Spring 2013

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ABSTRACT. The cost of child care varies from state to state and ranges from $3,911 to $11,669 per year. Does the cost deter women from entering the labor force? I use an ordinary least squares (OLS) regression model to investigate whether states with higher costs of child care have lower female labor force participation rates (LFPR). I find that the cost of child care is a significant factor in the labor force participation model, but doesn't have the expected negative impact.

I. Introduction

In 2011, the average annual cost for center-based, infant child care was higher than a year's in-state tuition at a four-year public college in 35 states. Child care cost as a percentage of a two-parent family budget has increased, and in many states is over 10% (Parents 2012). In 2006, USA Today reported that each week nearly 12 million children under the age of five are in some type of child care. Due to its relatively high cost, child care is a significant factor in a woman's decision to work. The relationship between child care costs and labor force participation has been a subject of concern for decades.

The labor force participation rate (LFPR) of women has been growing since the 1800's. The female labor force participation rate increased sharply during World War II and grew from 27.9% to 57.5% in the 50-year span from 1940-1990 (Blau, Ferber, and Winkler 2002, 85). Today, the average labor force participation rate for women is 60% in the United States, ranging from 48% in West Virginia to 68% in North Dakota (U.S. Census 2010). According to Claudia Goldin's book, *Understanding the Gender Gap* (1990), common factors that influence a woman's decision to work include age, education, wage levels, and fertility.

The increasing cost of child care poses a challenge for parents economically. Many parents seek employers that offer subsidized child care, some parents relocate, while others simply work more hours to afford child care costs. CBS News reported in February 2012 that some parents make the opposite choice and quit their jobs to avoid the expense

altogether. This raises the question about how the cost of child care may influence the labor force participation rate of women.

Blau and Robins (1988), Connelly (1992), and Blau et al. (2002) found higher costs of child care deter women from entering the labor force. Mork et al. (2008) found the cost of child care to be insignificant in their female LFPR model. I will use a regression model to analyze state by state data and establish if the cost of child care is a significant variable in determining the female LFPR and whether states with higher costs of child care have lower female LFPR.

II. Literature Review

According to Blau, Ferber, and Winkler (2002) and the Monthly Labor Review (2009), the presence of children is a factor in the labor force participation decision. James Heckman's revolutionary research (1974) looked at the differences between market and informal child care and the impact they have on the labor force decision. While Heckman lacked data on the cost of market care, he was able to find relationships between a mother's decision to work, the hours she works, and the form of child care she selects.

Blau and Robins looked at family labor supply as a whole, recognizing that the decision for a woman to work is "not automatically a decision to purchase child care in the market, since low-direct-cost informal sources may be available" (1988, 374). They showed that an increasing price of child care reduces the probability of both parents working and that there is a difference between the market child care and informal child care options. The level of education and wage rate were also factors influencing a woman's decision to work and women with higher education levels and higher levels of income were more likely to use market child care. According to their research, "higher market child-care costs discourage women from working even when an informal source of care is available" (1988, 379).

Connelly studied the effect child care costs had on the decision of married women with children to enter the labor force. She found that the LFPR of married women is sensitive to the average cost of child care and "the lower rate of labor force participation among mothers of preschoolers was shown to be entirely the result of higher child care cost faced by these women" (1992, 90). Other studies conducted by Berlinski and Galaiani in 2007 and Baker et al. in 2008 found that free or

subsidized child care and preschool lead to higher labor force participation rates of mothers.

This research differs from the findings of Mork, Lundin, and Ockert who looked at the effects reduced child care costs had on the female LFPR in Sweden. They found that "the estimated effects of childcare prices on labor supply are mostly statistically insignificant, but precisely estimated, indicating that reduced childcare prices do not seem to affect female labor supply at large" (2008, 659).

III. Methodology and Data

While many studies have investigated female labor force participation rates, none have looked at state-by-state data and incorporated the cost of child care. An ordinary least squares (OLS) regression model is used to test if states with higher costs of childcare have lower female labor participation rates. The dependent variable is state female LFPR. According to Hoffman (2009) explanatory variables for female LFPR include marital status, education, race and age. Bloom et al. (2009) also included women's fertility and type of residence (urban vs. rural) in their labor supply model. The independent variables used in this study are child care cost, educational level, the abortion rate, the divorce rate, age, ethnicity, income, and type of residence. A variety of regression models were tested. For reasons that will be explained, some of these variables were omitted from the final regression model. The final regression model is:

$$LFPR = \beta_0 + \beta_1\, COLLEGE + \beta_2\, COST + \beta_3\, COST^2 + \beta_4\, DIVORCE + \beta_5\, AGE + \beta_6\, WHITE + \beta_7\, URBAN$$

A. The female labor force participation rate (LFPR) is the dependent variable. This information was retrieved from the U.S. Census Bureau website. LFPR is to the percentage of a state's non-institutional female population age 16 and over participating in the labor force.

B. The COLLEGE variable tells us the percentage of the population age 25 and older in the state with a bachelor's degree or higher. This information was retrieved from the U.S. Census Bureau website. Education is positively associated with labor market earnings which

would lead us to expect that it is also positively associated with labor force participation (Blau, Ferber, and Winkler 2002). We would expect the COLLEGE variable to have a positive coefficient.

C. The variable COST is the average annual cost of center-based care for one four-year-old child. This information was retrieved from the Child Care Aware of America 2012 Report. The information was provided by State Child Care Resource and Referral Network offices and local agencies around the country. The report also included the average annual cost for center-based infant care which in all states was significantly higher. Family child care costs for infants and four-year-old children were also given for most states in the report. However, because parents only pay the infant cost for one year and a higher percentage of parents use center-based child care, the average cost for four-year-old children in center-based child care is the most representative measure for this variable.

    Parents are forced to weigh the benefits of entering the labor force against the costs, one of which is child care. Previous studies show that young children are a significant deterrent to women entering the labor force, and economic theory can be used to show that the expected cost of child care affects women's labor force participation. Lower costs will increase their participation and higher costs are expected to lower the participation rate (Blau, Ferber, and Winkler 2002). In this sense we would expect COST to have a negative coefficient.

    The COST variable was found to be correlated with COLLEGE, and the relationship between COST, COLLEGE, and female labor force participation creates a direction of causation problem. For example, as the number of women with college degrees increases we expect the female LFPR to increase. This would then cause the demand for child care to rise which would lead to an increase in the cost of child care. This shows a positive relationship between LFPR and COST, but as the cost of child care increases we expect this to have a negative effect on the LFPR. This relationship is shown in Figure 1. This relationship highlights the possibility that an increase in the cost of child care may not be great enough to discourage women from working. For this reason, we are unsure of the expected coefficient sign of COST.

Figure 1 – Relationship between COLLEGE, LFPR, & COST

$COST^2$ is added into the model because a nonlinear relationship is present. If the initial increase in the cost of child care doesn't have the expected negative impact on the labor force participation decision, at some point if the cost keeps increasing it will deter women from entering the labor force. $COST^2$ can be used to calculate the break-even cost of child care. This is the point at which if the average annual cost of child care were to increase beyond this price it would deter women from entering the labor force.

D. ABORTION is measured by the abortion rate per 1,000 women ages 15-44. This data was retrieved from the U.S. Census Bureau website. Bloom et al. (2009) used abortion laws as a predicting factor for fertility and found that higher fertility reduces female LFPR. Higher abortion rates imply lower fertility rates, and so would then be associated with higher LFPR among women. Thus, one would expect ABORTION to have a positive coefficient. The variables ABORTION and URBAN were highly correlated. ABORTION was left out of the final regression to avoid multicollinearity problems.

E. DIVORCE is measured by the divorce rate per 1,000 people. The data were retrieved from the U.S. Census Bureau website. "Divorced women have considerably less nonlabor income than married women and are thus more likely to participate in the labor force. (Blau, Ferber and Winker 2002, 118)" DIVORCE is expected to have a positive coefficient.

F. AGE is measured by the average age of females in the state. This information was retrieved from the U.S. Census Bureau website. According to the Bureau of Labor Statistics (2010), older women are less likely to participate in the labor force. Thus, we would expect AGE to have a negative coefficient.

G. WHITE is the ethnicity variable used in this regression. It is

measured by the percentage of a state's population that is white. This information was retrieved from the U.S. Census Bureau website. Hoffman (2009) found that white women are more likely than Hispanic and Asian women to participate in the labor force. States with a higher white population are expected to have higher female LFPR. WHITE is expected to have a positive coefficient.

H. The INCOME variable measures the median income of a state. This information was retrieved from the U.S. Census Bureau website. Higher levels of income are incentives for women to participate in the labor force. INCOME is expected to have a positive coefficient. INCOME is left out of the final regression because it is highly correlated with COST and COLLEGE.

I. URBAN measures the percentage of a state population living in urban areas. This information was retrieved from the U.S. Census Bureau website. Bloom et al. (2009, 81) found that the LFPR of women in rural areas was high because family responsibilities and agricultural work are often combined. In urban areas where the separation of home and work is common, female LFPR are much lower. Thus, we would expect URBAN to have a negative coefficient.

Table 1 provides descriptive statistics and a brief definition of the variables found in the final regression.

Empirical research faces many limitations. There are multiple ways to measure each variable, and there are limitations of each measurement. For example, to measure the educational level of women in a state I chose to use the percentage of the population age 25 and older with a bachelor's degree or higher. This age floor of 25 didn't match up with my LFPR data which has an age floor of 16. This mismatch is a limitation of my research findings. The measurement I used for the COST variable is also limiting. It assumes that when making the decision to participate in the labor force women either pay the market child care cost or they don't work. This simplifying assumption is another limitation of my regression model.

TABLE 1–Descriptive Statistics

	Description	Mean (S.D.)
Dependent Variable		
LFPR	Percentage of female population age 16 and older in labor force	59.91 (4.45)
Independent Variables		
COST	Average annual cost of center-based child care for one four-year-old child	7,550.80 (1,771.90)
COLLEGE	Percentage of population age 25 and older with a bachelor's degree or higher	27.17 (4.73)
DIVORCE	Divorce rate per 1,000 people	10.20 (2.03)
AGE	Average age of women	37.58 (2.27)
WHITE	Percentage of population that is white	76.74 (12.94)
URBAN	Percentage of population living in urban areas	71.69 (14.90)

IV. Discussion of Results

The dependent variable is the female labor force participation rate of a state. The final model is multivariate and uses Ordinary Least Squares to estimate the relationship between the female LFPR and independent variables. Table 2 shows the final OLS regression results. The model uses data from all 50 states. The R-squared is 0.5916 and the Adjusted R-squared is 0.5235. This means that 59.16% of the dispersion of the dependent variable is "explained" by the independent variables. All independent variables, except for DIVORCE, were found to be significant at the 5% level.

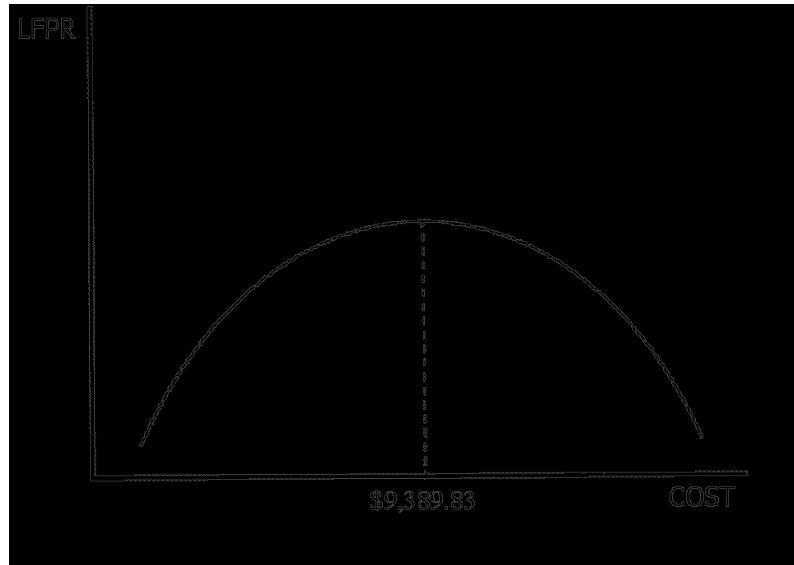The COLLEGE variable is positive and significant at the 1% level. This is consistent with the hypothesis that beter educated women are more likely to participate in the labor force. The coefficient is 0.45264 which means that for every 1 percentage point increase in percentage of the population age 25 and older with a bachelor's degree or higher the female labor force participation rate rises 0.45264 percentage points.

TABLE 2–Final Regression (n=50)

	Coefficient	Std. Error	t-ratio	p-value
CONSTANT	58.429	13.72	4.260	0.000 ***
COST	0.0048121	.0019136	2.485	0.017 **
COST^2	-0.25624E-06	0.1177E-06	-2.176	0.035 **
COLLEGE	0.45264	0.1663	2.722	0.009 ***
DIVORCE	-0.27014	0.2741	-0.9855	0.330
AGE	-0.73717	0.2473	-2.981	0.005 ***
WHITE	0.10043	0.04102	2.448	0.019 **
URBAN	-0.12565	0.04585	-2.741	0.009 ***

Mean Dependent Var	59.910	S.D. dependent var	4.4545
Sum squared resid	397.12	S.E. of regression	3.0750
R-squared	0.5916	Adjusted R-squared	0.5235
F (10,50)	8.690	P-Value (F)	0.000
Log-likelihood	-122.753	Akaike criterion	10.938
Schwarz criterion	14.852	Hannan-Quinn	12.289

***significant at 1%, **significant at 5%

The COST variable is positive and significant at the 5% level. The positive sign on the coefficient indicates that an increase in child care costs initially doesn't deter women from entering the labor force. The coefficient is 0.0048121 which means that for every $1 increase in the annual cost of child care, the female LFPR rises 0.0048121 percentage points. As previously stated, however, at some point if the cost continues to rise, it will deter women from entering the labor force. Figure 2 shows the relationship (not functional form) between COST and LFPR. The graph shows that COST increases at a decreasing rate with LFPR. The break-even cost is $9,389.83, indicating that if the annual price of child care were to rise above this, women would start leaving the labor force due to this cost.

Figure 2 – Relationship between COST & LFPR

The AGE variable is negative and significant at the 5% level. This is consistent with the hypothesis that older women are less likely to work. The coefficient is -0.73717. This means if the average age of women in a state increases 1 year the female LFPR decreases 0.73717 percentage points.

The WHITE variable is positive and significant at the 5% level. This confirms the hypothesis that white women are more likely to work. The coefficient is 0.10043, indicating that if the percentage of the population that is white were to increase 1 percentage point, the female LFPR increases 0.10043 percentage points.

The URBAN variable is negative and significant at the 1% level. This is consistent with the hypothesis that family responsibilities are more easily combined with work in rural areas and therefore women in rural areas are more likely to participate in the labor force. The coefficient is -0.12565 demonstrating that if the percentage of the population living in urban areas were to increase 1 percentage point, the female LFPR would decrease 0.12565 percentage points.

V. Conclusions

The cost of child care plays a role in the female labor force participation decision. My research finds that it is a significant factor, but doesn't have the expected negative impact on labor force participation until the annual cost rises above $9,389.80. I also found the percentage of adults with bachelor's degrees and the percentage of the population that is white both have positive impacts on female LFPR. The average age of women and the percentage of the population living in urban areas negatively influence LFPR.

This research looks at the impact child care cost has on female labor force participation between states. The limitations of the data, the regression model, and issue of direction of causation are reasons for further research. A Two-Stage Least Squares, probit, or logit regression model would likely be used. It would also be useful to get better, more precise data. Further research using data on an individual level would likely give a more exact measure of how the cost child care impacts a woman's labor force participation decision.

Appendix

TABLE 3–Cost of Child Care and Female LFPR by State

STATE	COST	LFPR
Alabama	$5,668.00	54.30%
Alaska	$8,856.00	65.30%
Arizona	$7,263.00	56.30%
Arkansas	$4,695.00	54.90%
California	$8,237.00	57.00%
Colorado	$9,239.00	63.00%
Connecticut	$10,530.00	62.80%
Delaware	$7,592.00	56.80%
Florida	$6,368.00	56.00%
Georgia	$6,062.00	57.20%
Hawaii	$7,752.00	58.30%
Idaho	$5,059.00	58.20%
Illinois	$8,996.00	60.10%
Indiana	$7,975.00	57.90%
Iowa	$7,551.00	66.60%
Kansas	$8,305.00	64.00%
Kentucky	$5,766.00	56.10%
Louisiana	$5,364.00	55.90%
Maine	$7,904.00	61.00%
Maryland	$9,278.00	63.10%
Massachusetts	$11,669.00	62.00%
Michigan	$7,930.00	56.70%
Minnesota	$10,470.00	66.90%
Mississippi	$3,911.00	53.20%
Missouri	$5,928.00	61.10%
Montana	$7,285.00	59.20%
Nebraska	$6,386.00	67.20%
Nevada	$7,532.00	58.00%
New Hampshire	$9,541.00	65.60%

STATE	COST	LFPR
New Jersey	$9,098.00	59.60%
New Mexico	$6,145.00	54.10%
New York	$11,585.00	57.10%
North Carolina	$7,774.00	57.40%
North Dakota	$6,807.00	68.40%
Ohio	$6,376.00	60.30%
Oklahoma	$5,397.00	56.20%
Oregon	$8,542.00	60.80%
Pennsylvania	$8,588.00	57.10%
Rhode Island	$9,932.00	63.70%
South Carolina	$5,455.00	55.20%
South Dakota	$5,665.00	66.80%
Tennessee	$6,578.00	56.30%
Texas	$6,414.00	57.40%
Utah	$5,988.00	60.20%
Vermont	$8,758.00	67.10%
Virginia	$8,296.00	62.10%
Washington	$8,320.00	62.40%
West Virginia	$5,806.00	48.20%
Wisconsin	$9,588.00	65.60%
Wyoming	$7,316.00	64.80%

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