More Money, More Meals?
The Effect of the Child Tax Credit on Child Food Insecurity

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Submitted in Partial Fulfillment
of the Prerequisite for Honors in
Economics

April 2023

Completed under the supervision of: Courtney C. Coile, Professor of Economics.

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Abstract

Recent historic expansions to the Child Tax Credit (CTC) during the COVID-19 pandemic have sparked discussions over whether the CTC should remain at pandemic levels. Integral to this debate is assessing the extent to which the Child Tax Credit improves food security, a fundamental measure of material well-being. While the current literature suggests that the 2021 CTC has significantly improved child food security, these studies are limited in their applicability because of the uniqueness of the pandemic and the large structural changes that occurred to the CTC during this time. Using 2005 to 2018 data from the Current Population Survey, this paper investigates the impact of the Child Tax Credit on child food insecurity by exploiting a natural experiment that occurs because 17 year olds are not eligible for the credit; holding the number of children in a household constant, I compare families with a 17 year old to families with a younger child. The estimates suggests that losing the full value of the CTC ($1,000) increases the predicted probability of children being food insecure by a statistically insignificant 0.6 percentage points or 6% relative to the mean. My paper additionally finds marginally significant results showing that losing the full value of the CTC increases a linear raw composite score of child food insecurity by 0.3 (on an 8-point scale) or 9% relative to the mean. Further research isolating different aspects of the 2021 expanded CTC and analyzing the pre-2021 CTC is needed to conclusively assess the impact of the credit on child food insecurity.

Acknowledgements

This thesis would not be possible without the guidance of my thesis advisor, Professor Courtney Coile, who turned a daunting project into an achievable goal. Her endless support and unwavering belief in my passions pushed me to pursue this thesis and were grounding in the face of any setbacks. I am grateful that this project gave me the opportunity and privilege to get to know and learn from her.

Thank you to the entire Economics Department. I am particularly indebted to Professor Pinar Keskin for sparking my love for Economics as well as for four years of lively conversations and invaluable encouragement; to Professor Ama Baafra Abeberese for inspiring me to take risks and for her unparalleled mentorship; and to Professor Dan Sichel for guiding me in finding avenues to combine my academic and service pursuits.

I am grateful to Professor Eric Hilt and the entire Economics Research Seminar (Mariela, Amy, Beatrice, Julie, and Nuzaina) for their feedback throughout the research process as well as for our engaging off-topic discussions of American Girl Doll and Taylor Swift. Thank you to the Knapp Thesis Fellowship in the Social Sciences for funding my research.

Thank you to the Federal Tax Clinic of the Harvard Legal Services Center for facilitating my interest in taxes as an avenue to enact social change and for ultimately being the catalyst for this thesis. A huge thanks goes to my amazing friends who have patiently listened to me monologue about taxes, economics, and my thesis every night.

Most importantly, I am infinitely indebted to my family for their constant encouragement and love. Every day I am inspired by them and the selflessness through which they lead their lives. They have truly pushed me to become a better person both professionally and personally, and thus, this thesis is dedicated fully to them.

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1 Introduction

In 2021, 5 million children in the United States lived in households in which both children and adults were food insecure ("Key Statistics & Graphics", 2022). Child food insecurity is a perennial issue, but concerns have mounted in recent years. Hunger rates rose during the pandemic and now, due to the dramatic inflation in food prices and the end of pandemic-related relief programs, they are surging again (Martinchek et al., 2021). While people of all ages who are food insecure are vulnerable to diet-sensitive chronic diseases and other health effects, lack of access to food is specifically devastating to children because of its developmental and lifelong consequences (Gundersen and Ziliak, 2015).

Numerous government programs such as the Supplemental Nutrition Assistance Program (SNAP), the Temporary Assistance for Needy Families (TANF), the Earned Income Tax Credit (EITC), and the Child Tax Credit (CTC) attempt to lower food insecurity in children and improve overall well-being. While there is significant research on the first three programs, there is surprisingly little previous literature on the Child Tax Credit. New studies have emerged in the past three years that focus on the expansion of the CTC during the pandemic (H. W. Hoynes and Schanzenbach, 2018). However, their relevance in comprehending the impact of the CTC's expansion or contraction under normal circumstances is restricted because of the uniqueness of the pandemic, the numerous policy changes enacted affecting food insecurity in close succession, and the fundamental structural change of the CTC in 2021.

This lack of relevant research on the CTC is particularly surprising given the fact that the CTC was the "single largest program in terms of federal expenditures on children ($118 billion) in 2019" (Hahn et al., 2020). More recently, the COVID-19 pandemic has highlighted the potential of the tax system as a mechanism to increase welfare, including food security. The American Rescue Plan's historic expansion of the federal tax code –including significant changes to the Child Tax Credit– in order to provide support to low-income and working families has sparked discussion over the long-term use of these programs. With 88% of children eligible for the CTC in 2021, the transformation of the Child Tax Credit has a substantial impact on most children in the U.S. ("IRS, Treasury", 2021). Preliminary research from 2021 has established that this expanded CTC has considerably increased food security (Parolin et al., 2021; Pilkauskas et al., 2022; Shafer et al., 2022). However, these substantial 2021 changes were not reinstated for 2022. Therefore, it is crucial to understand the impacts of this program now, with many Americans experiencing the ramifications of CTC support falling from a maximum of $3,600/child in 2021 to $2,000/child in 2022 and an anticipated $1,000/child by 2025.

Theoretically, there are advantages and disadvantages to using the CTC to enhance child food security. Because the CTC functions as a cash transfer or a reduction in liability, it provides flexibility for families to utilize it in a way that is most valuable to them. Additionally, families may find it easier to access the CTC benefits as opposed to other transfer methods since it is distributed through the federal tax system. However, it is not guaranteed that this money will be pass through to investment in or food for children. Historically, and in my time frame, the CTC is a annual (one-time) payment and hence may not have substantive medium or long term effects on hunger. Thus, the overall effect of the CTC on child food insecurity is unclear and my paper attempts to empirically answer this question.

Since CTC benefits are not randomly assigned but instead depend on family income and size, it is difficult to directly study the effect of the CTC on child food insecurity; lower income families, who are more likely to experience food insecurity due to their low income, are also the households eligible for the CTC. Instead, I use a natural experiment created by children aging out of the policy from 16 to 17. Controlling for number of children in the household, I compare families with a 17 year old to families with younger children to attempt to isolate the effect of the CTC. I find that losing the full value of the CTC ($1,000) increases the predicted probability of being food insecure by a statistically insignificant .006 (0.6 percentage points) or 6.4% relative to the mean. Using a linear measure of food insecurity additionally shows that losing the full value of the CTC increases the raw composite child food insecurity score (calculated out of maximum of eight) by 0.3 or 9% relative to the mean. This coefficient is statistically significant at the 10% level when not clustering standard errors by household.

I begin the paper by providing historical policy background on the CTC and offering an overview of the credit during my time period. I then contextualize my study within the broader pre-existing food security and tax credit literature. Section 3 details the 2005 to 2018 Current Population Survey (CPS) data I use for my analysis. Sections 4 and 5 expand upon my empirical strategy, specifying my first stage and reduced form results. In Section 6, I conclude with a discussion of the findings and their policy implications.

2 Background

2.1 Food Insecurity

Among the many ways of measuring well-being, food security is an important and frequently discussed one as many people view food as a basic right. Food security is broadly defined as having access at all times to enough food for an active, healthy life (Coleman-Jensen, 2021). Because this is difficult to measure, the federal government attempts to capture the severity of food insecurity by developing two categories of food security: low and very low food security. While households with low food insecurity reported multiple indications of issues in obtaining food and a decrease in diet quality, they usually reported less or no signs of a decrease in food consumption. Households who have very low food security, on the other hand, reported several signs of reduced food intake and disrupted eating patterns due to insufficient resources for food (Coleman-Jensen, 2021).

Rates of food insecurity are higher for households with children. For example, in 2021 the national average for food insecurity was 10.2% while the rate of food insecurity for households with children was 12.5% (Coleman-Jensen, 2021). Additional groups that have disproportionally higher food insecurity levels include households with children headed by single mothers as well as Black and Hispanic households.

The federal government has numerous policy tools that it historically used to decrease food insecurity. The three largest Federal nutrition assistance programs include SNAP, free/reduced-price school lunch, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (Coleman-Jensen, 2021).

2.2 Federal Child Tax Credit Policy History

The Child Tax Credit is a dollar-for-dollar reduction of the amount an eligible taxpayer with qualifying children under the age of 17 owes the government. Eligibility for the credit is determined by factors such as income, citizenship status and the number of children claimed under the age of 17 at the end of the tax year (December) (LaJoie, 2020).[1]

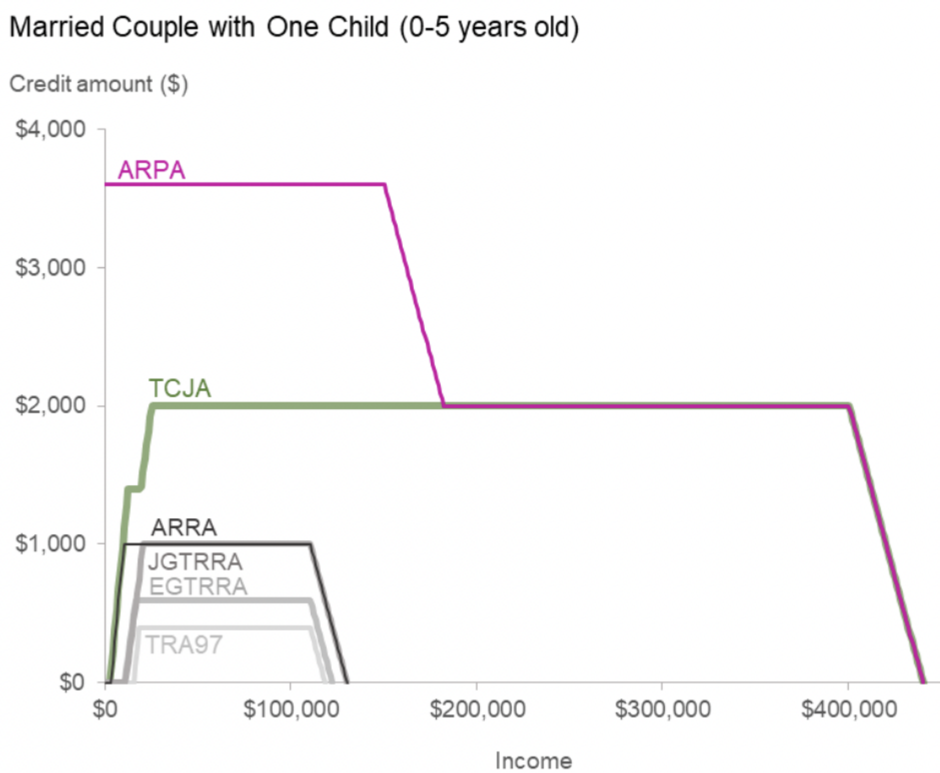
While initially designed in 1997 as a nonrefundable credit of $500 per child to lower the tax burdens of working class families, the CTC has expanded in the past two decades to provide a higher amount of support to a larger number of taxpayers. Figure 1 graphically depicts this expansion over time through selected key CTC legislation. In particular, The Economic Growth and Tax Relief Reconciliation Act of 2001 extended the refundable component of the credit — called the "Additional Child Tax Credit" or ACTC — to include a larger portion of families (Crandall-Hollick, 2018, p. 5). Partially refundable or refundable credits are expecially important because they support low-income families and can help ensure progressitivity in the tax system.

Refundable tax credits differ from nonrefundable credits in the fact that they can return extra money in the form of cash to taxpayers if the amount a taxpayer owes (the liability) is less than the value of the credit. Refundable credits are specifically relevant to lower income taxpayers, who often owe little to no taxes, because it allows them to receive the credit as direct cash assistance. While the CTC, the non-refundable portion of the credit that is deducted from the taxes owed, and the ACTC, the additional refundable credit above a taxpayer's liability that is given in cash assistance, are separate parts of the same broader credit, the two portions of the credit are frequently referred to together as simply the "CTC" in policy. For the purposes of my analysis, I will similarly use the CTC to refer to the total credit amount, including both the non-refundable and refundable components, and the ACTC will refer to the portion of the total CTC that is refundable.

Eligibility for the ACTC, the direct cash refundable component of the CTC, is determined by an earned income formula in which the amount of ACTC is equivalent to 10%-15% of earned income in excess of $10,000 (indexed for inflation) up to the maximum amount of the credit (Crandall-Hollick, 2018, p. 5). From tax year 2004 to 2017 (my period of study), the maximum CTC for each child was $1,000; this would mean that the

[1] To receive CTC benefits, the filer has to additionally be able to claim the child as a dependent, have had the child live with them for at least half the year (with some exceptions), have a specific relationship with the child (e.g. child, stepchild, foster child, sibling, etc.), and have provided at least half of the child's financial support. The child or dependent themselves has to be a U.S. citizen, U.S. national or U.S. resident alien ("Child Tax Credit", 2023).

Figure 1: Child Tax Credit Maximum Amount by Income for Selected Legislation, 1997-2021



Source: Crandall-Hollick, 2021b

Notes: Credit parameters generally reflect the first year the provision was in effect. The following legislation and their respective year they went into effect are in the graph above: The Taxpayer Relief Act of 1997 (TRA97), 1998; The Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA), 2001; The Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA), 2003; and The American Recovery and Reinvestment Act of 2009 (ARRA), 2009 (these and other changes were subsequently extended before being made permanent); The Tax Cuts and Jobs Act (TCJA), 2018 to 2025; and The American Rescue Plan Act of 2021 (ARPA), only 2021. In 2022, the credit returned to the TCJA values.

minimum earned income for a family with one child to be eligible for the full credit for tax year 2004 would be ∼$17,300 if the refundability rate is 15%.[2]

The credit amount also phases out at higher incomes, decreasing $50 for every $1,000 that a taxpayer's adjusted gross income exceeded the filing status thresholds. These thresholds were $110,000 for those married filing jointly, $75,000 for those filing head of household, and $55,000 for those married filing separately during my period of study(Crandall-Hollick, 2018, p. 4). For example, a married couple filing jointly with an income of $130,000 would have $1,000 subtracted from the amount of CTC they were eligible for during this period.

The credit has continued to broaden in applicability over time, with the minimum earnings threshold —or the minimum of earned income required to be eligible for the ACTC (and thus, in practice, the CTC as well)— dropping to $3,000 in tax year 2009. The 2017 Tax Cuts and Jobs Act (TCJA) doubled the CTC to $2,000 per child and increased the maximum amount for the ACTC to $1,400 per child. TCJA lowered the eligibility threshold from $3,000 of earned income to $2,500 of earned income and increased the phase out income levels (from $75,000 to $200,000 for head of household and single filers, and from $110,000 to $400,000 for married taxpayers filing joint returns) (Crandall-Hollick, 2021b). Additionally, the TCJA created a nonrefundable $500 credit for children aged 17 to 18, dependents between the ages of 19 to 24 who are in school at least 5 months of the year, and some older dependents — all of whom who do not meet the traditional CTC eligibility guidelines (LaJoie, 2020). The major changes from 2004 to 2017 are also summarized in Figure 2.

The most recent instance of the CTC expansions is in the 2021 American Rescue Plan Act (ARPA) passed during the COVID-19 pandemic. During this time, the CTC was raised to a maximum of $3,600 per child under the age of 6 and $3,000 per child aged 6 to 17. The credit became fully refundable with no minimum income requirement (Crandall-

[2] Because the $10,000 threshold is indexed for inflation each year, this minimum earned income value would change annually even if there was additional no policy change. For instance, if this same family was filing for tax year 2007, they would need a minimum earned income of ~$18,300 to receive the full credit.

Figure 2: Child Tax Credit Major Legislation Changes, 2004-2017

	2004	2008	2009	2010	2013	2015	2017
Maximum Credit Amount (per child)	$1,000 (2005-10)	-	-	$1,000 (2011-12)	$1,000 (permanent)	-	$2,000
Maximum Refundable Credit Amount (per child)	$1,000 (2005-10)	-	-	$1,000 (2011-12)	$1,000 (permanent)	-	$1,400
Refundability Threshold	$10,000 (2001-10)	$8,500 (2008)	$3,000 (2009-10)	$3,000 (2011-12)	$3,000 (2013-2017)	$3,000 (permanent)	$2,500
Refundability Rate	15% (2004-2010)	-	-	15% (2011-12)	15% (permanent)	-	-
Phaseout Threshold	$55,000 MFS, $75,000 HOH, $110,000 MFJ	-	-	-	-	-	$200,000 MFS, $200,000 HOH, $400,000 MFJ
Phaseout Rate	5%	-	-	-	-	-	-

Source: Crandall-Hollick, 2018

Notes: (1) Tax filing status is denoted as MFS (Married Filing Separately), HOH (Head of Household/Single), and MFJ (Married Filing Jointly). (2) The changes from the table are from the following legislation: P.L.108-311 (2004), P.L. 110-343 (2008), P.L. 111-5 (2009), P.L. 111-312 (2010), P.L. 112-240 (2013), P.L. 114-113 (2015), P.L. 115-97 (2017). Please note that the 2004 column includes certain details from changes that occurred prior to 2004 but are relevant for understanding the credit. The years reflect years in which the associated legislation was passed; for example, TCJA (P.L. 115-97) was passed in 2017 but only became effective in 2018. (3) "-" indicates that the credit was unchanged from the previous law. (4) Eligibility for ACTC (refundable portion) is calculated by multiplying the earned income above the refundability threshold by the refundability rate. (5) The initial refundability threshold is adjusted for inflation annually with the $10,000 threshold in 2001 US dollars. The $3,000 and $2,500 post-2009 were no longer adjusted for inflation annually. (6) Phase-out thresholds are based on Adjusted Gross Income (AGI).

Hollick, 2021a).[3] While the CTC has since returned to pre-American Rescue Plan values, there is a lot of uncertainty in the amount of CTC available to taxpayers due to the sunset of the temporary Tax Cuts and Jobs Act CTC changes in 2025 and the current political debate over the future of the CTC.

Additionally, it is important to note for my analysis that the CTC has historically only been available to children between the ages of 0 and 16 at the end of the tax year. As noted earlier, the TCJA and ARPA extended eligibility to children aged 17 and some dependents older than 17 for certain benefits starting in tax year 2018. In my study, I focus on the period 2005-2018 (tax years 2004-2017), during which 17 year olds were not eligible for benefits.

2.3 Literature Review

There is extensive literature documenting the detrimental impacts of food insecurity, specifically on children. Research has shown that food insecurity is associated with higher risks of being hospitalized, behavioral problems, and depression and anxiety (Gundersen and Ziliak, 2015, p. 1832). There are serious specific health implications associated with food insecurity. For example, food insecure 12-15 year old children are 2.95 times more likely than children in households without food insecurity to have iron deficiency anemia (Gundersen and Ziliak, 2015, p. 1833). Food insecurity in children particularly has significant impacts on early childhood development with important cognitive, language, motor, and socio-emotional consequences (de Oliveira et al., 2020).

Safety net programs have been shown to affect well-being including food security. Since taxes historically have been used in order to pursue policy goals, tax credits are one of the ways in which policymakers attempt to increase food security. There is substantial previous literature on the Earned Income Tax Credit (EITC), a refundable credit given

[3] The American Rescue Plan Act additionally changed the phase-out period and expanded eligibility of the Child Tax Credit to 17 year olds. Further, it "advanced" the credit, or provided half of the expected credit in periodic payments beginning in July, instead of the previous structure of providing all of the credit when filing taxes at the end of the year (Crandall-Hollick, 2021a). This could have positive benefits for lower income families who live on the margin month-to-month and may need the money to manage costs monthly.

to working taxpayers that is comparable to the CTC, demonstrating its success in lifting families out of poverty (H. Hoynes and Rothstein, 2016; Meyer, 2010) and in improving the health of children (Averett Wang, 2018). More specifically, the EITC has been positively associated with food expenditures (Lenhart, 2019), increased spending on healthy foods (McGranahan and Schanzenbach, 2013), and food security (Lenhart, 2022). Previous EITC studies have exploited the significant variation in policies over time and in credit amount based on family size. They have also leveraged the fact that benefits are paid out in one lump-sum at the end of the year instead of evenly across the year.

Because of their relative similarity, the EITC and CTC have frequently been studied together, without isolating the effects of the Child Tax Credit. Reports suggest that both credits lead to improved educational outcomes for young children in low-income households and reduce poverty for working families (Marr et al., 2015). However, a paper assessing the success of both policies found that while the EITC was successful in meeting its goals, the CTC is different in the fact that most of its benefits go to higher income households (H. Hoynes and Rothstein, 2016). There is limited pre-2021 literature studying the effects of the Child Tax Credit exclusively. One notable paper assesses the impact of the CTC on childhood injuries and behavior problems and finds significant results only when mothers receive the Advanced Child Tax Credit. This study uses longitudinal data as well as variations in credit amounts and eligibility to specify a fixed effects model that attempts to isolate the effect of the CTC (Rostad et al., 2020).

The 2021 Child Tax Credit expansions resulted in an increase in research analyzing the effect of the CTC on well-being. Early findings demonstrate that CTC payments significantly reduced food insufficiency (Shafer et al., 2022). Specifically, it was found that the initial payments resulted in a 7.5 percentage point decline in food insufficiency among low-income households with children (Parolin et al., 2021). A parameterized difference-in-differences study finds that the CTC expansion led to a reduction in material hardships experienced by families with low incomes and this reduction was primarily due to the declines in food insecurity (32% decline associated with $500 monthly credit)(Pilkauskas et al., 2022). In the study, Pilkauskas and colleagues use the timing of the CTC payments (the implementation of the expansion) as well as the benefit size depending on number and ages of children as the main sources of variation.[4]

These empirical findings align with statistics, surveys, and descriptive analyses from 2021 and 2022. National statistics suggest that the CTC kept children out of poverty in December 2021 and its absence resulted in millions more children in poverty in January 2022 (Parolin et al., 2022a, 2022b). These statistics are calculated by generating and comparing monthly poverty estimates pre-COVID relief, COVID relief but no CTC, and COVID relief with CTC. Surveys using two waves of questionnaires pre- and post-CTC similarly found that one of the most common purchases made with the credit was food (Adams et al., 2022; Hamilton et al., 2022) or the Household Pulse Survey (Karpman et al., 2021).

While there is substantial literature analyzing the effect of the 2021 Expanded CTC on food insecurity and a general consensus that the policy decreased food insufficiency in children, these studies are limited in their applicability. First, the nature of the COVID-19 pandemic had unique effects on employment, food insecurity, and other household factors that restrict the generalizability of findings to more "normal" years. Additionally, the significant change in the nature of the CTC in 2021 —including offering advanced payments monthly, expanding eligibility to the lowest income households, and incorporating different credit amounts based on child age— fundamentally shifted the impact of the policy. These additional changes may have differentially transformed the way in which the CTC can affect food insecurity and, with the 2022 CTC returning to the historical application of the policy, they may no longer provide an accurate characteristic of the CTC. Last, the combination of numerous fiscal policies enacted in close succession, such as the stimulus checks, and the bureaucratic hurdles in providing the support rapidly to Americans resulted in many families receiving the CTC credit later than anticipated or at the same time as other monetary support. This culminates in 2021 being a uniquely diffi-

[4] This study uses data from a national sample of families who receive SNAP that was obtained in collaboration with a mobile app which aids families in handling their SNAP benefits.

cult year to isolate the effects of the CTC over the other simultaneous policies that were also intended to support families. Thus, although numerous studies are employing the 2021 Expanded CTC to assess the impact of the CTC on food insecurity, it is important to understand and analyze this question prior to the 2021 changes. This paper contributes to the empirical literature on the relationship between the CTC and food insecurity by providing a historical pre-2021 analysis.

3 Data

This study uses nationally representative data from the monthly U.S. Current Population Survey (CPS), which is sponsored jointly by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics. CPS data provides household information including employment status, income categories, state of residence, ages of children, and marital status. Households are in the survey eight times: for 4 consecutive months, then out for 8 months, and back in for 4 months again. Because of this cycle, each household has data available for the same months for two consecutive years.[5]

In addition to the monthly basic survey, the CPS administers specific supplements during certain months to collect data on a wide variety of topics. The annual Food Security Supplement in December (1995 to 2021) offers numerous established household food insecurity scales, including ones I use as the dependent variables in my analysis. My main regression employs a 12-month child food security status variable that classifies households with children in one of three categories: food secure, low food secure, or very low food secure. I combine the latter two categories into one to create a dummy variable indicating child food security for ease of analysis. This child food security status variable is calculated based on eight food security questions asked in the CPS relating to the quantity and balanced nature of meals for children in the household.[6] In order to measure intensity of food insecurity I also use a raw composite score of these eight survey questions which has a maximum value of eight.

The CPS additionally includes detailed income and tax information in the March Annual Social and Economic Supplement (ASEC). The CPS is unique in the fact that it offers an estimate for each household's Child Tax Credit and Additional Child Tax Credit amounts calculated by the Census Bureau's tax model. The model incorporates

[5] I observe most households twice in the data. While in theory this may allow me to run a model with family fixed effects, in practice the number of households that are observed with and without a 17 year old is sufficiently small that this analysis is underpowered and does not yield meaningful results.

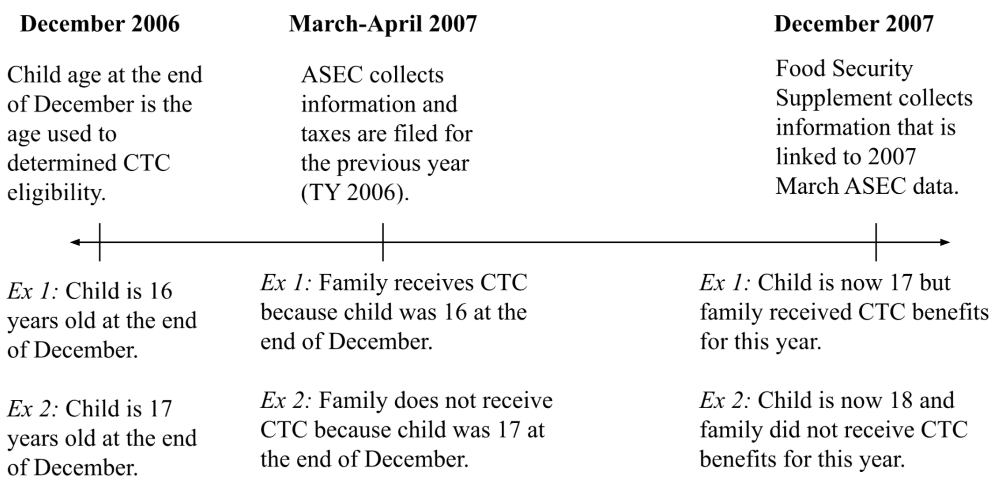
[6] For example, one of the survey questions asked is "In the last 12 months did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)"("Food Security in the U.S. Measurement", 2022). The Appendix lists all eight questions used to calculate both of the child food insecurity variables I used in my analysis.

information from non-CPS sources (including the IRS's Statistics of Income) as well as self-reported information regarding family composition and income to produce values for tax-related variables. This estimation method is likely more accurate than self-reported values of tax credits because people are unlikely to precisely recall detailed information from complicated tax returns. The ASEC includes other variables of interest including tax filer status and estimations of adjusted gross income and money received from the Earned Income Tax Credit. While the ASEC data has no information on my dependent variable (food insecurity), these variables can be used to test that the credit interacts with my age variation in the way I expect.

My primary analysis uses December CPS data pooled across 2005 to 2018, which encompasses a sample of 220,000 households with children. December data not only includes data on my dependent variable (food insecurity), but also offers the most accurate estimate for child age used for tax credits. Eligibility for the CTC is determined by child age at the end of December of the tax year. I use the reported child age in the December survey to determine whether a child was over or under 17 and therefore whether the child was eligible for the credit. Figure 3 outlines an example timeline for two children with different eligibility for the CTC in tax year 2006. Here, the child's age in December 2006 determines eligibility for CTC in March/April 2007. A household is expected to receive their CTC either as soon as they send in their return (through the reduced amount they owe the government in taxes) or in the following months in the form of an ACTC check. I then use food security measurements from December 2007 (based on questions covering the previous 12 months) to understand the effect of the CTC on child food insecurity.

It is important to note that using the December CPS survey age as a measurement of the age reported for taxes results in classical measurement error that biases the age 17 coefficient towards zero. Because the CPS conducts surveys throughout December while the tax eligibility depends on child age on the last day of December, there is a small number of children who are 16 when interviewed in December but turn 17 before December 31. I am unable to differentiate between these children and the vast majority of children

Figure 3: Sample Timeline for Children Aged 16 and 17 in December 2006 (TY 2006)



who are still 16 on December 31. Assuming an even distribution of birthday across the year, this would affect approximately 5% of the sample.[7] While I cannot correct for this measurement error since I do not have exact birthdays for individuals in the survey, I can use the ASEC data to test how accurate my age 17 variable is at predicting CTC eligibility.

[7] There is roughly 20 days between the CPS December survey and December 31 so the it would affect 20/365 of the sample (which is equivalent to 5%).

4 Empirical Methods

Exploiting the variation in CTC access due to the child eligibility cutoff at age 16, I specify a reduced form regression assessing the impact of the Child Tax Credit on child food insecurity levels. This model links the source of the CTC variation (having a 17 year old child) to food insecurity.

Consider first limiting the dataset to families with only one child. In this world, the effect of having a 17 year old over a younger child on child food security would be measured by:

$$FoodInsecurity_{ist} = \beta_0 + \beta_1 Age17DV_{ist} + \beta_2 X_{ist} + \alpha_s + \delta_t + \epsilon_{ist} \tag{1}$$

where $FoodInsecurity_{ist}$ is a measure of child food insecurity levels for family i in state s and year t, and $age17DV_{ist}$ is a dummy variable indicating whether the child in family i is 17 (as of the December survey). Restricting the world to only include families with 1 child, $Age17DV_{ist}$ would be equivalent to 1 if the family had a 17 year old child and 0 if the family had a child under 17. α_s and δ_t denote state and year fixed effects respectively, controlling for any state or time varying factors that affect all households similarly. X_{ist} controls for other factors that may be correlated with having a 17 year old child and may also affect food insecurity including race, Hispanic, marital status, head of household age, and education.

Factoring in families with greater than one child, next imagine restricting the sample to families with one or more children but a maximum of one 17 year old. This effect can be examined through:

$$\begin{aligned} FoodInsecurity_{ist} = \beta_0 + \beta_1 Age17DV_{ist} + \beta_2 TotalChildNumber_{ist} \\ + \beta_3 X_{ist} + \alpha_s + \delta_t + \epsilon_{ist} \end{aligned} \tag{2}$$

where $FoodInsecurity_{ist}$ is a measure of child food insecurity levels for family i in state s and year t, and $Age17DV_{ist}$ is a dummy variable indicating if there is a 17 year old child in family i. Because the maximum number of children aged 17 is still limited to

1, $Age17DV_{ist}$ would be equivalent to 1 if the family had a 17 year old child and 0 if not. $TotalChildNumber_{ist}$ is a continuous variable equal to the number of children age 17 or younger in the family; it controls for variations in family size that may affect child food security levels similarly in households with and without 17 year olds. α_s , δ_t , and X_{ist} denote the same controls as the previous regression.

However, it is possible that a family may have more than one 17 year old; for example a household may have twins (triplets etc.) or siblings that are born less than 12 months apart. Here, I specify the following regression:

$$\begin{aligned} FoodInsecurity_{ist} = \beta_0 + \beta_1 NumChildrenAge17_{ist} + \beta_2 TotalChildNumber_{ist} \\ + \beta_3 X_{ist} + \alpha_s + \delta_t + \epsilon_{ist} \end{aligned} \tag{3}$$

where $FoodInsecurity_{ist}$ is a measure of child food insecurity levels for family i in state s and year t. $NumChildrenAge17_{ist}$ indicates the number of 17 year old children in a household in state s and year t holding number of total children constant. $TotalChildNumber_{ist}$, α_s , δ_t , and X_{ist} denote the same controls as the previous regression.

The coefficient β_1 estimates the impact of having a 17 year old, as opposed to a younger child, on child food insecurity levels holding the number of total children in the household constant. I hypothesize that β_1 is a positive number because having a 17-year-old child as opposed to a younger child in the same family size reduces the amount of money the family receives in CTC payments. This should increase child food insecurity levels. Given the presence of the other control variables in the regression, the identifying assumption needed to interpret β_1 as a causal effect of the CTC on food insecurity is that, conditional on family size and other controls, there is no reason that having an age-17 child would affect child food insecurity other than due to the loss of the CTC. I additionally explore the relationship between having a 17 year old and the amount of CTC receipt in Section 4.3 below.

4.1 Income Groups

The Child Tax Credit structure includes a phase-in region, where benefits increase as income increases, and a phase-out region, where benefits decrease as income increases. In both of these regions, benefits are a portion of the maximum possible CTC amount that the family is eligible for. Because of the varying amounts of the CTC received by families in these regions, it is difficult to use my age variation as a standard instrument to estimate the effect of the CTC on child food insecurity.

In order to view the effect of having a 17 year old as a standardized value of the CTC, I limit my sample to families that receive the full credit, and thus are not in the phase-in or phase-out regions. The income values that denote the beginning and end of the phase-in and phase-out regions vary depending on tax year, number of children, and filing status. For example, imagine a family married filing jointly in tax year 2017 with two children. This family's income would categorize them in one of five groups: low-income ineligible (income under $3,000), phase-in (income between $3,000 and $16,333), full credit (income between $16,333 and $110,000), phase-out (income between $110,000 and $150,000), high-income ineligible (income above $150,000). Only if the family's income falls between $16,333 and $110,000 would they be factored into my main analysis because I assume they receive the full credit (which is equivalent to $2,000 total, or $1,000 per child). Unless specifically denoted otherwise, my summary statistics and regressions are restricted to this "full credit" group.

One possible concern with this approach is that I am conditioning my sample on an endogenous factor (income) which could bias my estimates. For example, families may choose to work more when their children are eligible for the CTC if their income is close to the start of the full credit group. When their child is no longer eligible for the credit, they could respond by choosing to work less, removing them from my sample group. However, previous literature examining the Child Tax Credit shows that this is not likely an issue for my analysis. One empirical study indicates that the loss of the CTC –even though it is lump-sum and predictable– when children turns 17 is a surprise to some families (Feldman

Table 1: Descriptive Statistics

Variables	**Mean**
Food Insecurity (DV)	0.0932
Food Insecurity Raw	0.345
Number of Age 17 Children	0.0571
Total Child Number	1.766
Married	0.697
Head of Household Age	39.83
Hispanic	0.173
Race	
White	0.813
Black	0.109
American Indian/Aleut/Eskimo	0.0149
Asian or Pacific Islander	0.0452
Multiracial	0.0177
Highest Education Level	
Less Than High School Graduate	0.109
High School Graduate	0.304
Some College	0.345
College Graduate or More	0.242

et al., 2016). Therefore, it is unlikely that a significant amount of households in my analysis are shifting their labor supply in anticipation of losing the credit. Further, recent literature has failed to find an effect of the expanded 2021 CTC on labor force participation and total hours worked, suggesting that the concerns regarding sample selection may not be relevant for my analysis (Ananat et al., 2022; Enriquez et al., 2023).

4.2 Summary Statistics

Summary statistics are presented in Table 1, restricted to the sample used for the reduced form regression. These statistics therefore are created using the December CPS data which includes the Food Security Supplement. They are also limited to the full credit income group and households that have non-missing values for food insecurity variables.

The *Food Insecurity(DV)*, *Married*, and *Hispanic* variables as well as the race and education categorical variables are all dummy variables. Because of this, the means of these variables can be interpreted as the proportion of observations that have the named value.

Notably, the mean of the food insecurity dummy variable indicates that approximately 9% of the households in my sample have food insecure children.

Table 8 in the Appendix presents the averages of each variable separated out by income group. As expected, the percentage of households in each income group that is food insecure decreases as income increases: 26.6% of the households in the lowest income group ("Low Income Ineligible") have food insecure children while 0.7% of the highest income group ("High Income Ineligible") have food insecure children.

4.3 First Stage

Prior to running the reduced form analyzing the effect of the number of 17 year olds in a family on child food insecurity, I use the March ASEC data to model a first-stage regression estimating the impact of number of 17 year olds in a family on child tax credit benefits:

$$\begin{aligned} ChildTaxCredit_{ist} = \beta_0 + \beta_1 NumChildrenAge17_{ist} + \beta_2 TotalChildNumber_{ist} \\ + \beta_3 X_{ist} + \gamma_c + \alpha_s + \delta_t + \epsilon_{ist} \end{aligned} \tag{4}$$

where $ChildTaxCredit_{ist}$ is the amount of Child Tax Credit family i in state s and year t receives. $NumChildrenAge17_{ist}$ indicates the number of 17 year old children in a household in state s and year t holding the number of children constant. $TotalChildNumber_{ist}$, α_s , δ_t, and X_{ist} denote the same variables or controls as in Equation 3.

For this analysis, I link March ASEC data, which offers Child Tax Credit estimates generated by a Census Bureau model, to December data, which provides a more accurate measure of child age at the end of the tax year. This restricts my first-stage data to approximately 50 thousand households with children or, in my income group of interest (the "full credit" group), 25 thousand households with children.

As discussed in Section 4.1, classifying a household as part of the "full credit" group depends on tax year, number of children, and filing status. There are two different income values in the ASEC Data which can be used to restrict the sample to the desired income group. First, ASEC data offers an Adjusted Gross Income variable which is an estimated value produced by the stimulated tax returns from the Census Bureau's tax model. This variable is only calculated for the ASEC Supplement (from March) and thus is not available for my reduced form regression that uses the Food Insecurity Supplement (from December). Alternatively, respondents are asked which category their income falls into every month in the survey. These categorical values of income offer a different approximate income that can be used to determine which households are in the full credit group. I run my first stage regression using the sample of those estimated to receive the full credit based on AGI values; I then rerun this regression using the sample estimated to receive the full credit based on their income as reported in the income categories.

Table 2 presents estimates from the first-stage regression, which includes the same controls present in the reduced form. Each column represents a separate regression. The first column represents the results of regression using the sample restricted by AGI values. This estimate suggests that having a 17 year old child reduces Total Child Tax Credit by $789 and is significant at the 1% level. Because my first stage is limited to the full credit group and my time frame is confined to a period when the maximum credit is $1,000 per child, the theoretical value of this coefficient should be 1,000 dollars. One reason why the coefficient is lower than $1,000 is that there may be some children that I have inaccurately classified as 16 year olds instead of 17 because they turn 17 after the survey is administered. The CTC value, modeled by the Census Bureau which has birthday data, for this child would be $0 while I would have expected a value of $1,000, biasing my coefficient towards 0. Another reason for the discrepancy between the theoretical value of $1,000 and the actual coefficient is citizenship status. The CTC is limited in eligibility children who are U.S. citizens, U.S. nationals or U.S. resident aliens. If there are children that do not pass this requirement, the CTC value associated with them will always be $0 instead of decreasing by $1,000 when they age from 16 to 17.

Column 2 of Table 2 displays the first stage estimates when limiting the sample using the categorical income variable. I use the mean of each family's income category to classify

Table 2: First Stage - The Effect of a 17 Year Old Child on Total CTC

	Income Used to Define Full Credit Sample		
	Adjusted Gross Income	Categorical Income	Conservative Categorical Income
Variables	(1)	(2)	(3)
Number of Age 17 Children	-788.9***	-725.4***	-729.5***
	(10.34)	(12.42)	(12.36)
Total Child Number	848.8***	783.9***	788.5***
	(3.862)	(4.598)	(4.618)
Black	44.67***	-11.66	-11.82
	(12.36)	(14.19)	(14.25)
American Indian/Aleut/Eskimo	-66.94**	-138.2***	-135.5***
	(31.10)	(34.76)	(34.83)
Asian or Pacific Islander	-22.70	-47.30**	-51.94**
	(16.56)	(20.36)	(20.27)
Multiracial	21.77	-7.777	0.319
	(27.28)	(31.24)	(31.16)
Marital Status	147.1***	267.3***	248.2***
	(8.306)	(9.299)	(9.344)
High School Graduate	51.77***	98.05***	89.72***
	(13.85)	(15.43)	(15.59)
Some College	64.22***	129.5***	118.6***
	(13.74)	(15.33)	(15.48)
College Graduate or More	-70.05***	93.75***	80.53***
	(14.05)	(16.13)	(16.24)
Head of Household Age	-9.198***	-10.48***	-10.54***
	(0.336)	(0.378)	(0.378)
Hispanic	28.11**	19.88	21.43*
	(11.03)	(12.74)	(12.77)
Constant	157.0***	161.4***	179.4***
	(37.76)	(44.08)	(44.25)
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Observations	32,300	26,829	26,169
R-squared	0.657	0.593	0.600

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The omitted groups reflected in the constant include white and less than high school graduate.

whether the family is in the full credit group.[8] This iteration of the first stage suggests that having a 17 year old child reduces Total Child Tax credit by $725 and is significant at the 1% level. In addition to aforementioned reasons why the AGI coefficient was below the theoretical $1,000 value of the credit, this categorical income estimation is likely lower than the AGI coefficient because it is a less precise estimation of income.[9] For example, there could be a family in the phase-in region with an income on the lower end of the income category that is misclassified by the mean of the income category as being in the full credit group. To account for this, I run an additional "conservative" iteration of the first stage that only categorizes a family in the full credit group if all income values in the category fall in the full credit group.[10] The coefficient for *Number of Age 17 Children* in Column 3 shows that for this conservative full credit group, having a 17 year old child reduces Total Child Tax credit by $730. This coefficient is significant at the 1% level and is very close to the less conservative categorical income iteration (Column 2).

For the rest of the paper, I restrict my sample to the full credit group using the categorical income (Column 2) method and use the associated coefficient ($725) as the estimation of the effect of having a 17 year old on Total CTC. This is because I do not have AGI estimations for my reduced form data and the categorical conservative income estimation is very close to the non-conservative estimate. Table 9 in the Appendix also presents the results of the first stage for each income group using the cutoffs generated by

[8] For example, for the income category $15,000 to $20,000, the mean income value would be $17,500. For a family with two eligible children in 2014, the phase-in region is from $3,000 to approximately $16,300; therefore, a family in the above income category with a mean income value of $17,500 would be in the full credit sample using the mean value classification.

[9] For further detail on the difference between the AGI and categorical income classifications, Table 7 in the Appendix presents a cross tabulation comparing both income group classifications. Specifically, the *"Full Credit"* column demonstrates that approximately 82% of households the categorical income classifies as full credit is also classified as full credit using the AGI method; this can be calculated by dividing 22,026 by 26,829.

[10] The same family mentioned in Footnote 8 would not be part of the full credit group through the conservative classification. This family is in the income category $15,000 to $20,000 and the phase-in region for this family of two children in 2014 is from $3,000 to approximately $16,300. While the mean income value ($17,500) would classify it as part of the full credit group (because $17,500 is greater than the phase-in end income value, $16,300), the conservative classification compares the phase-in end income value to the minimum income of the category ($15,000). Since the minimum income of the category is less than the phase-in end income ($16,300), there is a possibility that there are families in this group that have income values that meant to be classified as part of the phase in group instead of the phase out group. For this reason, this family would not be considered part of the full credit group here.

these categorical income values. These iterations show that the full credit income group has a larger coefficient than any other income group and a much larger coefficient than the ineligible groups as expected. The coefficient for ineligible groups still have a negative and statistically significant effect but that may be due to imperfect classification of income groups.

5 Results

5.1 Reduced Form: Main Regression

Table 3 reports the results of estimating Equation 3, regressing child food insecurity on the number of 17 year olds in the household, in order to exploit the variation in CTC arising from the aging out of benefits at age 17. I first use a dummy variable for child food insecurity, where 0 is equivalent to a household that is not food insecure and 1 is equivalent to a household that is food insecure.

The coefficient of interests are associated with the *Number of Age 17 Children* variable, which represents the impact of having a 17 year old child over a younger child holding number of total children constant. The first column includes no controls other than the number of total children and here the coefficient is statistically significant and positive as predicted. In incorporating year and state fixed effects in the second column, the coefficient of interest falls by 0.001 but remains statistically significant at 1% level. However, when including other relevant control variables such as race, marital status, educational attainment, head of household age, and Hispanic in Column 3, the coefficient is no longer statistically significant, even at the 10% level. I cluster the standard errors at the household level in Column 4 because household error terms may correlated with one another.

The main results including all controls and clustering of standard errors are not statistically significant at the 10% level. However, taking the coefficient at face value, it indicates that holding the number of children constant, having a 17 year old instead of a younger child increases the predicted probability of being food insecure by 0.004 (or 0.4 percentage points). Comparing this value to the mean of the child food insecurity dummy variable (.0932 or 9.32%), having a 17 year old increases probability of being food insecure by 4.6% relative to the mean.

In Section 4.3, my first stage estimated that holding the total number of children constant, having a 17 year old child over a younger child results in an average CTC reduction of $725. Scaling my coefficient to see the effects of the policy (which is equivalent to $1,000 for this full credit group), I find that losing the full value of the CTC increases

Table 3: **Food Insecurity Dummy Variable Reduced Form Results**

	Child Food Insecurity			
Variables	(1)	(2)	(3)	(4)
Number of Age 17 Children	0.0188***	0.0177***	0.00427	0.00427
	(0.00397)	(0.00397)	(0.00393)	(0.00444)
Total Child Number	0.0130***	0.0132***	0.0196***	0.0196***
	(0.00106)	(0.00106)	(0.00107)	(0.00119)
Black			0.0373***	0.0373***
			(0.00316)	(0.00384)
American Indian/Aleut/Eskimo			0.0194**	0.0194**
			(0.00763)	(0.00945)
Asian or Pacific Islander			0.00496	0.00496
			(0.00470)	(0.00440)
Multiracial			0.0297***	0.0297***
			(0.00700)	(0.00871)
Marital Status			-0.0755***	-0.0755***
			(0.00205)	(0.00248)
High School Graduate			-0.0448***	-0.0448***
			(0.00333)	(0.00420)
Some College			-0.0464***	-0.0464***
			(0.00333)	(0.00422)
College Graduate or More			-0.0872***	-0.0872***
			(0.00352)	(0.00419)
Head of Household Age			0.000174**	0.000174*
			(8.57e-05)	(9.19e-05)
Hispanic			0.0247***	0.0247***
			(0.00286)	(0.00334)
Constant	0.0692***	0.0524***	0.131***	0.131***
	(0.00205)	(0.00854)	(0.00971)	(0.0105)
Year Fixed Effects	No	Yes	Yes	Yes
State Fixed Effects	No	Yes	Yes	Yes
Clustered SE	No	No	No	Yes
Observations	99,992	99,992	99,992	99,992
R-squared	0.002	0.007	0.032	0.032

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The omitted groups reflected in the constant include white and less than high school graduate.

the predicted probability of being food insecure by .006 (0.6 percentage points) if I take my coefficient at face value. This translates to increasing the probability of being food insecure by 6.4% relative to the mean.

Most of the controls in Column 4 of Table 3 are statistically significant at the 1% level. Particularly, being Black over being White increases the predicted probability of child food insecurity by 0.037 (or 3.7 percentage points). While unsurprising, the fact that it is one of the largest coefficients (after *Marital Status* and education dummy variables) emphasizes the racial gap in child food insecurity. Education variables are also expectably significant and negative, demonstrating that accounting for controls, higher parental education attainment lowers probability of child food insecurity.

In Table 4, I run regressions parallel to those in Table 3 but using a different dependent measurement of food insecurity. I use a raw composite measurement of child food insecurity calculated from the eight CPS survey questions. This score is has values from zero to eight with higher values representing higher levels of food insecurity. While I lose the predicted probability ability of my earlier dummy variable, I am able to measure intensity of the effect because the raw score is a continuous measure. This variable thus captures both families moving from food secure to insecure and families becoming more food insecure while the dummy variable only captures the former.

Here, the coefficients of interest (*Number of Age 17 Children*) are representative of the impact of having a 17 year old child over a younger child holding number of total children constant on the raw child food insecurity score. Columns 1-4 have the same controls as the respective columns in Table 3. The coefficient is statistically significant at the 10% level when including year fixed effects, state fixed effects, and other controls. This coefficient maintains the same magnitude but loses significance at the 10% level when I cluster the standard errors at the household level.

The results show that holding the number of children constant, having a 17 year old instead of a younger child increases the raw food insecurity score by a statistically insignificant 0.0214 (out of 8). The summary statistics in Section 4.2 indicates that average

Table 4: Food Insecurity Raw Reduced Form Results

	Child Food Insecurity			
Variables	(1)	(2)	(3)	(4)
Number of Age 17 Children	0.0754***	0.0706***	0.0214*	0.0214
	(0.0122)	(0.0122)	(0.0120)	(0.0141)
Total Child Number	0.0434***	0.0443***	0.0670***	0.0670***
	(0.00326)	(0.00326)	(0.00326)	(0.00364)
Black			0.148***	0.148***
			(0.00965)	(0.0122)
American Indian/Aleut/Eskimo			0.0683***	0.0683**
			(0.0233)	(0.0290)
Asian or Pacific Islander			0.0261*	0.0261*
			(0.0143)	(0.0142)
Multiracial			0.125***	0.125***
			(0.0214)	(0.0283)
Marital Status			-0.264***	-0.264***
			(0.00626)	(0.00766)
High School Graduate			-0.163***	-0.163***
			(0.0101)	(0.0136)
Some College			-0.174***	-0.174***
			(0.0102)	(0.0136)
College Graduate or More			-0.316***	-0.316***
			(0.0107)	(0.0135)
Head of Household Age			0.000778***	0.000778***
			(0.000261)	(0.000288)
Hispanic			0.0957***	0.0957***
			(0.00873)	(0.0106)
Constant	0.264***	0.216***	0.487***	0.487***
	(0.00630)	(0.0262)	(0.0296)	(0.0335)
Year Fixed Effects	No	Yes	Yes	Yes
State Fixed Effects	No	Yes	Yes	Yes
Clustered SE	No	No	No	Yes
Observations	99,992	99,992	99,992	99,992
R-squared	0.003	0.010	0.044	0.044

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The omitted groups reflected in the constant include white and less than high school graduate.

family has a raw food insecurity score of 0.345 out of 8. Therefore, having a 17 year old raises the raw food insecurity score by 6.2% relative to the mean. This effect is associated with a $725 (estimated in my first stage) decrease in CTC as opposed to the $1,000 value of the credit. Scaling my coefficient to see the effects of the policy, I find that losing the full value of the CTC increases the raw child food insecurity score by 0.03 if I take my coefficient at face value. This translates to an approximately 9% increase in food insecurity relative to the mean.

While the effects for both the child food insecurity dummy variable and raw score seem small, these magnitudes align for this income group and data. For one, food insecurity impacts lower income families the most and thus could have had the largest effect of this credit. However, due to the nature of the credit in the time frame of my analysis, those who receive the full credit are mainly not part of this lowest income group and therefore not in my analysis. Additionally, depending on whether a family is receiving the credit as deductions from liability or direct cash assistance, the family will likely receive the credit sometime between February and May. Because I use child food insecurity data from the following December[11], I could be missing the potentially higher immediate effect of the CTC on food insecurity.

5.2 Robustness Checks and Additional Iterations

Table 5 shows the effect of having a 17 year old on the child food insecurity dummy variable estimated separately by income group. The coefficients of interest for all groups (including the full credit group as shown in Table 3) are not statistically different from each other or from 0 at the 10% level. The face value of each *Number of Age 17 Children* coefficient for the other income groups are lower than the value for the full credit group.

In Table 6, I run regressions parallel to those in Table 5, but instead use the linear measure of food insecurity as the dependent variable. Notably, the phase-in group has a higher face value coefficient of interest (*Number of Age 17 Children*) than the full credit

[11]While the answers given in December can reflect food security over the past 12 months, the answer may be more reflective of the family's more recent experience.

group; this may be explained by the fact that while this lower income group is not receiving the full credit, the amount they are receiving is helping them a lot because food insecurity is a larger issue for them. The extent to which these *Number of Age 17 Children* coefficients can be analyzed is limited as they are all statistically insignificant.

I run three other analyses, included in Table 10 in the Appendix. I first continue the analysis of the full credit income group but focus on a subset of this group that earns less than $75,000 to observe whether there is an effect for the relatively lower income families in this group. I next run an additional iteration of the main analysis but include only families that have at least one 16 or 17 year old. Because in theory there could be key differences between 17 year olds and much younger children, this iteration attempts to narrow in on more comparable families to the "treatment group". Both of these yield similar or slightly higher coefficients on *Number of Age 17 Children*, although they are statistically insignificant. In the third analysis I shift from using a continuous measure of total number of children as a control to using fixed effects in response to any concerns that the total number of children may not have a linear relationship with food insecurity. These results yield a slightly lower coefficient that is similarly statistically insignificant.

Table 5: Food Insecurity DV Reduced Form Results (Separated by Income Group)

	Child Food Insecurity				
VARIABLES	Low Income Ineligible	Phase In	Full Credit	Phase Out	High Income Ineligible
Number of Age 17 Children	-0.0305	-0.00270	0.00427	0.00304	0.00307
	(0.0239)	(0.0157)	(0.00444)	(0.00422)	(0.00360)
Total Child Number	0.0171***	0.0130***	0.0196***	0.00659***	0.00353***
	(0.00500)	(0.00288)	(0.00119)	(0.00120)	(0.000968)
Black	0.0470***	0.0257**	0.0373***	0.0215***	0.0188***
	(0.0146)	(0.0105)	(0.00384)	(0.00538)	(0.00530)
American Indian/Aleut/Eskimo	-0.0130	-0.00931	0.0194**	-0.00279	0.0191
	(0.0339)	(0.0219)	(0.00945)	(0.0119)	(0.0170)
Asian or Pacific Islander	0.0422	0.0125	0.00496	0.00505	0.000929
	(0.0372)	(0.0220)	(0.00440)	(0.00358)	(0.00169)
Multiracial	0.0471	0.0632**	0.0297***	0.0175*	-0.00298
	(0.0374)	(0.0266)	(0.00871)	(0.00999)	(0.00572)
Marital Status	-0.0821***	-0.0617***	-0.0755***	-0.0268***	-0.0167***
	(0.0128)	(0.00760)	(0.00248)	(0.00346)	(0.00266)
High School Graduate	-0.0267*	-0.0189**	-0.0448***	-0.0215**	-0.0204
	(0.0138)	(0.00915)	(0.00420)	(0.0106)	(0.0149)
Some College	-0.0377**	-0.00486	-0.0464***	-0.0251**	-0.0245*
	(0.0153)	(0.0101)	(0.00422)	(0.0104)	(0.0146)
College Graduate or More	-0.133***	-0.0513***	-0.0872***	-0.0328***	-0.0298**
	(0.0219)	(0.0153)	(0.00419)	(0.0103)	(0.0144)
Head of Household Age	0.00351***	0.00143***	0.000174*	0.000147	7.11e-05
	(0.000484)	(0.000320)	(9.19e-05)	(0.000117)	(9.76e-05)
Hispanic	0.0350**	0.0136	0.0247***	0.00186	0.0119***
	(0.0167)	(0.0100)	(0.00334)	(0.00382)	(0.00449)
Constant	0.0361	0.152***	0.131***	0.0411***	0.0426**
	(0.0427)	(0.0348)	(0.0105)	(0.0144)	(0.0186)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes
Observations	6,826	15,824	99,992	23,320	19,068
R-squared	0.040	0.014	0.035	0.020	0.019

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The omitted groups reflected in the constant include white and less than high school graduate.

Table 6: Food Insecurity Raw Reduced Form Results (Separated by Income Group)

	Child Food Insecurity				
VARIABLES	Low Income Ineligible	Phase In	Full Credit	Phase Out	High Income Ineligible
Number of Age 17 Children	-0.0207	0.0529	0.0214	0.0151	0.0140
	(0.0867)	(0.0543)	(0.0141)	(0.0145)	(0.0116)
Total Child Number	0.0599***	0.0516***	0.0670***	0.0263***	0.0131***
	(0.0170)	(0.00936)	(0.00364)	(0.00382)	(0.00310)
Black	0.177***	0.127***	0.148***	0.0943***	0.0700***
	(0.0516)	(0.0354)	(0.0122)	(0.0188)	(0.0164)
American Indian/Aleut/Eskimo	0.0251	0.00764	0.0683**	-0.00392	0.0787
	(0.127)	(0.0715)	(0.0290)	(0.0366)	(0.0559)
Asian or Pacific Islander	0.0434	0.0566	0.0261*	0.0225	0.00681
	(0.126)	(0.0769)	(0.0142)	(0.0143)	(0.00648)
Multiracial	0.285**	0.220**	0.125***	0.0499**	-0.00175
	(0.135)	(0.0930)	(0.0283)	(0.0253)	(0.0176)
Marital Status	-0.277***	-0.229***	-0.264***	-0.108***	-0.0631***
	(0.0443)	(0.0248)	(0.00766)	(0.0114)	(0.00791)
High School Graduate	-0.0649	-0.0478	-0.163***	-0.0846**	-0.0541
	(0.0460)	(0.0292)	(0.0136)	(0.0370)	(0.0459)
Some College	-0.0596	-0.0159	-0.174***	-0.0908**	-0.0760*
	(0.0535)	(0.0323)	(0.0136)	(0.0367)	(0.0448)
College Graduate or More	-0.470***	-0.176***	-0.316***	-0.125***	-0.0945**
	(0.0693)	(0.0509)	(0.0135)	(0.0362)	(0.0444)
Head of Household Age	0.0107***	0.00545***	0.000778***	0.000298	5.89e-05
	(0.00162)	(0.00104)	(0.000288)	(0.000391)	(0.000282)
Hispanic	0.159***	0.0426	0.0957***	0.0109	0.0428***
	(0.0587)	(0.0325)	(0.0106)	(0.0138)	(0.0124)
Constant	0.255*	0.512***	0.487***	0.164***	0.137***
	(0.138)	(0.109)	(0.0335)	(0.0464)	(0.0514)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes
Observations	6,826	15,824	99,992	23,320	19,068
R-squared	0.040	0.020	0.048	0.030	0.026

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The omitted groups reflected in the constant include white and less than high school graduate.

6 Conclusion

Child food insecurity is a major national health concern because of the detrimental and long-lasting consequences it can have on children's physical, mental, and social well-being. Programs such as SNAP, TANF, and the EITC have historically been shown to reduce child food insecurity, but the Child Tax Credit may offer another avenue to support these efforts. The recent substantial changes to the CTC during the COVID-19 pandemic emphasized the possibility of using the CTC to provide public welfare support, particularly through increasing food security. With the end of the American Rescue Plan's CTC expansions igniting debates over the long-term viability of these programs and CTC support set to fall again to half the current maximum amount by 2025, it is crucial to assess the effects of this program on child food insecurity now.

Recent research focusing on the 2021 CTC expansions demonstrates that the payments significantly reduced food insecurity. However, the uniqueness of the COVID-19 pandemic along with the numerous policy changes outside of CTC limits the applicability of the research in evaluating the program's effects. In addition to these factors, the 2021 CTC diverged greatly from the historic structure of the CTC by advancing payments, expanding eligibility to lower-income families, and increasing the maximum value of the credit; it is difficult to separate which of these components, if any, were the driving factor in affecting child food insecurity levels. My paper contributes to existing literature by isolating the effect of increasing or decreasing the maximum monetary value of the CTC on child food insecurity in non-pandemic years.

My analysis utilizes a natural experiment that occurs because 17 year old children are not eligible for the credit. Holding the number of children in a household constant, I compare families with a 17 year old (who no longer provide their family the per child credit) to families with a younger child. My paper finds that losing the full value of the CTC ($1,000) increases the predicted probability of children being food insecure by a statistically insignificant .006 (0.6 percentage points) or 6.4% relative to the mean. Results additionally show that losing the full value of the CTC increases the raw composite child food insecurity score by 0.3 (on an 8-point scale) or 9% relative to the mean. This coefficient is statistically significant at the 10% level when not clustering standard errors by household. There are four potential reasons why these results may not find significant effects of the Child Tax Credit on child food insecurity and thus does not align with the recent 2021 CTC research.

For one, there could be something inherently different between 17 year olds and children who are younger than 17 that is affecting child food insecurity outside of the CTC. For instance, 17 year olds could be more likely to work which adds income to the family and may lower child food insecurity. This can be reducing the effects of losing the CTC and would bias my coefficient towards 0.

Additionally, the CTC money may only have a very short-term effect on child food insecurity. Because households receive the credit in the first third of the year and I use food insecurity data from following December, these results may not reflect the immediate effect of the CTC and the effect of the CTC may lessen or disappear over the following months. Families who are food insecure generally live month-to-month so it is plausible that they needed to spend the CTC money in the first couple of months and were not able to save enough for it to have effects on child food insecurity 6 to 12 months later ("Key Statistics & Graphics", 2022). This "immediacy" effect may be a reason why the 2021 CTC research found significant results of the CTC on child food insecurity while my analysis did not. Unlike the annual CTC payment during my time period, the 2021 CTC provided a monthly credit to families for the second half of the year. The research based on this Advanced CTC used monthly real-time measurements of food insecurity and therefore accounts for any very immediate effects of the credit. Further, if these immediacy effects are important for child food insecurity, the advanced nature of the credit could also be one reason that the 2021 CTC broadly affected child food insecurity more than the historical credit.

Third, food insecurity disproportionately affects families with lower incomes, and the $1,000 per child CTC may have a more significant impact on this group. However, households who receive the full credit are not part of this lowest income group due to the structure of the credit during my analysis. This is different from 2021 CTC which expanded the full credit to the lowest income families and hence could impact those most likely to be affected by food insecurity.

Last, it is possible that the CTC money is not being spent on increasing the quantity or healthiness of food for children. Because of the numerous policies enacted during the pandemic and the effect of the pandemic itself on several key factors including food insecurity levels itself, 2021 CTC research could be capturing other outside effects other than the CTC. The numerous surveys and research studies done demonstrate that this reason is probably unlikely (Parolin et al., 2021; Pilkauskas et al., 2022; Shafer et al., 2022).

Ultimately, with the CTC reverting back to its historical structure in 2022 and soon in 2025 reducing back to $1,000/child (from as much as $3,600/child during the pandemic), it is critical to understand which aspects of the 2021 CTC expansion, if any, policymakers need to keep. There are many avenues through which the CTC could be extended — including increasing the maximum credit amount, expanding those who are eligible, and advancing payments— and in order to understand how to change the CTC in the future they need to assess which aspects are truly affecting welfare. This cannot be done by exclusively studying the 2021 CTC. Further research needs to be done isolating different aspects of the credit through the historical CTC to evaluate the potentially detrimental effects of the current and future reduction in the program.

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Appendix

CPS Survey Questions Used to Calculate Raw Child Food Insecurity

1. “We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food.” Was that often, sometimes, or never true for you in the last 12 months?

2. “We couldn’t feed our children a balanced meal, because we couldn’t afford that.” Was that often, sometimes, or never true for you in the last 12 months?

3. “The children were not eating enough because we just couldn’t afford enough food.” Was that often, sometimes, or never true for you in the last 12 months?

4. In the last 12 months, did you ever cut the size of any of the children’s meals because there wasn’t enough money for food? (Yes/No)

5. In the last 12 months, were the children ever hungry but you just couldn’t afford more food? (Yes/No)

6. In the last 12 months, did any of the children ever skip a meal because there wasn’t enough money for food? (Yes/No)

7. (If yes to previous question) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

8. In the last 12 months did any of the children ever not eat for a whole day because there wasn’t enough money for food? (Yes/No)

Source: “Food Security in the U.S. Measurement”, 2022.

Table 7: Income Group Classification Based on AGI and Categorical Income

	Categorical Income Groups					
AGI Income Groups	Low Income Ineligible	Phase In	Full Credit	Phase Out	High Income Ineligible	Total
Low Income Ineligible	899	856	1,158	41	48	3,002
	(2.05%)	(1.96%)	(2.65%)	(0.09%)	(0.11%)	(6.86%)
Phase In	354	1,674	1,567	78	53	3,726
	(0.81%)	(3.82%)	(3.58%)	(0.18%)	(0.12%)	(8.51%)
Full Credit	315	1,324	22,026	3,534	2,393	29,592
	(0.72%)	(3.02%)	(50.32%)	(8.07%)	(5.47%)	(67.61%)
Phase Out	6	40	1,140	1,325	573	3,084
	(0.01%)	(0.09%)	(2.60%)	(3.03%)	(1.31%)	(7.05%)
High Income Ineligible	5	29	938	1,074	2,319	4,365
	(0.01%)	(0.07%)	(2.14%)	(2.45%)	(5.30%)	(9.97%)
Total	1,579	3,923	26,829	6,052	5,386	43,769
	(3.61%)	(8.96%)	(61.30%)	(13.83%)	(12.31%)	(100.00%)

Table cells report percentages (in parenthesis) and number of households in each cell.

Table 8: Descriptive Statistics (Separated by Income Group)

	Mean				
Variables	Low Income Ineligible	Phase In	Full Credit	Phase Out	High Income Ineligible
Food Insecurity (DV)	0.266	0.249	0.0932	0.0143	0.00718
Food Insecurity Raw	0.999	0.909	0.345	0.0588	0.0287
Number of Age 17 Children	0.0526	0.0513	0.0571	0.0576	0.0613
Total Child Number	1.930	2.581	1.766	1.873	1.840
Married	0.256	0.417	0.697	0.850	0.827
Head of Household Age	35.85	37.01	39.83	42.02	43.69
Hispanic	0.231	0.303	0.173	0.0722	0.0607
Race					
White	0.610	0.705	0.813	0.861	0.850
Black	0.306	0.209	0.109	0.0569	0.0500
American Indian/Aleut/Eskimo	0.0347	0.0343	0.0149	0.00626	0.00514
Asian or Pacific Islander	0.0253	0.0291	0.0452	0.0603	0.0822
Multiracial	0.0240	0.0225	0.0177	0.0157	0.0128
Highest Education Level					
Less Than High School Education	0.324	0.303	0.109	0.0193	0.0121
High School Graduate	0.368	0.365	0.304	0.140	0.0775
Some College	0.246	0.270	0.345	0.267	0.163
College Graduate or More	0.0626	0.0624	0.242	0.574	0.748
Observations	6,826	15,824	99,992	23,320	19,068

Table 9: First Stage - The Effect of a 17 Year Old Child on Total CTC (Separated by Income Group)

	Total Child Tax Credit				
VARIABLES	Low Income Ineligible	Phase In	Full Credit	Phase Out	High Income Ineligible
Number of Age 17 Children	-135.4**	-356.4***	-725.4***	-687.4***	-351.3***
	(63.72)	(78.81)	(12.42)	(40.07)	(26.50)
Total Child Number	116.6***	374.0***	783.9***	717.7***	393.1***
	(15.86)	(13.94)	(4.598)	(11.67)	(12.61)
Black	9.146	-49.84	-11.66	51.35	141.0***
	(49.59)	(52.88)	(14.19)	(48.48)	(48.97)
American Indian/Aleut/Eskimo	-207.7**	-191.7*	-138.2***	-41.52	301.3**
	(102.6)	(105.1)	(34.76)	(124.2)	(153.6)
Asian or Pacific Islander	48.42	-0.957	-47.30**	-17.80	51.05
	(142.8)	(106.4)	(20.36)	(45.58)	(40.28)
Multiracial	-28.60	88.80	-7.777	-0.373	-165.4*
	(132.3)	(121.9)	(31.24)	(88.54)	(88.10)
Marital Status	509.8***	793.7***	267.3***	-100.5***	-221.2***
	(44.53)	(38.44)	(9.299)	(30.85)	(28.37)
High School Graduate	91.30**	159.0***	98.05***	121.9	-77.39
	(46.47)	(47.21)	(15.43)	(84.92)	(100.1)
Some College	191.7***	183.2***	129.5***	96.02	-150.7
	(50.44)	(50.82)	(15.33)	(82.45)	(96.33)
College Graduate or More	203.5**	237.6***	93.75***	-91.53	-366.5***
	(83.26)	(80.52)	(16.13)	(81.39)	(94.32)
Head of Household Age	-2.081	-10.49***	-10.48***	-8.386***	-0.0170
	(1.554)	(1.628)	(0.378)	(1.200)	(1.228)
Hispanic	108.4**	106.1**	19.88	138.7***	132.0***
	(54.88)	(50.97)	(12.74)	(44.13)	(43.11)
Constant	-76.04	152.7	161.4***	424.3***	388.1**
	(156.4)	(165.9)	(44.08)	(146.5)	(183.2)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes	Yes
Observations	1,579	3,923	26,829	6,052	5,386
R-squared	0.180	0.320	0.593	0.421	0.231

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The omitted groups reflected in the constant include white and less than high school graduate. The income groups are separated based on categorical income value.

Table 10: Robustness Checks and Additional Analyses

	Food Insecurity Dummy Variable			
Variables	Main Regression (1)	Full Credit Group Income Under $75,000 (2)	16 Year Olds as Control Group (3)	Total Child Num Fixed Effects (4)
Number of Age 17 Children	0.00427	0.00467	0.00667	0.00376
	(0.00444)	(0.00525)	(0.00535)	(0.00445)
Total Child Number	0.0196***	0.0228***	0.0208***	
	(0.00119)	(0.00145)	(0.00291)	
Total Child Number FE				
Two Total Children				0.0210***
				(0.00212)
Three Total Children				0.0463***
				(0.00334)
Four Total Children				0.0587***
				(0.00595)
Five Total Children				0.0695***
				(0.0133)
Six Total Children				0.0475**
				(0.0226)
Seven Total Children				-0.0486**
				(0.0215)
Eight Total Children				0.0972
				(0.0992)
Nine Total Children				-0.0714***
				(0.00565)
Ten Total Children				-0.0668***
				(0.00824)
Constant	0.131***	0.116***	0.122***	0.149***
	(0.0105)	(0.0121)	(0.0316)	(0.0104)
Additional Controls	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes
Observations	99,992	81,407	15,453	99,992
R-squared	0.032	0.026	0.038	0.035

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The omitted groups that are reflected in the constant include: white (race) and less than high school graduate (education). The constant in Column 4 additionally reflects households with only one child. All regressions include the same set of demographic controls that were in the main regression.

Additional Notes: Column 1 displays the main regression as a comparison for the robustness checks. Column 2 runs the same regression as Column 1 with the subset of households in the full credit group making less than $75,000. Column 3 presents the results from the regression that limits the sample to families who have at least one 16 or 17 year old. Column 4 shows the results from the regression that includes *Total Child Number* as a fixed effect instead of a linear measurement.