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Hyein Kang
Doctoral Candidate
University of Kentucky
Department of Economics

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Author Correspondence

hyein.kang@uky.edu

**University of Kentucky Center for Poverty Research
Gatton College of Business and Economics, 550 South Limestone,
234 Gatton Building, Lexington, KY, 40506-0034
Phone: 859-257-7641. E-mail: ukcpr@uky.edu**

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The Child Tax Credit and Labor Market Outcomes of Mothers

Hyein Kang*

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Abstract

This paper examines the effect of the Child Tax Credit (CTC) on the labor supply of single and married mothers using the numerous policy reforms in the credit generosity and eligibility criteria since its inception in 1997. I use variation in the simulated benefits for a nationally representative sample to estimate the labor supply response at the extensive and intensive margins. Using 25 years of data from the Current Population Survey my results suggest that an increase of \$1,000 in the average CTC benefit leads to a 1.7 percentage point increase in employment of single mothers and a 35-hour increase in annual work. I find a greater effect when I restrict the sample to single mothers with high school or less education. For married mothers, I find that an additional \$1,000 in the average CTC benefit is associated with a 28-hour increase in annual work. The results are robust to an alternative identification strategy using only variation in the maximum credit across time.

Keywords: income tax credit, female labor supply, child subsidies

JEL Classification Codes: H24, I38, J22

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1 Introduction

This paper analyzes how changes to the Child Tax Credit (CTC) have affected the labor supply of mothers. The CTC, introduced in 1997, aimed to ease the financial burdens on working parents with children under 17 through a tax credit program. With continuous expansions, the CTC has grown to be the largest individual income tax credit program. Figure 1 illustrates tax spending on the CTC compared to that on the Earned Income Tax Credit (EITC), which is one of the major tax expenditures of the federal government.¹ Between tax year 2017 and 2018, spending on the CTC increased from \$51.4 billion to \$117.7 billion with the addition of the Credit for Other Dependents (ODC).^{2,3,4} While the CTC is continuously increasing in size, little is known about the impact of the program.

Since the 2000s, the employment-to-population ratios in the U.S. have declined for both men and women (Abraham and Kearney, 2020). Factors contributing to this trend and ways to boost employment are a focus of attention among policy makers. Accordingly, the following question arises: have expansions of the CTC stimulated work among women with children? As child care cost is one of the impeding factors for many mothers' employment (Connelly and Kimmel, 2003), a child subsidy in the form of an employment-based tax benefit may translate into an upturn in labor supply of mothers. The CTC's impact on maternal labor supply is relevant to the Biden administration's dramatic expansion of the CTC for tax year 2021, and understanding this relationship could help policy makers decide if the expansion should be made permanent.

¹The CTC is composed of the credit used to offset income tax liability and the refundable portion, where the refundable portion is called the Additional CTC (ACTC). In this paper, the CTC refers to the credit including the ACTC.

²Source: Internal Revenue Service, Publication 1304, various years. See Table 3.3. Retrieved from <https://www.irs.gov/pub/irs-soi>. Accessed November 14, 2020.

³The expenditure in tax year 2018 includes the expenditure on the ODC because the IRS only reports the sum of spending on the CTC and the ODC. The ODC provides taxpayers whose dependents do not meet the eligibility of the CTC, worth up to \$500 per dependent, non-refundable. The total spending on the CTC (offsetting tax) and the ODC was \$81.5 billion and that on the ACTC of the CTC was \$36.2 billion.

⁴The spending on CTC also surpasses the Child and Dependent Care Credit (CDCC) by a significant amount. For example, the expenditure on the CDCC, was \$3.8 billion in 2018. The CDCC is a tax credit directly subsidizing a certain percentage of child care costs for working parents with children under 13.

To identify the impact of the CTC, I use data from the 1997-2020 Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS). Since there have been frequent changes to CTC policy parameters, I assess those changes over time using a simulated credit model. The simulated credit model exploits variation in simulated CTC, which is an estimate of the CTC that varies by family size and tax year; this approach captures changes to all CTC policy parameters, including changes in the maximum credit, earnings eligibility, refundability, and phase-in rate. Using the simulated CTC also helps address concerns of endogeneity of actual CTC receipts by individuals with respect to their fertility and labor supply decisions. By simulating tax benefits based on a nationally representative sample, the simulated CTC captures policy-driven changes in the credit while holding individuals' behavior constant. This model is a reduced-form approach exploiting exogenous policy changes prior to the 2021 expansion. Instead of attempting to estimate the structural parameter of the effect of actual CTC benefits on maternal labor supply, I focus on estimating intent-to-treat (ITT) effects.

I find that a \$1,000 increase in average CTC benefit led to a 1.7 percentage point increase in employment and a 35-hour increase in annual work among single mothers. For married mothers, results suggest an additional \$1,000 increase in the average CTC is associated with a 28-hour increase in annual work. I do not find any statistically significant impact on the extensive margin. Results also show a pattern that the impact is greater when I restrict the sample to lower-educated single mothers.

I perform several additional analyses for extensions and robustness checks. I show that mothers' responses are greater to the changes in the refundable CTC, using the changes in the refundable amount of the credit generosity. I also find that most of the labor supply responses arise from the credit generosity rather than other policy parameters, using the time-series variation in the maximum credit only.

There are two papers that examine the CTC's effect on employment. [Feldman et al. \(2016\)](#) study taxpayers' response to the change in tax benefits using regression disconti-

nuity with a sample of households with incomes ranging from \$30,000 to \$100,000. The authors show that taxpayers do not respond in the year in which they lose the benefit but in the following year, suggesting taxpayer confusion and misinterpretation of tax liability in the first year of the change. [Lippold \(2019\)](#) examines parental labor supply behavior, focusing on lower-income households with income below \$20,000. The author uses a difference-in-regression discontinuity approach and finds that parents who lose CTC eligibility reduce employment by 8.4 percentage points and labor force participation by 9.6 percentage points. In both studies, the population of interest is parents with teenage children, since their approach uses the loss of CTC eligibility from the dependent child turning 17.⁵

This paper studies the labor supply response of all mothers aged 25-54, those in their prime working years, using various empirical methods. The simulated credit approach is akin to approaches used in existing public economics literature to study Medicaid ([Currie and Gruber, 1996](#)), Canadian child benefits ([Milligan and Stabile, 2011](#)), safety net programs ([Schmidt et al., 2016](#)) and the EITC ([Hoynes and Patel, 2018](#); [Jones and Michelmore, 2018](#)).⁶ The additional specification using the variation in the maximum credit is similar to methods that have been used in the context of the EITC ([Bastian and Michelmore, 2018](#); [Schanzenbach and Strain, 2020](#)).

While an extensive body of literature has examined the effect of the EITC on labor market outcomes ([Eissa and Liebman, 1996](#); [Meyer and Rosenbaum, 2001](#); [Grogger, 2003](#); [Eissa and Hoynes, 2004](#); [Bastian, 2017](#); [Kleven, 2019](#)), the impact of the CTC is understudied. This research contributes to the literature in several ways: First, it provides evidence on female labor supply exploiting all the expansions in the CTC prior to the COVID-19

⁵The mean age of the treatment group in [Feldman et al. \(2016\)](#) is 46. The average age of the primary sample in [Lippold \(2019\)](#) is 44.

⁶[Currie and Gruber \(1996\)](#) simulate fraction Medicaid eligible using the same sample of women for each state and year to instrument the actual fraction Medicaid eligible. [Milligan and Stabile \(2011\)](#) use simulated child benefits as an instrument in their study of Canadian child benefit. [Schmidt et al. \(2016\)](#) create simulated safety net program eligibility and benefits as instrument variables to study the impact of safety net programs on food insecurity. [Hoynes and Patel \(2018\)](#) construct simulated EITC based on a sample from the 1983 CPS to study the impact of the EITC on poverty.

pandemic. Second, this paper expands the population of interest by evaluating the impact of the CTC on all mothers of age 25-54 across demographic characteristics (marital status and education level). Third, this study adds additional evidence on the effectiveness of the CTC as a child subsidy and as an employment-based tax credit program.

The rest of this paper proceeds as follows: Section 2 provides background information and describes the structure and policy changes of the CTC. Section 3 describes the empirical model I adopt. Section 4 describes main data used for this paper. Section 5 presents results and robustness checks. Section 6 concludes.

2 Overview of the CTC

Under the Taxpayer Relief Act (TRA) of 1997, the CTC was implemented to relieve tax burdens of middle- and upper-middle income families with children (Crandall-Hollick, 2018). Taxpayers are eligible to claim the CTC for a dependent child that is under the age of 17.⁷ Figure 2 illustrates the CTC schedule as a function of wage and salary income by family size as of tax year 2017.⁸ The schedule is composed of a zero-benefit range, a phase-in range, a plateau range, and a phase-out range. In the zero-benefit range, the credit benefit is zero. The credit is not available at the first dollar of earned income; a taxpayer needs an income exceeding a certain amount to qualify for the CTC. I refer to this dollar amount as *minimum earned income threshold* hereafter. In the phase-in range,

⁷The CTC dependent must meet certain requirements. A qualifying child is defined as a child that 1) is under age 17 at the end of the tax year, 2) is a citizen or resident of the United States, 3) is claimed as a dependent on the taxpayer's tax return but not on another taxpayer's return, 4) is the taxpayer's a) son or daughter, b) stepchild or foster child, c) brother or sister, d) stepbrother or stepsister, or e) a descendant of a qualifying dependent (e.g., grandchild, niece, or nephew), 5) does not provide over half of own support for the reporting tax year, and 6) lives with the taxpayer for more than half of the reporting tax year (exceptions apply). In case a child qualifies as a dependent for child tax credits for multiple taxpayers, only one taxpayer can claim the child as a qualifying dependent for the credit. (source: IRS, Instructions for Form 1040 and Publication 972, various years.)

⁸The CTC benefit depends on modified adjusted gross income (AGI). Modified AGI is AGI with an income from Puerto Rico and foreign earned income added, where the AGI consists of wages, salaries, capital gains (losses), tax-exempt interest income, and other miscellaneous income. Since wages and salary are the primary sources of AGI, I assume zero for all other incomes when calculating the tax benefit.

the credit increases at a certain rate (the phase-in rate) for each additional dollar of earned income exceeding the minimum earned income threshold. In the plateau range, taxpayers receive the full credit. In the phase-out range, the credit decreases at a certain rate (the phase-out rate) for each additional dollar of earned income.⁹

In tax year 1998, the CTC began as a tax credit that was worth up to \$400 per child (see Table 1 for a timeline). The credit was partially refundable in certain cases, and the refundable portion of the CTC is called the ACTC. Provided that the federal tax liability was smaller than the eligible credit amount, the credit was refundable 1) for taxpayers with three or more children¹⁰ and 2) up to the amount by which the taxpayer's payroll taxes (sum of social security and Medicare taxes withheld) exceeded the taxpayer's EITC.¹¹ However, most of the low-income families with three or more children were not able to claim the refundable portion as the payroll taxes are not big enough to exceed the EITC in general.¹² The modified AGI threshold at which the credit begins to phase out (*maximum income for the full credit*) was set at \$110,000 for taxpayers married filing jointly and \$75,000 for head of households.

The Economic Growth and Tax Relief Reconciliation Act (EGTRRA) of 2001 expanded the credit refundability to families with one or two children by eliminating the three-or-more-children requirement and adopted a new formula to determine the amount of the ACTC. The maximum amount of the ACTC was set to 10 percent of the earned in-

⁹This phase-out rate has remained at 5 percent since the implementation of the CTC. To be more exact, the credit decreases at the rate of \$50 for each additional \$1,000 adjusted gross income (AGI) in excess of the threshold. Detailed CTC schedule by tax year, filing status, and family size is available in the Appendix (see Table A.1).

¹⁰Beginning in tax year 2001, this requirement was eliminated and the refundability was expanded to families with one or two qualifying children.

¹¹Source: Internal Revenue Service, Form 8812, various years; and U.S. Government Publishing Office (GPO), An act to provide for reconciliation pursuant to subsections (b)(2) and (d) of section 105 of the concurrent resolution on the budget for fiscal year 1998, available at <https://www.govinfo.gov/app/details/PLAW-105publ34>.

¹²Social security and Medicare withholding rates are respectively 6.2 percent and 1.45 percent (combined to 7.65 percent) on earnings, and the EITC subsidy rate was approximately 40 percent of the earned income. This means that one's earned income has to be in the phase-out region of the EITC where the EITC subsidy rate is below 7.65 percent. For example, the minimum earned income to receive the refundable portion of the CTC was approximately \$22,000 in tax year 1998. (source: author's calculation using simulation from the NBER's TAXSIM (version 32), assuming no income source other than wages).

come that exceeded \$10,000 (the minimum earned income threshold), so a taxpayer with an earnings over \$10,000 were eligible to receive the refundable credit. This minimum earned income threshold was indexed for inflation and set to \$11,750 in 2007 (see Table 2 for changes in the minimum earned income threshold over time). Families with three or more children could choose between this new formula or the old formula (i.e., the alternative formula), but in most cases the new formula yielded greater value of the ACTC. Under the EGTRRA, the maximum per-child credit also increased to \$600.

For tax year 2003, the Jobs and Growth Tax Relief Reconciliation Act raised the maximum credit to \$1,000 per child. In 2004, the Working Families Tax Relief Act increased the subsidy rate (phase-in rate) by setting the amount of the ACTC to 15 percent of earned income exceeding the minimum earned income threshold. In 2008, the Emergency Economic Stabilization Act reduced the minimum earned income threshold to \$8,500. In February 2009, then-President Obama signed the American Recovery and Reinvestment Act (ARRA) which once again lowered the threshold to \$3,000 beginning in tax year 2009. Figure 3 shows how these changes in the minimum earned income threshold shifted the CTC schedule. This has allowed many low-income households who did not qualify for the CTC benefit (partial or full) under the prior policy to qualify. For example, prior to tax year 2009, families with one qualifying child needed an annual income over \$15,000 to benefit from the full credit. Beginning in 2009 they would need to earn \$9,667 to benefit the maximum credit.¹³ This event has turned the CTC into a more accessible tax benefit program for the economically disadvantaged population of America.

The Tax Cuts and Jobs Act (TCJA) of 2017 brought a dramatic change. It doubled the maximum credit to \$2,000 per qualifying child and lowered the minimum earned income to \$2,500 beginning in tax year 2018. A cap for the refundable portion was newly introduced; the Act set the amount of the ACTC not to exceed \$1,400. The maximum income for the full credit was raised to \$400,000 for taxpayers married filing jointly and

¹³For more examples, see Table A.1

\$200,000 for other filing statuses, expanding the benefits to relatively high-income households. By this change, single-parent-headed households with one qualifying child earning between \$24,000 and \$200,000 were eligible for the maximum credit of \$2,000. It also introduced new social security number (SSN) requirement for the CTC dependent qualification; specifically, a SSN valid for employment.¹⁴ Prior to this policy change, a child with an Individual Taxpayer Identification Number (ITIN) was qualified as a CTC dependent, where the ITINs are issued to those who are not eligible to receive SSNs. This new requirement excluded families with children who are neither U.S. citizens nor lawful permanent residents.

On March 11, 2021, the American Rescue Plan Act (ARPA) of 2021 was signed into law by President Biden, expanding the CTC temporarily for tax year 2021. This expansion includes 1) an increase of the credit amount to \$3,600 for a qualifying child aged 0-5 and \$3,000 for a child aged 6-17 for tax year 2021, 2) a modification in credit refundability to full refund from partial refund, 3) a removal of minimum earnings requirement, 4) an elimination of the ACTC cap of \$1,400 per child, 5) an expansion of the age eligibility to a qualifying child under the age of 18, and 6) a new maximum income threshold for the full benefit of the temporary increased credit.^{15,16}

To see how changes in the policy affected relatively low-income families, I look at real federal expenditures (2012 dollars) on the ACTC across income distribution for taxpayers with AGI under \$40,000 (see Figure 4). Prior to tax year 2001, spending on the ACTC was nearly zero. The spending started to grow gradually for those with AGI between \$10,000 and \$40,000 since tax year 2001. This reflects the ACTC's expansion to families with one or two children and the adoption of the new formula to determine

¹⁴Source: Internal Revenue Service, Publication 972 for 2018 Returns. Retrieved from <https://www.irs.gov/pub/irs-prior/p972--2018.pdf>. Accessed January 26, 2020.

¹⁵The AGI threshold at which the credit begins to phase out for the additional credit (\$1,600 for a child under age 6 and \$1,000 for a child aged 6-17) was reduced to \$75,000 (single filers), \$112,500 (head of household) and \$150,000 (married filing jointly). The maximum income for the existing credit (\$2,000 per child) remained the same.

¹⁶See [Crandall-Hollick \(2021\)](#) for more detailed information on the temporary expansion of the CTC.

the amount of the ACTC. Between 2008 and 2009, there is a steep increase for all income groups, when the minimum earned income threshold was lowered to \$8,500 and to \$3,000. It is noteworthy the refundable credit benefit increased by a significant amount for households with AGI between \$20,000 and \$40,000 while there was a trivial impact for those earning under \$20,000.

The CTC parameters that are subject to change include the following: per-child maximum benefit amount, minimum earned income threshold, phase-in rate (subsidy rate), maximum earned income for the full benefit where the credit begins to phase-out, and phase-out rate. I use variations in these parameters to identify the impact of the CTC on maternal labor supply, which I explain in the next Section.

3 Empirical Method

My goal is to identify how policy changes to the CTC affect the labor supply behavior of mothers. I adopt a simulated credit model that captures variations in CTC policy parameters from numerous legislative changes altogether, between its inception in 1997 and a recent reform in 2018.¹⁷ It is important to note that the simulated credit model utilizes changes in both the credit generosity and income eligibility. For outcome variables, I measure the extensive margin as the employment rate and the intensive margin as annual hours of work. Employment rate is measured by a binary variable for whether women were ever employed in a given year (worked at least one hour). Annual hours of work is calculated by multiplying usual weekly hours of work and usual weeks worked in a year.

The CTC benefit amount and eligibility are a function of earnings, while earnings depend on my outcome variables (both the decision to work and hours of work). The CTC is also associated with one's fertility decision (number of children), which is correlated with labor supply behavior. Compared to mothers with one child, mothers with two

¹⁷The most recent reform of the CTC is a temporary expansion for tax year 2021 as a response to the Covid-19 pandemic, but due to a data limitation it is not a subject of this study.

children are eligible for larger CTC benefits, may spend more time on childcare, and therefore may have less labor supply incentives both on the extensive and intensive margins. Regressing labor outcomes on actual CTC benefits raises a potential endogeneity issue. To address this endogeneity issue, I use a simulated instrument variables (IV) strategy and estimate the impact of the CTC benefit generosity on maternal labor supply. I estimate the following reduced form model:

$$y_{it} = \delta \cdot \overline{SIMCTC}_{ct} + \gamma_c + \xi_s + \lambda_t + X'_{it} \cdot \beta + \eta \cdot u_{st} + \theta \cdot (child_i \times u_{st}) + \epsilon_{it} \quad (1)$$

where y_{it} is a labor market outcome variable of individual i in tax year t . On the right hand side, \overline{SIMCTC}_{ct} is the simulated CTC for women with c number of children in year t (in thousands of dollars), which measures average CTC generosity across family size and tax year.¹⁸ The coefficient of interest δ represents the change in my outcome variables (employment rate or annual hours of work) for a \$1,000 increase in the average CTC benefit at the family size and year level.

The idea of the simulated CTC is to capture variations in benefit from policy changes only, holding labor supply and fertility decisions constant, thus excluding any changes in tax credits due to those behavioral changes. To do this, I construct the simulated CTC based on a national sample from a point before the CTC introduction. If the simulated CTC is constructed based on the actual sample, the benefits would include both exogenous policy changes and endogenous responses of labor supply and fertility. I take a sample of women from the 1997 March CPS and replicate the same individuals over time through calendar year 2019, allowing the family structure to remain unchanged. The 1997 March CPS corresponds with calendar year 1996, which is two years before the CTC implementation and one year before the TRA of 1997; therefore, I avoid any potential

¹⁸In my analysis, a child is defined as a CTC-qualifying child, a child that is under 17 and meets other requirements of the CTC qualifications. A mother is defined as a woman who has a CTC-qualifying child.

behavioral response of individuals to the introduction of the CTC.^{19,20} With this replicated sample, I inflate each individual's income using the Consumer Price Index (CPI).²¹ I then run the replicated sample through NBER's tax simulating program TAXSIM (version 32) to calculate tax information and obtain average CTC benefits per household by tax year and family size (number of qualifying children = 1, 2, 3, 4+) to construct the simulated CTC.^{22,23,24} The variation in the simulated CTC I construct is illustrated in Figure 5. The simulated CTC represents the changes in the average CTC benefit that mothers of one, two, three, and four-or-more children in the 1996 sample would have received respectively. Although the CTC is a per-child credit, Figure 5 shows that the average CTC benefit at the family size level is not in exact proportion to the number of children; this is likely due to the minimum earned income threshold to qualify for the CTC. I also present the variation in the simulated ACTC to show development of the refundable benefit (see Appendix Figure A.1).

In the model, I also control for fixed effects and include demographic characteristics. γ_c are number-of-children ($c = 0, 1, 2, 3, 4+$) fixed effects to account for differences across family size, ζ_s are state fixed effects to account for time-invariant differences across states, and λ_t are year fixed effects to capture business cycle and other changes that are common to all states. X'_{it} is a vector of demographic controls that includes age (25-29, 30-34, 35-39, 40-44, 45-49, 50-54), race, Hispanic ethnicity, education level (less than high school, high

¹⁹The CTC was introduced under the TRA of 1997 and implemented effective in tax year 1998.

²⁰Given the 1993 EITC expansion was phased in over multiple years (over 1994-1996 for families with two or more children), using an earlier year as the benchmark year could be confounded by potential behavioral change to the 1993 EITC expansion.

²¹I adjust income by the ratio of the CPI of each year to the CPI of the base year, 1996 (simple inflation). Using compound inflation is likely to overstate the income.

²²Although there is no limit on the number of children that can be claimed as a dependent, I treat families with four or more children the same given that a family with five or more qualifying children is rare.

²³TAXSIM calculates the CTC (that offsets income tax liability) and the ACTC (refundable portion) separately, so I combine these values before taking the mean. Taking advantage of this feature, I also use the average ACTC benefits to conduct further analysis to evaluate how mothers respond to the refundable benefits of the CTC.

²⁴For tax year 2018 and after, TAXSIM returns non-zero values for the CTC and the ACTC for those with no CTC-qualifying dependents, due to the introduction of the ODC. For these individuals, I manually assign zero for their tax benefits.

school degree only, some college, college degree), the age of youngest child (0-1, 2-3, 4-6, 7-9, 10-13, 14-16), and marital status.^{25,26} Finally, u_{st} is the unemployment rate in state s and year t , which is then interacted with a mother dummy $child_i$ (presence of children) to allow the effect of unemployment rate (business cycle) to vary by the presence of children.²⁷ Robust standard errors are clustered at the state level.

Extensions and Robustness Checks

The CTC is consisted of credit offsetting tax liability and refundable portion. Since low-educated single mothers are likely to pay low income tax, the refundable portion of the CTC may play an important role encouraging their labor supply. I expand my analysis and estimate the simulated credit model using the refundable portion of the CTC only. I replace the simulated credit in Equation (1) with simulated refundable credit. I estimate the following equation:

$$y_{it} = \delta \cdot \overline{SIMACTC}_{ct} + \gamma_c + \zeta_s + \lambda_t + X'_{it} \cdot \beta + \eta \cdot u_{st} + \theta \cdot (child_i \times u_{st}) + \epsilon_{it} \quad (2)$$

where $\overline{SIMACTC}_{ct}$ is defined as the average generosity of the simulated ACTC at the family size and tax year level.

Second, the simulated credit utilizes policy variations from both the credit generosity and the eligibility. Thus, I consider a maximum credit model that focuses on changes in the credit generosity only.²⁸ This analysis explores by what degree the responses arise from the changes in the credit generosity as opposed to the changes in other policy pa-

²⁵Following [Kleven \(2019\)](#) I categorize women's age and the age of youngest child.

²⁶For single women analysis, marital status (never married or being separated, divorced, or widowed) is included as an additional control.

²⁷I follow [Hoynes et al. \(2015\)](#) and [Kleven \(2019\)](#) and include the interaction control of unemployment rate and mother dummy as a control. [Schanzenbach and Strain \(2020\)](#) find this interaction control to be important in their study on the EITC.

²⁸A similar approach of exploiting changes in the maximum amount of the tax benefit was used in [Schanzenbach and Strain \(2020\)](#) to examine the effect of the EITC. They use inflation-adjusted benefits (2019 dollars) while I use benefits in nominal dollars.

rameters. Figure 6 exhibits the change in the maximum CTC over time. I modify Equation (1) by replacing the simulated credit with the maximum credit that varies across family size and year. I estimate the following reduced form equation:

$$y_{it} = \delta \cdot MAXCTC_{ct} + \gamma_c + \zeta_s + \lambda_t + X'_{it} \cdot \beta + \eta \cdot u_{st} + \theta \cdot (child_i \times u_{st}) + \epsilon_{it} \quad (3)$$

where $MAXCTC_{ct}$ is the maximum amount of the CTC for women with c number of children in year t (in thousands of dollars). The coefficient of interest δ indicates the change in my outcome variables (employment rate or annual hours of work) for a \$1,000 increase in the maximum CTC benefit.

4 Data

I use data from the 1997-2020 CPS ASEC, also known as the March CPS. The data correspond with 1996-2019 calendar year. The CPS is a large repeated cross-sectional dataset of nationally representative samples of household-based individuals surveying between 60,000-90,000 households annually.²⁹ The dataset contains labor market information (employment status, usual weekly hours worked, weeks worked in a year), income, and personal demographics (age, marital status, education level, children in the household, age of each child). Using this information, I run the data through NBER's TAXSIM to obtain simulated tax information including the CTC and the ACTC eligibility and the benefit amount.³⁰ Further, I use data from the University of Kentucky Center for Poverty Research ([University of Kentucky Center for Poverty Research, 2021](#)) for state-by-year unemployment rates. The CPI data for inflating income come from the U.S. Bureau of Labor Statistics.

I limit the sample to women aged 25-54 and drop those with any nonresponse to

²⁹Since the 2001 survey year, the CPS ASEC added SCHIP oversample, thus each survey year consists of 90,000 households in the ASEC sample.

³⁰Following [Bollinger et al. \(2019\)](#), I use rank-swap values for income variables in my study.

the interview or allocations of income or work information.³¹ I choose this age range for the following reasons. First, college education is in general completed before the age of 25. Second, individuals under the age of 24 can be claimed as a dependent for tax purposes if enrolled in school. By restricting the sample to those aged 25 or older, I avoid confounding factors with human capital investments and possibility of being claimed as a dependent. Third, the 25-54 age range is commonly used in the Federal Reserve Economic Data, so-called "prime working age".

Table 3 provides summary statistics of women aged 25-54 pooled across all years, broken down by demographics. I present the mean of each subgroup by marital status, education level, and whether or not one has a child. This is to note similarities and differences in general of treatment and comparison groups.

The first two columns compare single mothers and single, childless women. Single mothers are slightly younger, more likely to have less education (high school or less), and more likely to be widowed, divorced, or separated than never married. They also work less hours and have lower earnings compared to single, childless women. Married mothers are relatively younger, more likely to have a college degree, and less likely to be employed. They work less hours and make less earnings than childless married women, though their average amount of family income is almost identical to married, childless women.

5 Results

Table 4 presents results from the simulated credit model, specified as Equation (1). Columns (1) - (3) show estimates for annual employment rate, which is an indicator for whether individuals worked more than one hour. Columns (4) - (6) report estimates for annual

³¹I drop households with whole imputes or item imputes. For the item imputes, I keep individuals whose usual weekly hours of work, weeks worked, earnings, farm self-employment earnings, non-farm self-employment earnings, and wages and salaries are not allocated. See [Bollinger et al. \(2019\)](#) for evidence of substantial nonresponse in the CPS.

hours of work, which is calculated by multiplication of usual hours of work and usual weeks worked. Panel A restricts the sample to single women and panel B restricts the sample to married women. Columns (1) and (4) present basic regression results including demographics only. Columns (2) and (5) add state-by-year unemployment rate in the regression. Columns (3) and (6) add the interaction term of unemployment rate with the treatment status (mother of a CTC-qualifying child). The estimated coefficients and statistical significance are similar across columns and remain robust when adding additional controls.

Column (3) under Panel A suggests that an increase of \$1,000 in the average CTC benefit at the family-size-by-year level increased annual employment rates for single mothers by 1.7 percentage points. This can be also interpreted as a percent impact; an increase of \$1,000 in the average CTC benefit led to a 2.3 percent increase in annual employment of single mothers.³² When I restrict the sample to single women with high school degrees or less, the estimated effects are greater. For an additional \$1,000 increase in the average CTC benefit, low-educated single mothers' employment increased by 3.7 percentage points, which corresponds to a percent impact of 5.5. On the intensive margin, I also find positive impact of the CTC on single mothers in general. Column (6) suggests that each \$1,000 increase in the average CTC benefit increased annual work hours by 35 hours for single mothers in general and by 59 hours for low-educated single mothers.

Panel B displays results for married mothers. I do not find a statistically significant change to married mothers' likelihood of employment. I find a small decrease in the employment rate among low-educated married mothers with the estimated coefficient of 0.9 percentage point (statistically significant at the 10 percent level). For annual hours of work, I find relative small but positive impact of the CTC. An increase of \$1,000 in the average CTC benefit led to a 28 hour increase in married mothers' annual work. I find zero or smaller impact of the change in the average CTC generosity on married mothers.

³²The mean annual employment rate of single mothers is 0.76 (see Table 3). The percent impact is $0.0173/0.76 \times 100 (\%) = 2.2763 (\%)$.

Recall that married mothers are less affected by changes in the CTC parameters compared to single mothers as married mothers are likely to have positive spousal income and the CTC is based on family earnings.

Overall, I find positive impact of the CTC both on the extensive and intensive margin of labor supply among single mothers. This work-boosting impact of the CTC was most pronounced among single mothers with high-school-or-less education, which is consistent with my expectations.

Refundable Credit Analysis

The results focusing on the refundable portion only are presented in Table 5. I scale the amount of the benefit to \$500 as the amount of the ACTC is likely to be smaller. Results are robust, and I find greater impact of the refundable benefit on labor market outcomes of single mothers, especially among those with less education. Column (3) suggests that an increase of \$500 in the average ACTC increased single mothers' annual employment rate by 2.2 percentage points and 4.4 percentage points for single mothers with low education. Column (6) indicates an increase of 48 and 80 hours of work among single mothers and low-educated single mothers, respectively, for an increase of \$500 of the average ACTC. I find no significant employment impact among married mothers, which is a consistent result with the analysis using the average CTC. On the intensive margin, not only are the impacts of the refundable benefits greater, but I also find that married mothers with low education increased their hours of work, a group that I find no impact on using the simulated CTC analysis. This illustrates that mothers with qualifying children respond more to the actual cash transfer, "refundable" credit.

Maximum Credit Analysis

I provide estimates of the maximum credit model - equation (3) - that exploits changes in the maximum credit generosity over time. Results are documented in Table 6. The

first column reports estimates from regression with basic demographics, the second adds unemployment rates, and the third adds the interaction term of unemployment rate and mother status. Results are similar across columns.

Panel A shows results for single mothers. In column (3), I find that a \$1,000 increase in the maximum CTC benefit leads to a 1.5 percentage point increase in the likelihood of employment for single mothers. When I restrict the sample to single mothers with high school degrees or less, the magnitude increases to 3.0 percentage points.

Column (6) suggests that an additional \$1,000 increase in the maximum CTC benefit also increases hours of work for single mothers by 30 hours. As with the results on annual employment rate, the magnitude when restricting the sample to single mothers with high school or less is greater, with an estimated coefficient of 49 hours.

Panel B presents analysis on married mothers. I find no impact of the change in the maximum CTC benefit on married mothers' annual employment rate. The results are similar with and without controls. On the intensive margin, I find that each \$1,000 increase in maximum CTC benefit leads to an increase in married mothers' work by 21 hours a year. I do not find a significant impact when the sample is restricted to low-educated married mothers.

Comparing these estimates with the simulated credit model estimates, the estimates are close to but slightly smaller. This implies that most of the responses come from the changes in the credit generosity as opposed to the changes in other policy parameters such as the income eligibility threshold.

I also present the estimates after inflation-adjusting the credit amount to be in 2012 dollars (see Appendix Table [A.2](#)). Results suggest that an additional \$1,000 increase in the inflation-adjusted maximum CTC is associated with a 3.1 percentage point increase in low-educated single mothers' employment and a 1.6 percentage point increase in single mothers' employment. In comparison with the findings in the existing EITC literature of [Schanzenbach and Strain \(2020\)](#) and [Grogger \(2003\)](#), both of whom use the changes in the

maximum credit, the effect sizes of the CTC are slightly smaller. [Schanzenbach and Strain \(2020\)](#) find that each additional \$1,000 in the maximum EITC (2019 dollars) increases employment rate by 3.0 to 3.3 percentage points among low-educated single mothers and by 1.9 to 2.2 percentage points among single mothers. [Grogger \(2003\)](#) finds that a \$1,000 increase in the maximum EITC (1998 dollars) is associated with 3.6 percentage point increase in single mothers' employment.

6 Conclusion

This paper studies the labor supply responses of mothers to policy changes to the CTC over the past 20 years. I analyze heterogeneous maternal labor supply responses across marital status and education level using the simulated credit model. The simulated credit model is a comprehensive approach exploiting numerous changes over a 20-year period. I show robust evidence that the CTC increased both the extensive and intensive margin of labor supply for single mothers and intensive margin for married mothers. I find that a \$1,000 increase in the average CTC benefit led to an increase in single mothers' annual employment by 1.7 percentage points and an increase in annual work by 35 hours. I also find greater impacts for single mothers with high-school-or-less education, on both the extensive and intensive margin. I do not find statistically or economically significant impacts on married mothers' employment. On the intensive margin, I find relatively small positive impacts on married mothers labor supply. An additional analysis using the changes in the maximum credit only shows that the responses of mothers are mostly due to the changes in the credit generosity rather than the changes in the other policy parameters.

As a response to the Covid-19 pandemic, a substantial but temporary enhancement of CTC benefits for many families with children was signed into law in 2021. Given that the discussion on whether to permanently boost the CTC and by how much is an ongoing

topic among policymakers, these findings provide evidence on the effect of past changes in the CTC over the last two decades on labor supply behavior.

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Tables

Table 1: Timeline of the Major Policy Changes on Child Tax Credit

1997	<p>The Taxpayer Relief Act</p> <ul style="list-style-type: none">• Beginning in tax year 1998, taxpayers were able to claim child tax credit for each qualifying dependent child under the age of 17.• For tax year 1998, the credit amount was \$400.• For tax year 1999, the credit amount increased to \$500.• The credit is phased out for taxpayers with modified adjusted gross income (AGI) over certain thresholds at the rate of \$50 for each additional \$1,000 AGI in excess of the threshold. The threshold depends on the filing status:<ul style="list-style-type: none">• \$75,000 for single, head of household or qualifying widow(er);• \$110,000 for married filing jointly;• \$55,000 for married filing separately.• The credit was made partially refundable, which was referred to as the additional child tax credit, to taxpayers with three or more qualifying children by which their social security taxes exceeded their EIC.
2001	<p>The Economic Growth and Tax Relief Reconciliation Act</p> <ul style="list-style-type: none">• Beginning in tax year 2001:<ul style="list-style-type: none">• The credit amount was increased to \$600;• The eligibility for the ACTC was extended to taxpayers with 1 or 2 children;• The <i>minimum earned income</i> to claim the ACTC was set to \$10,000;• The maximum amount of the ACTC was 10 percent of the earned income that exceeded the <i>minimum earned income</i>. Families with 3 or more children could choose the greater of this value or the amount determined using an alternative formula, the amount by which their social security taxes exceeded their EIC.• The <i>minimum earned income</i> for the ACTC was to be inflation adjusted by the amount of cost-of-living adjustment. As a result, the <i>minimum earned income</i> to claim the ACTC increased to:<ul style="list-style-type: none">• \$10,350 for tax year 2002;• \$10,500 for tax year 2003;• \$10,750 for tax year 2004;• \$11,000 for tax year 2005;• \$11,300 for tax year 2006;• \$11,750 for tax year 2007.

2003	<p>The Jobs and Growth Tax Relief Reconciliation Act</p> <ul style="list-style-type: none"> • Beginning in tax year 2003, the credit amount increased to \$1,000.
2004	<p>The Working Families Tax Relief Act</p> <ul style="list-style-type: none"> • Beginning in tax year 2004, the maximum amount of the ACTC increased to 15 percent of a taxpayer's earned income exceeding the <i>minimum earned income</i>.
2005	<p>The Katrina Emergency Tax Relief Act</p> <ul style="list-style-type: none"> • For tax year 2005, affected taxpayers could use 2004 income for the ACTC, if the 2005 income was less than the income in the previous year.
2008	<p>The Emergency Economic Stabilization Act</p> <ul style="list-style-type: none"> • For tax year 2008, the <i>minimum earned income</i> to claim the ACTC was reduced to \$8,500.
2008	<p>The Midwestern Disaster Tax Relief Act</p> <ul style="list-style-type: none"> • For tax year 2008, affected taxpayers could elect to use 2007 earned income to figure 2008 ACTC.
2009	<p>American Recovery and Reinvestment Act (ARRA)</p> <ul style="list-style-type: none"> • For tax year 2009 and 2010, the <i>minimum earned income</i> to claim the ACTC was reduced to \$3,000.
2010	<p>Tax Relief and Job Creation Act</p> <ul style="list-style-type: none"> • The <i>minimum earned income</i> to claim the ACTC (\$3,000) was continued.
2017	<p>Tax Cuts and Jobs Act (TCJA)</p> <ul style="list-style-type: none"> • Beginning in tax year 2018: <ul style="list-style-type: none"> • The maximum amount of the credit increased to \$2,000 per qualifying child; • The maximum amount of the ACTC was set to \$1,400; • The <i>minimum earned income</i> to claim the ACTC was reduced to \$2,500; • The modified AGI threshold at which the credit starts to phase out increased to \$400,000 for married filing jointly and to \$200,000 for all other filing status.

2017	Disaster Tax Relief and Airport and Airway Extension Act <ul style="list-style-type: none">For tax year 2017, affected taxpayers could use 2016 earned income to figure 2017 ACTC.
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Source: Internal Revenue Service, Instructions for Form 1040, Publication 972, and Form 8812, various years; and U.S. Congress, accessed at <https://www.congress.gov>.

Notes: This table shows timeline of major policy changes and the corresponding Acts on the CTC.

Table 2: Child Tax Credit by Tax Year and Filing Status

Tax Year	Minimum Earned Income (\$)	Phase-in Rate (%)	Maximum Credit per Child (\$)	AGI Threshold (\$) [Phase-out Start Point (\$)]			Phase-out Rate (%)
				Married Filing Jointly	Married Filing Separately	Head of Household or Qualifying Widow(er)	
1998	N/A ^a	N/A ^a	400	110,000	55,000	75,000	5
1999	N/A ^a	N/A ^a	500	110,000	55,000	75,000	5
2000	N/A ^a	N/A ^a	500	110,000	55,000	75,000	5
2001	10,000	10	600	110,000	55,000	75,000	5
2002	10,350	10	600	110,000	55,000	75,000	5
2003	10,500	10	1,000	110,000	55,000	75,000	5
2004	10,750	15	1,000	110,000	55,000	75,000	5
2005	11,000	15	1,000	110,000	55,000	75,000	5
2006	11,300	15	1,000	110,000	55,000	75,000	5
2007	11,750	15	1,000	110,000	55,000	75,000	5
2008	8,500	15	1,000	110,000	55,000	75,000	5
2009	3,000	15	1,000	110,000	55,000	75,000	5
2010	3,000	15	1,000	110,000	55,000	75,000	5
2011	3,000	15	1,000	110,000	55,000	75,000	5
2012	3,000	15	1,000	110,000	55,000	75,000	5
2013	3,000	15	1,000	110,000	55,000	75,000	5
2014	3,000	15	1,000	110,000	55,000	75,000	5
2015	3,000	15	1,000	110,000	55,000	75,000	5
2016	3,000	15	1,000	110,000	55,000	75,000	5
2017	3,000	15	1,000	110,000	55,000	75,000	5
2018	2,500	15	2,000 ^b	400,000	200,000	200,000	5
2019	2,500	15	2,000 ^b	400,000	200,000	200,000	5
2020	2,500	15	2,000 ^b	400,000	200,000	200,000	5
2021	0 ^c	N/A	3,000 ^d	150,000 ^e	112,500 ^e	75,000 ^e	5

Source: Internal Revenue Service, Publication 972, various years. Accessed 14 September 14 2019.

Notes: This table shows CTC parameters by tax year since the introduction of the CTC in tax year 1998. The credit for each qualifying child starts to reduce after the AGI threshold, which is also referred to as phase-out kink point. After the threshold income, the child tax credit starts to reduce by \$50 increment for every \$1,000 additional adjusted gross income. The exhaustion point of the CTC depends on the number of children, as the CTC is a per child credit - it is calculated as the AGI threshold + 20 × (number of children × maximum credit per child).

^aFor tax years 1998-2000, the ACTC was available for families with three or more children only and the credit amount was calculated using the alternative formula, not the minimum earned income formula.

^bBeginning in tax year 2018, the maximum amount of the ACTC was capped at \$1,400 per child.

^cThe minimum earned income eligibility was eliminated temporarily.

^dFor qualifying children under age six, the temporary additional credit was \$1,600 per child, therefore the full credit was increased to \$3,600 per child.

^eThis temporary reduced phase-out income threshold is for the additional credit of \$1,000 (\$1,600 for children under age 6) only. The existing phase-out income threshold applies for the current credit of \$2,000 per child.

Table 3: Summary Statistics

	Single						Married					
	All Educations		High School or Less		All Educations		All Educations		High School or Less		All Educations	
	Mothers	Childless Women	Mothers	Childless Women	Mothers	Childless Women	Mothers	Childless Women	Mothers	Childless Women	Mothers	Childless Women
Age	36.92	39.55	36.16	41.37	38.02	44.23	37.31	45.87				
Age of Youngest Child	7.84	18.20	7.57	18.06	6.76	18.31	7.23	18.24				
Black	0.23	0.18	0.25	0.22	0.06	0.08	0.06	0.08				
White	0.70	0.72	0.69	0.70	0.86	0.82	0.87	0.83				
Hispanic Ethnicity	0.38	0.36	0.47	0.42	0.37	0.37	0.53	0.45				
Less than High School	0.16	0.11	0.33	0.30	0.10	0.09	0.29	0.23				
High School Only	0.32	0.27	0.67	0.70	0.24	0.30	0.71	0.77				
Some College	0.36	0.29	0.00	0.00	0.28	0.28	0.00	0.00				
College or More	0.17	0.33	0.00	0.00	0.38	0.33	0.00	0.00				
Married	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00				
Never Married	0.41	0.58	0.47	0.50	0.00	0.00	0.00	0.00				
Widowed, Divorced, or Separated	0.59	0.42	0.53	0.50	0.00	0.00	0.00	0.00				
Number of Children under 17	1.76	0.00	1.89	0.00	1.96	0.00	2.04	0.00				
Employment Rate	0.76	0.75	0.67	0.60	0.69	0.76	0.59	0.66				
Annual Hours of Work	1,786	1,942	1,698	1,831	1,685	1,903	1,638	1,820				
Annual Earnings	20,342	25,803	12,998	13,977	20,584	25,334	11,878	15,488				
Real Annual Earnings (\$2012)	24,214	30,407	14,746	15,610	26,103	30,897	13,638	18,044				
Real Family Income (\$2012)	33,199	49,064	22,440	33,586	100,574	101,321	63,728	73,670				
N	99,510	147,356	47,092	56,217	321,078	144,886	108,641	56,999				

Notes: This table reports summary statistics samples used for the simulated credit model and the maximum credit model. The sample includes women aged 25-54 from the 1997-2020 March CPS. Any samples with whole non-response to the supplement interview or allocated work-related questions (weekly hours of work and annual weeks of work) or earnings-related questions are excluded. Dependent/Children refers to CTC-qualifying children. Annual hours of work is conditional on annual employment.

Table 4: Effects of the CTC Policy Changes on Mothers by Marital Status and Education Level - Simulated Credit Model

<i>Simulated CTC (\$1,000)</i>	Employment			Annual Hours of Work		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Single Women						
All Levels of Education	0.017*** (0.005)	0.017*** (0.005)	0.017*** (0.005)	34.74*** (5.61)	35.09*** (5.66)	35.15*** (5.61)
High School or Less	0.037*** (0.006)	0.037*** (0.006)	0.037*** (0.006)	58.37*** (8.01)	58.72*** (8.09)	59.16*** (8.08)
Panel B: Married Women						
All Levels of Education	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)	28.41*** (4.99)	28.46*** (4.99)	27.98*** (4.98)
High School or Less	-0.008 (0.005)	-0.008 (0.005)	-0.009* (0.005)	10.35 (7.25)	10.34 (7.24)	8.52 (7.29)
Demographics	X	X	X	X	X	X
Unemployment Rate		X	X		X	X
Unemployment Rate × Mom			X			X

* $p < .1$, ** $p < .05$, *** $p < .01$

Notes: This table presents the effect of the CTC using the simulated CTC amount that varies by number of children and tax year (in thousands of dollars). The estimates are from the model specified in Equation (1). Demographics include age (in category), race, Hispanic ethnicity, education level, marital status (for single women), and age of youngest dependent (in category). The sample includes women aged 25-54 from the 1997-2020 March CPS (1996-2019 calendar year). Robust standard errors clustered at the state level are presented.

Table 5: Effects of the CTC Policy Parameter Changes on Mothers by Marital Status and Education Level - Simulated ACTC

<i>Simulated ACTC (\$500)</i>	Employment			Annual Hours of Work		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Single Women						
All Levels of Education	0.020*** (0.007)	0.020*** (0.007)	0.022*** (0.007)	45.78*** (9.68)	46.03*** (9.78)	47.63*** (9.53)
High School or Less	0.041*** (0.008)	0.041*** (0.008)	0.044*** (0.008)	76.55*** (11.94)	76.69*** (12.13)	79.64*** (12.30)
Panel B: Married Women						
All Levels of Education	-0.003 (0.004)	-0.003 (0.004)	-0.003 (0.004)	37.26*** (6.92)	37.29*** (6.91)	35.63*** (7.40)
High School or Less	-0.008 (0.005)	-0.008 (0.005)	-0.009* (0.005)	24.65** (10.06)	24.60** (10.07)	21.62** (10.13)
Demographics	X	X	X	X	X	X
Unemployment Rate		X	X		X	X
Unemployment Rate × Mom			X			X

* $p < .1$, ** $p < .05$, *** $p < .01$

Notes: This table presents the effect of the CTC using the change in the simulated ACTC benefits that varies by number of children and tax year (in five hundred dollars). The estimates are from modifying the Equation (1). I use the refundable portion of the CTC only, replacing the average simulated CTC amount with the average simulated ACTC amount. Demographics include age (in category), race, Hispanic ethnicity, education level, marital status (for single women), and age of youngest dependent (in category). The sample includes women aged 25-54 from the 1997-2020 March CPS (1996-2019 calendar year). Robust standard errors clustered at the state level are presented.

Table 6: Effects of the CTC Policy Changes on Mothers by Marital Status and Education Level - Maximum Credit Analysis

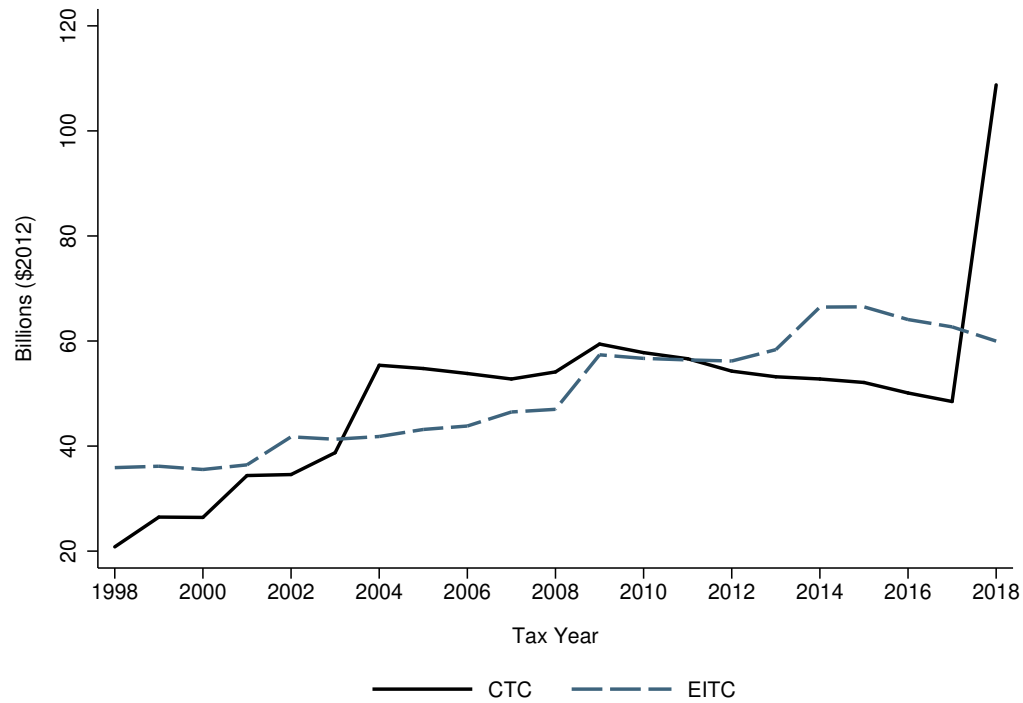
<i>Maximum CTC (\$1,000)</i>	Employment			Annual Hours of Work		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Single Women						
All Levels of Education	0.014*** (0.004)	0.014*** (0.004)	0.015*** (0.004)	29.13*** (4.61)	29.44*** (4.65)	29.52*** (4.59)
High School or Less	0.029*** (0.005)	0.029*** (0.005)	0.030*** (0.005)	48.00*** (6.51)	48.28*** (6.56)	48.65*** (6.54)
Panel B: Married Women						
All Levels of Education	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)	21.04*** (3.84)	21.09*** (3.84)	20.66*** (3.85)
High School or Less	-0.005 (0.004)	-0.005 (0.004)	-0.005 (0.004)	8.08 (5.50)	8.08 (5.50)	6.75 (5.50)
Demographics	X	X	X	X	X	X
Unemployment Rate		X	X		X	X
Unemployment Rate × Mom			X			X

* $p < .1$, ** $p < .05$, *** $p < .01$

Notes: This table presents the effect of the CTC using the change in the maximum CTC benefits that varies by number of children and tax year (in thousands of dollars). The estimates are from the model specified in Equation (3). Demographics include age (in category), race, Hispanic ethnicity, education level, marital status (for single women), and age of youngest dependent (in category). The sample includes women aged 25-54 from the 1997-2020 March CPS (1996-2019 calendar year). Robust standard errors clustered at the state level are presented.

Figures

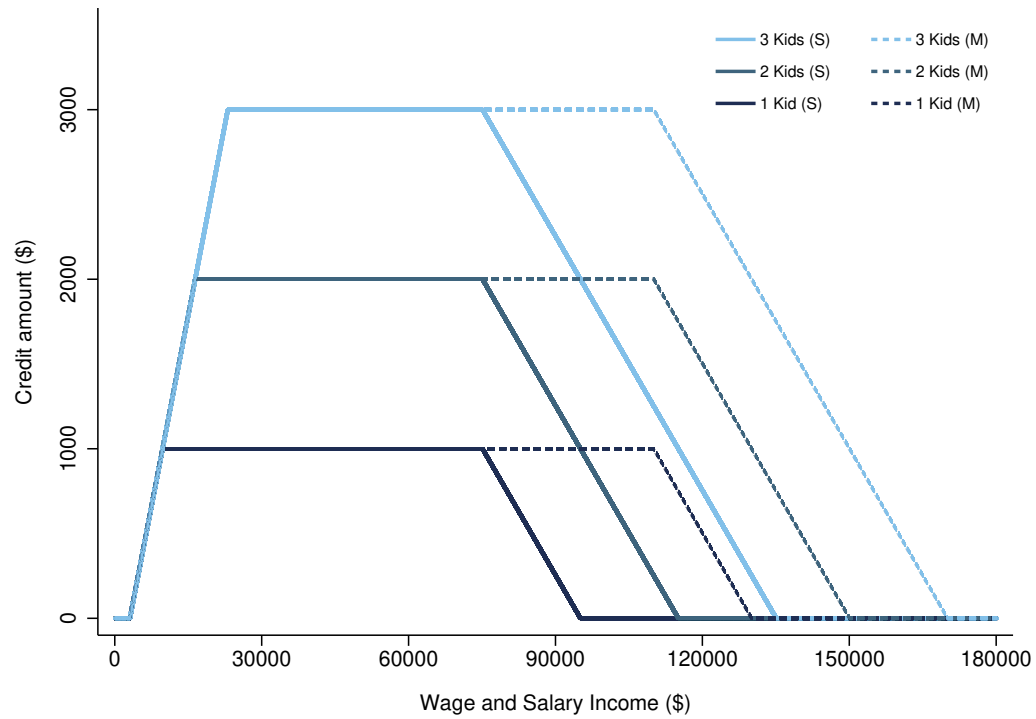
Figure 1: Real Federal Expenditure on the CTC and the EITC



Source: Internal Revenue Service, Statistics of Income Division, Publication 1304, various years (see Table 3.3.); Tax Policy Center. "Credit Type and Amount." Retrieved from <https://www.taxpolicycenter.org/statistics/credit-type-and-amount>; and Council of Economic Advisers, Economic Report of the President, March 2021.

Notes: This figure shows real federal spending on the CTC and the EITC from tax year 1998, when the CTC was introduced. The CTC includes the refundable portion. The credit was adjusted to 2012 U.S. Dollars using Personal Consumption Expenditures (PCE) deflator. The amount of the ACTC in 1998 is not included as the data does not exist in the source. The Credit for Other Dependents was newly added in tax year 2018 and included in the CTC.

Figure 2: CTC Schedule by Number of Qualifying Children, Tax Year 2017

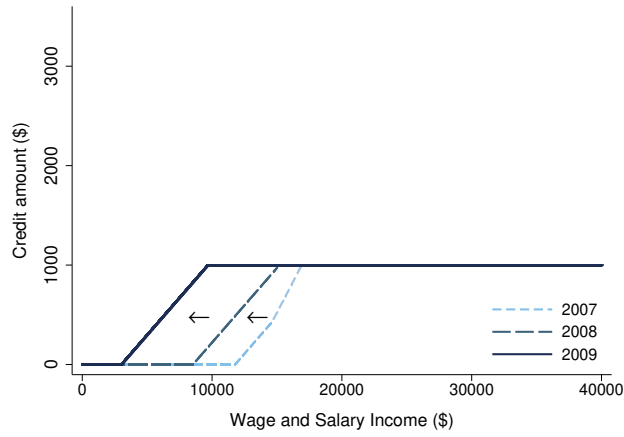


Source: Author's calculation using NBER's TAXSIM and the IRS publications 972 (various years).

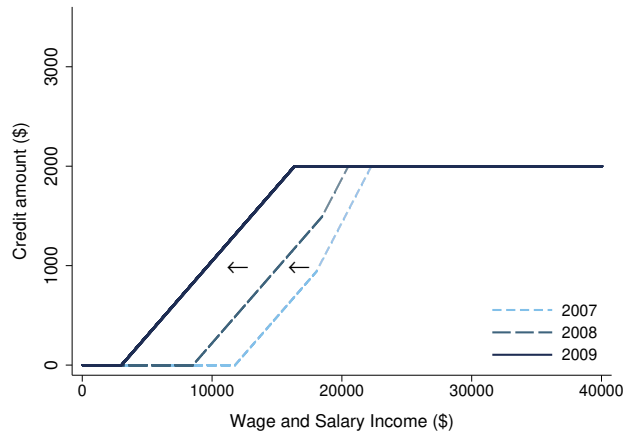
Notes: This figure shows the CTC schedule for households with different numbers of CTC-qualifying children for Head of Household and Married Filing Joint filing statuses. Schedule for households with four or more children is not shown, but they would have the same phase-in start point and the phase-in rate with larger maximum credit eligible, as the CTC is a per-child credit. The schedule is created by a simulation, assuming wages and salary income are the same as modified AGI (i.e., no other income than wages and salaries and no adjustments to income). The credit includes the refundable portion. Credit amount is in nominal dollars.

Figure 3: 2008-09 Eligibility Expansion

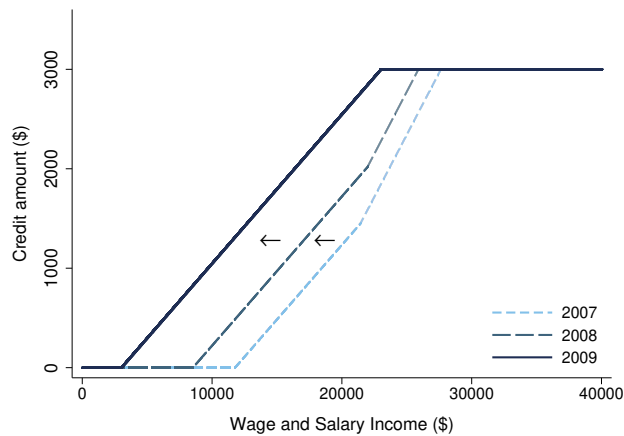
A. 1 Kid



B. 2 Kids



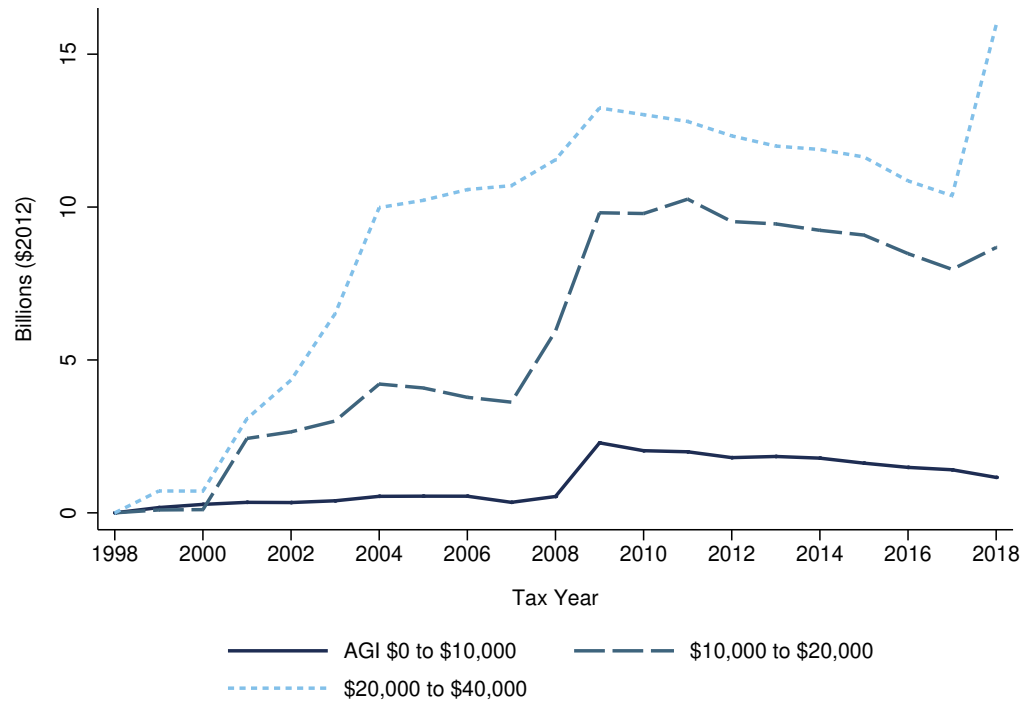
C. 3 Kids



Source: Author's calculation using NBER's TAXSIM.

Notes: This figure shows the CTC schedule change before and after the threshold event by number of the children. The minimum earned income threshold was reduced to \$8,500 and \$3,000 in tax year 2008 and 2009. The plateau and phase-out parameters did not change. Credit amount is in nominal dollars.

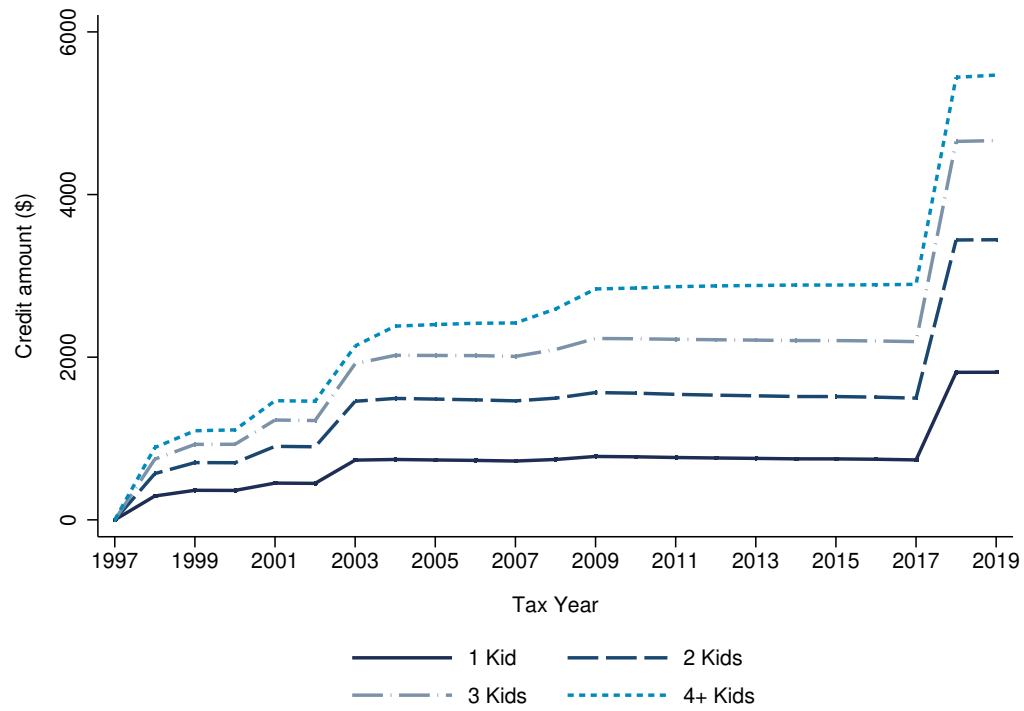
Figure 4: Real Federal Spending on the ACTC for Adjusted Gross Income under \$40,000



Source: Author's calculation using data from the Internal Revenue Service and Tax Policy Center.

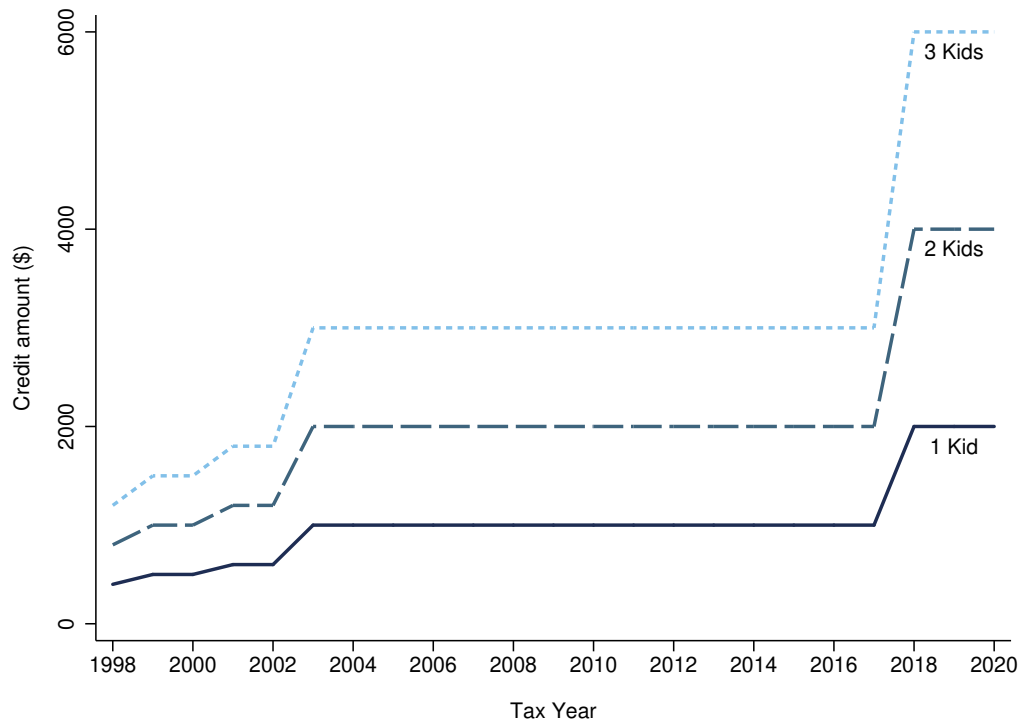
Notes: The dollar is inflation-adjusted to 2012 U.S. Dollars using the PCE.

Figure 5: Simulated CTC by Number of Qualifying Children and Tax Year (1998-2019)



Notes: This figure displays the simulated CTC for taxpayers with 1-4+ qualifying dependents. The simulated CTC was constructed by taking average generosity of CTC based on the 1997 March CPS sample.

Figure 6: Maximum CTC by Number of Qualifying Children and Tax Year (1998-2020)



Source: Data come from the Internal Revenue Service (publication 972) and the Tax Policy Center.

Notes: This figure displays the maximum CTC benefits for taxpayers with one to three qualifying children. The maximum credit for four or more children is not shown, but the credit is proportional to the number of children.

Appendix

A Supplementary Tables and Figures

Table A.1: CTC Schedule by Filing Status and Number of Children

A. Filing Status: Head of Household

Number of Children	Tax Year	Maximum Credit (\$)	Phase-in Start (\$)	Phase-in Rate (%)*	Plateau Start (\$)	Phase-out Start (\$)	Phase-out Rate (%)	Credit Exhaustion (\$)
1	1998	400	11,650	15	14,317	75,000	5	83,000
	1999	500	11,850	15	15,184	75,000	5	85,000
	2000	500	12,050	15	15,384	75,000	5	85,000
	2001	600	10,000	14.20	14,225	75,000	5	87,000
	2002	600	10,350	14.04	14,625	75,000	5	87,000
	2003	1,000	10,500	15.87	16,800	75,000	5	95,000
	2004	1,000	10,750	19.84	15,790	75,000	5	95,000
	2005	1,000	11,000	19.69	16,080	75,000	5	95,000
	2006	1,000	11,300	19.46	16,440	75,000	5	95,000
	2007	1,000	11,750	19.38	16,910	75,000	5	95,000
	2008	1,000	8,500	15.15	15,100	75,000	5	95,000
	2009	1,000	3,000	15	9,667	75,000	5	95,000
	2010	1,000	3,000	15	9,667	75,000	5	95,000
	2011	1,000	3,000	15	9,667	75,000	5	95,000
	2012	1,000	3,000	15	9,667	75,000	5	95,000
	2013	1,000	3,000	15	9,667	75,000	5	95,000
	2014	1,000	3,000	15	9,667	75,000	5	95,000
	2015	1,000	3,000	15	9,667	75,000	5	95,000
	2016	1,000	3,000	15	9,667	75,000	5	95,000
	2017	1,000	3,000	15	9,667	75,000	5	95,000
	2018	2,000	2,500	9.3	24,000	200,000	5	240,000
2019	2,000	2,500	9.3	24,000	200,000	5	240,000	
2020	2,000	2,500	9.3	24,000	200,000	5	240,000	
2021*	3,000	N/A	N/A	0	112,500	5	240,000	
2	1998	800	14,350	15	19,684	75,000	5	91,000
	1999	1,000	14,600	15	21,267	75,000	5	95,000
	2000	1,000	14,850	15	21,517	75,000	5	95,000
	2001	1,200	10,000	13.83	18,675	75,000	5	99,000
	2002	1,200	10,350	13.68	19,125	75,000	5	99,000
	2003	2,000	10,500	15.59	23,325	75,000	5	115,000
	2004	2,000	10,750	19.46	21,030	75,000	5	115,000
	2005	2,000	11,000	19.31	21,360	75,000	5	115,000
	2006	2,000	11,300	19.12	21,760	75,000	5	115,000
	2007	2,000	11,750	19.01	22,270	75,000	5	115,000
	2008	2,000	8,500	16.67	20,500	75,000	5	115,000
	2009	2,000	3,000	15	16,334	75,000	5	115,000
	2010	2,000	3,000	15	16,334	75,000	5	115,000
	2011	2,000	3,000	15	16,334	75,000	5	115,000
	2012	2,000	3,000	15	16,334	75,000	5	115,000
	2013	2,000	3,000	15	16,334	75,000	5	115,000
	2014	2,000	3,000	15	16,334	75,000	5	115,000
	2015	2,000	3,000	15	16,334	75,000	5	115,000
	2016	2,000	3,000	15	16,334	75,000	5	115,000
	2017	2,000	3,000	15	16,334	75,000	5	115,000
	2018	4,000	2,500	14.55	30,000	200,000	5	280,000
2019	4,000	2,500	14.55	30,000	200,000	5	280,000	
2020	4,000	2,500	14.55	30,000	200,000	5	280,000	
2021*	6,000	N/A	N/A	0	112,500	5	280,000	

Number of Children	Tax Year	Maximum Credit (\$)	Phase-in Start (\$)	Phase-in Rate (%)*	Plauteau Start (\$)	Phase-out Start (\$)	Phase-out Rate (%)	Credit Exhaustion (\$)
3	1998	1,200	17,050	19.84	23,097	75,000	5	99,000
	1999	1,500	17,350	22.16	24,120	75,000	5	105,000
	2000	1,500	17,650	21.90	24,498	75,000	5	105,000
	2001	1,800	10,000	13.71	23,125	75,000	5	111,000
	2002	1,800	10,350	13.56	23,625	75,000	5	111,000
	2003	3,000	10,500	15.61	29,720	75,000	5	135,000
	2004	3,000	10,750	19.33	26,270	75,000	5	135,000
	2005	3,000	11,000	19.18	26,640	75,000	5	135,000
	2006	3,000	11,300	19.01	27,080	75,000	5	135,000
	2007	3,000	11,750	18.89	27,630	75,000	5	135,000
	2008	3,000	8,500	17.24	25,900	75,000	5	135,000
	2009	3,000	3,000	15.02	22,980	75,000	5	135,000
	2010	3,000	3,000	15	23,000	75,000	5	135,000
	2011	3,000	3,000	15	23,000	75,000	5	135,000
	2012	3,000	3,000	15	23,000	75,000	5	135,000
	2013	3,000	3,000	15	23,000	75,000	5	135,000
	2014	3,000	3,000	15	23,000	75,000	5	135,000
	2015	3,000	3,000	15	23,000	75,000	5	135,000
	2016	3,000	3,000	15	23,000	75,000	5	135,000
	2017	3,000	3,000	15	23,000	75,000	5	135,000
	2018	6,000	2,500	18.31	35,267	200,000	5	320,000
	2019	6,000	2,500	18.31	35,267	200,000	5	320,000
2020	6,000	2,500	18.31	35,267	200,000	5	320,000	
2021*	9,000	0	N/A	0	112,500	5	320,000	

B. Filing Status: Married Filing Joint

Number of Children	Tax Year	Maximum Credit (\$)	Phase-in Start (\$)	Phase-in Rate (%)*	Plauteau Start (\$)	Phase-out Start (\$)	Phase-out Rate (%)	Credit Exhaustion (\$)
1	1998	400	15,201	15	17,867	110,000	5	118,000
	1999	500	15,450	15	18,784	110,000	5	120,000
	2000	500	15,750	15	19,084	110,000	5	120,000
	2001	600	10,000	10	16,000	110,000	5	122,000
	2002	600	10,350	10	16,350	110,000	5	122,000
	2003	1,000	10,500	11	19,575	110,000	5	130,000
	2004	1,000	10,750	15	17,417	110,000	5	130,000
	2005	1,000	11,000	15	17,667	110,000	5	130,000
	2006	1,000	11,300	15	17,967	110,000	5	130,000
	2007	1,000	11,750	15	18,417	110,000	5	130,000
	2008	1,000	8,500	15	15,167	110,000	5	130,000
	2009	1,000	3,000	15	9,667	110,000	5	130,000
	2010	1,000	3,000	15	9,667	110,000	5	130,000
	2011	1,000	3,000	15	9,667	110,000	5	130,000
	2012	1,000	3,000	15	9,667	110,000	5	130,000
	2013	1,000	3,000	15	9,667	110,000	5	130,000
	2014	1,000	3,000	15	9,667	110,000	5	130,000
	2015	1,000	3,000	15	9,667	110,000	5	130,000
	2016	1,000	3,000	15	9,667	110,000	5	130,000
	2017	1,000	3,000	15	9,667	110,000	5	130,000
	2018	2,000	2,500	9	24,000	400,000	5	440,000
	2019	2,000	2,500	9	24,000	400,000	5	440,000
2020	2,000	2,500	9	24,000	400,000	5	440,000	
2021*	3,000	N/A	N/A	N/A	0	150,000	5	440,000

Number of Children	Tax Year	Maximum Credit (\$)	Phase-in Start (\$)	Phase-in Rate (%)*	Plateau Start (\$)	Phase-out Start (\$)	Phase-out Rate (%)	Credit Exhaustion (\$)
2	1998	800	17,901	15	23,234	110,000	5	126,000
	1999	1,000	18,200	15	24,867	110,000	5	130,000
	2000	1,000	18,550	15	25,217	110,000	5	130,000
	2001	1,200	10,000	11.32	20,600	110,000	5	134,000
	2002	1,200	10,350	11.16	21,100	110,000	5	134,000
	2003	2,000	10,500	12.82	26,100	110,000	5	150,000
	2004	2,000	10,750	15.95	23,290	110,000	5	150,000
	2005	2,000	11,000	15.72	23,720	110,000	5	150,000
	2006	2,000	11,300	15.53	24,180	110,000	5	150,000
	2007	2,000	11,750	15.36	24,770	110,000	5	150,000
	2008	2,000	8,500	15	21,834	110,000	5	150,000
	2009	2,000	3,000	15	16,334	110,000	5	150,000
	2010	2,000	3,000	15	16,334	110,000	5	150,000
	2011	2,000	3,000	15	16,334	110,000	5	150,000
	2012	2,000	3,000	15	16,334	110,000	5	150,000
	2013	2,000	3,000	15	16,334	110,000	5	150,000
	2014	2,000	3,000	15	16,334	110,000	5	150,000
	2015	2,000	3,000	15	16,334	110,000	5	150,000
	2016	2,000	3,000	15	16,334	110,000	5	150,000
	2017	2,000	3,000	15	16,334	110,000	5	150,000
	2018	4,000	2,500	14.55	30,000	400,000	5	480,000
2019	4,000	2,500	14.55	30,000	400,000	5	480,000	
2020	4,000	2,500	14.55	30,000	400,000	5	480,000	
2021*	6,000	N/A	N/A	0	150,000	5	480,000	
3	1998	1,200	20,600	32.14	24,334	110,000	5	134,000
	1999	1,500	20,950	33.90	25,375	110,000	5	140,000
	2000	1,500	21,350	33.91	25,773	110,000	5	140,000
	2001	1,800	10,000	11.96	25,050	110,000	5	146,000
	2002	1,800	10,350	11.80	25,600	110,000	5	146,000
	2003	3,000	10,500	13.56	32,625	110,000	5	170,000
	2004	3,000	10,750	16.87	28,530	110,000	5	170,000
	2005	3,000	11,000	16.67	29,000	110,000	5	170,000
	2006	3,000	11,300	16.48	29,500	110,000	5	170,000
	2007	3,000	11,750	16.32	30,130	110,000	5	170,000
	2008	3,000	8,500	15	28,460	110,000	5	170,000
	2009	3,000	3,000	15	23,000	110,000	5	170,000
	2010	3,000	3,000	15	23,000	110,000	5	170,000
	2011	3,000	3,000	15	23,000	110,000	5	170,000
	2012	3,000	3,000	15	23,000	110,000	5	170,000
	2013	3,000	3,000	15	23,000	110,000	5	170,000
	2014	3,000	3,000	15	23,000	110,000	5	170,000
	2015	3,000	3,000	15	23,000	110,000	5	170,000
	2016	3,000	3,000	15	23,000	110,000	5	170,000
	2017	3,000	3,000	15	23,000	110,000	5	170,000
	2018	6,000	2,500	18.31	35,267	400,000	5	520,000
2019	6,000	2,500	18.31	35,267	400,000	5	520,000	
2020	6,000	2,500	18.31	35,267	400,000	5	520,000	
2021*	9,000	N/A	N/A	0	150,000	5	520,000	

Source: Author's calculation using earnings simulation and NBER's TAXSIM.

Notes: This table illustrates CTC parameters for tax filing status as head of household and married filing jointly.

*In 2021, the maximum credit was increased by \$1,600 for children under age 6 and by \$1,000 for children aged 6-17. This temporary increase in maximum credit phased out at a new lowered income threshold documented in this Table at a rate of 5 percent. The maximum income threshold for the per-child credit of \$2,000 is the same as the existing 2020 threshold.

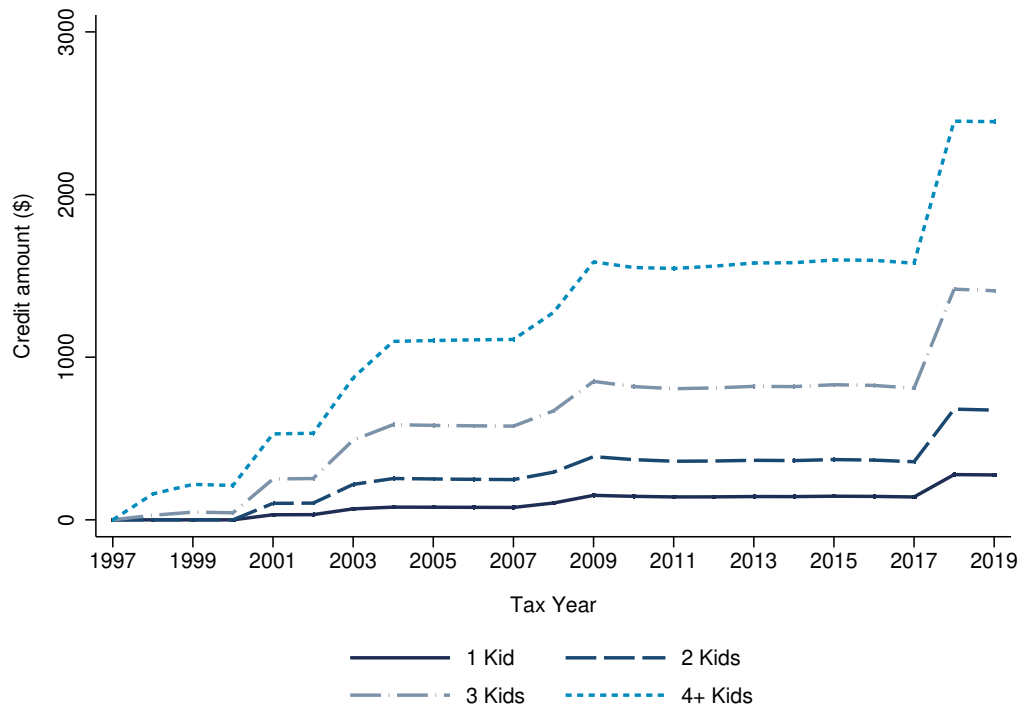
Table A.2: Effects of the CTC Policy Changes on Mothers by Marital Status and Education Level - Maximum Credit Model (Inflation-adjusted)

<i>Maximum CTC (thousands, \$2012)</i>						
	Employment			Annual Hours of Work		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Single Women						
All Levels of Education	0.016*** (0.005)	0.016*** (0.005)	0.016*** (0.005)	33.19*** (4.84)	33.56*** (4.89)	33.65*** (4.82)
High School or Less	0.031*** (0.005)	0.031*** (0.005)	0.031*** (0.005)	54.45*** (6.70)	54.77*** (6.73)	55.11*** (6.66)
Panel B: Married Women						
All Levels of Education	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)	18.24*** (4.05)	18.30*** (4.05)	17.86*** (4.06)
High School or Less	-0.004 (0.004)	-0.004 (0.004)	-0.004 (0.004)	7.09 (5.60)	7.08 (5.60)	5.84 (5.65)
Demographics	X	X	X	X	X	X
Unemployment Rate		X	X		X	X
Unemployment Rate × Mom			X			X

* $p < .1$, ** $p < .05$, *** $p < .01$

Notes: This table presents the effect of the CTC using the change in the maximum CTC benefits that varies by number of children and tax year (in thousands of dollars, inflation-adjusted to 2012 U.S. dollars using the PCE). The estimates are from the model specified in Equation (3). Demographics include age (in category), race, Hispanic ethnicity, education level, marital status (for single women), and age of youngest dependent (in category). The sample includes women aged 25-54 from the 1997-2020 March CPS (1996-2019 calendar year). Robust standard errors clustered at the state level are presented.

Figure A.1: Simulated ACTC by Number of Qualifying Children and Tax Year (1998-2019)



Notes: This figure displays the simulated ACTC for taxpayers with 1-4+ qualifying dependents. The simulated ACTC was constructed by taking average generosity of refundable portion of the CTC based on the 1997 March CPS sample.