

DISCUSSION PAPER SERIES

IZA DP No. 12233

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Expansion to Maternal Mental Health**

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*Urban Institute and IZA*

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**IZA – Institute of Labor Economics**

Schaumburg-Lippe-Straße 5–9  
53113 Bonn, Germany

Phone: +49-228-3894-0  
Email: [publications@iza.org](mailto:publications@iza.org)

[www.iza.org](http://www.iza.org)

## ABSTRACT

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# Credit Where It's Due: Investigating Pathways from EITC Expansion to Maternal Mental Health

While Earned Income Tax Credit (EITC) expansions are typically associated with improvements in maternal mental health, little is known about the mechanisms through which the program affects this outcome. The EITC could affect mental health through direct tax credit, changes in labor supply and changes in health insurance coverage of participants. To disentangle these mechanisms, we assess the effects of state and federal EITC expansion on mental health, employment and health insurance by maternal marital status. We find that federal EITC expansions are associated with 1) large positive effects on employment for unmarried mothers and 2) improved self-reported mental health for all mothers. State EITC expansion, which generate smaller changes in the effective wage rate, are associated with improvements in mental health for married mothers only and have no effect on employment for married or unmarried mothers. We find no impact of EITC expansions on health insurance coverage for married or unmarried mothers. These findings suggest that while EITC expansions improved mental health for unmarried mothers through a combination of the credit and employment, for married mothers, improved mental health is driven through the direct credit alone.

**JEL Classification:** H24, I12, I14

**Keywords:** earned income tax credit, state earned income tax credit, maternal mental health, labor supply, health insurance coverage

**Corresponding author:**

Anuj Gangopadhyaya  
Urban Institute Health Policy Center  
500 L'Enfant Plaza SW  
Washington, DC 20024  
USA

E-mail: [agangopadhyaya@urban.org](mailto:agangopadhyaya@urban.org)

## **1. Introduction**

Mental illness in adulthood can have adverse effects on a person's financial wellbeing and quality of life, and can have broader consequences for families, labor markets, and public programs. Mental illness in adulthood is associated with lower earnings and lower education attainment (Kessler et al., 2008; Breslau et al., 2008), while poor maternal mental health is associated with increased need for medical care among children (Thu Le and Nguyen, 2018). In addition, 26 percent of disabled workers receiving Social Security Disability Income (SSDI) were categorized as disabled based on mental health disorders, the second most common diagnostic group among SSDI recipients (Social Security Administration, 2016). Developing policies targeted to mental health will require a better understanding of its determinants and the potential mechanisms through which policy can affect mental health.

Previous studies of safety-net programs indicate that many policy interventions have the potential to affect mental health. Means-tested programs may be particularly effective due to the concentration of mental illness among low-income populations: more than 20 percent of nonelderly adults report having any mental illness and 40 percent of these adults have incomes below 200% of the Federal Poverty Level (Kaiser Family Foundation, 2014/2015). While recent state Medicaid expansions to cover low-income adults under the Affordable Care Act have not demonstrated wide-ranging short-term improvements in overall health, mental health has consistently been shown to improve following Medicaid expansions (Baicker et al., 2013; Simon et al., 2017; McMorroo et al., 2017). These improvements in mental health could be driven by increased access to and utilization of healthcare (Baicker et al 2013; Simon et al., 2017) or reduced financial distress through fewer medical debt collections and lower out-of-pocket

spending (Caswell and Waidmann, 2017; Hu et al., 2018; Abramowitz, 2018). However, researchers have not been able to separately identify these two potential mechanisms.

This study has two main objectives. First, we assess the impact of the Earned Income Tax Credit (EITC) program on the mental health of mothers with a high school degree or less education. The EITC provides refundable tax credits to low-income working families and is the nation's foremost poverty reduction program. We focus our analysis on mothers because maternal mental illness may be a source of intergenerational transmission of poverty (Thu Le and Nguyen, 2018) and because the EITC has been shown to directly affect maternal labor supply (Meyer and Rosenbaum 2001, Bastian 2017). Extending previous work by Evans and Garthwaite (2010), we assess the impact of more than two decades of federal expansions in EITC credits and the implementation of state-specific EITC programs on maternal mental health.

This study's second objective is to disentangle the mechanisms through which the EITC program influences mental health. We identify three potential pathways: First, the EITC tax credit alone could directly improve mental health by increasing family income. In 2015, the average EITC payment to families with children was \$3,186 (CBPP, 2016). Prior studies have found that pseudo-random increases in income can have positive effects on mental health (Lindahl, 2005; Banerjee et al., 2010; Snyder and Evans, 2006). Among households with incomes in the EITC-eligible range, the credit itself (independent of changes in earnings) has reduced the number of households in poverty by 32 percent (Chetty et al., 2013). The direct refundable tax credit individuals receive may affect mental health not only by reducing financial distress, but also by improving access to medical care and mental health treatment among low-income populations. Analysis of consumer banking data finds that out-of-pocket healthcare spending increases by 60 percent the week that individuals receive their tax refunds (Farell et al.,

2018). Nearly two-thirds of this spending is attributable to in-person spending at a site of care, suggesting that individuals delay needed healthcare due to cost.

Second, due to the structure of how the credit varies with earned income, and the incentives (and disincentives) it presents for work, expansions in the EITC program may affect the labor supply decisions of mothers, which in turn can influence health. The EITC's structure is designed to encourage labor force participation among single parents, but it also discourages labor force participation for some secondary earners in married couples.<sup>1</sup> Past studies observe that EITC expansions are associated with increased employment and labor force participation among unmarried mothers and a reduction in the labor supply of married low-income mothers who may use the cash windfall to substitute toward leisure from labor (Adireksombat, 2008; Meyer and Rosenbaum, 2001; Eissa and Hoynes, 2004). The impact of employment on mental health is theoretically ambiguous – the increased earnings from employment comes with the stress of work life and at the expense of non-work time.<sup>2</sup>

Third, the EITC program may affect mental health through the program's impact on health insurance coverage of those induced to work (Braughman, 2005; Hoynes et al., 2015). However, the effect of EITC on health insurance coverage is also ambiguous: EITC participants may obtain employer-sponsored insurance (ESI) by gaining employment but could also lose Medicaid eligibility if their earnings rise above program eligibility thresholds specified in their state of residence. Consequently, EITC expansions could increase insurance coverage, if those who were

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<sup>1</sup> See Nichols and Rothstein (2015) for a review of the literature surrounding the EITC program and maternal labor supply.

<sup>2</sup> Recently, there has been a sharp increase in interest studying the relationship between employment and health. Guidance from the Centers of Medicare and Medicaid Services motivated implementing work requirements in Medicaid by stating that “a growing body of evidence suggests that targeting certain health determinants, including productive work and community engagement, may improve health outcomes.” (Neale 2018). In this guidance, none of the accompanying citations address concerns of reverse causality or omitted variable bias.

previously uninsured gain ESI coverage, or decrease coverage, if low-income individuals lose Medicaid eligibility due to increased earnings and are employed at firms that do not offer ESI. As a potential indirect effect, EITC recipients could see improvements in mental health if they gain health insurance in response to program expansion.

Estimating the impact of income, employment, and health insurance coverage on mental health is challenging due to reverse causality or selection on unobserved attributes. Poor mental health may negatively impact productivity and labor supply and may influence health insurance coverage decision-making. To address this, we estimate the intent-to-treat effect of the EITC program on maternal mental health by exploiting variation in EITC benefits at both the state-year level (arising from the establishment or changes in state EITC programs over time) and family-size level (arising from two major federal changes in benefit structures based on family size). Because the EITC program has theoretically distinct effects on the labor supply of mothers who are primary and secondary earners, we stratify our results by marital status (Adireksombat, 2008; Eissa and Hoynes, 2004).

This study contributes to a large literature on the impact of income-related policies on population health (summarized in Aron et al., 2015) but also to a small but growing literature of the spillover health benefits of the EITC program (Strully et al., 2010; Evans and Garthwaite, 2014; Boyd-Swan et al., 2016; Hoynes et al., 2015, Braga et al. 2019). Two studies have previously documented the impact of the expansion of the federal EITC program on the mental health of nonelderly adult women following the Omnibus Reconciliation Acts of 1990 and 1993 (Evans and Garthwaite, 2014; Boyd-Swan et al., 2016). These expansions increased the typical benefit received, and, from 1993-1996, increased the differences between the maximum benefit available to families with two or more children as compared to families with only one child. Our

analysis is consistent with both studies, but also provides several contributions to the literature. First, we assess the impact of EITC expansions occurring over a much longer period (1993-2016), which allows us to exploit changes in the benefit schedule across family size generated by two changes in the federal EITC benefit structure. We also investigate the contribution that the lesser studied state EITC expansions may have had on mental health and employment during this period. State-specific EITC programs present added flexibility through which local employment and earnings shocks may be addressed, and, during this period, have become an increasingly used policy tool. Second, and most important, we investigate the mechanisms through which the EITC affects this maternal mental health. In addition to direct tax credit, we consider changes in labor supply and health insurance as potential mechanisms, which is important given the emerging consensus around the impact of Medicaid on adult mental health and was not examined by either of the aforementioned studies.

Using data from the Behavioral Risk Factors Surveillance System (BRFSS), we find that a \$1,000 increase in the maximum available credit is associated with a 4.0 percent reduction in the likelihood of reporting any poor mental health days in the past month for married mothers and a 4.7 percent reduction for unmarried mothers. This estimate is robust to the inclusion of various state policy and demographic controls as well as state-specific time trends. In our assessment of mechanisms, we find little evidence that changes in the EITC benefit structure affect uninsured status of mothers in our sample. Consistent with prior literature, we find that federal EITC expansions are associated with increased employment for unmarried mothers and small reductions in employment for married mothers. Since effects of EITC expansions on maternal mental health are concentrated among both subgroups, we conclude that the likely primary mechanism through which the EITC impacts maternal mental health is through the direct



refundable tax credit received for married mothers and potentially a combination of the credit and its employment effects for unmarried mothers. State-specific EITC expansions are associated with improved mental health for married mothers only, and have no observed impact on employment for married or unmarried mothers. Therefore, for state-specific programs, the direct income credit is likely the only channel through which state EITC programs affect mental health for married mothers.

## 2. Background

### A. Federal and state EITC programs

The EITC program was established in 1975 and has grown to be one of the most important means-tested transfer programs in the country. There were over 27 million recipients of the program sharing about \$65 billion in total EITC federal expenditures in 2017 (IRS 2018).<sup>3</sup> In addition to the federal program, 26 states (including the District of Columbia) have established their own state EITC supplements. In most cases, state EITC programs are refundable credits equal to a specified share of the federal EITC.

While the benefits of the program have increased substantially since its introduction, the main structure of the program has remained the same. The EITC is a tax credit program targeted to low-wage earners and eligibility is based on family structure, earnings, and state of residence. The tax credit increases for the lowest section of the wage distribution (referred to as the “phase-in” section), holds steady for a subsequent section of the wage distribution, and then decreases for a section of the wage distribution until it reaches zero (a “phase-out” section). This creates a trapezoidal benefit structure by wage level (Figure 1). The shape of this trapezoid (i.e. the height

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<sup>3</sup> <https://www.eitc.irs.gov/partner-toolkit/basic-marketing-communication-materials/eitc-fast-facts/eitc-fast-facts>

and the slopes of the phase-in/phase-out regions) varies by year, marital status, family size, and, in the case of states that augment the federal EITC with their own state program, by state of residence. For all regions of the EITC benefit structure, the size of the credit has generally grown over time.

The largest changes in the maximum credit were driven by two federal expansions for larger family sizes and the introduction of state EITCs. Beginning in 1993, families with two or more children received larger credits relative to families with just one child, while a small credit was added for families without children (Figure 2). Beginning in 2009, the EITC program paid greater credits to families with three or more children and for married couples.

State EITC programs began in 1986, as Rhode Island established their own nonrefundable EITC equal to a percentage of the federal credit. As of 2016, 26 states and the District of Columbia had implemented state EITC programs. Between 1993-2016, our available years of analysis, 21 states enacted their own EITC programs were enacted. As shown in Table 1, there is substantial variation in state EITC programs' matching percentages within states across time, ranging from 4 percent in Louisiana to 85 percent in California.

#### *B. Differences in EITC exposure by maternal marital status*

In addition to family size, the EITC uses total family income to calculate credits. The distribution of total family income of married mothers is to the right of unmarried mothers, and consequently a lower share of married mothers receive EITC relative to unmarried mothers. Panel A in Figure 3 indicates that about 60 percent of unmarried mothers with a high school degree or less education receive EITC payments at their median family income; at the median family income for married mothers with a high school degree or less, about 10 percent receive EITC payments (Panel B).

However, because the EITC is also conditional on earned income, there exists a critical difference in exposure to EITC between *nonworking* married and unmarried mothers. The earned family income for nonworking unmarried mothers is extremely low and therefore the share receiving any EITC payments is low as well — less than 1 percent of nonworking unmarried mothers receive any EITC payments at their median family income (Panel C). For married mothers who are not working, approximately 20 percent receive EITC payments (Panel D). That is, at group-specific median family incomes, nonworking married mothers are *twice* as likely to receive EITC payments as married mothers at large. Unmarried mothers who do not work, on the other hand, have almost zero chance of receiving any EITC payments (a 60-percentage point difference relative to unmarried mothers at large).

Importantly, if the EITC program fails to incentivize a married mother with a high school degree or less education to enter the labor force, her chance of receiving any EITC is likely either unaffected or *increases* because of the implications this has on the distribution of total family income. If the EITC program fails to incentivize an unmarried mother to enter the labor force, her chances of receiving any EITC is likely eliminated. Clearly, the EITC program creates distinct labor supply incentives for married and unmarried mothers.

### **3. Data and Sample**

Our primary data source is the 1993-2016 Behavioral Risk Factor Surveillance System (BFRSS). The BFRSS is an annual telephone survey of adults conducted by the Centers for Disease Control and Prevention. The survey is conducted continuously throughout the year and collects information on health risk behaviors, health care access, and health outcomes. The BFRSS averages around 300,000 observations over our period of analysis and includes detailed demographic information and state identifiers, which makes it particularly valuable for analyzing

state-varying policies such as the EITC. Our primary outcomes of interest are derived from the following survey question: “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?”<sup>4</sup> We construct two measures of mental health from this question: 1) an indicator for whether the individual experienced any days of poor mental health in the past 30 days and 2) the number of days of poor mental health in the past 30 days.<sup>5</sup>

We also use questions on the BRFSS related to employment status, health insurance status (measured in the BRFSS as insured or uninsured), and health care access to analyze the mechanisms through which the EITC could affect mental health. The BRFSS includes two measures related to access to care. The first measure is an indicator for whether the respondent identifies an instance of needing to see a doctor but could not due to cost. This question is assessed in every survey year of the BRFSS except for 2002. The second measure is an indicator for whether individuals had a routine checkup with a doctor in the past year. This question is asked in every survey year of the BRFSS except for 2003 and 2004.

Our sample on the BRFSS includes all nonelderly mothers with no more than a high school degree who report a child less than 18 years old in their household. We use educational attainment as our sample selection criteria because income is poorly measured on the BRFSS and endogenous to our research question. Given the strong relationship between low education levels

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<sup>4</sup> Slabuagh et al. (2017) demonstrate that this question, in addition to other survey questions from the BRFSS *Health Days* survey instrument, tracks well with standard clinical measures of mental health disorders. Individuals diagnosed with serious psychological disorders or depression report far higher poor mental health days relative to those who do not.

<sup>5</sup> Through 2010, the BRFSS samples respondents from landlines only. After 2010, the survey combined responses from landlines and cellphones. Cellphone access by may vary by state and may be associated with EITC expansion; in all regression models described in our econometric approach below, we include an indicator identifying mothers responding to the cellphone survey to control for within-state compositional changes in the sample.

and low-income levels in the United States, we expect this group to be the segment of the population targeted by the EITC.

Table 2 presents summary statistics for our sample overall and stratified by marital status. Forty percent of married mothers report having at least one day of poor mental health in past month and averaged about 4 days of poor mental health in the past month. Nearly half of all unmarried mothers with high school degree or less education experience at least one day of bad mental health in the past month and average nearly 6 days of poor mental health in the past month. More than a quarter of married mothers are uninsured and 53 percent are working. More than 30 percent of low-educated unmarried mothers are uninsured and slightly more than half report employment at the time of the survey. Married and unmarried mothers are exposed to similar EITC benefits, indicating that these groups are not distinctively different in terms of geographic residence or the number of children in the household, the two parameters determining EITC benefit size in our econometric approach

We obtained data on EITC policies and state-level controls from the University of Kentucky Center for Poverty Research National Welfare Data (UKCPR), the Urban-Brookings Tax Policy Center, and the March Current Population Survey (CPS). From the UKCPR dataset, we use federal EITC amounts, state EITC information, state and federal minimum wage laws, whether a state had a Democratic governor, and the AFDC/TANF cash benefit for a family of four by state. We obtained state revenue per capita from the Tax Policy Center and state-level demographic data from the March CPS.

#### **4. Econometric approach**

##### *A. Difference-in-differences Approach*

Our econometric models exploit state, time, and family size variation in the maximum tax credit for the EITC program. We use a difference-in-differences specification with a continuous treatment measure – the maximum tax credit available in each state, year, and family size cell. Our main specification is described below:

$$(1) y_{isft} = \alpha + \theta_s + \gamma_f + \lambda_t + \beta_1(EITC_{sf(t-1)}) + \Gamma'X_i + \Phi'Z_{st} + \theta_st + \epsilon_{isft}$$

In (1),  $y_{isft}$  is the outcome of interest for person  $i$ ;  $\theta_s$ ,  $\gamma_f$ , and  $\lambda_t$  represent indicators for state  $s$ , number of children in family  $f$ , and survey quarter/year  $t$ , respectively;  $X_i$  represent individual characteristics, including indicators for age group, racial and ethnic group, marital status, and high school degree;  $Z_{st}$  represents state-contextual variables, including parental Medicaid eligibility thresholds, an interaction between state ACA Medicaid expansion status and a post 2014 indicator, the share of state population age 0-17, share age 65 or older, share black non-Hispanic, share Hispanic, and share other non-Hispanic race. Because state EITC generosity might be related to minimum wage legislation, welfare benefits, and political atmosphere—all of which may be related to mental health—we further test the sensitivity of our estimates to the inclusion of controls for state minimum wage, AFDC/TANF needs standards, and an indicator for whether the governor of the state is a Democrat.

The variable  $EITC_{sf(t-1)}$  is the exposure to the EITC program in 2015 dollars.<sup>6</sup> It is the maximum credit a family could receive given their state of residence, family size, and tax year, regardless of own family income or parental marital status. We merge on the maximum credit schedule available in the year prior to the survey; therefore, this represents the maximum credit

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<sup>6</sup> We use the Consumer Price Index for Urban Consumers from the Bureau of Labor Statistics to adjust for inflation.

they could *receive* in the year of the survey.<sup>7</sup> The coefficient  $\beta_1$  represents the intent-to-treat effect of a \$1,000 increase in the maximum available EITC credit in the previous year on our outcomes of interest. The identifying assumption of the difference-in-differences model is that prevalence of poor mental health for high treatment intensity groups would have trended similarly to those of lower treatment intensity groups had there been no difference in EITC credits. Our main specification also includes state-specific linear time trends ( $\theta_{st}$ ) to control for differing trends across states in mental health. All standard errors are clustered at the state-level.

This approach has several limitations. We do not observe which mothers do and do not receive the tax credit and do not know where mothers are located in the wage distribution prior to EITC expansions. Therefore, we cannot directly observe samples of mothers in different regions of the EITC benefit schedule (i.e. in the phase-in or phase-out sections) who face distinct labor supply incentives. Moreover, our difference-in-differences estimation strategy is threatened if our comparison groups (mothers of differentially sized families or mothers in states that did not implement EITC expansions) are not appropriate counterfactuals to treated mothers. This may occur if EITC expansions impact fertility, migration, or marital decisions. However, several studies have shown that EITC expansions have little association with fertility effects (Baughman and Dickert-Conlin, 2009). In addition, we explore whether EITC expansions are associated with changes in state-to-state migration or marital status using data from the American Community Survey (ACS) and the BRFSS in Appendix Table A1. We find no association between the EITC expansions and interstate migration between 2006-2016 using the ACS; no association between EITC expansion and the likelihood of being married in the previous year between 2008-2016

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<sup>7</sup> For example, for a mother in our sample in the year 2000, we merge on the EITC benefit schedule from 1999. She would receive the tax credit for her 1999 earnings, family size, and state of residence, in the spring of 2000.

using the ACS; and, no association between EITC expansions and marital status in the BRFSS for the years 1993-2016.

### *B. Examining State EITC policies*

Using several methodological approaches, we further assess the impact of state-specific programs that were implemented during this period on maternal mental health and maternal labor supply. First, we use a model similar to equation (1), except replace the maximum credit families would earn with a state-level binary indicator for whether the mother's state of residence has a program in effect:

$$(2) \quad y_{isft} = \alpha + \theta_s + \gamma_f + \lambda_t + \beta_1(STATEEITC_{s(t-1)}) + \Gamma'X_i + \Phi'Z_{st} + \theta_{st} + \mu_{isft}$$

In equation (2),  $STATEEITC_{s(t-1)}$  is an indicator that is 1 for state-year combinations that have a separate state EITC program in place. However, as described in Table 1, state programs exhibit a wide range in generosity. To investigate the relationship between program generosity and our outcomes of interest, we estimate a model similar to (2) but directly use the state EITC multiplier (entering it as zero for states with no program in effect) rather than the binary indicator.

The analysis in equation (2) depends on a parallel trends assumption that mothers in treated states would have trended similarly to mothers in untreated states in mental health measures and employment in the absence of these policies. One way to assess this is to investigate whether mothers were trending similarly in these outcomes in the years leading up to policy implementation. To test this assumption, we implement an event-history model described below:



$$(3) \quad y_{isft} = \alpha + \theta_s + \gamma_f + \lambda_t + \sum_{k=-5}^{-2} \beta_k (\text{Expand}_s \times \text{Multiplier}_s \times \text{Year}_k) + \sum_{k=0}^4 \omega_k (\text{Expand}_s \times \text{Multiplier}_s \times \text{Year}_k) + \Gamma' X_i + \Phi' Z_{st} + \theta_{st} + \eta_{isft}$$

In equation (3),  $\text{Expand}_s$  is an indicator for whether each mother lives in a state that will expand their EITC programs during the analysis period and  $\text{Multiplier}_s$  is the average EITC state multiplier in the post period. We interact these two variables with indicators for the year relative to policy implementation ( $\text{Year}_k$ ). We include 5 years prior to policy implementation ( $k < 0$ ), the year of implementation ( $k = 0$ ), and 4 years after the year of implementation ( $k > 0$ ).<sup>8</sup> By interacting the event indicator with the average size of the state's credit multiplier in the post period, we incorporate heterogeneity in program generosity across states. We assess whether the 5 pre-period interactions ( $\beta_{-5}$  through  $\beta_{-2}$ ) are statistically zero. Any policy effects should be observed in the period of implementation and sustained in the years after ( $\omega_0$  through  $\omega_4$ ).

## 5. Results

### A. *Impact of Federal and State EITC Expansions on Maternal Mental Health, Employment, and Insurance Coverage*

Table 3 presents results on the impact of changes in the EITC maximum credit on maternal mental health for married and unmarried mothers. For each group, the first column provides our baseline specification controlling for individual and state-level contextual variables. The second column reports the results from models adding state-linear trends and the third column displays our preferred model that adds state-linear trends and state political and economic controls to the baseline specification. We use two measures of mental health: an

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<sup>8</sup> In equation (3) and throughout this paper, the year prior to implementation ( $k = -1$ ) is the omitted reference year.

indicator of experiencing any days of poor mental health in the past 30 days (extensive margin) and the number of poor mental health days in the past 30 days (the intensive margin).

Overall, a \$1000 increase in the maximum EITC benefit is associated with a 1.6 percentage point (4.0 percent relative to sample average) and a 2.3 percentage point (4.7 percent) reduction in the likelihood of experiencing any days of poor mental health day in the past 30 days for married and unmarried mothers, respectively. These estimates are robust across model specifications and are not sensitive to the inclusion of state-specific time trends or state economic and political controls. For the intensive margin measure, a \$1000 increase in the maximum EITC benefit is associated with 0.254 fewer poor mental health days in the past month among married mothers. The magnitude associated with EITC expansion is similar (-.207 days) for unmarried mothers, but this estimate is not significant at the 95 percent level. Altogether, estimates in Table 3 demonstrate that EITC expansions are associated with a reduction in poor mental health days among single and married mothers with a high school degree or less, a finding consistent with the results from Evans and Garthwaite (2014).

We assess the potential mechanisms driving these estimated changes in mental health in Table 4. The top row shows aggregate effects for each sample. For married and unmarried mothers, we observe no significant relationship between EITC expansions and uninsured status. However, EITC expansions have significant effects on employment, in opposite directions, for these groups. We find that a \$1,000 increase in the maximum benefit is associated with a 0.8 percentage point *decrease* in employment for married mothers and a 3.1 percentage point *increase* in employment for unmarried mothers. These employment results are consistent with the findings of Eissa and Hoynes (2004), who find that the EITC expansions of the 1980s and 90s reduced labor force participation among married women, and Meyer and Rosenbaum (2001),

who find that EITC expansions are associated with increases in the employment of single mothers.

Table 4 also stratifies samples by race (white vs. non-white), age (ages 18-44 vs. ages 45-64), and education (no high school degree vs. high school graduate). There are three key findings. First, among both married and unmarried mothers, EITC expansions are associated with improved mental health among nearly all subgroups, with older mothers (between the ages of 45-64) as the sole exception. Second, there is no significant association between EITC expansion and insurance coverage in 10 of the 12 subgroups analyzed, largely ruling out changes in insurance coverage (through EITC) as a mechanism for improved mental health. Third, for married mothers, all employment effects are negative and most are statistically indistinguishable from zero, but for unmarried mothers EITC expansions are associated with positive and significant employment effects (between 2.4-3.3 percentage points) among *all* subgroups. Despite experiencing differential effects on employment, both married and unmarried mothers reported improved mental health following expansions in the EITC program, suggesting mixed evidence on the role of employment as a potential mechanism.

The final potential pathway to improved mental health is through the added income associated with the direct refundable tax credit individuals receive. As discussed, this income can improve mental health in a variety of ways, for example, by reducing financial distress or through expanded access to medical care if individuals increase out-of-pocket healthcare spending after receiving their tax refunds. Table 5 explores this latter hypothesis by repeating the subgroup analysis in Table 4 using two measures of access to medical care. Broadly, we find that the EITC is associated with improved access to medical care for both married and unmarried mothers *despite* having no measured impact on insurance coverage. A \$1,000 increase in the

maximum credit is associated with a 1.1 percentage point decrease in the likelihood of not seeing a doctor due to cost in the past year among married mothers and a 0.9 percentage point decrease among unmarried mothers. For unmarried mothers with less than a high school degree, the sole subgroup for which EITC expansion are associated with increased uninsured rates, EITC expansions are associated with a 1.6 percentage point reduction in the likelihood of not visiting a doctor due to cost, the largest magnitude effect among all subgroups of unmarried mothers. A \$1000 increase in the maximum EITC benefit is also associated with a 0.6 percentage point increase in the likelihood of visiting a doctor in the past year for married mothers, but there is no change associated with unmarried mothers, suggesting that cost is not the sole barrier to care unmarried mothers in our sample.

#### *B. Lead and Lag Effects of EITC Expansions on Mental Health*

Our difference-in-differences research design hinges on the parallel trends assumption that mothers who were differentially exposed to EITC expansions would have trended similarly in terms of mental health in the absence of changes to the EITC benefit schedule. In Table 6, we investigate whether future EITC expansions (i.e. occurring after the time of the survey) have any association with mental health at the time of the survey, which would be indicative of nonparallel trends. Moreover, we assess whether there are dynamic mental health responses to EITC expansions by investigating whether past EITC expansions (i.e. before the time of the survey) are associated with improved maternal mental health at the time of the survey.

The first three columns in Table 6 assess the impact of EITC expansions including expansions occurring after the time of the survey. We include our main EITC expansion estimate in the year prior to the survey in these models because 1) we would like to test the sensitivity of this estimate to the inclusion of other timed expansions and 2) to help control for the collinearity

between the maximum credit available at the time of the survey and the maximum credit available in the surrounding periods.<sup>9</sup> EITC expansions after the survey should have no association with mental health at the time of the survey. Each column in this panel represents estimates from a single regression. These regressions only use data from 1993-2013 because we choose to investigate expansions occurring up to two years after the survey, and since our data on EITC benefits is through 2016.

When restricting the analysis to these years, we observe that EITC expansions are associated with a 1.5 percentage point reduction in the likelihood of experiencing any days of poor mental health in the past 30 days for married mothers, and a 2.0 percentage point reduction for unmarried mothers. For married mothers, this estimate is not sensitive to the inclusion of EITC expansions occurring in the years after the survey. Expansions occurring one or two years after the survey have no association with mental health at the time of survey (columns 2 and 3). For unmarried mothers, expansions occurring one year or two years after the survey are also statistically indistinguishable from zero.

Columns 4 and 5 of Table 6 explore whether EITC expansions in the past have lasting effects on maternal mental health. We find that for both married and unmarried mothers, past expansions in the maximum EITC credit have no association with maternal mental health at the time of the survey, indicating that treated mothers do not experience continuously diverging mental health relative to untreated mothers. Further, we observe that the estimate of the main effect of EITC expansions occurring in the year prior to the survey *increases* in magnitude. Since

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<sup>9</sup> We keep at least a two-year gap rather using consecutive years in this analysis. This is because maximum credits in consecutive years are highly predictive of one another, resulting in large standard errors, and makes our falsification test exposed to Type-II errors. For example, using our main model specification with the EITC credit in year (t+1) as the dependent variable, the coefficient on the EITC credit in year (t) is 0.8. Using the credit in year (t+2) as the dependent variable, the coefficient on the EITC credit in year (t) drops to 0.5.

there is strong collinearity in EITC expansions by state and family size, controlling for EITC expansions in the past further pinpoints the timing on our main estimate; the increase in the magnitude of our main parameter suggests that the omission of previous EITC expansions leading up to the time of the survey dilutes the estimated main effect.

### *C. The Contribution of State EITC expansion*

In this section, we assess the impact of state-specific EITC programs on maternal mental health and employment. Our primary model uses two sources of EITC variation. We use variation arising from federal expansions, which allocate differential credits based on the number of children in the household (Figure 1). We also use variation from implementation and changes to state-specific EITC programs. Expansions at the federal- and state-level may have differing impacts on mothers due to differences in credit size and differences in population awareness about expansions. In Appendix Table A2, we assess the contribution of federal expansions by removing all states that have a state EITC program in place by 2016. This restricts our analysis to 25 states and exploits just family size variation to assess the impact of EITC credit expansions on maternal mental health and employment. In these models, increases in the maximum federal credit are associated with modest to no improvements in the likelihood of experiencing any bad mental health days in the past 30 days for married and unmarried mothers. While federal EITC expansions have little association on maternal health on this extensive margin, we find that they are associated with large reductions on the number of days of poor mental health among both married and unmarried mothers. We find that federal expansions in the EITC are associated with negative employment effects for married mothers and positive, large, and significant employment effects for unmarried mothers. Our results are largely consistent with our main findings and with Evans and Garthwaite (2004).

Table 7 exploits variation in state-specific EITC programs. Panel A uses an indicator for whether the state has a state-specific EITC program in effect; outcomes in states that did not have EITC programs serve as counterfactual trends. Following the implementation of a state EITC program, the likelihood of married mothers having a poor mental health day in the past 30 days is reduced by 4 percentage points and the number of poor mental health days decreases by 0.28 days. We find no corresponding effects for unmarried mothers. State EITC expansions are not associated with any change in employment for married mothers or for unmarried mothers.

Using an indicator to describe state EITC variation ignores heterogeneity in the amount of additional credit made available among states that have a state EITC program in effect. In Panel B we exploit variation in the EITC state multiplier to assess the impact of EITC expansion on maternal mental health – states without separate EITC programs are included in the analysis with a multiplier of zero. Coefficients in these models are interpreted as increasing the multiplier from 0% to 100%, equivalent to doubling the federal credit. We find that for married mothers, a 10-percentage point increase in the state EITC credit multiplier is associated with 2.8 percentage point reduction in the likelihood of having a poor mental health day and a .25 decrease in the number of days of poor mental health in the past month. As with our previous model isolating state EITC programs, increases in the state multiplier have no association with improved mental health among unmarried mothers. Employment results in Panel B are consistent with Panel A: where federal expansions are associated with meaningful changes in maternal labor supply, there is little relationship between state-specific EITC programs and maternal employment.

Finally, we implement an event-history model to assess the timing of state EITC programs and to investigate whether mothers in treated states exhibited distinct trends in outcomes relative mothers in untreated states in the years leading up to policy implementation

(equation 3). Our results are presented in Figure 5.<sup>10</sup> In all models, the year just prior to implementation (-1 in Figure 5) is set as the reference year. As noted in our methodological approach, these policies are scaled by the average EITC multiplier in the post period for each state. Therefore, the interpretation of the coefficient at year 0 (the year of implementation) is the impact of a state EITC policy that has a 100% multiplier, equivalent to doubling the federal credit.

The top panel in Figure 4 investigates the relationship between any days of poor mental health in the past 30 days and state EITC implementation for unmarried and married mothers. For both married and unmarried mothers, the years leading up to policy intervention are not associated with distinct trends in mental health. This suggests that there are no distinct pre-trends in the share of mothers with any bad days of mental health in the past 30 days across treated and untreated states in the years leading up to policy implementation. Of the 8 pre-policy coefficients presented in Table A3, just one is significant at the  $p < 0.05$  level. In the year of implementation and subsequent years after implementation, there is no significant change in mental health for unmarried mothers, consistent with both panels of Table 7. For married mothers, there is a sharp, significant decrease in the likelihood of experiencing any bad days of mental health in the year of implementation. This is sustained for 3 years before trending back up toward zero about 4 years out.

The bottom panel of Figure 4 investigates the impact of state EITC expansions on maternal employment. For both married and unmarried mothers we observe that these state programs had no effect on employment, consistent with findings in Table 6. As shown in Figure 3, because employment for unmarried mothers is unchanged, very few *new* unmarried mothers

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<sup>10</sup> Corresponding point estimates for Figure 5 are reported in Appendix Table A3.



are affected by state-specific EITC programs. Married mothers, on the other hand, will still have considerable exposure to state EITC irrespective of their employment status.

## **Conclusion**

Overall, we find that EITC expansions improved maternal mental health for married and unmarried mothers with a high school degree or less education, did not have a significant effect on health insurance status, and had varying effects on employment. These findings are robust to several model specifications and our estimates are not sensitive to the inclusion of state-specific time trends (as demonstrated in Table 3). We also observe no lead-in effects (Table 6) of EITC expansion nor evidence of non-parallel trends in outcomes for mothers across states with differentials in state EITC generosity (Figure 4).

Despite differential responses on employment, both married and unmarried mothers experience improvements in mental health following expansions in the EITC program. Married mothers exhibit small decreases in employment and no change in health insurance coverage, suggesting that improvements in mental health for this sample are likely driven by the direct tax credit received following EITC expansion. For unmarried mothers, EITC expansion is associated with both an increase in labor supply (and, therefore, likely an increase in earnings from work) *and* additional income received through the tax credit.

Among unmarried mothers with a high school degree or less, federal expansions in the EITC are associated with strong employment effects, but state expansions in the EITC are not. This is likely because federal expansions created larger changes in the effective wage rate relative to state EITC expansions. For example, consider an unmarried mother of two children in 1993 with the option of working 50 weeks of the year, 30 hours per week, and earning \$10,000 a year. Her hourly wage rate (or opportunity cost for not working) is about \$6.67. In 1993, she

would receive an additional maximum credit of \$1,511, raising her effective hourly wage rate to \$7.67. In 1996, when the federal expansion in the EITC benefit to families with two or more children is fully phased-in, the same unmarried mother of two would receive a maximum credit of \$3,556, raising her effective hourly wage to \$9.04, an 18 percent increase in her wage rate prior to the federal expansion. By comparison, the average state multiplier is 16 percent. Applied to our hypothetical unmarried mother of 2 in 1993, if a state EITC program were established with this average 16 percent multiplier, her state and federal credit total would be \$1822, which translates into an effective wage of \$7.88, or a 2.7 percent increase in her effective wage rate. We find that such small changes in the effective wage rate created by the state EITC expansions did not induce changes in employment among unmarried mothers.

Because state EITC expansions have little-to-no effect on maternal employment, state EITC expansions accrue credits only to unmarried mothers who are already working, which may be why we observe no measurable reduction in bad mental health days following state EITC expansions for this sample. Ultimately, for unmarried mothers, we are unable to disentangle these employment and income pathways. For married mothers, state EITC expansions have no impact on employment and federal expansions have modest *negative* effects on employment. If spouses of married mothers are predominantly working, larger percentages of this sample will receive the tax credit benefit following both federal and state expansions relative to unmarried mothers. Indeed, married mothers experience a modest and marginally significant reduction in bad mental health days following federal expansions and substantial reductions in bad mental health days following state EITC expansions. For this group, the sole mechanism likely affecting mental health is the increased income received from the credit.

These findings suggest that programs providing income supports for the poor such as SNAP, TANF, and unemployment benefits are likely to provide maternal mental health benefits. Medicaid expansion under the ACA made public health insurance available to low-income adults and is also associated with improved mental health (Baicker et al., 2013). Of the two primary pathways through which Medicaid may impact mental health, healthcare access and financial wellbeing, evidence drawn in this study from the EITC program indicates that the financial wellbeing pathway cannot be ruled out.

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**Table 1.** State EITC Programs Implemented Between 1993-2016

<b>State</b>	<b>Year of Implementation</b>	<b>Average EITC Multiplier</b>
California	2016	85%
Colorado	1999	10%
Connecticut	2011	29%
Delaware	2006	20%
District of Columbia	2000	34%
Illinois	2000	6%
Indiana	2003	7%
Kansas	1998	15%
Louisiana	2008	4%
Maine	2000	5%
Massachusetts	1997	15%
Michigan	2008	9%
Nebraska	2006	10%
New Jersey	2000	21%
New Mexico	2007	10%
New York	1994	26%
North Carolina	2008	5%
Ohio	2014	8%
Oklahoma	2002	5%
Oregon	1997	6%
Virginia	2006	20%

Source: University of Kentucky Center for Poverty Research. 2016. "UKCPR National Welfare Data, 1980-2016." Gatton College of Business and Economics, University of Kentucky, Lexington, KY. <http://www.ukcpr.org/data>.

**Table 2. Sample Means for mothers with a high school degree or less, BRFSS 1993-2016**

	All Mothers	Married Mothers	Unmarried Mothers
<i>Outcomes/Mechanisms</i>			
Any Days or Bad Mental Health in past month	0.44	0.40	0.49
Number of Days of Bad Mental Health in past month	5.03	4.23	5.98
Uninsured	0.29	0.26	0.32
Employed	0.52	0.53	0.52
Could not see doctor due to cost	0.25	0.23	0.28
Routine Check-up in past year	0.67	0.67	0.68
<i>EITC</i>			
EITC Maximum Credit (\$2015)	\$4,651	\$4,653	\$4,648
State EITC (binary)	0.25	0.23	0.28
State EITC multiplier	0.04	0.03	0.04
<i>Individual Demographics</i>			
Age	34.69	36.97	31.98
Number of Children	2.01	2.06	1.96
Less than High School Degree	0.32	0.28	0.36
High School Degree	0.68	0.72	0.64
White, non-Hispanic	0.52	0.61	0.42
Black, non-Hispanic	0.15	0.07	0.24
Hispanic	0.29	0.28	0.29
Other race, non-Hispanic	0.05	0.04	0.05
<i>State contextual variables</i>			
Share of state pop. white, non-Hispanic	0.66	0.66	0.65
Share of state pop. black, non-Hispanic	0.12	0.12	0.13
Share of state pop. Hispanic	0.16	0.16	0.16
Share of state pop other, non-Hispanic	0.06	0.06	0.07
Share of state pop ages 0-17	0.25	0.26	0.25
Share of state pop ages 65+	0.12	0.12	0.13
AFDC/TANF benefits for family of 4	\$620	\$624	\$615
State governor is Democrat	0.43	0.43	0.43
Minimum Wage	\$7.36	\$7.32	\$7.42
Observations	452,886	240,761	212,125

Notes: Sample restricted to mothers with a high school degree or less. All sample means use survey weights.



**Table 3. Effect of \$1,000 increase in the maximum Earned Income Tax Credit on the mental health of Mothers with a High School Degree or Less, by marital status**

	Married Mothers			Unmarried Mothers		
	(1)	(2)	(3)	(1)	(2)	(3)
Any days of poor mental health, past 30 days	-0.018** (0.006)	-0.016** (0.006)	-0.016** (0.006)	-0.022** (0.006)	-0.023** (0.006)	-0.023** (0.006)
Mean	0.40	0.40	0.40	0.49	0.49	0.49
Number of poor mental health days, past 30 days	-0.287** (0.106)	-0.257** (0.107)	-0.254** (0.106)	-0.214* (0.123)	-0.210* (0.118)	-0.207* (0.119)
Mean	4.36	4.36	4.36	6.53	6.53	6.53
Observations	240,761	240,761	240,761	212,125	212,125	212,125
State linear trends	N	Y	Y	Y	Y	Y
State political and economic Controls	N	N	Y	N	N	Y

*Notes:* BRFSS 1993-2016. Sample restricted to mothers with a high school degree or less. OLS estimates reflect the intent-to-treat impact of a \$1,000 increase in the maximum EITC credit on the number of poor mental health days. All regressions include state fixed effects, time fixed effects (quarterly frequency), and indicators for number of children in the family, race/ethnicity, gender, age group, education, and marital status. All regressions also include state-level contextual variables including parental Medicaid eligibility income limits, an interaction between state ACA Medicaid expansion status and post 2014 indicator, and the share of the state population that is black, Hispanic, other race non-Hispanic, ages 0-17, and ages 65+. State political and economic controls are state minimum wage, AFDC/TANF needs standards, and an indicator for whether the governor of the state is a Democrat. Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1

**Table 4. Effect of \$1,000 increase in the Maximum Earned Income Tax Credit among Mothers with a High School Degree or Less by Subgroup**

Subgroup	Married				Unmarried			
	Any Days of poor mental health	Days of poor mental health	Uninsured	Employed	Any Days of poor mental health	Days of poor mental health	Uninsured	Employed
All	-0.016** (0.006)	-0.254** (0.106)	-0.001 (0.004)	-0.008* (0.004)	-0.023** (0.006)	-0.207* (0.119)	0.007 (0.005)	0.031** (0.005)
White	-0.014* (0.008)	-0.275** (0.126)	0.0003 (0.005)	-0.005 (0.006)	-0.015 (0.009)	-0.138 (0.182)	-0.003 (0.006)	0.027** (0.005)
Non-white	-0.016** (0.08)	-0.130 (0.144)	-0.006 (0.005)	-0.020** (0.006)	-0.025** (0.006)	-0.122 (0.131)	0.009 (0.007)	0.031** (0.006)
18-44	-0.014** (0.006)	-0.265** (0.096)	-0.002 (0.004)	-0.004 (0.005)	-0.024** (0.007)	-0.209 (0.131)	0.009* (0.005)	0.031** (0.005)
45-64	-0.015 (0.012)	-0.173 (0.290)	-0.004 (0.008)	-0.010 (0.009)	-0.004 (0.009)	-0.067 (0.215)	-0.010 (0.013)	0.032** (0.013)
Less than High School	-0.016 (0.011)	-0.423** (0.192)	0.000 (0.010)	-0.007 (0.006)	-0.039** (0.009)	-0.551** (0.184)	0.021** (0.007)	0.028** (0.006)
High School Graduate	-0.017** (0.008)	-0.203* (0.108)	-0.001 (0.004)	-0.008 (0.005)	-0.017** (0.008)	-0.033 (0.136)	-0.0004 (0.005)	0.029** (0.006)

*Notes:* BRFSS 1993-2016. OLS estimates reflect the intent-to-treat impact of a \$1000 increase in the maximum EITC credit at the state-year-family size cell. All regressions include state fixed effects, time fixed effects (quarterly frequency), state specific linear trends, and indicators for number of children in the family, race/ethnicity, gender, age, education, and marital status, when the sample is not restricted to the particular variable. All regressions also include state-level variables including parental Medicaid eligibility income limits, an interaction between state ACA Medicaid expansion status and post 2014 indicator, the share of the state population that is black, Hispanic, other race non-Hispanic, ages 0-17, and ages 65+. All regression include the state minimum wage rate, AFDC/TANF needs standards, and an indicator for whether the governor of the state is a Democrat. Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1

**Table 5. Effect of \$1,000 increase in the Maximum Earned Income Tax Credit on Healthcare access among Mothers with a High School Degree or Less by Subgroup**

Subgroup	Married		Unmarried	
	Did not see doctor due to cost in past year	Visited doctor in past year	Did not see doctor due to cost in past year	Visited doctor in past year
All	-0.011** (0.005)	0.006* (0.003)	-0.009** (0.003)	0.000 (0.006)
White	-0.007 (0.005)	0.001 (0.003)	-0.015** (0.005)	-0.001 (0.008)
Non-white	-0.022** (0.008)	0.012* (0.007)	-0.006 (0.006)	-0.002 (0.008)
18-44	-0.009* (0.006)	0.011** (0.003)	-0.007** (0.003)	0.002 (0.007)
45-64	-0.027** (0.009)	-0.001 (0.009)	-0.015 (0.016)	0.006 (0.009)
Less than High School	-0.021* (0.012)	-0.003 (0.009)	-0.016** (0.007)	-0.023 (0.014)
High School Graduate	-0.008** (0.004)	0.009** (0.004)	-0.005 (0.006)	0.012** (0.004)

*Notes:* BRFSS 1993-2016. OLS estimates reflect the intent-to-treat impact of a \$1000 increase in the maximum EITC credit at the state-year-family size cell. Sample restricted to mothers with a high school degree or less. All regressions include state fixed effects, time fixed effects (quarterly frequency), and indicators for number of children in the family, race/ethnicity, gender, age group, education, and marital status. All regressions also include state-level contextual variables including parental Medicaid eligibility income limits, an interaction between state ACA Medicaid expansion status and post 2014 indicator, and the share of the state population that is black, Hispanic, other race non-Hispanic, ages 0-17, and ages 65+. State political and economic controls are state minimum wage, AFDC/TANF needs standards, and an indicator for whether the governor of the state is a Democrat. Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. The outcome Did not see Doctor due to cost in past year is not assessed in the 2002 survey—the main regression on the full sample has 414,512 observations. The outcome visited doctor in the past year is not asked in 2003-2004 surveys—the main regression on the full sample has 366,419 observations. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1

**Table 6. Analysis of Leads and Lags of EITC expansions on Maternal Mental Health**

	Any Days of Poor Mental Health, Past 30 days					
<i>Married Mothers</i>	(1)	(2)	(3)	(4)	(5)	(6)
EITC ( $t=0$ )	-0.015** (0.006)	-0.015** (0.007)	-0.014** (0.007)	-0.021* (0.011)	-0.022** (0.010)	-0.023** (0.011)
EITC expansion 1 year after survey ( $t+2$ )		0.001 (0.010)	-0.008 (0.017)			-0.005 (0.017)
EITC expansion 2 years after survey ( $t+3$ )			0.011 (0.016)			0.009 (0.016)
EITC expansion 3 years before survey ( $t-2$ )				0.007 (0.008)	0.014 (0.013)	0.014 (0.013)
EITC expansion 4 years before survey ( $t-3$ )					-0.006 (0.014)	-0.007 (0.014)
<i>Unmarried Mothers</i>	(1)	(2)	(3)	(4)	(5)	(6)
EITC ( $t=0$ )	-0.020** (0.006)	-0.014* (0.007)	-0.013* (0.007)	-0.027** (0.009)	-0.030** (0.010)	-0.023** (0.011)
EITC expansion 1 year after survey ( $t+2$ )		-0.011 (0.008)	-0.017 (0.013)			-0.014 (0.015)
EITC expansion 2 years after survey ( $t+3$ )			0.007 (0.016)			0.006 (0.017)
EITC expansion 3 years before survey ( $t-2$ )				0.007 (0.007)	0.025 (0.017)	0.023 (0.017)
EITC expansion 4 years before survey ( $t-3$ )					-0.016 (0.014)	-0.015 (0.014)

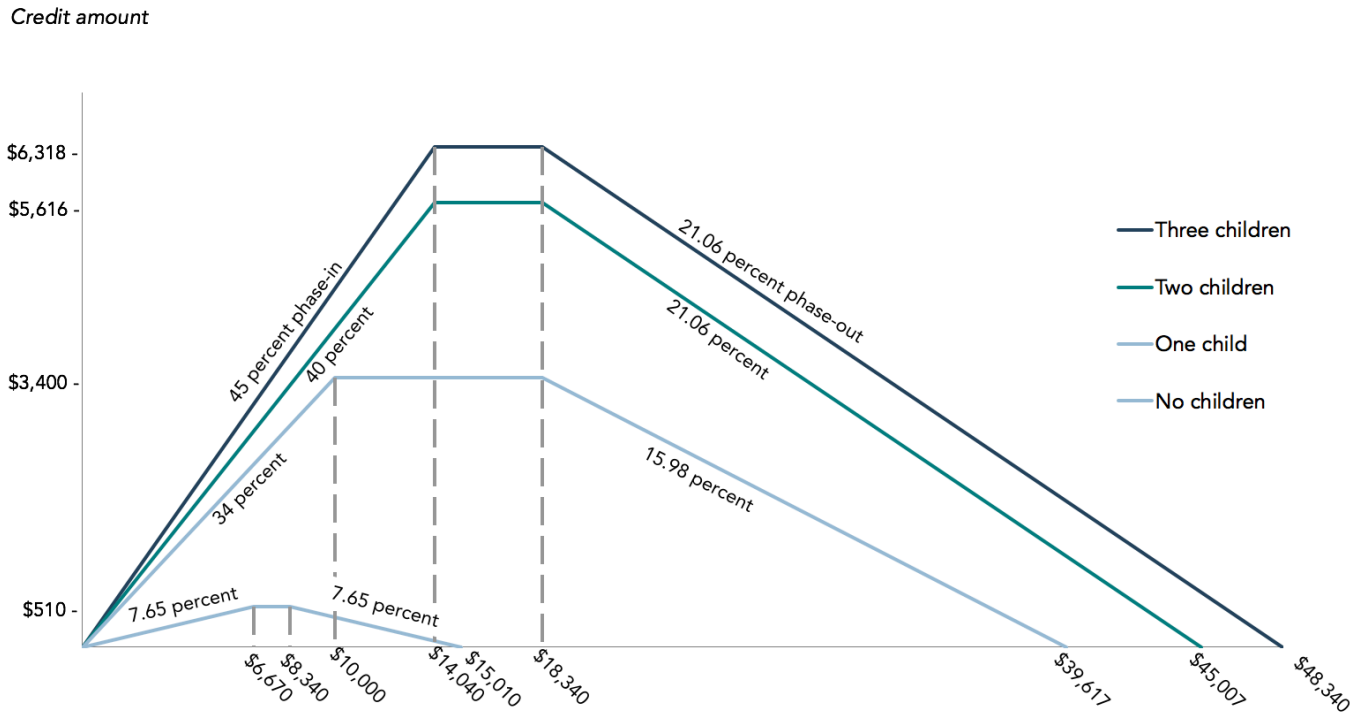
*Notes:* BRFSS data from 1993-2013. Subscript refers to year of policy relative to survey year. “(t+2)” refers to changes in EITC maximum credits occurring two treatment periods after the survey year. See Table 3 for details on model specification. Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1

**Table 7. Isolating Effects of State EITC Expansions, BRFSS (1993-2016)**

	Any days of poor mental health, past month		
	All Mothers	Married Mothers	Unmarried Mothers
<b><u>Impact of State EITC expansions</u></b>			
<i>Panel A: Using Indicator for State EITC Program</i>			
Any days of poor mental health, past month	-0.023 (0.015)	-0.040** (0.016)	-0.002 (0.021)
Number of days of poor mental health, past month	-0.142 (0.197)	-0.542** (0.226)	0.316 (0.281)
Employed	0.005 (0.005)	0.005 (0.005)	0.004 (0.010)
<i>Panel B: EITC state multiplier</i>			
Any days of poor mental health, past month	-0.191** (0.053)	-0.281** (0.076)	-0.092 (0.082)
Number of days of poor mental health, past month	-1.56* (0.836)	-2.48** (1.05)	-0.597 (1.25)
Employed	0.027 (0.048)	0.030 (0.036)	0.033 (0.065)

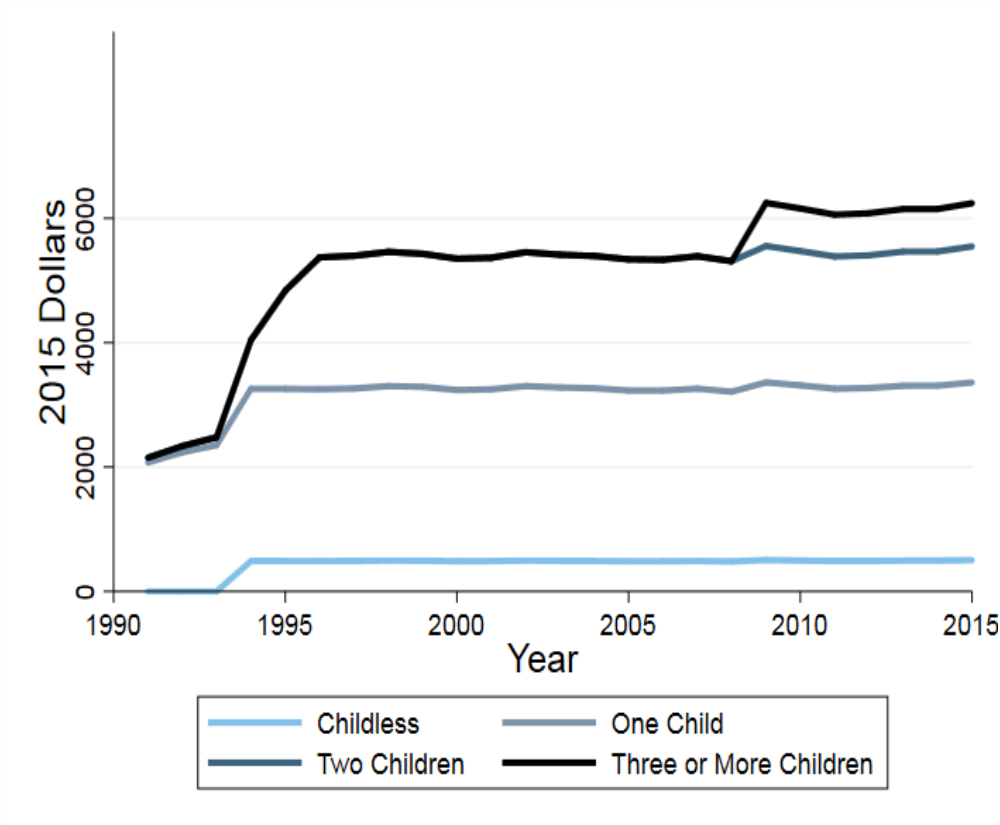
*Notes:* See Table 3 for details on model specification. Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1

**Figure 1.** Structure of the EITC, 2017



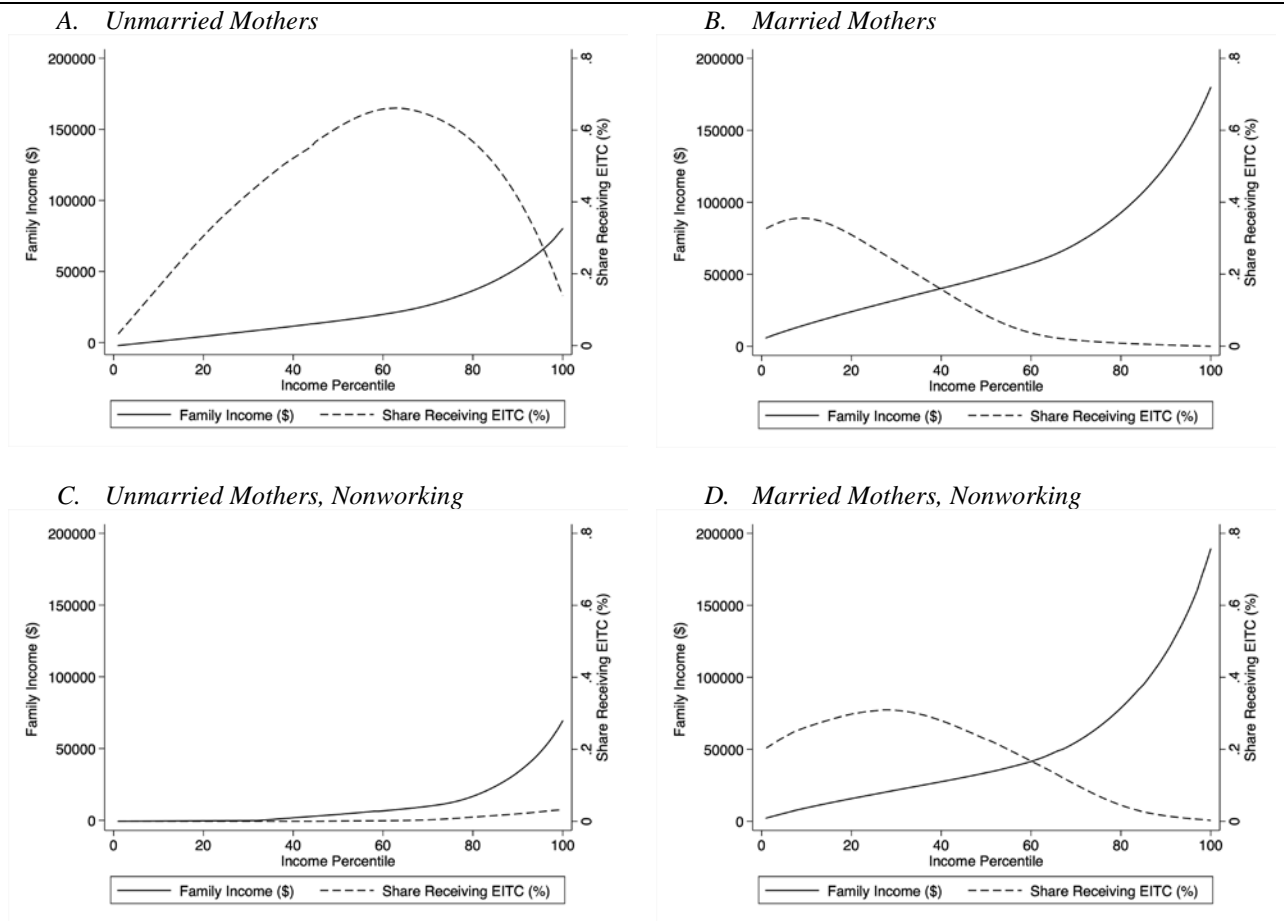
**Source:** Urban Institute Tax Policy Center 2017

**Figure 2.** Federal EITC Maximum Credit by Number of Children over Time



**Source:** University of Kentucky Center for Poverty Research. 2016. "UKCPR National Welfare Data, 1980-2015." Gatton College of Business and Economics, University of Kentucky, Lexington, KY. <http://www.ukcpr.org/data>.

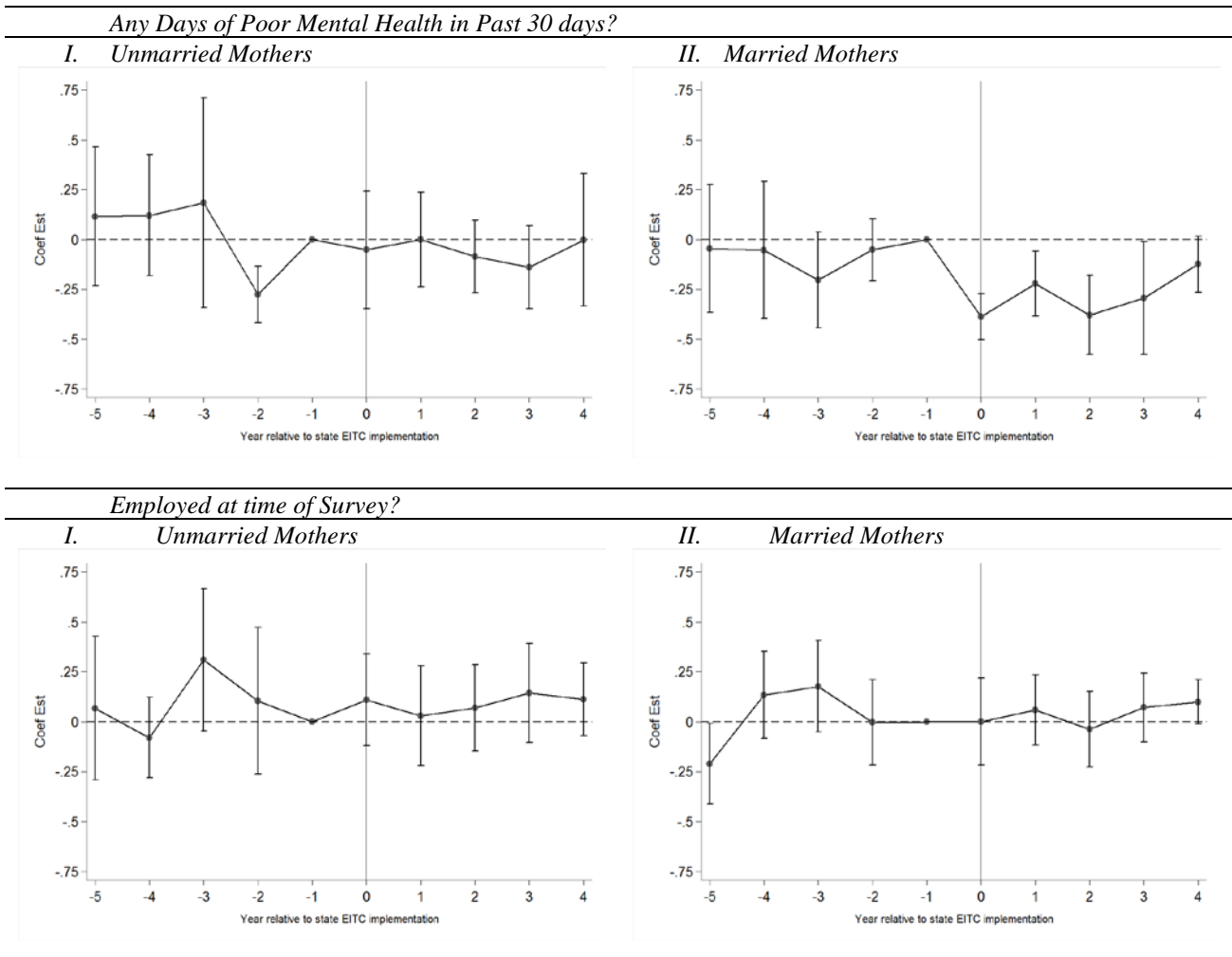
**Figure 3. Family Income of Mothers and Share of Mothers Receiving EITC, by Marital Status (2005)**



**Notes:** 2005 CPS ASEC. Sample restricted to mothers with a high school degree or less education.



**Figure 4. The Impact of State EITC Expansions on Mental Health and Employment among Mothers with a High school degree or less education, by marital status**



**Notes:** BRFSS (1993-2016). Estimates reflect impact of implementing a state EITC program with a 100% multiplier of the federal credit in the year relative to actual implementation date and are relative to the omitted reference year (year prior to implementation). Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. Upper and lower vertical bars indicate 95% confidence intervals.

## Appendix

**Table A1. Verifying EITC expansion does not affect treatment/comparison composition**

Dependent Variable	Analysis Sample		
	All Mothers	Married Mothers	Unmarried Mothers
Moved Across States (ACS 2006-2016)	-0.0004 (0.0008)	-0.0008 (0.0046)	-0.0006 (0.0015)
Married in the last year (ACS 2008-2016) <sup>a</sup>	0.0004 (0.0009)	--	--
Married (BRFSS 1993-2016)	0.002 (0.003)	--	--

*Notes:* See Table 3 for details on model specification. Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1.

<sup>a</sup> Since this ACS questions refers to the previous year, this analysis merges on EITC credits from two years prior.

**Table A2. Isolating Effects of Federal EITC Expansions, BRFSS (1993-2016)**

	Any days of poor mental health, past month		
	All Mothers	Married Mothers	Unmarried Mothers
<b><u>Impact of Federal EITC expansions</u></b>			
<i>Restricting to States that never implement an EITC program</i>			
Any days of poor mental health, past month	-0.013 (0.008)	-0.011 (0.008)	-0.013 (0.014)
Number of days of poor mental health, past month	-0.250* (0.138)	-0.161** (0.078)	-0.413* (0.217)
Employed	0.010 (0.002)	-0.011* (0.006)	0.034** (0.007)

*Notes:* See Table 3 for details on model specification. Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1

**Table A3. Event History Analysis of Impact of State EITC expansions on maternal mental health and employment, by marital status.**

	Any days of poor mental health, past month		Employed	
	Unmarried Mothers	Married Mothers	Unmarried Mothers	Married Mothers
<b><u>Impact of Federal EITC expansions</u></b>				
5 years prior to State EITC expansion	0.115 (0.174)	-0.046 (0.160)	0.067 (0.179)	-0.210** (0.100)
4 years prior to State EITC expansion	0.121 (0.151)	-0.053 (0.171)	-0.079 (0.101)	0.134 (0.108)
3 years prior to State EITC expansion	0.183 (0.262)	-0.203* (0.119)	0.309* (0.177)	0.177 (0.114)
2 years prior to State EITC expansion	-0.276** (0.070)	-0.052 (0.078)	0.104 (0.182)	-0.004 (0.106)
Year of State EITC expansion	-0.052 (0.147)	-0.387** (0.057)	0.109 (0.115)	0.001 (0.108)
1 year after State EITC expansion	0.000 (0.118)	-0.222** (0.081)	0.030 (0.125)	0.058 (0.088)
2 years after State EITC expansion	-0.086 (0.090)	-0.378** (0.099)	0.069 (0.108)	-0.038 (0.094)
3 years after State EITC expansion	-0.140 (0.104)	-0.295** (0.141)	0.143 (0.123)	0.071 (0.086)
4 years after State EITC expansion	-0.002 (0.165)	-0.124* (0.070)	0.113 (0.090)	0.100* (0.056)

*Notes:* BRFSS (1993-2016). Estimates reflect impact of implementing a state EITC program with a 100% multiplier of the federal credit in the year relative to actual implementation date and are relative to the omitted reference year (year prior to implementation). Mothers are identified as an adult female respondent reporting at least one child under 18 in the household. All regressions are weighted using survey weights. All estimates are clustered at the state. Asterisk marks represent estimate significance at the following p-values: \*\* p<0.05, \* p<0.1