The Effect of the Child Tax Credit on the Labor Supply of Mothers

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Abstract

This paper analyzes the effects of changes in the Child Tax Credit and Additional Child Tax Credit on labor force participation and hours worked among mothers. I focus on three periods: the late 1990s when the policy was first introduced, the early 2000s when the Child Tax Credit per dependent expanded, and the late 2000s when the earned income threshold level to receive the tax credit was lowered to allow more tax-filers with children to qualify for the credit. The predicted loss in tax revenue to the government by this tax credit in 2010 alone was $52 billion. I examine the effect of the total tax credit on labor force participation and hours worked among women using difference-in-difference regressions with women with no children as the control group since they do not qualify for the Child Tax Credit and women with children as the treatment group. I find an increase in labor force participation and hours worked, conditional on working, among single mothers relative to single women with no children following the introduction of the Child Tax Credit, but no significant change in the subsequent years surrounding the expansions of the tax credit.

I. Introduction

There has been much debate over ways to create welfare policies that do not discourage work among those who benefit from them because the welfare system is predicted to discourage labor force participation and hours worked. Now, there are tax and transfer policies which try to emphasize work. With tax and transfer programs like the earned income tax credit (EITC), policy makers have been trying to encourage work among needy families with children while also redistributing money. Arguably, these tax policies promote working among certain groups, i.e. single mothers, while transferring them money.

On August 5, 1997, the United States Congress passed the Taxpayer Relief Act which introduced the Child Tax Credit (CTC) for the 1998 tax year at $400 per dependent (nominal). It increased by 122 percent in real terms (2009 US Dollars) by the 2003 tax year to $1000 per dependent. In 2001, a refundable portion of the CTC was created for all families with children, the Additional Child Tax Credit (ACTC). To qualify for this credit, the tax filers must have an earned income that exceeds an income threshold. The expected tax revenue loss due to this credit in 2010 alone was $52 billion. Because it is a recent tax credit, the incentive effects of the CTC and ACTC on labor supply are largely unknown.

In this paper, I examine the effects of the introduction of the Child Tax Credit and Additional Child Tax Credit, and their subsequent expansions, on labor force participation and hours worked. Since the tax credit only applies to those families with dependents under 17 years of age, the target group includes needy single and married mothers. The credit should have no effect on single women with no children because they have no dependents qualifying for the tax credit.

I use these three groups, single women with no children, single mothers, and married mothers, to study the effect of the tax credit. Labor supply theory suggests that an increase in the tax credit received by the single and married mothers would unambiguously increase labor force participation among these groups but have an ambiguous effect on hours worked. I use difference-in-difference regressions to analyze the change in labor force participation and hours worked of single mothers to the change in labor force participation and hours worked of single women with no children. I do a similar analysis between married mothers and single women with no children. I focus on three periods surrounding the introduction of the tax credit and its expansions: from 1995 to 2000, 2001 to 2005, and 2006 to 2009, excluding 2008. I find that after the introduction of the Child Tax Credit, the labor force participation of single women with children increased by 4.7 percentage points relative to single women without children, with no significant difference after the 2003 expansion or the 2008 lowering of the earned income threshold for the Additional Child Tax Credit. Conditional on working, after the introduction of the Child Tax Credit, single mothers worked 30.6 hours, an increase of 2.07%, more relative to single women with no children, and no significant difference between the two groups after the 2003 and 2008 expansions.

The rest of the paper is split into 7 sections. Section II is the history of the Child Tax Credit and Additional Child Tax Credit. Section III is a literature review of previous research highlighting the effect of tax credit policies on labor supply. Section IV discusses the basic labor supply theory on the effects that the Child Tax Credit and Additional Child Tax Credit would have on labor force participation and hours worked. Section V describes the data and sample used in this paper. Section VI presents the results of both labor force participation and hours

worked and robustness of labor force participation results. Section VII discusses the results and its implications. Section VIII is the conclusion.

II. The Child Tax Credit and Additional Child Tax Credit

The Child Tax Credit was introduced at $400 per child in 1998 and was scheduled to increase each year up to $1000 by 2009. However, due to the Economic Growth Tax Relief Reconciliation Act (EGTRRA), signed into law June 7, 2001, and Jobs and Growth Tax Relief Reconciliation Act (JGTRRA), signed into law May 28, 2003, the tax credit grew to $1000 by 2003 (122 percent in real terms) and the refundable credit, the Additional Child Tax Credit, became available to all families with children, not just those with three or more. To qualify for the Child Tax Credit, the household must have a child under 17, have an earned income above the earned income threshold, and have a SSN or a ITIN. The child must also not earn enough to provide half of their own support. Through 2003 to 2010 tax years the CTC remained at $1000 per qualifying child. The earned income limits for receiving the CTC are $110,000 if married and filing jointly, $75,000 if single head of household, and $55,000 for married, filing separately. The credit is reduced by $50 for each additional $1,000 in earned income. For example, if a married couple is filing jointly with an earned income of $120,000 and 2 qualifying children, the CTC received is $1500 (=2*$1000-($120,000-$110,000)*$50/$1000).

The Additional Child Tax Credit (ACTC) is a refundable tax credit for those who did not receive the full amount of the CTC because it reduced their tax liability to zero before exhausting the credit. The ACTC expanded in 2008 and 2009 by lowering the earned income threshold to qualify for the credit. The Emergency Economic Stability Act, signed into law October 1, 2008 lowered the earned income threshold to $8,500. Prior to the law being signed, only those who were earning in excess of $12,050 could receive the ACTC at 15% of their earnings less

$12,050. The earned income threshold was reduced to $3,000 for the tax years 2009 and 2010 by the American Recovery and Reinvestment Act signed into law on February 17, 2009. In 2009 and 2010 tax year, a qualifying household would receive a refund equal to the lesser of these two values: the remaining CTC unused or 15% of the earned income that is more than $3000. Table 1 outlines the changes in the tax credit between 1997 and 2012. The CTC and ACTC were expected to sunset after the 2010 tax year back to pre-2001 standards. However, due to the Tax Relief Act of 2010, the tax credit levels will remain the same through tax year 2012. Table 1 presents the progression of the Child Tax Credit and Additional Child Tax Credit paired with the policy changes.

Table 1: Child Tax Credit and Additional Child Tax Credit Changes (1997-2012)

Policy	Year	Maximum Credit per dependent*	Refundability	Maximum Refund	Earned Income Threshold
TRA97	1997	$0	0		
	1998	$400	No**		
	1999	$500	No**		
	2000	$500	No**		
EGTRRA	2001	$600	Yes	Up to 10% of earnings over	$10,000
	2002	$600	Yes	Up to 10% of earnings over	$10,350
JGTRRA	2003	$1,000	Yes	Up to 10% of earnings over	$10,500
WFTRA	2004	$1,000	Yes	Up to 15% of earnings over	$10,750
	2005	$1,000	Yes	Up to 15% of earnings over	$11,000
	2006	$1,000	Yes	Up to 15% of earnings over	$11,300
	2007	$1,000	Yes	Up to 15% of earnings over	$11,750
EESA	2008	$1,000	Yes	Up to 15% of earnings over	$8,500
ARRA	2009	$1,000	Yes	Up to 15% of earnings over	$3,000
TRA10	2010	$1,000	Yes	Up to 15% of earnings over	$3,000
	2011	$1,000	Yes	Up to 15% of earnings over	$3,000
	2012	$1,000	Yes	Up to 15% of earnings over	$3,000

*The phase-out threshold for married couples is $110,000 if filing jointly and $55,000 if filing separately. Also the threshold for single parents is $75,000. For each additional $1,000, the credit is reduced by $50.

** A family with three or more children gets a refundable child credit to the extent that the employee share of Social Security taxes plus individual income taxes exceeds its Earned Income Tax Credit up to the amount of the full child credit.

III. Literature Review

In general, studies on the EITC have found increases in labor force participation among those most affected by expansions in the tax credit. DeSimone and Rinehart (2001) reported that labor force participation among women with 1 and 2 children increased due to the expansion in the EITC in 1993.[1] Since the gap closed after the expansion and since the expansion would have only affected those women with children, this would imply that the tax credit expansion increased the labor force participation rate of women with 1 or 2 children. Eissa and Hoynes (1998) found that for married couples with children, labor force participation varied in response to the expansions in the EITC between 1984 and 1996.[2] The expansions in the EITC increased labor force participation among married men with children but decreased among married women with children. This means that the result of the expansion made it more costly for married women to work so more stayed at home. Eissa and Liebman (1996) performed a study that examined tax credit expansions on labor supply in the extensive and intensive margins.[3] They showed that the Tax Relief Act of 1986 impacted labor supply of single women with children, increasing their labor force participation by 2.8 percentage points relative to single women with no children but was unchanged in hours worked.

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[1] DeSimone J and Rinehart J (2001). Labor Force Participation Responses to the 1993 EITC Expansion. *Economics Bulletin*, Vol. 8, No. 6, pp. 1-9.

[2] Eissa N and Hoynes HW (1998). The Earned Income Tax Credit and the Labor Supply of Married Couples. *NBER Working Paper*, No. 6856, pp. 1-60.

[3] Eissa N and Liebman JB (1996). Labor Supply Response to the Earned Income Tax Credit. *Quarterly Journal of Economics*, Vol. 111, No. 2, pp. 605-637.

Hotz, Mullins, and Scholz (2006) examine the difference in effects that the EITC has on employment, comparing families with one child to families with two or more children.[4] They find that when the EITC expansion took place in the 1990s, there were differences in employment between families with two or more children relative to one-child families, consistent with previous findings. Meyers and Rosenbaum (2001) showed that the EITC greatly impacted the increase in work among single mothers between 1984 and 1996.[5] All of these studies have examined the effect of the EITC expansions on certain groups impacted by these changes.

This study is similar to Eissa and Liebman (1996) in that I use a similar method of analysis, comparing mothers, both single and married, to single women with no children, on the introduction and changes to the CTC and ACTC. There has been little research done on the incentive effects of the CTC and ACTC on labor supply. Yet, this is interesting to study the CTC and ACTC because it has such a large impact on tax revenue (expected 2010 loss of $52 billion) and it is not a small tax credit at $1,000 per dependent. This is the first know study to examine the impact of the CTC and ACTC on labor force participation and hours worked among mothers.

IV. Theory

A labor supply model would suggest an unambiguous positive effect on labor force participation due to the expansion in the CTC and ACTC. This unambiguous positive effect exists because the credit increases after-tax income and those who are already working will remain working to qualify for the tax credit and some of those who are not working will decide to work because the marginal benefit from receiving the credit is greater than the opportunity

[4] Hotz VJ, Mullins CH and Scholz JK (2006). Examining the Effect of the Earned Income Tax Credit on the Labor Market Participation of Families on Welfare. *NBER Working Paper,* No. 11968, pp. 1-57.

[5] Meyer BD and Rosenbaum DT (2001). Welfare, the Earned Income Tax Credit, and the Labor Supply of Single Mothers. *Quarterly Journal of Economics,* Vol. 116, Issue 3, pp. 1063-1114.

cost of working. However, there is an ambiguous effect on the number of hours worked. The phase-in region of the tax credit on after-tax income is the portion where each marginal hour worked increases the size of the credit received so that the after-tax income is increasing greater with the credit, than without it. The phase-out region of the tax credit on after-tax income is the portion where each marginal hour worked decreases the size of the credit received so after-tax income is increasing at a lower rate with the credit, than without it. Therefore, if leisure is a normal good, in the phase-in region of the tax credit, the income and substitution effects go in opposite directions with the substitution effect motivating individuals to work more hours and an income effect motivating them to work less. In the maximum credit region of the tax credit, where the tax-payer is receiving the maximum tax benefit of the credit for all individuals with similar characteristics, there is only an income effect motivating less work. In the phase-out region, the substitution effect acts in the same direction as the income effect, motivating those who earn over the earned income to qualify for the tax credit to work fewer hours.

Thus, with the labor supply model, I should expect an unambiguous positive effect on labor force participation and an ambiguous effect on the hours worked with the introduction of the Child Tax Credit and Additional Child Tax Credit, and their subsequent expansions.

V. Data and Methods

The data I use come from the 1995 to 2010 March Current Population Survey. It is an annual survey of more than 50,000 households, capturing labor and income information of the United States population. It includes household data on income, labor supply, and a rich set of demographic characteristics for the tax years from 1994 to 2009. This period includes the introduction the Child Tax Credit and the Additional Child Tax Credit, and its subsequent expansions.

The primary unit of analysis in this study is the family, the tax-filing entity. Since I am using the CPS definition of families, I separate individual subfamilies in each household as a separate tax-filing entity. For the family to qualify for the CTC, they must have a dependent under the age of 17 who does not earn half of his or her own financial support. To generate expected Child Tax Credit and Additional Child Tax Credit for each household, I used the program Internet Taxsim, created by the National Bureau of Economic Research to calculate state and federal tax liabilities from inputted data.[6] Taxsim imputes tax liabilities and credits using information on the tax year, whether the person was married or single (single was coded as being head of the household) and the number of dependents under the age of 17, who qualify under the Child Tax Credit specifications. Since the Child Tax Credit and Additional Child Tax Credit are federal tax credits, I do not use state identifiers. The main identifier is the household head for single mother families and spouses or heads of households for married mothers. Since adopted children are listed as separate household entities, I counted all adopted children under the age of 17 residing in the same household, attaching them to the primary family in each household. This has a minimal effect overall and applies to less than 1% of the sample in this study. I take the Child Tax Credit and Additional Child Tax Credit variables produced by Internet Taxsim and normalize them into 2009 dollars while also creating the variable for the real Total Child Tax Credit (real_TCTC) which is the sum of the CTC and ACTC.

The sample is primarily of female heads of families, including single women with no children, single mothers, and married mothers. I exclude women who reported not working the previous year for reasons relating to disability, retirement, or education. I also restrict the sample's age range from 16 to 54 to exclude those retired or too young to be working. A single

[6] Feenberg DR and Coutts E (1993). An Introduction to the TAXSIM Model. *Journal of Policy Analysis and Management*, Vol. 12, No. 1, pp 189-194.

woman with no children is defined as being the household head (family head) or an unrelated roommate (family head), with no children residing in the household (to be claimed as dependents). Single mothers are defined to be single women with children, that is, they have dependents under the age of 17. Married mothers are women listed as married and having dependents less than 17 years old. The resulting sample size, for all years 1994-2009, is 498,475 observations.

Table 2 presents summary statistics of the characteristics of single mothers, single women with no children, and married mothers. The first column is single women with no children. Columns 2 and 3 present characteristics of single mothers and married mothers, respectively. The real ESA income is the real equivalence scale adjusted income. The equivalence scale is calculated by taking the sum of the number of adults and 0.7 times the number of children in the family unit and then raising this quantity to the power of 0.7. The ESA income, then, is the real income divided by that equivalence scale. Single women with no children are clearly different from the other groups being both the youngest (35.47 years old) and most educated (96.11% graduated from high school). Although single mothers have the lowest real income and real equivalent scaled adjusted (ESA) income ($36,231.81 and $20,005.28, respectively) of all three groups, it has an average labor force participation rate of 88.13%, greater than that of married mothers. Married mothers have the lowest labor force participation rate at 76.52% but the highest real income.

These summary statistics suggest that any differences in labor force participation or hours worked between any of the groups, specifically the treatment groups (married and single mothers) and the control group (single women with no children), should be considered carefully because there could be other influences not related to changes in the credits.

Table 2: Summary Statistics

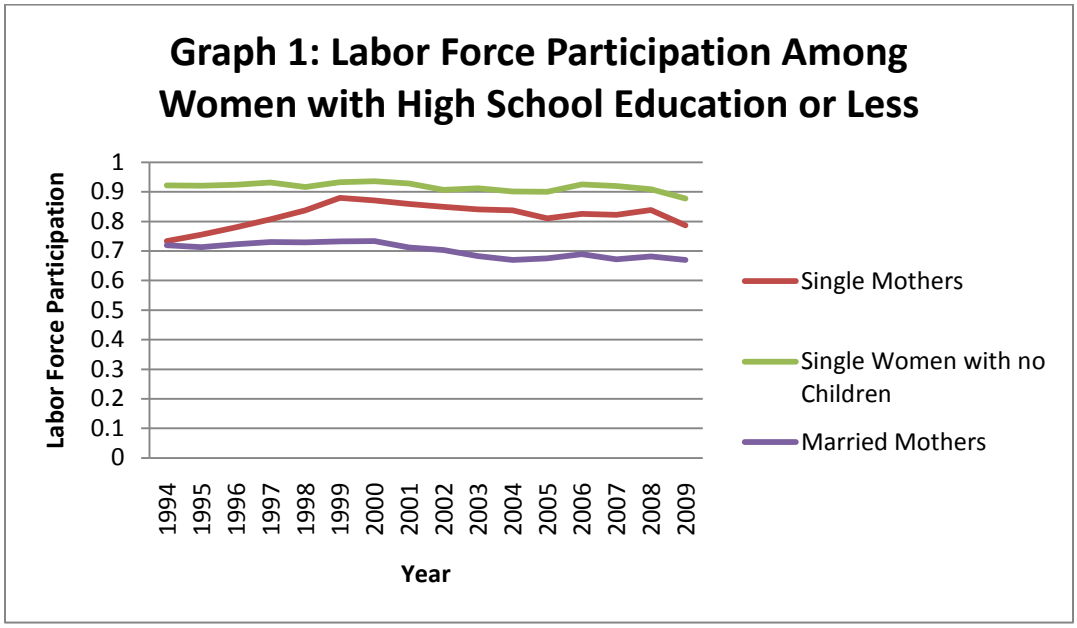
Variable	Single Women	Single Mothers	Married Mothers
Age	35.4719	36.8696	38.47702
	(10.98758)	(9.022132)	(8.013086)
Have a High School Degree	0.9332046	0.8354098	0.8954337
	(0.2496688)	(0.3708124)	(0.3059942)
White	0.7834513	0.6471667	0.8518886
	(0.4118949)	(0.477854)	(0.3552109)
Real Income	41702.38	36231.81	96990.48
	(41585.83)	(37596.4)	(82630.12)
Real ESA Income	37947.79	20005.28	40364.26
	(37334.74)	(20891.32)	(34762.82)
Labor Force Participation	0.9610878	0.8813262	0.7652284
	(0.193387)	(0.3234061)	(0.4238567)
Hours worked	1826.736	1574.921	1282.484
	(766.5843)	(861.7777)	(952.5504)
Observations	80989	90130	327354

*Table 2: These means are weighted with CPS March supplement weights. The sample contains single women with no children, single mothers, and married mothers. Real income is in 2009 dollars and ESA stands for equivalence scale adjusted which takes real income and divides it by the sum of the number of adults and of 0.7 times the number of children in the household raised to the power of 0.7. Standard errors are in parentheses.

Since income is endogenous and other factors could be contributing to the income level of a household, I compare changes in labor supply before and after the expansions for single mothers to that of single women without children, estimating a difference-in-difference model. It should be noted that it may be difficult to examine independently the effects of the expansion in the CTC in the late 1990s because of other welfare reforms taking place at the same time, i.e.

following EITC expansion, but controlling for state effect, year effects, and state-year interactions should account for any of these differences by state and policy introduction.

I summarized labor force participation rates among women with low education considering their decisions to not work do not include full-time student, retired or disabled. Graph 1 shows the time series of labor force participation for single mothers, single women without children and married mothers.



*Graph 1: I exclude women who reported not working the previous year for reasons relating to disability, retirement, or education and rule out those retired or too young to be working by restricting the age range from 16 to 54. A single woman with no children is defined as being the household head (family head) or an unrelated roommate, both with no children residing in the household (to be claimed as dependents). Single mothers are defined to be single women with children, that is, they have dependents under the age of 18. Married mothers are women listed as married and having dependents less than 18 years old.

This graph shows that after the Child Tax Credit was introduced in 1998, the labor force participation among single mothers increased at a greater rate relative to single women with no children. However, starting from 1994, there is a trend in labor force participation among single mothers increasing at a greater rate relative to single women with no children, so year controls will be important in absorbing year effects. From 2000 to 2004, single mothers' labor force

participation rate declined very slowly, while single women with no children oscillated. Married mothers experienced a fall in labor force participation between 2000 and 2004. Between 2008 and 2009, single mothers' labor force participation fell drastically relative to single women with no children.

The model I am using in this paper is:

(1)

In equation (1), T represents the outcome variables of worked last year or hours worked last year for individual i during period t. Worked last year is signified by 0 or 1, 0 meaning did not work and 1 meaning did work. *Treatment* is a dummy variable for whether the observation is in the treatment group (represented by 1) or not (represented by 0). Similarly, *Post* is dummy variable for whether the observation is in the post-policy introduction group or not The post-policy period includes the year the change in policy occurred and the subsequent years in the same period of analysis. The coefficient of interest is $_3$, the coefficient for the interaction term between the treatment group and post-policy group because this will show the effect that the policy change has on the outcome variable of the treatment group relative to that of the control group.

X is all the control variables including age, age squared, race, number of dependents, and education level when education is not specified as a treatment and control group or the group is limited to one education level. Because the treatment and control groups have varying demographic characteristics, this will allow for more efficient results by reducing residual variance. and are the state and year fixed effects, respectively, and for state s and period t. The interaction term * controls for state and year interactions. By including state dummies, year dummies, and state and year interaction terms, I am controlling for any individual state

welfare programs that would have been introduced around the same time that this policy came into effect. I control for these variables because, before the Child Tax Credit was introduced, the Personal Responsibility and Work Opportunity Reconciliation Act was passed in 1996. The bill created a workforce development component to the welfare system that encouraged the poor to work while also giving individual states some control over developing their own welfare systems as long as they met certain federal standards. With this variation in state-designed systems and when these programs were introduced, state and year fixed effects need to be added to the regression. Finally, is the error term.

Difference-in-difference regressions will be helpful in determining the actual effects that the CTC and ACTC expansions had on labor supply in the extensive and intensive margins. I will be testing that the labor force participation for low education mothers increased when the CTC and ACTC were introduced and expanded and that the hours worked remained unchanged when the CTC and ACTC were introduced and expanded, focusing on the periods from 1995 to 2000, 2001-2005, and 2006 to 2009, except 2008 to show emphasize the decrease in the income threshold for the Additional Child Tax Credit.

Similar to Eissa and Liebman (1996), this study uses different treatment groups. The first is single mothers compared to single women with no children. I also compare married mothers to single women with no children. Furthermore, I restrict the treatment group and control group to low education to focus the impact of the tax credit introduction and expansions on low income families. I also restrict the groups to predicted low incomes (using exogenous characteristics such as age, race, education, and year fixed effects) to compare the treatment groups to the control groups. Within the treatment groups, I also compare high education to low education and high predicted income to low predicted income. This will compare those less likely to be affected

by the tax credit and those more likely to be affected by the tax credit. By using multiple control and treatment groups, if I find similar results, I can check the robustness of these results to see how well they explain the effect of the tax credit on labor force participation and hours worked. Also, I can be more convinced that I am correctly estimating the actual effects of the tax credit introduction and expansion and not effects of other, simultaneous changes or trending.

VI. Results

a. Labor Force Participation

Table 3 presents difference in difference regressions results for labor force participation rates between single mothers (treatment) and single women with no children (control), controlling for demographic characteristics, state fixed effects, year fixed effects, and state and year interaction effects. The *treatment* variable identifies the group being affected directly by the policy change, so in this case for specification 1, the treatment group is the group of single mothers. For some specifications, the treatment groups are those within single mothers more likely to be impacted than the control group, i.e. 1^{st} predicted income quintile to 5^{th} predicted income quintile among single mothers.

I expect that the coefficient on *treatment* to be negative if single mothers have lower labor force participation rates than single women with no children, even after controlling for other characteristics. The *post* variable estimates the change in labor force participation among both the treatment and control groups within each period between the pre-policy institution and post-policy institution. To identify the effect that the policy change has on labor force participation among the treatment group relative to the control group, I test to see that the coefficient on the interaction term between *treatment* and *post* is greater than zero.

Table 3: Single Mothers vs. Single Women with no children

Dependent Variable	Worked Last Year	Worked Last Year	Worked Last Year	Worked Last Year
Period	1995-2000	1995-2000	1995-2000	1995-2000
Sample	Single Women	Single Women; Less Than a High School Education	Single Mothers	Single Mothers
Treatment Group	Mothers	Mothers	1st Predicted Quintile	1st and 2nd Predicted Quintile
Control Group	Women with No Children	Women with no children	5th Predicted Quintile	5th Predicted Quintile
Specification	(1)	(2)	(3)	(4)
Treatment	-0.013	-0.051	-0.162	0.107
	(0.005)**	(0.021)*	(0.015)**	(0.060)
Post	0.015	0.223	0.051	0.026
	(0.045)	(0.186)	(0.118)	(0.084)
Post*Treatment	0.047	0.08	0.073	0.047
	(0.005)**	(0.024)**	(0.013)**	(0.012)**

Dependent Variable	Worked Last Year	Worked Last Year	Worked Last Year	Worked Last Year
Period	2001-2005	2001-2005	2001-2005	2001-2005
Sample	Single Women	Single Women; Less Than a High School Education	Single Mothers	Single Mothers
Treatment Group	Mothers	Mothers	1st Predicted Quintile	1st and 2nd Predicted Quintile
Control Group	Women with No Children	Women with no children	5th Predicted Quintile	5th Predicted Quintile
Specification	(5)	(6)	(7)	(8)
Treatment	0.019	-0.008	0.445	0.145
	(0.005)**	(0.021)	(0.053)**	(0.035)**
Post	-0.036	-0.235	-0.123	-0.115
	(0.023)	(0.131)	(0.059)*	(0.048)*
Post*Treatment	-0.011	0.008	-0.004	0.002
	(0.005)*	(0.024)	(0.012)	(0.011)

Dependent Variable	Worked Last Year	Worked Last Year	Worked Last Year	Worked Last Year
Period	2006-2007, 2009	2006-2007, 2009	2006-2007, 2009	2006-2007, 2009
Sample	Single Women	Single Women; Less Than a High School Education	Single Mothers	Single Mothers
Treatment Group	Mothers	Mothers	1st Predicted Quintile	1st and 2nd Predicted Quintile
Control Group	Women with No Children	Women with no children	5th Predicted Quintile	5th Predicted Quintile
Specification	(9)	(10)	(11)	(12)
Treatment	-0.008	-0.043	-0.12	0.126
	(0.005)	(0.025)	(0.020)**	(0.039)**
Post	-0.032	-0.181	-0.019	-0.022
	(0.032)	(0.165)	(0.068)	(0.059)
Post*Treatment	-0.009	0.034	-0.014	-0.011
	(0.007)	(0.038)	(0.024)	(0.023)

Standard Errors in Parentheses

* significant at 5%; ** significant at 1%

*Table 3: All regressions have controls for age, age squared, race, number of dependents, state fixed effects, year fixed effects, state and year interactions, and education level (except 2, 6, and 10 where there is only one education level in the regression). The March CPS weight is used in each regression. Predicted income quintiles are determined by calculating the regression of predicted real ESA income with controls for age, age squared, marital status, race, education level number of dependents and year effects, with the March CPS weight. Then the predicted income quintiles are created for all observations, 1 being the lowest and 5 being the highest. The post period is created to include the year the change went into effect, that is, 1998-2000, 2003-2005, and 2009.

Table 3 presents results comparing single mothers to single women with no children. The first 4 specifications examine the period from the pre-CTC introduction to the post-CTC introduction. The first specification includes all single mothers and single women with no children with controls for demographic characteristics, state effects, year effects, and state and year interactions. The second specification includes only those single mothers and single women with no children who have an education equivalent to a high school dropout or less. The coefficient for the *post* variable is small and insignificant, implying there is no trend in the labor

force participation for the two groups between 1995 and 2000. The coefficient on the *treatment* variable is negative for both specifications (-0.013 and -0.051, respectively), highlighting the fact that there are differences in characteristics between single mothers and single women with no children which affect labor force participation. Since both are statistically significant, this means that children lower the labor force participation rates of single mothers relative to them not having children. The interaction term is positive and significant for both specifications, increasing by 3.3 percentage points when limiting the sample to those with an education less than a high school degree, from 4.7 percentage points to 8.0 percentage points (standard errors of 0.005 and 0.024, respectively). This would suggest that the introduction of the tax credit affected all single mothers, on average, by having a 4.7 percentage point increase in labor force participation relative to single women with no children, and when restricting to the low educated group, the increase is greater. These results are not sensitive to year effects, state effects, year and state interactions, or changes to the period when taking away years. These results allow us to reject the null hypothesis and labor theory supports this.

Looking within the group of single mothers, specifications 3 and 4 present results comparing those in the lower income levels to those in the higher income levels. Since there is a phase-out to the tax credit, those in the highest income quintile would not be affected by this tax credit introduction because they would not be able to qualify for it, while those in the lowest income quintiles would be expected to receive the most benefit from the tax credit. The treatment groups once again have a significant increase in labor force participation after the policy for the CTC is enacted (0.073 and 0.047). This means the tax credit appears to have positively affected the group targeted to benefit from it. In the subsequent periods from 2001 to 2005 and from 2006-2009, there is less impact of the tax credit expansions on labor force participation among

single mothers relative to single women with no children. The only significant interaction coefficient is that for all single mothers and single women with no children between 2001 and 2005, when the largest real increase in the tax credit occurred. But this effect was negative for the treatment group, with a 1.1 percentage point decrease in labor force participation, compared to the control group. For within group analysis, there was no significant effect due to the tax credit expansions between the poor and rich among single mothers.

Table 4 presents similar specifications as Table 3 only replacing the treatment group with married mothers. For all three periods, the effect of the tax policy changes on married mothers' labor force participation rate is small and insignificant relative to single women with no children. The only significant coefficient on the interaction term between *treatment* and *post* is for 2006-2007, 2009 comparing all married mothers to all single women with no children, where there is a positive change in labor force participation of married mothers relative to their single and childless counterparts (1.3 percentage point increase). When analyzing within-group effect on married mothers, comparing the lowest and highest income quintile, all three periods report significant impacts of the tax policy changes on the lowest income quintile. Within the first period, there is a positive effect of the introduction of the CTC on those married mothers in the lower income quintiles, varying by 1.0 percentage points between the two specifications. For the second period, the expansion in the CTC affected the lower predicted income quintiles negatively. There was a negative change in labor force participation relative to married mothers in the highest predicted income quintile. There is a similar effect in the last period, with significance only comparing the lowest two predicted income quintiles relative to the highest predicted income quintile.

Table 4: Married Mothers vs. Single Women with no children

Dependent Variable	Worked Last Year	Worked Last Year	Worked Last Year	Worked Last Year
Period	1995-2000	1995-2000	1995-2000	1995-2000
Sample	Married Mothers and single women with no children	Married Mothers and single women with no children; Less than High School Education	Married Mothers	Married Mothers
Treatment Group	Married Mothers	Married Mothers	1st Predicted Income Quintile	1st and 2nd Predicted Income Quintile
Control Group	Single Women with no children	Single Women with no children	5th Predicted Income Quintile	5th Predicted Income Quintile
Specification	(1)	(2)	(3)	(4)
Treatment	-0.089	-0.156	0.059	0.083
	(0.004)**	(0.018)**	(0.033)	(0.016)**
Post	-0.021	0.152	-0.037	-0.073
	(0.034)	(0.135)	(0.071)	(0.059)
Post*Treatment	-0.002	-0.022	0.031	0.021
	(0.004)	(0.022)	(0.012)*	(0.008)*

Dependent Variable	Worked Last Year	Worked Last Year	Worked Last Year	Worked Last Year
Period	2001-2005	2001-2005	2001-2005	2001-2005
Sample	Married Mothers and single women with no children	Married Mothers and single women with no children; Less than High School Education	Married Mothers	Married Mothers
Treatment Group	Married Mothers	Married Mothers	1st Predicted Income Quintile	1st and 2nd Predicted Income Quintile
Control Group	Single Women with no children	Single Women with no children	5th Predicted Income Quintile	5th Predicted Income Quintile
Specification	(5)	(6)	(7)	(8)
Treatment	-0.105	-0.209	0.059	0.032
	(0.004)**	(0.019)**	-0.053	(0.046)
Post	0.004	0.079	0.075	0.044
	(0.024)	(0.106)	(0.057)	(0.044)
Post*Treatment	-0.005	0.014	-0.049	-0.04
	(0.004)	(0.022)	(0.011)**	(0.008)**

Dependent Variable	Worked Last Year	Worked Last Year	Worked Last Year	Worked Last Year
Period	2006-2007, 2009	2006-2007, 2009	2006-2007, 2009	2006-2007, 2009
Sample	Married Mothers and single women with no children	Married Mothers and single women with no children; Less than High School Education	Married Mothers	Married Mothers
Treatment Group	Married Mothers	Married Mothers	1st Predicted Income Quintile	1st and 2nd Predicted Income Quintile
Control Group	Single Women with no children	Single Women with no children	5th Predicted Income Quintile	5th Predicted Income Quintile
Specification	(9)	(10)	(11)	(12)
Treatment	-0.102	-0.222	0.585	0.161
	(0.004)**	(0.022)**	(0.053)**	(0.155)
Post	-0.009	-0.079	-0.121	-0.009
	(0.034)	(0.157)	(0.064)	(0.055)
Post*Treatment	0.013	0.029	-0.031	-0.027
	(0.006)*	(0.035)	(0.016)	(0.011)*

Standard Errors in Parentheses

* significant at 5%; ** significant at 1%

*Table 4: All regressions have controls for age, age squared, race, number of dependents, state fixed effects, year fixed effects, state and year interactions, and education level (except 2, 6, and 10 where there is only one education level in the regression.) The March CPS weight is used in each regression. Predicted income quintiles are determined by calculating the regression of predicted real ESA income with controls for age, age squared, marital status, race, education level number of dependents and year effects, with the March CPS weight. Then the predicted income quintiles are created for all observations, 1 being the lowest and 5 being the highest. The post period is created to include the year the change went into effect, that is, 1998-2000, 2003-2005, and 2009.

b. Hours Worked

Table 5 presents results for hours worked conditional on working comparing single mothers as the treatment group and single women with no children as the control group. The previous results suggest that the introduction of the CTC could have caused the increase in labor force participation among single mothers relative to single women with no children. But the introduction of the tax credit is predicted to reduce the hours worked by many of these women

already employed in the labor force. Yet, in the first specification, the coefficient of the interaction term between the post period and the treatment group is positive and significant (30.551 with a standard error of 13.703). This would mean that there is a relative increase in hours worked by single mothers compared to single women with no children after the introduction of the CTC, although small. When considering only those with less than a high school education, the coefficient is statistically insignificant. Also when looking at the last period of analysis, the coefficients on the interaction terms of similar specifications are small and insignificant.

When focusing on only single mothers and comparing quintile groups, in the first period, the interaction effect is positive and significant for both first quintile and first and second quintiles, relative to the fifth quintile group (115.474 and 108.149, respectively). Conversely, there is a negative and significant effect when comparing the same groups in the last period of 2006-2007 and 2009 (-169.583 and -170.136).

Table 5: Single Mothers vs.
Single Women with no children

Dependent Variable	Hours Worked Last Year	Hours Worked Last Year	Hours Worked Last Year	Hours Worked Last Year
Period	1995-2000	1995-2000	1995-2000	1995-2000
Sample	Single Women	Single Women; Less Than a High School Education	Single Mothers	Single Mothers
Treatment Group	Mothers	Mothers	1st Predicted Quintile	1st and 2nd Predicted Quintile
Control Group	Women with No Children	Women with no children	5th Predicted Quintile	5th Predicted Quintile
Specification	(1)	(2)	(3)	(4)
Treatment	-35.145	-93.08	-203.374	158.591
	(12.394)**	(42.355)*	(39.260)**	(129.651)
Post	-132.766	669.222	-165.319	-233.874
	(95.957)	(247.587)**	(191.935)	(159.234)
Post*Treatment	30.551	81.897	115.474	108.149
	(13.703)*	(50.754)	(45.062)**	(43.261)*

Dependent Variable	Hours Worked Last Year	Hours Worked Last Year	Hours Worked Last Year	Hours Worked Last Year
Period	2006-2007, 2009	2006-2007, 2009	2006-2007, 2009	2006-2007, 2009
Sample	Single Women	Single Women; Less Than a High School Education	Single Mothers	Single Mothers
Treatment Group	Mothers	Mothers	1st Predicted Quintile	1st and 2nd Predicted Quintile
Control Group	Women with No Children	Women with no children	5th Predicted Quintile	5th Predicted Quintile
Specification	(5)	(6)	(7)	(8)
Treatment	-44.485	14.374	-225.089	167.898
	(13.214)**	(50.226)	(47.570)**	(80.670)*
Post	-107.922	-254.301	245.106	105.683
	(76.130)	(328.128)	(163.496)	(140.837)
Post*Treatment	12.979	2.028	-169.583	-170.136
	(18.098)	(72.270)	(64.994)**	(63.535)**

Standard Errors in Parentheses

* significant at 5%; ** significant at 1%

*Table 5: All regressions have controls for age, age squared, race, number of dependents, state fixed effects, year fixed effects, state and year interactions, and education level (except 2 and 6 where there is only one education level in the regression). The March CPS weight is used in each regression. Predicted income quintiles are determined by calculating the regression of predicted real ESA income with controls for age, age squared, marital status, race, education level number of dependents and year effects, with the March CPS weight. Then the predicted income quintiles are created for all observations, 1 being the lowest and 5 being the highest. The post period is created to include the year the change went into effect, that is, 1998-2000, 2003-2005, and 2009.

The effect in the early 2000s is small and insignificant among all specifications. For married mothers compared to single women with no children there is no significant effect at all under all specifications for all periods.

c. Robustness

The robustness of my previous results on labor force participation is checked when comparing education levels within the groups of single mothers and married mothers. Since low educated single mothers are most likely to receive the greatest benefit from the tax credit,

comparing them to the highest education level will show if the tax policy affected the group it intended to. Table 6 presents these results.

Table 6: Robustness of Labor Force Participation

Dependent Variable	workly	workly	Workly
Period	1995-2000	2001-2005	2006-2007, 2009
Sample	Single Mothers	Single Mothers	Single Mothers
Treatment Group	Less than High School Education	Less than High School Education	Less than High School Education
Control Group	College Bachelor's Degree or higher education	College Bachelor's Degree or higher education	College Bachelor's Degree or higher education
Specification	(1)	(2)	(3)
Treatment	-0.247	-0.149	-0.17
	(0.013)**	(0.012)**	(0.013)**
Post	0.017	-0.204	-0.095
	(0.175)	(0.097)*	(0.098)
Post*Treatment	0.106	-0.025	-0.037
	(0.016)**	(0.016)	(0.023)
R-Squared	0.23	0.15	0.18
Dependent Variable	Workly	workly	Workly
Period	1995-2000	2001-2005	2006-2007, 2009
Sample	Married Mothers		
Treatment Group	Less than High School Education	Less than High School Education	Less than High School Education
Control Group	College Bachelor's Degree or higher education	College Bachelor's Degree or higher education	College Bachelor's Degree or higher education
Specification	(4)	(5)	(6)
Treatment	-0.204	-0.166	-0.215
	(0.009)**	(0.009)**	(0.010)**
Post	-0.013	0.049	0.043
	(0.066)	(0.054)	(0.062)
Post*Treatment	0.028	-0.037	-0.021
	(0.012)*	(0.012)**	(0.017)
R-Squared	0.11	0.1	0.11

Standard Errors in Parentheses

* significant at 5%; ** significant at 1%

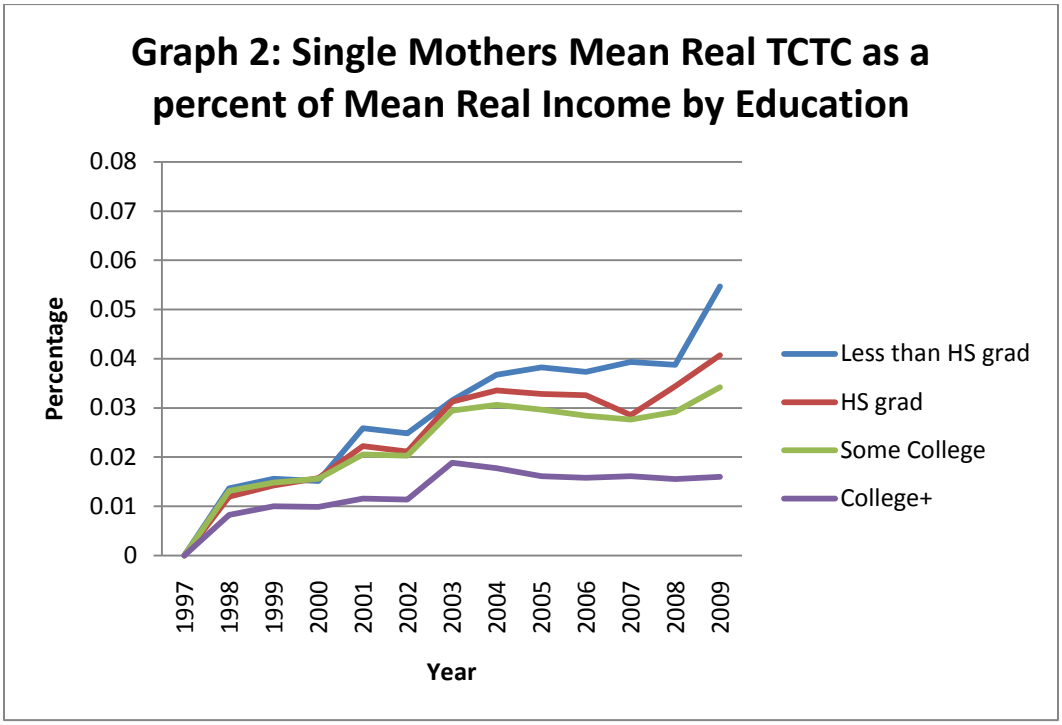
*Table 6: All regressions have controls for age, age squared, race, number of dependents, state fixed effects, year fixed effects, and state and year interactions. Education levels are clearly stated in each regression. The March CPS weight is used in each regression. Predicted income quintiles are determined by calculating the regression of predicted real ESA income with controls for age, age squared, marital status, race, education level number of dependents and year effects, with the March CPS weight. Then the predicted income quintiles are created for all observations, 1 being the lowest and 5 being the highest. The post period is created to include the year the change went into effect, that is, 1998-2000, 2003-2005, and 2009.

In the first period, the coefficient of the interaction term for single mothers is .106 (with a standard error of 0.016) and the regression had an R^2 value of .23 (the highest of all the samples and specifications among any of the groups). This means that the change in labor force participation among single mothers with less than a high school education is 10.6 percentage points greater than that of single mothers with a college education or higher, even after controlling for demographic characteristics, state, year, and state-year effects. For the other two periods among single mothers, the coefficients on the interaction terms are negative and insignificant (R^2 of .15 and .18, respectively). Therefore I cannot reject the null hypothesis.

Among married mothers, the coefficient on the interaction term in the first period between low and high educated is 0.028 (with a standard error of 0.012). This means that after the introduction of the CTC, low educated married mothers had a change in their labor force participation rate of 2.8 percentage points greater compared to high educated ones. In the second period, the coefficient of the interaction term changes sign and increased in magnitude. Therefore, married mothers with less than a high school education had a decrease in their labor force participation of 3.7 percentage points (standard error of 0.012) relative to college graduate or higher married mothers. The coefficient of the interaction term in the third period for married mothers comparing education levels is small and insignificant.

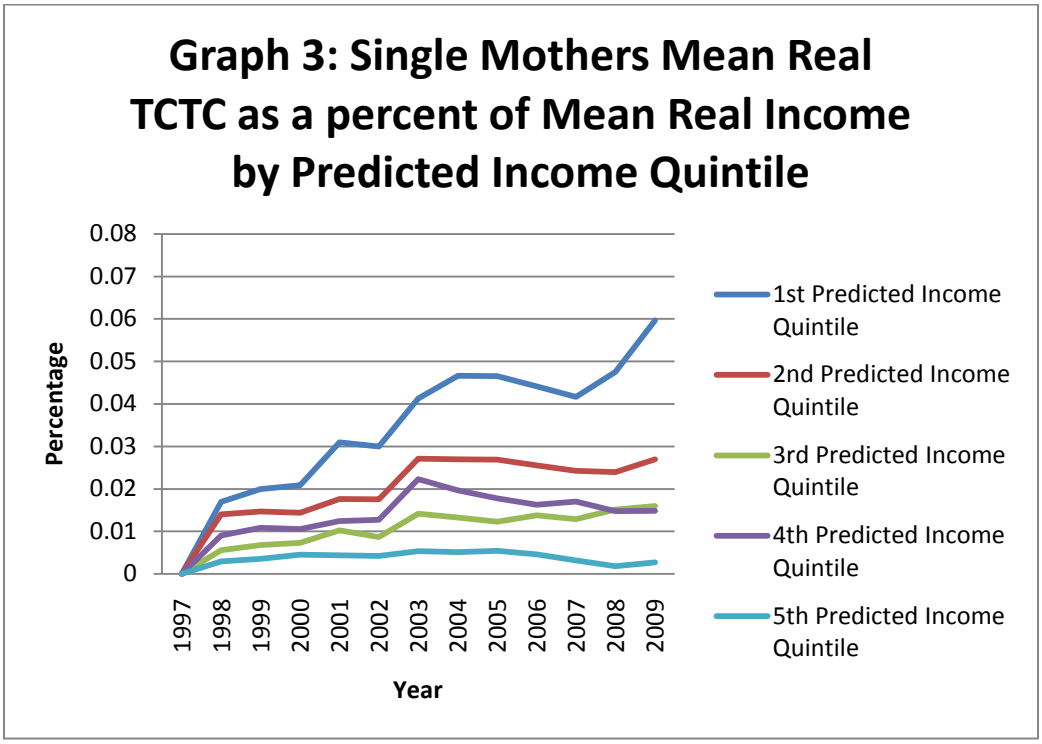
VII. Discussion

The results on labor force participation comparing single women with no children to single mothers indicates that after the introduction of the CTC, the change in labor force participation was positive among both treatment group relative to single women with no children. This is also seen in Graph 2 where, among all education groups, the total tax credit becomes a significant percentage of the real income. Between 2001 and 2005, percentage of real income that is real TCTC increases most for those with less than a high school education. This could simply be caused by the expansion in the tax credit because there was not a significant difference in the change in labor force participation relative to single women with no children surrounding this period. Similarly, there was no significant change in labor force participation among single mothers relative to single women with no children in the period between 2006 and 2009, despite an increase in real TCTC as a percent of real income among most education levels.



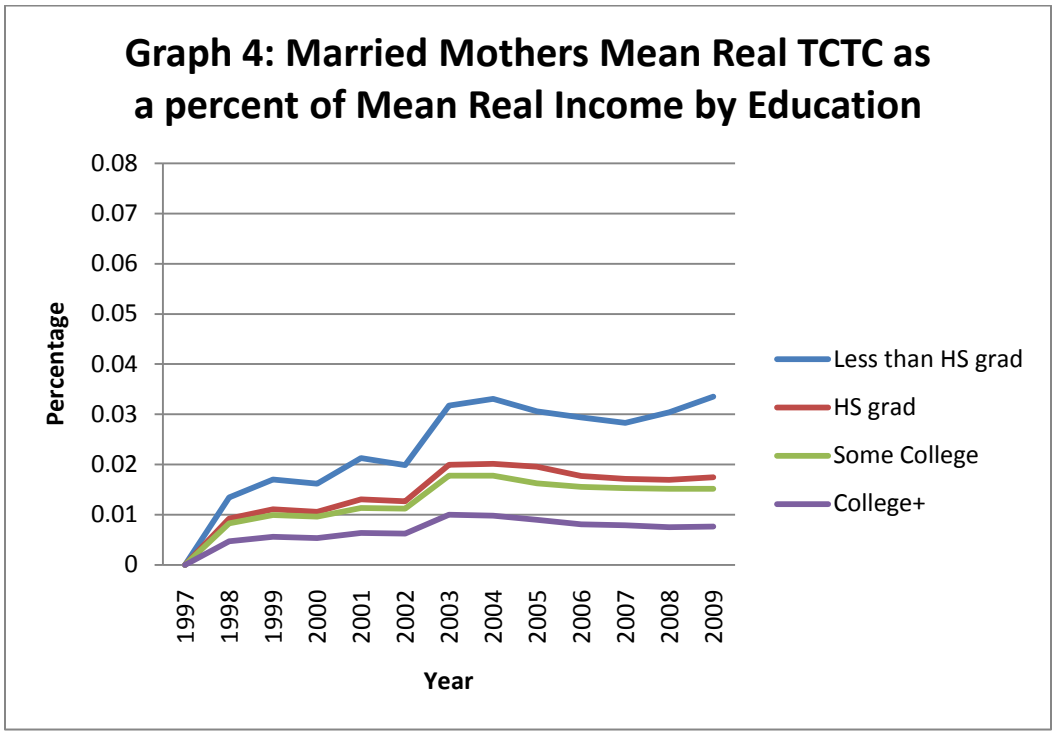
*Graph 2: The percentages are conditional on working.

Considering the results between predicted income quintiles, Graph 3 represents the mean real TCTC as a percent of real income by predicted income quintiles for single mothers. The positive significant effect in the period 1995-2000 is reinforced by this graph showing how the first and second quintile groups have a greater portion of their income in real TCTC compared to the fifth quintile group. However, Graph 3 contrasts with the results for the last two periods among single mothers where the proportion of real income that is real TCTC increases more for both first and second predicted income quintiles relative to the fifth quintile group, while the coefficients for the interaction terms are negative, implying a negative change in labor force participation for the lowest quintile group compared to the highest quintile group. Therefore I cannot reject the null hypothesis that there is a positive change in labor force participation among single mothers compared to single women with no children in these later periods.



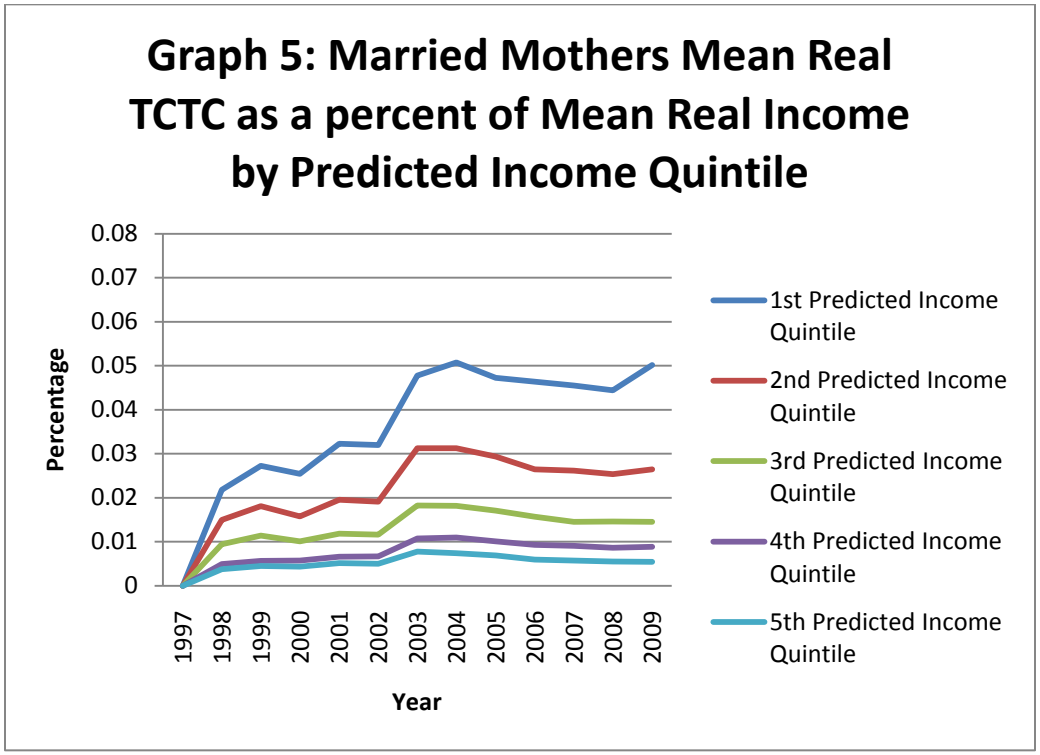
*Graph 3: The percentages are conditional on working.

Looking at married mothers, there was no apparent change overall relative to single women with no children in terms of labor force participation between these two groups in all three periods. Graph 4 illustrates the mean real TCTC of married mothers as a percent of their mean real income by education level. The graph shows an increase in the real TCTC as a percent of income in the middle period was much greater for the low educated than for the high educated. This would be expected to have a relative increase in work force participation, but there is no significant effect as a result of the difference-in-difference regressions. This could be because the size of the tax credit is small compared to real income. Ultimately, this shows that I cannot reject the null hypothesis that the tax credit had a significant effect on labor force participation among married mothers relative to single women with no children in all three periods of analysis.



*Graph 4: The percentages are conditional on working.

When analyzing differences in married mothers between predicted income quintiles, the regression results indicate a relative increase in labor force participation of low quintile groups to high quintile groups in the first period and relative decrease in the latter periods. In all three periods, when there is a change in policy, the percentage of income that is real TCTC increases more for low quintile groups than high quintile groups. Graph 5 represents the real TCTC as a percent of real income by predicted income quintile of married mothers. The only unexplainable difference is in the middle period where the lowest predicted income quintile experiences the greatest increase in their real TCTC as a percent of their real income, yet they have a decrease in labor force participation relative to the highest quintile.



*Graph 5: The percentages are conditional on working.

Overall, when the CTC and ACTC were introduced, it is estimated that single mothers benefitted most from the tax credit. Married mothers do not receive much benefit from the tax credit, usually having small and insignificant effects relative to single women with no children.

Single mothers' share of income as the tax credit is larger than that of married mothers as time progresses for the low educated. But the change in the tax credit does not increase labor force participation in the latter periods among single mothers compared to single women with no children. So the tax credit introduction has the only significant impact on labor force participation for single mothers.

VIII. Conclusion

In this paper, I have examined the effects of the introduction of the Child Tax Credit and Additional Child Tax Credit, and their subsequent expansions, on labor force participation and hours worked. I estimate that after the introduction of the Child Tax Credit, the labor force participation of single women with children increased by 4.7 percentage points relative to single women without children, with no significant difference after the 2003 expansion and EESA of 2008 when the income threshold was lowered for the Additional Child Tax Credit. Conditional on working, after the introduction of the Child Tax Credit, single mothers worked 30.6 hours more relative to single women with no children, and no significant difference between the two groups after the 2003 expansion and the EESA of 2008. The introduction of the tax credits had the only significant impact on labor force participation and hours worked among the treatment groups compared to the other two periods. Married mothers experience a slight increase in labor force participation relative to single women with no children but remained generally insignificant.

These results correspond with the work of Eissa and Liebman (1996) showing positive response to the initial change in the tax credit policy, that is, the introduction of the Child Tax Credit and Additional Child Tax Credit for the targeted treatment group of the low income earners (low educated). Yet, there was some positive effect on hours worked after the

introduction of the credits among single mothers relative to single women with no children. This is very robust, as well, since controls were in place for demographic characteristics, state fixed effects for individual state welfare policies, year fixed effects for trends, and year and state effects for individual state policy introduction and changes.

Ultimately, the Child Tax Credit and the Additional Child Tax Credit are income transfer programs instituted to help those mothers who struggle to meet their financial needs for maintaining a household with children. The introduction of the policy immediately impacted those families with children, resulting in a relative increase in labor force participation and hours worked, but the labor force participation and hours worked remained unchanged among married and single mothers relative to single women with no children.

This paper shows that the CTC and ACTC were only effective at encouraging work among single mothers when the CTC and ACTC were first introduced but not with their subsequent expansions.

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