA data were intended to represent statewide average prices for full-time center-based care for infants and for four year olds. Clearly these data ignore the variation in fees across centers within states or even within neighborhoods. The average price is not a full representation of the market for child care centers; we also would need to consider the range and variation of prices. Nonetheless, as noted below, differences in the statewide average prices are highly correlated with other statewide characteristics and thus can be used to describe overall differences in child care center prices across states.

The demand for child care is driven largely by the number of children needing non-parental care, and so we include two measures to capture this demand: number of children in the state and the employment rate. The number of children under age 13 was obtained from U.S. Census estimates for the year 2004. The percentage of the (adult) population that is employed in the paid labor force was obtained from the U.S. Bureau of Labor Statistics. While the employment rate of parents, or in particular, mothers, would be more closely related to the need for child care services, we do not include it in the model because of the simultaneity problem as mothers’ employment decisions will be affected by child care prices. Numerous studies have shown that child care costs influence mothers’ decisions to work in the paid labor market (see, for example, Connelly and Kimmel, 2003; Davis and Connelly, 2005; Blau and Hagy, 1998; Powell, 1997, 2002).

Other demand-side factors include family income (measured by state median family income) and government policies that reduce child care costs for families, such as subsidies and tax credits. Government funding for child care subsidies may lead to an increase in the demand for paid child care and thus may put upward pressure on child care prices. Wolfe and Scrivner (2004) find that many low-income mothers prefer center care but cannot afford it. While parents receiving child care subsidies may choose any legal care provider, many do choose center care. The amount spent to help low-income families pay for child care through the Child Care and Development Fund was nearly \$12 billion in 2006 (Center for Law

and Social Policy, 2008).³ In this study, we use the percentage of children receiving subsidies (the number of children receiving child care subsidies in a state, in 2004, divided by the number of children under age 13) as the measure of government subsidy policy. By this measure, the percentage of children in a state who receive child care subsidies averaged 3.2% across all 50 states in 2004. The percentage receiving child care subsidies ranged from a low of 1.1% in Nevada to a high of 6.4% in North Carolina.

The federal government, along with a number of state governments, allows parents to reduce the income tax they owe to the government by receiving a credit for their child care expenses (up to a set limit). By reducing the effective cost of child care to parents, these tax credits are likely to increase demand for paid child care services. We include a dummy variable for states that have a refundable child care tax credit. Thirteen states have state refundable child care tax credits, and another thirteen have a non-refundable credit. We included separate dummy variables for refundable and non-refundable state tax credits, but only the former had a statistically significant coefficient.

As noted earlier, the supply of child care will be influenced both by direct costs such as wages and rent, and costs related to government regulations such as minimum staff-child ratios. Factors that increase the cost of providing care or that decrease the availability of center care would be expected to increase the price. Key cost factors are captured by including the state average wage for child care workers and average median rent for the state. Certain government regulations are expected to increase the cost of providing child care services, and thus may result in higher average prices in the state. State governments typically set a minimum number of staff per child in different age groups for child care centers. The required staff-child ratio for four-year olds averages 13 children per staff member across all states in 2004 (data obtained from the National Child Care Information Center). New York had the strictest requirement where child care facilities were required to have one staff for every eight children. The most lenient ratio was in the state of North Carolina where the minimum requirement was 20 four-year old children for every staff member.

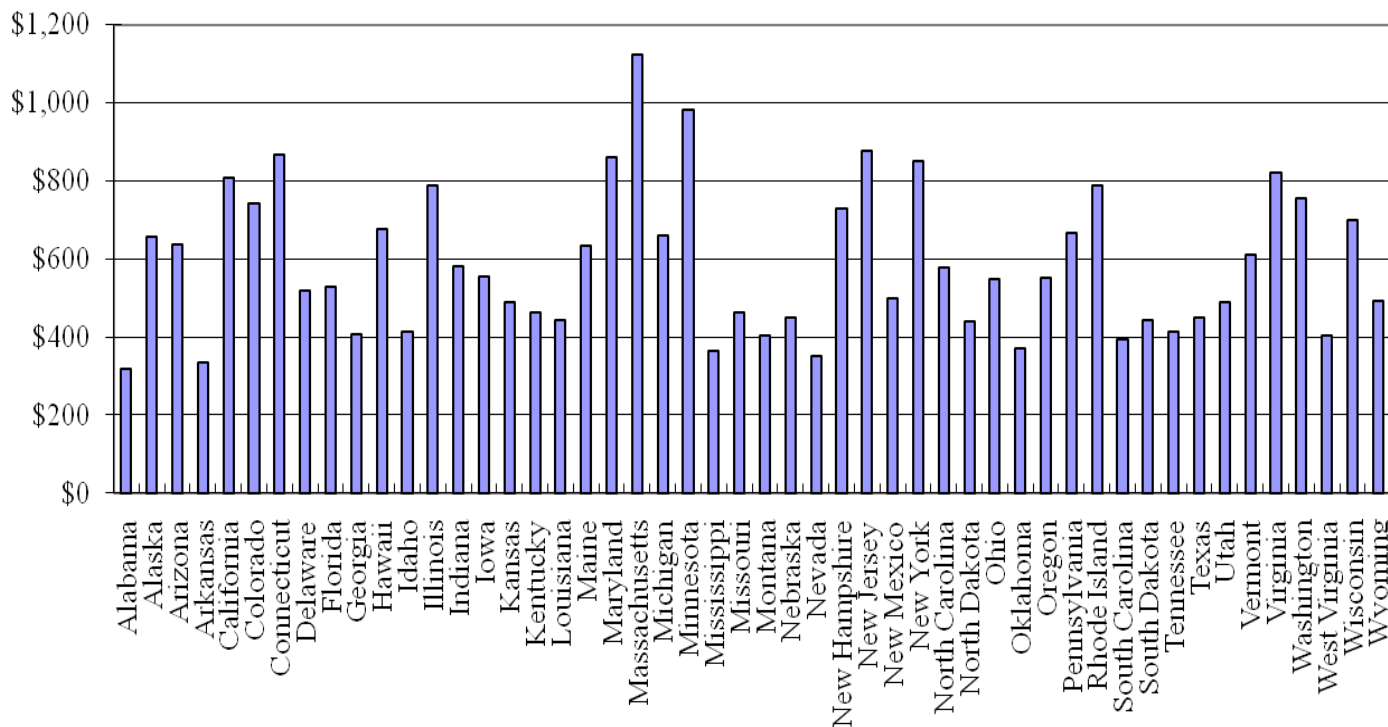
To meet the accreditation requirements of the National Association for the Education of Young Children (NAEYC), child care centers hire teachers with more education and work experience, and often have more staff per child than required by state regulation. As a result, labor costs at these centers may be higher

³ This amount includes federal and state expenditures from CCDBG and TANF transfers to child care.

than at child care centers that have not been accredited. For this study, we measure the accredited program ratio as the number of children in accredited programs (from the National Child Care Information Center) as a percentage of the child population under age 13 in the state. The average accredited ratio across the 50 states was 1.7% in 2004. The ratio was ranged from 0.5% in South Dakota and to a high of 7.8% in Massachusetts.

Figure 1 illustrates the wide variation in average monthly child care fees for an infant in full-time center

care across states, based on data from the NACCRRA 2006 study. The average monthly fees for infant full-time care across states were \$587 in 2004, ranging from a low of \$317 in Alabama to a high of \$1,123 in Massachusetts. Child care centers typically charge higher fees for infants than older children, but the variation across states was almost as large for four-year olds (ranging from \$251 in Alabama to \$802 in Massachusetts with an average of \$487 per month across all states).



Source: NACCRRA (2006)

Figure 1. Statewide average monthly center fees for full-time infant care (2004)

Comparison of child care fees with average rent across states provides a context for understanding how expensive child care is relative to family budgets.⁴ Monthly average child care center fees for a full-time four-year-old exceed 70% of median monthly rent in 30 states. The price of full-time center care also represents a sizeable portion of family income. The monthly child care fees for a full-time four-year-old average about 9% of the median monthly family in-

come across all states. The share is equal to or higher than 10% in 18 states. The monthly child care price for full-time infant care averages about 11% of the median monthly family income across all states.

Prices of many goods and services are higher in states with higher family incomes, and child care is no exception. The highest median income states are, in rank order (in 2004), New Jersey, Connecticut, Maryland, Massachusetts, and New Hampshire. The top states for child care center prices are, in rank order, Massachusetts, Minnesota, New Jersey, Connecticut, and Maryland. However, the variation in incomes across states is much smaller than the variation in

⁴Note that these costs are the fees charged for full-time care for one child in a child care center. Many parents use care that is less than full-time or full-year. On the other hand, many families have more than one child in paid care. The average amount paid for child care per working family in the U.S. in 2000 was \$286 in year for those families who paid for care with children under 13 (Giannarelli and Barsimantov, 2000).

child care prices. The coefficient of variation⁵ for infant child care prices, 0.32, is double the magnitude of the same statistic, 0.16, for median income. Thus, while child care prices and income are correlated, child care prices (as measured by the statewide average) are much more variable across states.

4. Empirical results

The OLS regression results are reported in Table 2 for infants and Table 3 for four-year olds. Despite the local nature of child care markets, the estimated model of state-level factors is able to explain a high percentage of the differences in average child care center fees across states. More than 70% of the price variation is explained by state economic factors (Model I in each table). The key factors correlated with average child care center price across states are state median income, number of children, and child care worker wages. For each one percent increase in median income, child care prices are estimated to be about one percent higher for both infants and four-year-olds. A one percent increase in the number of children in a state is associated with about 0.05% higher child care prices for infants.

Along with demand-side variables, factors related to the cost of providing care, such as child care worker wages and median rent, were expected to be positively associated with child care prices. The results show that average child care worker wage in a state is positively associated with prices. However, the estimated coefficient on median rent is not significantly different from zero for either age group. Other studies have noted the importance of rent or space costs in the cost (not price) of child care, however, and as discussed below, the high correlation between median income and median rent in a state may explain the lack of statistical significance.

While these basic economic characteristics of a state (median income, number of children, employment rate, and child care worker wages) explain a large proportion of the variation in child care prices across states, other factors are likely to influence the demand and supply of child care. The columns labeled Model II in Tables 2 and 3 add a number of policy-related and institutional variables to the regression. As expected, government subsidies for child care, either through Child Care and Development Fund (CCDF) subsidies or child care tax credits, increase the demand for child care by lowering the effective price paid by parents. For both infants and four-year olds, the estimated coefficients for these variables are positive and statistically significant. In states with a refundable child care

tax credit, statewide average fees are about 0.1% higher for both age groups. Similarly, a one percent increase in the proportion of children receiving child care subsidies is associated with about a 0.1% increase in child care prices.⁶

Average prices are also higher where the share of children in accredited programs is higher (though the estimated coefficient in the model for prices for four year olds has a p-value of 0.107). The results indicate that a one percent increase in the share of children in accredited programs is associated with a slightly less than 0.1% increase in both infant and four-year-old child care prices. The estimated coefficient for the required staff-child ratio is positive, as expected, for both age groups, but is not statistically significant in either model.

Tables 2 and 3 also show the standardized beta coefficients in order to provide a sense of the relative magnitude of the relationship between the various factors and child care prices.⁷ For both infant and four-year-old models, median family income has the largest effect on state average child care prices (based on the standardized coefficients). For infants, after income the variables with the next largest standardized coefficients are the number of children and wages of child care workers. For four-year-olds, the state average wage of child care workers has the next largest standardized coefficient after median income. In both models, however, the standardized coefficient for median family income is about twice as large as the next largest standardized coefficient.

Overall, the model explained a high proportion of variation in average child care prices across states (the R-squared ranged from 0.72 to 0.86). While the predicted and actual average center prices may diverge for any particular state, the results show that the predicted child care price was close to the actual average for nearly all states. For a small number of states, however, the prediction was less accurate. Table 4 lists the states where the absolute value of the studentized residual (the difference between the predicted value and the actual value, divided by its estimated standard error) was more than 1.5 (in natural logarithms).

⁶ One reason we estimated the model first without these policy variables is the possibility of simultaneity: that states with higher child care prices might be more likely to enact tax credits or higher subsidies as a result. We address concerns about endogeneity in the next section.

⁷ A standardized beta coefficient is obtained by subtracting its mean and dividing by its standard deviation. The explanatory variable with the largest standardized beta coefficient is the "most important" in the sense that a one standard deviation change in that explanatory variable is associated with a larger change in the dependent variable than for any other explanatory variable (Wooldridge, 2006, p. 196).

⁵ The coefficient of variation is defined as the ratio of standard deviation to the mean for a variable.

The model underestimated both the infant and four year old prices in Virginia, and overestimated both in Missouri. Infant prices were underestimated also in Arizona, Minnesota and Utah, while four-year-old prices were also underestimated in New Jersey. The reported statewide average child care prices in these states were higher than predicted by the model. In all cases, however, the predicted value was within 5% of the (natural logarithm of) actual child care price.

Figures 2 and 3 illustrate the difference between actual and predicted child care fees for infants and four-

year olds, respectively, for nine selected states. The figures show the states with the three lowest actual average child care fees, the three highest, and three with fees near the median for all states. These figures demonstrate that aside from the small number of states with large residuals identified above, the predicted price was similar to the actual price for both high and low-priced states. This suggests that there is not a systematic factor causing the over- or under-prediction (such as an omitted variable).

Table 2. Ordinary least squares (OLS) estimates for average child care center prices for infants

Dependent Variable: (Log) Child Care Center Fees for Infants				
Variables	Model I		Model II	
	Estimated Coef- ficient	Standardized Coefficient	Estimated Coef- ficient	Standardized Coefficient
Median income	1.14 *** (0.21)	0.58	0.97 *** (0.22)	0.50
Number of children	0.05 ** (0.02)	0.15	0.07 *** (0.02)	0.22
Employment rate	0.17 (0.26)	0.04	0.28 (0.23)	0.07
Childcare worker average wage	1.00 *** (0.26)	0.38	0.59 * (0.31)	0.23
Median rent	-0.06 (0.19)	-0.04	0.13 (0.21)	0.08
Percent of children receiving childcare subsidies			0.09 * (0.05)	0.11
State refundable tax credit			0.09 ** (0.04)	0.13
Accredited ratio			0.08 * (0.04)	0.14
Staff-child ratio			0.22 (0.13)	0.15
Intercept	-16.14 *** (1.92)	0.00	-10.57 *** (3.32)	0.00
R ²	0.81		0.86	

Notes: All variables are included in natural logarithm form. Estimated standard errors in parentheses.
Significance levels: *10%, **5%, ***1%.

Table 3. Ordinary least squares (OLS) estimates for average child care center prices for four year olds

Dependent Variable: (Log) Child Care Center Fees for Four-Year Olds				
Variables	Model I		Model II	
	Estimated Coefficient	Standardized coefficient	Estimated Coefficient	Standardized coefficient
Median income	1.04 *** (0.23)	0.58	0.90 *** (0.25)	0.51
Number of children	0.02 (0.02)	0.09	0.04 * (0.02)	0.15
Employment rate	0.17 (0.29)	0.05	0.26 (0.27)	0.07
Childcare worker average wage	0.99 *** (0.29)	0.42	0.69 * (0.36)	0.29
Median rent	-0.17 (0.21)	-0.11	-0.03 (0.24)	-0.02
Percent of children receiving child care subsidies			0.11* (0.06)	0.14
State refundable tax credit			0.10 ** (0.05)	0.15
Accredited ratio			0.08 (0.05)	0.15
Staff-child ratio			0.15 (0.15)	0.12
Intercept	-14.01 *** (2.12)	0.00	-9.70 *** (3.78)	0.00
R ²	0.72		0.77	

Notes: All variables are included in natural logarithm form. Estimated standard errors in parentheses.
Significance levels: *10%, **5%, ***1%.

Table 4. Over and underprediction of child care center prices

Rank	<u>States with underestimated prices</u>		<u>States with overestimated prices</u>	
	Infants	Four-Year Olds	Infants	Four-Year Olds
1	Virginia (0.96)	Virginia (0.96)	Nebraska (1.03)	Missouri (1.05)
2	Arizona (0.96)	New Jersey (0.97)	Georgia (1.03)	Alabama (1.04)
3	Minnesota (0.97)		Missouri (1.03)	Maryland (1.04)
4	Utah (0.97)		Delaware (1.02)	Nevada (1.03)

Notes: Table includes all states with studentized residuals over 1.5 or below -1.5.
Predicted value as percentage of actual value (in natural logarithms) in parentheses.

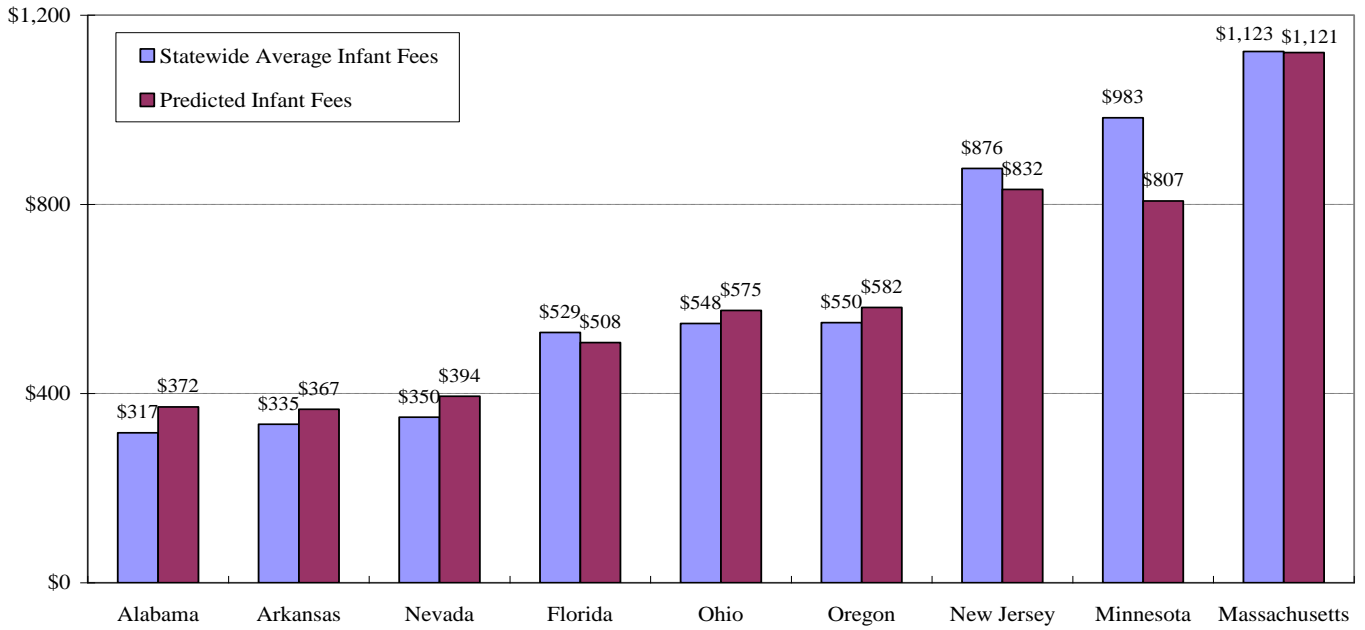


Figure 2. Comparison of predicted and actual statewide average center fees for infants (selected states)

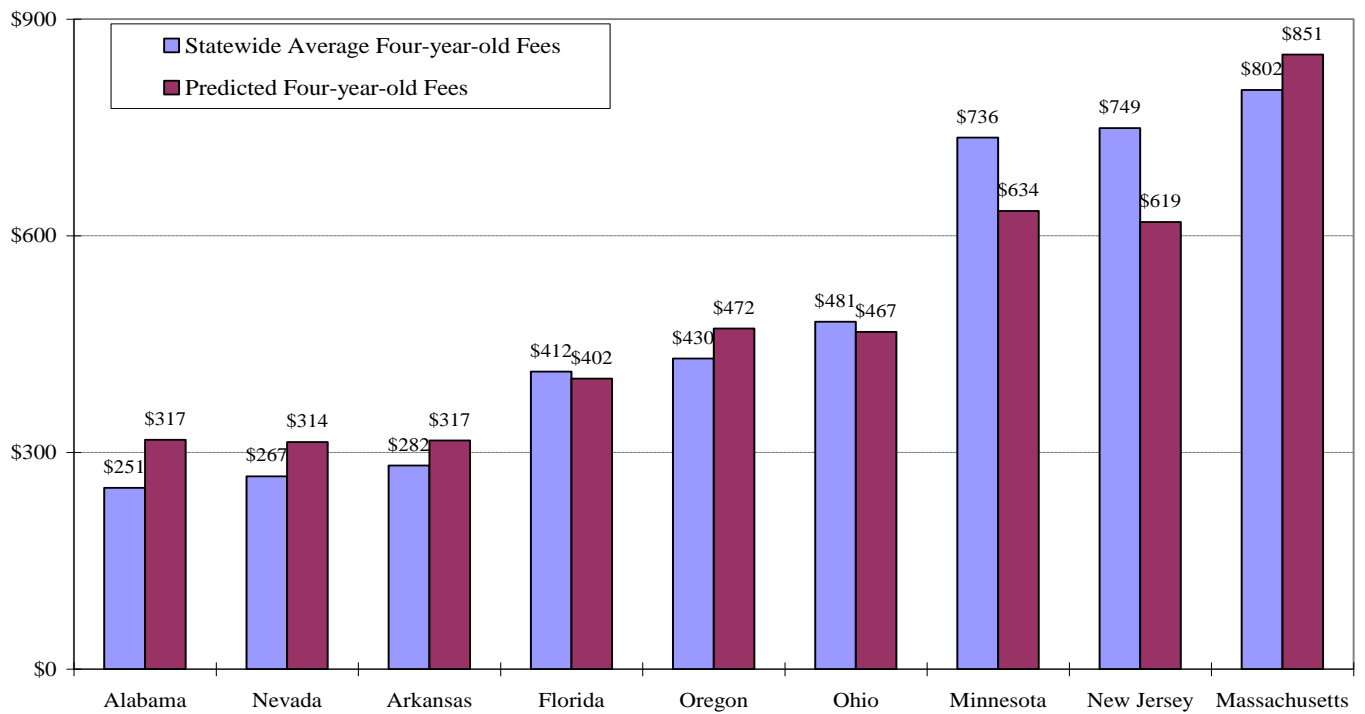


Figure 3. Comparison of predicted and actual statewide average center fees for four year olds (selected states)

4.1 Residual and sensitivity analyses

We conducted a number of statistical tests and estimated variations of the base model in order to assess the robustness of the results. We first tested for heteroscedasticity using both the general White test and the Breusch-Pagan test. Results from both tests failed to reject constant variance in the residuals. Tests for individual variables using the Breusch-Pagan test (with multivariate Bonferroni confidence interval adjustment) also did not suggest a problem of heteroscedasticity. Thus we did not adjust the estimated OLS standard errors using a heteroskedasticity correction.

Several of the variables included in the model are likely to be highly correlated, including median income, median rent, and child care worker wages. Excluding the income variable from the regression, for example, increased the size of the estimated coefficient on rent and it became statistically significant. Similarly, excluding the rent variable increased the size of the child care worker wage variable. Given the theoretical support for these variables in determining supply and demand, we included rent, income and wages in our preferred specification, noting that the collinearity among them may have impacted the significance tests. In practice, the combination of high goodness of fit (R-square) and few significant estimators is usually an indication of the existence of severe multicollinearity. In our analysis, we found the relationship between median income, rent, and child care worker wage worth noting, but based on the results, it was unlikely that there was severe multicollinearity.

We considered a number of additional explanatory variables that may be related to the demand for or supply of child care and so may affect statewide average prices. In order to try to capture differences across states in support for both education in general and preschool education, we tested additional models including measures of educational spending or attainment. In particular, the measures included the number of children funded through Head Start and state publicly funded pre-kindergarten programs, total education spending per capita in the state, and the proportion of the state's population with a college degree. The results did not change substantially for the key explanatory variables in the base model, and none of the estimated coefficients for these additional variables were large or statistically significant.

Demand for center-based child care may also be influenced by preferences for different types of care and the availability of informal care. While direct measures of the availability of informal care at the state level are not available, we tested measures of state demographic characteristics that might be related to preferences regarding center-based child care versus other forms

of care. These variables included the percentage of the population that is Hispanic and the percentage of single parents. Neither variable was statistically significant. In addition, we would like to have measures of the availability of informal care as a possible substitute for center-based child care, but direct measures are not available. Instead we included the percent of people in each state who lived in the same house (and alternatively, the percent who lived in the same county) as a possible measure of the availability of informal care. Those who have lived in the same place longer may have more contacts for informal child care through friends, neighbors and relatives. In the models including state economic and policy variables, the estimated coefficients on these measures were small and not statistically significant.

We also included additional measures of state regulation of child care: group size (the maximum number of children in a group for age 18 months) and number of hours of pre-service training hours required for teachers in child care centers. More training and smaller group sizes may be expected to increase costs of providing child care services, and may improve the quality of care (Blau, 2003). These variables were not statistically significant in any specification and tended to be quite small. Therefore, we did not include these variables in the preferred specification in part because they were correlated with the other regulatory variables.

Finally, we were concerned with the possibility that the availability of family child care home providers might influence prices charged by centers, and that availability might vary across states due to differences in state policies on licensing and other requirements. We included the number of family child care homes (divided by number of children) in the state as a measure of an alternative or substitute for child care centers. The estimated coefficient was negative as expected, and significant at the 10 percent level. Other results did not change qualitatively. However, because of missing data on family child care homes in a number of states, we did not include this variable in the preferred model specification.

A concern in estimating the model of statewide average child care prices using aggregate data is the potential for endogeneity if the explanatory variables are not truly independent and instead should be considered endogenously determined. If this is the case, the OLS estimates would be biased and inconsistent. In this analysis, for example, wages paid to child care workers were thought to affect the cost of providing care and therefore the price; however, higher child care prices might also lead to higher wages for care providers. The national trend in child care wages

suggest that this is not occurring. Wages paid to child care workers have increased more slowly than child care prices on average, increasing by about 2% per year between 2000 and 2005 (based on data from the U.S. Bureau of Labor Statistics, Occupational Employment and Wages). Nonetheless, to test for the possible endogeneity of child care worker wages, we employed two approaches. First we replaced child care worker wage in the OLS model with the state-wide average wage for all workers. The estimated coefficient on average wage was positive but smaller than for child care worker wage, and not statistically significant. Other results did not change substantially. In addition, we used the state average wage for all workers as an instrument for child care worker wage in a three-stage least squares (3SLS) model, because the two are highly correlated. In this model, the estimated coefficient on average wage was not statistically significant with few changes in other estimated coefficients.

Another possible concern is that the funding for child care subsidies may be related to the price of child care. Under some circumstances, an increase in the price of child care might lead to an increase in the amount spent for a subsidized child care slot. However, the amount of money spent on subsidies is typically allocated by state legislatures and varies primarily for reasons related to political and budgetary considerations.

4.2 Study limitations

The study focused on prices charged by child care centers in large part due to the availability of price data only for centers in the NACCRRRA 2006 report. Yet the availability and price of child care services provided by family day care homes is an important part of the child care market. The fees charged by family child care providers typically are lower than those charged by centers, though they tend to follow similar trends (Davis and Li, 2005). Future research is needed to examine the factors associated with the variation in prices of family child care providers across states.

The supply and demand framework is a clearly a simplification of the child care market. The basic model assumes one price in the market, yet child care prices vary by type of care, age of child, quality and services provided, even within small geographic areas. By using state averages, we are masking considerable local variation in child care center prices. However, the relationships uncovered between average center price in a state and economic variables provide evidence that the child care market operates in ways consistent with economic theory. Recent studies in three states have found similar relationships between eco-

nomic variables and average child care prices across counties for both centers and family child care homes (Marrufo, O'Brien-Strain and Oliver, 2003; Davis and Li, 2005; Davis, Li, Weber and Grobe, 2009). Nonetheless, further studies are needed to better understand variations in price and supply in local child care markets and how these are affected by policy as well as local economic conditions.

5. Conclusions

In contrast to education of children in grades K to 12, most of the cost of early care and education for children younger than kindergarten age is paid by parents. These costs can be a large burden, absorbing nearly 10% of family earnings on average for those who pay for care, and an even higher percentage for families with low incomes (Giannarelli and Barsimantov, 2000). The amount a family spends on child care depends on the number of children in the family, their ages, and the type and hours of care chosen. Given that child care can consume a sizeable fraction of a family's budget, parents are likely to be sensitive to the price of child care. But the prices families face in the child care market vary considerably across locations.

Although the government plays an important role in the child care market, most child care services are provided by the private sector and paid for by parents. The objective of this study was to understand the variation in prices of child care, using state averages as a means of comparing regional differences. The variation in the average price charged by child care centers across states primarily reflected differences in economic characteristics and state regulations. We found that a large proportion (more than 70%) of the variation in average child care prices across states can be explained by a small number of state-level variables, including median family income, wages paid to child care workers, and the number of young children in the state. State policies on staff-child ratios, child care tax credits and child care subsidies also were found to be positively associated with average prices.

While the results suggest the importance of market forces in determining state-level average prices at child care centers, this does not imply that government intervention in the market is not necessary or desirable. Paying for child care is a tremendous burden on some families, but lowering the (market) price is not the solution. At the same time that parents struggle to afford child care, child care centers earn on average a margin or surplus of only 3 to 5%, and child care workers earn lower-than-average wages compared to similar workers (Helburn and Howes, 1996,

Center for the Child Care Workforce, 2004). It is well documented that the quality of child care in the U.S. as provided by the current system is, in large part, not adequate to support child development and school readiness. But concerns about quality and affordability cannot be separated. As Adams and Rohacek (2002) state, "One reason behind the inadequate quality of child care is that it is driven by what parents can afford" (p. 422). Despite some government involvement, the U.S. child care market responds primarily to what parents are willing and able to afford. As shown in this study, the importance of median family income in explaining child care price variation emphasizes the critical role of demand and affordability in the child care market.

Given the long-run public benefits from high quality child care for low-income children, helping families afford quality care is an important public policy objective (Rolnick and Grunewald, 2003). Recent concerns about child development and school readiness have led to renewed focus on the quality of child care and the expansion of pre-kindergarten programs in many states. Yet these initiatives rarely consider the realities of the private child care market. Government programs focused on school readiness (such as Head Start) and quality improvement (such as quality rating systems) are largely divorced from programs to help parents pay for child care. The findings of this study suggest that policies to address child care affordability, such as expanded child care subsidies or more generous tax credits, may be as important as direct investments in quality on the supply side. Most child care facilities rely primarily or totally on fees paid by parents, and therefore the prices charged by child care centers will largely determine the resources available to provide quality care. Given the importance of quality child care to current workforce needs and to future human capital development, economic development strategies are needed that focus on both the demand side (affordability) and the supply side (quality investments) of the child care market.

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Appendix

Table A-1. Variable definitions and data sources

Variables	Data	Year	Data Source
Infant price	State average child care fees for an infant in full-time center care	2004	NACCRRRA (2006)
Four-year old price	State average child care fees for a four-year old in full-time center care	2004	NACCRRRA (2006)
Median income	State median income for family of four	2004	U.S Census Bureau www.census.gov
Number of children	Estimated number of children under age 13 in the state	2004	U.S Census Bureau www.census.gov
Employment rate	Percentage of employed persons in total population	2004	U.S. Bureau of Labor Statistics www.bls.gov
Child care subsidy percentage	Number of children receiving child care subsidies divided by child population	FY2004	Child Care Bureau: Program Data and Statistics
Child care worker wage	State average child care worker wage	2004	U.S. Bureau of Labor Statistics www.bls.gov
Median rent	State median monthly housing costs for renter-occupied housing	2004	American Community Survey, 2004, obtained from NACCRRRA (2006)
Accredited ratio	Number of children in accredited programs divided by child population	2004	National Child Care Information Center www.nccic.org
Staff-child ratio	State regulation on child-staff ratio (inverted to staff-child ratio) (age 4)	2005	National Child Care Information Center www.nccic.org
State refundable child care tax credit dummy	Equals one if the state offers refundable child care tax credits and zero otherwise.	2005	National Center for Children in Poverty www.nccp.org