



5-2018

# The cost of child care on female labor force participation

Richard Joseph Goyette  
rgoyette@vols.utk.edu

Follow this and additional works at: [https://trace.tennessee.edu/utk\\_chanhonoproj](https://trace.tennessee.edu/utk_chanhonoproj)

 Part of the [Econometrics Commons](#), [Labor Economics Commons](#), and the [Public Policy Commons](#)

---

## Recommended Citation

Goyette, Richard Joseph, "The cost of child care on female labor force participation" (2018). *University of Tennessee Honors Thesis Projects*.  
[https://trace.tennessee.edu/utk\\_chanhonoproj/2185](https://trace.tennessee.edu/utk_chanhonoproj/2185)

This Dissertation/Thesis is brought to you for free and open access by the University of Tennessee Honors Program at Trace: Tennessee Research and Creative Exchange. It has been accepted for inclusion in University of Tennessee Honors Thesis Projects by an authorized administrator of Trace: Tennessee Research and Creative Exchange. For more information, please contact [trace@utk.edu](mailto:trace@utk.edu).

University of Tennessee Honors Thesis and Public Policy Capstone

# The cost of child care on female labor force participation

Richard Goyette

5/7/18

BCPP 490 Capstone Advisors: Dr. Matthew Murray and Dr. Katie Cahill

Honors Thesis Advisor: Dr. Benjamin Compton

## Abstract

The purpose of this study is to examine the effect that the cost of child care has on the labor force participation of women, in order to help direct policy initiatives to alleviate the growing proportion of women who are poor and unemployed. Evidence shows that labor force participation is affected by race, income, marital status, and other demographic variables. Data used for this study is collected from the Panel Study of Income Dynamics (PSID). This study uses regression analysis to determine the relationship that the cost of child care has on labor force participation, with data at the family level from the years 1999-2015. A pooled cross-sectional analysis is the choice of method, accomplished by grouping the observations by their years and assigning dummy variables for each year. Previous year child care expenditures were predicated for each respondent based on their other reported characteristics, and used instead of their reported child care expenditures. This is done to avoid issues of causality. This study uses a multinomial logit, probit, and linear probability model. The multinomial logit and probit find statistical significance for the variables of interest at the 95% confidence level. The results for the linear probability model are suspect, hinting that the linear form of the model may not be a good predictor of these relationships. According to the results of the multinomial logit and probit, child care expenditures have a negative effect on employment, meaning they discourage work, a result that reinforces the notion that child care is a barrier to employment. Other important results are that female householders are 1.5% (multinomial logit) to 4.1% (probit) less likely than male householders to be employed. A married householder is 4.15% more likely to be employed compared to an unmarried householder, while married female householders are from 4% (probit) to 27% (multinomial logit) less likely to be employed. Householders with college degrees are 6-7% more likely to be employed. Black householders are 4% less likely to be employed according to both Models #1 and #2.

## Introduction

The cost of child care is prohibitively expensive for many families. Throughout the United States, the annual cost of child care can range from around \$4,822 in Mississippi to \$22,600 in Washington D.C. (Economic Policy Institute, 2016). While much of this variation is due to the different costs of living across the country, in terms of percentage of income, child care is unaffordable for many families. The Department of Health and Human Services defines “affordable” child care as child care which takes up no more than 10% of a family’s annual income. For a median family couple, the cheapest child care is found in Mississippi, where a median family will pay around 10.8% of their income per year on child care (Economic Policy Institute, 2016). For a minimum wage worker in Mississippi, child care would take up to around 32% of their annual income (Economic Policy Institute, 2016). For single parents, particularly single mothers, these costs lead to uncomfortable decisions regarding child care. Either they need to stay home and care for their children, or they have to dedicate a significant portion of their income on child care arrangements. According to the American Community Survey (ACS), around 82% of males participate in the labor force, while about 72.2% of females participate (U.S. Census Bureau, 2015). However, the participation for females drops to around 70% if they have children under six years of age (U.S. Census Bureau, 2015). For those with children younger than six years of age and children from six to 17 years old, the labor force participation rate is around 64.5%. Gornick and Meyer (2003) state that “Among married and cohabitating American parents aged twenty-five to fifty years old, 93 percent of fathers and 69 percent of mothers are employed either part-time or full-time” (pg. 59). Women with children younger than six years of age and children from six to 17 years old have an unemployment rate of around 10%, while those with only children under six have an unemployment rate of around 9.4% (U.S. Census Bureau, 2015). The National Woman’s Law Center (Gallagher Robbins &

Morrison, 2014) estimates that “the poverty rate for female-headed families with children was 39.6%, compared to 19.7% for male-headed families with children, and 7.6% for families with children headed by a married couple” (pg.2). The data suggests that single female-headed households are more prone to the poverty and negative labor market outcomes caused by children than married couples and single male-headed households.

This study seeks to examine the effect that the cost of child care has on the female labor force participation rate in order to provide policy suggestions in order to help alleviate the economic pressures felt by a growing number of the population within the United States. This study uses a multinomial logit, a probit, and a linear probability model (OLS) to accomplish this analysis. The data used in this study comes from the Panel Study of Income Dynamics (PSID), managed by the University of Michigan. This dataset begins in 1968, and the public family dataset includes data on around 5,000 families.

Data collected for this study includes demographic information, information on child care expenditures during the previous year, labor and income information, geographic information, and more. The years included in this study are 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, and 2015. These years were the most comprehensive in terms of the variables required for this analysis. Due to the nature of the PSID data collection, there is no way of tracking a family across the years that they are surveyed; they are assigned a new ID every wave which only represents the order the interviews were conducted. Therefore the regression analysis uses a pooled cross-sectional methodology instead of a panel study. Previous research has focused on panel data, often collected from the Survey of Income and Program Participation, determining the impact that child care expenditures have on labor force participation. Therefore this study

uses a slightly different methodology and focuses on a specific category, female householders and their labor force participation.

The results for the linear probability model are suspect, hinting that the linear form of the model may not be a good predictor of these relationships. According to the results of the multinomial logit and probit, child care expenditures have a negative effect on employment, meaning they discourage work, a result that reinforces the notion that child care is a barrier to employment. Other important results are that female householders are 1.5% (multinomial logit) to 4.1% (probit) less likely than male householders to be employed. A married householder is 4.15% more likely to be employed compared to an unmarried householder, while married female householders are from 4% (probit) to 27% (multinomial logit) less likely to be employed. Householders with college degrees are 6-7% more likely to be employed. Black householders are 4% less likely to be employed according to both Models #1 and #2.

### **Policy History**

The policy history for child care in the United States is diverse. Policy exists at the federal, state, and local level, and can include a myriad of different regulations and stipulations. Policies aimed at providing child-care directly or subsidizing child-care attempt to deal with the low labor force participation of mothers. As discussed more fully below in the literature review section, Kimmel (1998) finds that “single mothers’ labor force participation behavior can be expected to respond to subsidized child care, although the impact is not substantial” (pg.292). For instance, the GOP tax bill, which was signed into law by President Trump on December 22, 2017 enhances existing subsidies to make them more appealing to low-income families. Before the tax plan, the Child Tax Credit (CTC) offered \$1,000 per qualifying individual, but the CTC was nonrefundable. Under the new tax bill, the CTC benefit per child doubled to \$2,000 per

qualifying individual, while making up to \$1,400 of the tax credit refundable. These subsidies can be used to help pay for child-care, thus decreasing the cost and raising labor force participation.

Another major policy which sought to address this relationship was the Family and Medical Leave Act (FMLA). The FMLA was enacted in 1993, and it requires that those with certain medical and/or family situations be allowed to take a 12-week period of leave without having to worry about losing their job. However, this 12-week period is unpaid, so the only monetary benefit provided are the health benefits provided by the company. This is most often used for maternity/paternity leave, and allows for the parents to become accustomed to their child as well as care for the child for those first twelve weeks. However, the FMLA is one of the few maternity leave policies among OECD countries which does not offer compensation. This makes the decision to return to work difficult for married mothers, who often choose to stay home after the 12-week period as the benefits of returning to work are outweighed by the costs of providing care for the newborn child.

Another major policy which effects the labor force participation for low-income families is the Earned Income Tax Credit. This is effective for single mothers, as it provides refundable tax credits based on income and on the number of children who qualify. This tax credit encourages work for single mothers<sup>1</sup> while discouraging work for married mothers<sup>2</sup>; the benefits phase out at 21% for a family with more than one qualifying child, and so it is preferable to also supplement this tax credit with income from an increase in work.

These policies all attempt to solve the problem of low labor force participation for families, though certain policies like the FMLA are often criticized for not doing enough to

1. Eissa and Liebman (1996) find that the Earned Income Tax Credit increases labor force participation “of single women with children increased by up to 2.8 percentage points relative to single women without children” (pg. 607).
2. Eissa and Hoynes (2004) find that after EITC expansions “the labor force participation rate of married men increased by about 0.2 percentage points, that of married women decreased by just over a full percentage point” (pg. 1931).

alleviate the problem. However, these policies all show that the costs of child care can have significant impacts on the labor force participation of the family.

### **Literature Review**

There is a strong background of research which focuses on the labor force participation rate for mothers and the effects of child care and its cost have on labor force participation. Most of this research finds that as the cost of child care increases, the labor force participation for mother's decreases. The methods for these studies differ, as does the data. Significance also varies across studies, but the conclusions remain the same. David Blau and Philip Robins (1988) model family labor supply using both informal and market child care. They find that "higher child-care costs raise the probability of state 0 relative to states 3 and 4" (pg. 379). State 0 is when the mother does not work and the husband is not an available source of child care, while states 3 and 4 both have the mother working and purchasing child-care from the market and not an informal source. Blau and Robins also state that "the cost of child care, as measured by the site-average weekly cost of market care, has a consistently negative effect on the probability of choosing any of the states in which the wife work" (pg. 378). Interestingly, they find that high costs for child-care still dissuade mothers from working even if there is an informal care provider available, which Blau and Robins theorize may be because "informal care is not a perfect substitute for market care" (pg. 379). Based on their results, Blau and Robins estimate an average price elasticity of employment over the range of child-care costs to be -0.38. They also find multiple significant variables, such as the number of children needing care, husband's income, nonwage income, and educational attainment.

Some research has shown that child care is a luxury good. One of these studies, conducted by Charles Michalopoulos and Philip Robbins (1992), finds that "single mothers

increase child care expenditures in response to wage changes at a three times greater than that of married mothers (.52 versus .17)” (Michalopoulos & Robbins, 1992). Another study seeks to explain the variation in elasticities of employment found by prior research (Kimmel, 1998). Kimmel does this by using an improved version of the Survey of Income and Program Participation (SIPP) for her data. Kimmel states that “evidence exists to suggest that insufficient child care options can be a strong barrier to labor force participation” (pg. 287). Kimmel defines labor force participation as a function of hourly wage, price of child care, and other factors (pg. 288). Kimmel finds that “single mothers pay nearly twice the percentage of their income in child care than do married mothers” (pg. 289-290). Kimmel finds a child care price elasticity of -0.22, so every percentage point that child care increases leads to almost a quarter-of-a-percentage point drop in time worked, for single mothers and -0.92 for married mothers (pg. 291), contradicting the theory that “married families’ child care expenditures are more responsive to quality factors than are care expenditures in families with single mothers” (pg. 291). As Kimmel states that this theory “suggests that the child care price elasticity for single mothers should be greater than that of married mothers” (pg. 291), however her results do not reflect that relationship.

Josefina Posadas and Marian Vidal-Fernandez (2013) attempt to study the effect that the availability of grandparents as a source of child-care has on the labor force participation of the mother. They find that “when grandparents take care of grandchildren, young mothers are almost 16 percentage points more likely to participate in the labor force” (pg.11). In addition, they find statistical significance for age, number of children, race, and educational attainment.

In a study conducted by the USDA Center for Nutrition Policy and Promotion (Lino et al. 2017), estimated annual spending on a child is found to range from \$9,330 to \$9,980 for families

making less than \$59,200 before-tax annual income (pg.ii). Expenditures on child care & education accounted for around 20% of expenses from 0-2 years of age, and 20% from 3-5 years of age (pg.12). Although these estimates are said to be essentially the same for married-couple families and single-parent families, “average income for single-parent families in the lower income group was \$24,000, compared with \$36,300 for married-couple families” (pg.13). This means that the expenditures on child-care and on the child in general take up a larger percentage of the single parent’s income.

The National Women’s Law Center (NWLC) releases a national “snapshot” of poverty among women and families every year. In their most recent study the NWLC’s Kayla Patrick (2017) finds that “the poverty rate for female-headed families with children was 35.6 percent, compared to 17.3 percent for male-headed families with children and 6.6 percent of families with children headed by married couples” (pg.3).

Though these studies all differ in their methods, they find that the high cost of child care is an impediment to participating in the labor force for mothers, especially for single mothers. This is unsurprising given the theory behind such an assumption, however it shows that this relationship is one which is present regardless of methodology.

## **Data**

Defining employment status created some challenges due to the nature of the response options in the PSID. Only a few categories could be condensed into “Not currently working”. Other options such as retired, student, and permanently/temporarily disabled cannot simply be condensed into “Not currently working”, as these groups are not working for different reasons than those in the “Looking for work/Unemployed” category.

Data are taken from the PSID. The dataset used is the Family Public Data Index, which is collected at the family level and includes information on around 5,000 families. The survey starts in 1968 and continues until 2015, however only the odd years in the 1999-2015 window are being used for this study, as they provide the most complete data for the variables I am interested in. The frequency of surveying changed so that within the 1999-2015 timeframe, data is only collected for 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, and 2015. This study is to determine the effect of the cost of child care on female labor force participation rate.

The PSID is conducted during the year, and so some variables cannot be accurately determined using only half of a year's worth of data. Therefore, certain variables are based on a respondent's information from the previous year. Both Child Care Expenditures and Total Family Income are reported based on the previous year, so for this study an assumption has to be made that these families will spend a similar amount on child care in the current year, and will receive a similar amount of income this current year. This is not an unreasonable assumption to make, as the majority of families will most likely not experience a significant shift in income or child care expenditures.

Kimmel's (1998) study defines labor force participation as a function of hourly wage, and the hourly price of child care, along with other factors. I follow this approach on specifying my model. The dependent variable is the respondent's current employment status: currently working or not currently working. My primary independent variable is the amount out-of-pocket income that the family spent on childcare in the previous year. Other explanatory variables account for demographics information, income information, labor market information, and others. The literature summarized above has pointed to the importance of these factors in affecting labor

supply. These variables can be seen in Table 1. In total, there are 72,911 observations. A table of summary statistics can be found in the appendix.

<b>TABLE 1- VARIABLE DESCRIPTIONS</b>		
<b>DEPENDENT VARIABLE</b>	<b>DESCRIPTION</b>	
<b>EMPLOYED</b>	Is head employed? (1= yes, 0=no)	
<b>INDEPENDENT VARIABLES</b>	<b>DESCRIPTION</b>	<b>EXPECTED SIGN OF COEFFICIENT</b>
<b>EXPECTED CHILD CARE EXPENDITURES</b>	Expected dollar amount of Child Care expenditures per respondent.	Negative- Would expect that large amounts of child care expenditures discourage work.
<b>TOTAL FAMILY INCOME</b>	Dollar amount of family income of previous year	Positive- Larger amounts of income would mean more work.
<b>MARRIED</b>	Is head married? (1= yes, 0=no)	Positive- If married, there is a potential spouse who can stay home.
<b>AGE</b>	Age of householder	Negative- The older the respondent, the less likely they are to be working due to health and retirement.
<b>AGE<sup>2</sup></b>	Age squared	N/A
<b>COLLEGE DEGREE</b>	Has householder received a college degree? (1= yes, 0=no)	Positive- Those with degrees find employment easier than non-degree holding respondents.
<b>WHITE (RACE)</b>	Races compared to white (Black, Hispanic, etc.)	Positive
<b>NUMBERCHILDRENINFU</b>	Number of children in household	Negative- The more children in the household, the harder it is to work and provide care.
<b>FEMALE</b>	Is head female? (1= yes, 0=no)	Negative- Based on historical trends and differences in opportunities.
<b>OWNS HOME</b>	Does the householder own/rent their current residence?	Positive- Owning a home implies
<b>DAYCARECENTER</b>	Was child in day care in the previous year?	Positive- With a child in daycare, parent is free to work.
<b>AGEYOUNGESTCHILD</b>	Age of the youngest child in the household.	Positive- As child gets older, less of a need to provide care.
<b>NUMBERADULTSINFU</b>	Number of adults in the family unit.	Positive- Would expect more adults in the FU to allow for more potential childcare providers.
<b>NORTHEAST (REGION)</b>	Geographic Region (South, West, etc.) compared to Northeast	Positive- Depending on the region
<b>YEAR1999-2015</b>	Was this data from 1999-2015? (1= yes, 0=no)	N/A

Marital status was condensed into a simple dummy variable, with a “1” for Married and a “0” for Not Currently Married. Not Currently Married is a conglomeration of multiple categories such as Widowed, Never Married, Separated, Divorced, etc. Since the effect of all of these options leads to the head of the household not being married, it makes sense to condense them into one category.

For college degree, the responses were narrowed down to "No" and "Yes", with the responses which were labeled as "Inap.: educated outside the U.S. only or had no education; NA, RF where Head received education; did not attend college; DK, NA, or RF whether attended college; completed less than one year of college" coded as a "No" response, as these responses are a significant portion of the total responses, and cannot be thrown out. However, when this is done, and the "NA/Refused" observations are deleted, the total ratio shows that 39.9% of the sample population has a college degree, which is extremely close to the 2012 national average of 39.4%.

Kimmel (1998) includes the geographic location of the mother as a variable (pg.289). Her choice in variable is a dummy variable representing whether the mother lives in the South. Kimmel also includes another geographic dummy variable which looks at whether the mother lives in a metropolitan area. Kimmel includes these variables to control for inherent differences found across the various regions of the United States. It is possible that Kimmel includes these because there are fewer employment opportunities in the South, though metropolitan areas may lessen this discrepancy. The South also has a different economic and social makeup when compared to the rest of the country, which Kimmel seems to think is important enough that it might have an effect on the mother's employment decisions. Since this information is provided by the PSID data, it is logical to include it. Kimmel's data uses survey data which is only

collected at the state level, however the reasoning for the inclusion of this variable in her model validates including it in my model. While the PSID data does not specify whether the respondent lives in a metropolitan area, it does ask the respondents what region they currently reside in. Instead of only including a dummy for “South” like Kimmel does, this study includes dummy variables for all possible responses. Responses available in this survey are Northeast, North Central, South, West, Alaska/Hawaii, and Foreign Country.

## **Methods**

For this study, there are multiple potential models. At first glance, a multinomial logit makes the most sense, as my dependent variable is categorical and can take on more than two states based on the way I’ve constructed the variable. However, I can also use a probit by dropping the extra employment categories (retired, student, disabled), leaving me with a dichotomous dependent variable. I can also count these categories as unemployed, however these categories are unemployed for completely different reasons than someone who has been laid off, and so including them may bias the results. With a dichotomous dependent variable, I can also use a linear probability model. These three models and their results can be seen in Appendix Table #3. The dependent variable will be employment status for men and women, and I will break down the model into different specifications based on gender and marital status afterwards. Berger and Black (1992) use probit equations to estimate the effect that subsidies have on employment. Kimmel (1998) also uses a probit model, however her employment data is based on whether the respondent worked within the last month, which is a simple “yes or no” question, and thus a probit is appropriate in that case.

The main independent variable I am interested in is the “expected cost of child care”. The PSID includes a variable which gives the amount of money the family reported spending on child

care in the previous year. The problem with using reported child care expenditures is that these householders are spending money on child care so that they can work instead of stay home. This means that, if these values are used, the model suffers from a simultaneity problem. However, this issue is fixed by using Stata to predict the expected child care expenditure for each observation using the other available characteristics of the respondent, which is shown below. This essentially states that “respondent #1, given all of respondent #1’s other characteristics, is expected to spend X on child care”. This solves our simultaneity problems, while also providing an estimate for every observation, increasing the amount of respondents with child care expenditures from 9,885 to 72,911.

Other explanatory variables used will be variables which affect labor force participation, including previous year total family income, number of children in the family unit, sex of the head of household, race of the head of household, and whether the head of household has a college degree. A condensed model would look something like the model below, where “C” is the amount of child care expenditures for the previous year, “T” represents time related variables, “I” represents income variables, and “D” represents demographic information for the head of household such as race, age, marital status, etc. This is similar to the variable groupings used in Huston’s (2002) study, which grouped family structure variables, human capital variables, ethnic variables, and personal variables to try and predict parental decisions surrounding the use of child care.

$$\text{Main Model: EmploymentStatus}_i = \beta_0 + C_i\beta_1 + D_i\beta_2 + I_i\beta_3 + T_i\beta_4 + \varepsilon_i$$

$$\text{Predicting Expected Child Care: ExpectedCC}_i = \beta_0 + D_i\beta_1 + I_i\beta_2 + T_i\beta_3 + \varepsilon_i$$

Then Stata runs a prediction to estimate child care expenditures per observation.

Marital status will be a dummy variable, either a 1 for “yes” or a 0 for “no”. Since a large portion of single female householders live in poverty, comparing to those who are married can help show that relationship.

Problems with this data generally revolve around the type of data being used. The data for an individual family cannot be tracked across years, and so this study cannot use a true panel methodology. To make up for this I created dummy variables for each year and assigned a “1” to observations within that year and a “0” to the other observations. I am restricted to using data starting in 1999 as that is the first year that a question about child care expenditures is included, which is the independent variable I am focusing on. Therefore lots of potential variables included within the PSID dataset cannot be used because they do not ask those questions during the time frame I am looking at. Another problem was the simultaneity potential in the data, which was fixed by using expected child care expenditure values instead of the reported values. Despite these potential issues, I am able to include many of the core variables used by Kimmel, and so I have confidence that my results will be meaningful and significant, and that the few variables I am missing will not be very detrimental.

## **Analysis**

This study seeks to determine the effect that the cost of child care has on female labor force participation. To determine this, a total of three models were used.

### *Model 1*

The results of my regressions are shown in Table 1 below. Model #1 uses a multinomial logit. Model #1 does not use robust standard errors. Robust standard errors are used in order to avoid heteroskedasticity. Due to the non-linear nature of the multinomial logit, it is difficult to

test for heteroskedasticity, however the results of the model are the same with or without robust standard errors, thus there is no reason to include them. The results for Model 1 show the comparison of those who are “unemployed” and those who are employed. In this model, “Unemployed” is defined as those who responded that they were only temporarily laid off, looking for work/unemployed, on sick leave, on maternity leave, or keeping house. Those who reported they were retired, students, or disabled were not counted as unemployed in this model. The results for those categories are not included as they are not of interest. The variables of

interest are expected child care expenditures, sex, age, total family income, marital status, college degree, age of youngest child, daycare, and race. For Model 1, all of the variables of interest are statistically significant at the 95% level of confidence. There are also two interactions included in this model, these can be seen in Table #1 and in Table #4. The first interaction shows the effect of Expected Child Care expenditures on the employment status of the head of household, but the interaction effect states that the effect of child care expenditures is dependent on the sex of the head of household. The second interaction shows the effect of the marital status of the householder on the employment status of the head of household, also dependent on the sex of the head of household. These interactions are present for all three models. To interpret these results, the margins command is needed to find the average marginal effect of these variables. The interaction effects need to be hand computed, otherwise they are lost when using the margins

<b><i>EMPLOYMENTSTATUS-Working Model 1</i></b>	
<b>ExpectedCC</b>	-0.0002403***
<b>Female</b>	-0.0152533***
<b>ExpectedCC*Female</b>	0.0022642***
<b>Age</b>	-0.0076629***
<b>Married</b>	0.093351***
<b>Married*Female</b>	-0.266278***
<b>College Degree</b>	
<b>Yes</b>	0.069662***
<b>Total Family Income</b>	2.64E-06***
<b>Age of youngest child</b>	-0.0036003***
<b>Daycare</b>	
<b>No</b>	-0.2609914***
<b># of adults in FU</b>	-0.0538219***
<b>White</b>	
<b>Black</b>	-0.0434881***
<b>Year2009</b>	-0.0284286***

command. Once these are computed, the results show the average marginal effect of child care expenditures on unemployment is  $-0.0002403$ . This looks small but it is significant. Though the coefficient cannot be interpreted itself, due to the non-linear nature of the model, the sign of the coefficient can be interpreted, which shows that, on average, as a householder's child care expenditures grow, they are less likely to be employed, holding all else constant. This is what was expected, the theory behind this expectation is that as child care becomes more and more expensive, it become unfeasible to pay for it, forcing the parent to stay home to provide the care themselves. The interaction effect shows that increases in child care expenditures actually increases the likelihood of employment slightly when sex is taken into consideration. This is likely because the vast majority of female-headed households with the data are not married, and so they cannot afford to quit their job. Summary statistics can be seen in the appendix. Instead, they may have to find more employment to help pay for increases in child care expenditures. The results show that female householders are 1.5 percentage points less likely to be employed than male householders, which is consistent with trends seen in the actual world. A married householder is 9.3 percentage points more likely to be employed than a non-married householder, which in context of this study, suggests that having a spouse who can stay home allows for the other parent to work. Married female householders are 26.6% less likely to be employed than married men. Total family income has a positive effect on employment, though the actual coefficient itself cannot be interpreted for the same reasons as the child care expenditure coefficient. A householder with a college degree is approximately 7 percentage points more likely to be employed than a householder without a college degree, while a black householder is 4.3 percentage points less likely to be employed compared to a white

householder. All of these results are as predicted, which is encouraging and shows that the model is at least not suffering from any major errors or problems of functional form.

### *Model 2*

Model 2 is a probit model. Our dependent variable is categorical and can range from “0” for “Not currently working” to “1” for “Working now”. As shown in appendix Table 4, this model has 59,195 observations as opposed to Model 1, which has 72,911 observations. This is because to run the probit, the other possible

employment categories, Retired, Student, and Permanently/Temporarily Disabled, need to be removed. This leaves a dichotomous dependent variable, which allows the use of a probit. Our choices are to either drop these observations or count them as “Not currently working”.

However, these categories are not working for different reasons than those already counted as “Not currently working”, and so including them

in this category with those who are unemployed for economic/social reasons does not make sense. Therefore, the choice was made to simply drop them for Model 2 and Model 3. Table 2 shows the marginal effects of these variables of interest, while including interaction effects as well. It shows that female householders are approximately 4.14% less likely to be employed than male householders. The overall effect of being married means that a married householder is approximately 8.4% more likely to be employed than a single householder. The interaction effect shows us that the probability of a married female householder being employed is approximately

<b>EMPLOYMENTSTATUS-Working Model 2</b>	
<b>ExpectedCC</b>	-0.000173***
<b>Female</b>	-0.0413518***
<b>ExpectedCC*Female</b>	0.0002083***
<b>Age</b>	-0.0040503***
<b>Married</b>	0.083986***
<b>Married*Female</b>	0.0379013***
<b>College Degree</b>	
<b>Yes</b>	0.0623616***
<b>Total Family Income</b>	1.34E-6***
<b>Age of youngest child</b>	-0.0023519***
<b>Daycare</b>	
<b>No</b>	-0.1770549***
<b># of adults in FU</b>	-0.0399077***
<b>White</b>	
<b>Black</b>	-0.042187***
<b>Year2009</b>	-0.0292403***

43%, while the probability of a married male householder being employed is approximately 80%. This means that a married female householder is 37 percentage points less likely to be employed than a male household. Householders with a college degree are 6.2% more likely to be employed than those without a college degree. Those without children in daycare are 17.7% less likely to be employed. Total family income has an extremely small effect, but the sign is significant. More income means a higher chance of being employed. There are multiple reasons that this is the estimated relationship, ranging from reverse causality to potential career enchantment opportunities like additional classes or training. Black householders are 4.2% less likely to be unemployed than a white householder. The number of adults in the family unit also has a negative effect on employment; for every additional adult in the household, there is approximately a 4% decrease in probability of unemployment. This could be because most additional adults other than the householder and spouse are grandparents, and grandparents may require care as well.

### *Model 3*

Model 3 is a linear probability model. This model allows the use of ordinary least squares, and lets us see the results of the regression in a linear form, as opposed to the non-linear forms of the probit and multinomial logit. As shown in appendix Table 4, this model has 59,195 observations as opposed to Model 1, which has 72,911 observations. The reason for this is the same reasoning for Model 2. Testing for heteroskedasticity shows that the null hypothesis can be rejected and that the model does suffer from heteroskedasticity, which is unsurprising with this type of data. Running the model with robust standard errors decreases the SEs, and thus increases the probability of Type II error. However, the t-stats for the linear probability model were large enough to where this was not a problem and no significance was lost. Table 3 shows

the regression output of the variables of interest for Model 3. As it shows expected child care expenditures has a negative effect on employment. A \$1 increase in child care expenditures leads to a 0.02051% decrease in the probability of employment. The interpretation behind this is sound, but no one is ever going to decide to not work because of a \$1 increase. The coefficient can be multiplied by 1000, which changes the

interpretation to show that every \$1000 increase in expected child care expenditures leads to a 20.51% decrease in the probability of employment. Interestingly, female is statistically insignificant, however the interactions with female are significant. The interaction between female and child care expenditures shows that female householders are approximately 7.36% ( $(-0.0002051 + 0.0001315) * 1000 * 100$ ) less likely to be employed than a male householder for every

\$1000 spent on child care. A married woman is 3.54% less likely to be employed than a married man, which is found by adding the married coefficient and the female interaction coefficient ( $0.1354055 - 0.1708344 \sim -0.0354$ ). A householder with a college degree is 8.29% more likely to be employed than those without a college degree. Unsurprisingly, householders with children not in daycare are 14.38% less likely to be employed than those with children in day care. Black householders are approximately 6.1% less likely to be employed compared to white householders. Householders in 2009 were 3.33% less likely to be employed compared to 2011, which makes sense considering the recession of 2008-2009. The coefficient for total family

Table 3

<b>EMPLOYMENTSTATUS-Working Model 3</b>	
<b>ExpectedCC</b>	-0.0002051***
<b>ExpectedCC*Female</b>	0.0001315***
<b>Age</b>	0.0121414***
<b># of Children in FU</b>	0.0936002***
<b># of Children in FU*Female</b>	-0.0819576***
<b>Married</b>	0.1354055***
<b>Married*Female</b>	-0.1708344***
<b>College Degree</b>	
<b>Yes</b>	0.0829407***
<b>Total Family Income</b>	6.67E-7***
<b>Age of youngest child</b>	-0.0018616***
<b>Daycare</b>	
<b>No</b>	-0.1437847***
<b>White</b>	
<b>Black</b>	-0.0608419***
<b>Year2009</b>	-0.0333888***

income is an extremely small effect, but it is significant. Though interpreting the coefficient itself is essentially meaningless, the sign of the coefficient tells us that as total family income increases, the probability of being employed increase as well. This could be an example of reverse causality, however there are potentially other reasons that increases in income could lead to employment. None of these results are surprising, and most have the signs that were predicted. Age of youngest child has a negative effect, though it was predicted to have a positive effect. The results show for every additional year of age for the youngest child, the probability of employment decreases by approximately -0.186%. This is the opposite of what was predicted; the theory behind expecting a positive effect was that as a child gets older, there is less of a need to provide care either through a stay at home parent or through a daycare service, and so parents would be able to seek employment. This result may be due to the linearity of the model, and may suggest that this is not the best functional form.

## **Conclusion**

The results of all three models confirm that increases in child care expenditures discourages work. However, the results show that as child care expenses increase, female householders are more likely to be employed. This could be due to the fact that within the PSID data being used, the majority of female householders were single, which means they cannot simply stop working to provide care at home. This suggests that as child care becomes more expensive, these single female householders wither have to work longer or find more employment in the form of a second job. Models #1 and #2 show that marriage in general increases the likelihood of employment, however when sex is accounted for, married female householders are much less likely to be employed than a male householder. Other variables show the relationships which were expected, and while the magnitudes of these variables may not

always be realistic, these results show that Model #1 and Model #2 seem to be correctly specified. As noted before, Model #3 is a linear probability model. Model #3 has a few suspect results, for instance finding that the sex of the head of household is insignificant. This suggests that the linear form of the linear probability model is a bad fit for the data, and so the Model #3 results should not be considered with too much weight.

In light of these results, policy options should consider focusing on married mothers. Married mothers appear to be much less likely to participate in the labor force, and so policies which encourage reentrance into the workforce should be the focus. Policies could include a reconsideration of maternity/paternity leave; the United States is currently one of the few countries in the world that does not offer some form of paid maternity leave. Policies focusing on single mothers could potentially target making more of the Earned Income Tax Credit (EITC) and Child Tax Credit (CTC) refundable.

## Appendix

**Table 4**  
**Categorical Data Regression Analysis**  
**1999-2015 Data**

“\*\*\*” = 95% Statistical Significance, “\*\*” = 90% Statistical Significance

<i>EMPLOYMENTSTATUS-Working</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
ExpectedCC	0.0029522***	-0.0013107***	-0.0002051***
Female	-0.2370684***	0.116474***	-0.0007907
ExpectedCC*Female	-0.000688***	0.0003813***	0.0001315***
Age	-0.0443066***	0.0268751***	0.0121414***
Age <sup>2</sup>	0.0011162***	-0.0006717***	-0.0001954***
# of Children in FU	-1.471792***	0.6611432***	0.0936002***
# of Children in FU*Female	0.3768921***	-0.2327394***	-0.0819576***
Married	-1.509613***	0.8014418***	0.1354055***
Married*Female	1.243335***	-0.7635405***	-0.1708344***
Owns			
Pays Rent	0.6443567***	-0.4163929***	-0.0721368***
Neither	1.848806***	-1.150495***	-0.2727209***
College Degree			
Yes	-0.9172026***	0.4918497***	0.0829407***
Northeast (Region)			
North Central	0.3777112***	-0.1923253***	-0.0351113***
South	0.1429663***	-0.0647609***	-0.0135147***
West	0.4234663***	-0.2167716***	-0.0325209***
Alaska, Hawaii	1.010814***	-0.3980738***	-0.0351502
Foreign country	0.2714382	-0.1619499	-0.0180623
Total Family Income	-0.0000245***	9.28E-6***	6.67E-7***
Age of youngest child	0.0426433***	-0.0162945***	-0.0018616***
Daycare			
Yes	0.0603502	0.0132776	0.0198051***
No	2.06336***	-0.9894295***	-0.1437847***
# of adults in FU	0.6125362***	-0.2764859***	-0.0385982***
White			
Black	0.5320072***	-0.2766724***	-0.0608419***
American Indian, Aluet, Eskimo	0.8588314***	-0.5481958***	-0.0977551***
Asian, Pacific Islander	-0.0674497	0.0119568	0.000269
Mentions Lation origin or desc	0.2063006**	-0.0917706	-0.0203328***
Other	-0.0827652	0.0103011	0.0003133
Year1999	0.0450995	0.002584	-0.004493
Year2009	0.3401697***	-0.2025805***	-0.0333888***
Year2015	-0.1412269***	0.1134833***	0.0215221***
Quantity of Observations	<b>72,911</b>	<b>59,195</b>	<b>59,195</b>
Type of Model	Multinomial Logit	Probit	Linear Probability Model (OLS)
Robust Standard Errors?	No	No	Yes

**Table 5- Tabulation of Sex and Marital Status (1= Married, 0=Not Married)**

. tab SEXOFHEAD if HEADMARITALSTATUS==1

SEX OF HEAD	Freq.	Percent	Cum.
Male	34,940	99.00	99.00
Female	352	1.00	100.00
Total	35,292	100.00	

. tab SEXOFHEAD if HEADMARITALSTATUS==0

SEX OF HEAD	Freq.	Percent	Cum.
Male	15,410	40.96	40.96
Female	22,209	59.04	100.00
Total	37,619	100.00	

**Table 6- Summary Statistics for Model #1 (Multinomial logit)**

Variable	Obs	Mean	Std. Dev.	Min	Max
NUMBERINFU	72,911	2.654565	1.479832	1	14
AGEOFHEAD	72,911	45.19313	16.32963	16	104
SEXOFHEAD	72,911	.309432	.4622627	0	1
NUMBERCHIL~U	72,911	.83473	1.171137	0	11
HEADMARITA~S	72,911	.4840422	.4997487	0	1
OWN_RENTOR~T	72,911	2.909273	2.2658	1	8
EMPLOYMENT~S	72,911	1.55063	1.479633	0	7
RACEOFHEAD	72,911	1.601788	1.110741	1	7
WTRRECDCOL~E	72,911	.2868566	.4522971	0	1
CURRENTREG~N	72,911	2.681955	.9557616	1	6
TOTALFAMIL~R	72,911	63850.52	93427.9	-971399	6317099
CHILDCAREE~R	72,911	477.5944	1961.458	-351	49362
Year	72,911	2007.456	5.108709	1999	2015
WTRCHILDIN~R	72,911	1.666813	2.281406	0	5
AGEYOUNGES~D	72,911	2.999698	4.819208	0	17
Year1999	72,911	.0938267	.2915895	0	1
Year2001	72,911	.0983802	.2978301	0	1
Year2003	72,911	.104607	.3060484	0	1
Year2005	72,911	.1082553	.3107047	0	1
Year2007	72,911	.112123	.3155199	0	1
Year2009	72,911	.1172663	.3217395	0	1
Year2011	72,911	.1202973	.3253112	0	1
Year2013	72,911	.1227113	.3281077	0	1
Year2015	72,911	.122533	.3279026	0	1
NUMBERADUL~U	72,911	1.819835	.7637673	1	9
ExpectedCC	72,911	477.5944	655.6945	-2289.603	16531.79

Table 7- Summary Statistics for Model #2 and #3 (Probit and Linear Probability Model)

Variable	Obs	Mean	Std. Dev.	Min	Max
NUMBERINFU	59,195	2.797601	1.49587	1	14
AGEOFHEAD	59,195	40.89301	12.81945	16	97
SEXOFHEAD	59,195	.2942816	.455723	0	1
NUMBERCHIL~U	59,195	.9582904	1.205426	0	11
HEADMARITA~S	59,195	.4936397	.4999638	0	1
OWN_RENTOR~T	59,195	2.969879	2.261928	1	8
EMPLOYMENT~S	59,195	.8751753	.3305229	0	1
RACEOFHEAD	59,195	1.623836	1.140211	1	7
WTRREDCOL~E	59,195	.303252	.459667	0	1
CURRENTREG~N	59,195	2.688791	.9564362	1	6
TOTALFAMIL~R	59,195	68973.27	99462.07	-971399	6317099
CHILDCAREE~R	59,195	573.5071	2141.278	-351	49362
Year	59,195	2007.371	5.097828	1999	2015
WTRCHILDIN~R	59,195	1.899755	2.340052	0	5
AGEYOUNGES~D	59,195	3.397517	4.968735	0	17
Year1999	59,195	.0950756	.2933218	0	1
Year2001	59,195	.0995692	.2994273	0	1
Year2003	59,195	.1070867	.3092261	0	1
Year2005	59,195	.1104823	.3134926	0	1
Year2007	59,195	.1144184	.3183215	0	1
Year2009	59,195	.1158882	.3200935	0	1
Year2011	59,195	.1187769	.3235286	0	1
Year2013	59,195	.1193175	.3241645	0	1
Year2015	59,195	.1193851	.3242438	0	1
NUMBERADUL~U	59,195	1.839311	.7597006	1	9
ExpectedCC	59,195	573.5071	712.8691	-2441.131	17370.37

## References

- Blau, D. M., & Robins, P. K. (1988). Child-care costs and family labor supply. *The Review of Economics and Statistics*, 374-381.
- Eissa, N., & Hoynes, H. W. (2004). Taxes and the labor market participation of married couples: the earned income tax credit. *Journal of public Economics*, 88(9-10), 1931-1958.
- Eissa, N., & Liebman, J. B. (1996). Labor supply response to the earned income tax credit. *The quarterly journal of economics*, 111(2), 605-637.
- Gornick, J. C., & Meyers, M. (2003). *Families that work*. New York: Russell Sage Foundation.
- Huston, A. C., Chang, Y. E., & Gennetian, L. (2002). Family and individual predictors of child care use by low-income families in different policy contexts. *Early Childhood Research Quarterly*, 17(4), 441-469.
- Kimmel, J. (1998). Child care costs as a barrier to employment for single and married mothers. *The Review of Economics and Statistics*, 80(2), 287-299.
- Michalopoulos, C., Robins, P. K., & Garfinkel, I. (1992). A structural model of labor supply and child care demand. *Journal of Human Resources*, 166-203.
- Panel Study of Income Dynamics, public use dataset. Produced and distributed by the Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI 2018.
- Patrick, K. (2017). National snapshot: Poverty among women & families, 2016. Washington D.C.: National Women's Law Center.
- Posadas, J., & Vidal-Fernández, M. (2013). Grandparents' childcare and female labor force participation. *IZA Journal of Labor Policy*, 2(1), 14.