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The Earned Income Tax Credit and Expected Social Security Retirement Benefits Among Low-Income Women

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Abstract

Expansions in the Earned Income Tax Credit (EITC) are associated with increases in formal employment and increases in long-term year-over-year growth in earnings for single mothers. In this study, we examine whether expansions in the EITC are likely to lead to increases in Social Security retirement benefits for less-educated women (those likely to be affected by the EITC) by increasing their employment and earnings when young.

The increases in benefits could occur through two channels: First, as the EITC pulls additional less-educated women into market work, those women may accrue more quarters of employment and thus be more likely to qualify for Social Security retirement benefits. Second, to the extent that the EITC leads to increased earnings growth, less-educated women may qualify for higher benefits.

We rely on administrative earnings data from the Social Security Administration and existing estimates of the effect of the EITC on employment and earnings growth to simulate the impact of an EITC expansion on the future Social Security retirement benefits of less-educated women. The results of this simulation suggest that the EITC leads to an increase in the share of less-educated women that will be eligible for Social Security retirement benefits and leads to an increase in their monthly benefit amount. Thus, the existence of the EITC contributes to the financial security of affected women as they age and retire.

INTRODUCTION

Studies have found that expansions in the Earned Income Tax Credit (EITC) are associated with increases in formal employment (e.g., Eissa and Liebman, 1996; Meyer and Rosenbaum, 2000, 2001) and increases in long-term year-over-year growth in earnings for single mothers (Dahl, DeLeire, and Schwabish, 2009). In this study, we examine whether expansions in the EITC are likely to lead to increases in Social Security retirement benefits for less-educated women (those likely to be affected by the EITC) by increasing their employment and earnings when young. The increases in benefits could occur through two channels: First, as the EITC pulls additional less-educated women into market work, those women may accrue more quarters of employment and thus be more likely to qualify for Social Security retirement benefits. Second, to the extent that the EITC leads to increased earnings growth, less-educated women may qualify for higher benefits.

Our earlier work (Dahl, DeLeire, and Schwabish, 2009; hereafter referred to as DDS), exploited the differential expansions in the EITC between 1994 and 1997 for single mothers with two or more qualifying children compared with single mothers with only one qualifying child to estimate the effect of the EITC on employment and earnings growth.

In this paper, we use the estimates from that earlier work to simulate the impact of the EITC on future Social Security retirement benefits for a sample of less-educated women. To do so, we use an administrative data set from the Social Security Administration (SSA): the Continuous Work History Sample (CWHS), which includes data on earnings from 1978 to 2007 for a 1 percent sample of all issued Social Security

numbers. We find that, if the EITC had increased from 1980 to 1983 in the same way that it increased from 1994 to 1997 for single mothers with two or more children compared with single mothers with one child, the EITC would have increased the share of women who are eligible for Social Security retirement benefits by between 2 to 3 percentage points and the monthly benefit amount for eligible women would have increased by 2 percent to 7 percent.

Although our results suggest that the EITC has a delayed effect on the financial security of women (beyond the immediate effects on employment and earnings growth), for two reasons the results are best viewed as indicative of the direction of the effect of the EITC on retirement benefits. First, we apply estimates of the effects of the EITC on the employment and growth in earnings of single mothers to a population of less-educated women because we cannot identify single mothers in the administrative data. Thus we are likely overstating the effect of the EITC on Social Security retirement benefits. Second, Social Security retirement benefits for many women will be completely unaffected by changes in their own earnings history because their eligibility and benefit levels will be tied to a husband's or ex-husband's earnings history. We discuss both of these concerns in more detail below.

BACKGROUND

In this section we provide some background information on the EITC and on Social Security retirement benefits.

The Earned Income Tax Credit

The federal EITC is a refundable income tax credit that lowers the tax liability of

and provides cash to some lower-income working parents.[1] The credit was established in 1975 and was greatly expanded in the 1990s.

Today the EITC is a major component of federal efforts to reduce poverty. In 2011 the total cost of the EITC was $78 billion; in comparison, total costs (benefits and administrative costs) for the Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp Program) were $77 billion in fiscal year 2011 (CBO, 2012).[2]

The amount of credit a worker receives is based on the earnings and income of the people in the tax unit (in the case of joint filers, that includes income from both spouses), the number of children, and marital status. In 2010, the maximum EITC was $457 for workers without qualifying children, $3,050 for workers with one qualifying child, $5,036 for workers with two qualifying children, and $5,666 for workers with three or more qualifying children. The amount of the credit increases as earnings increase until the maximum credit is reached. As earnings increase beyond that point, the amount of the credit remains constant until a threshold is reached; then the credit decreases.

Theoretically, the EITC, by increasing the returns to work, unambiguously encourages employment (that is, work on the extensive margin) for low-income single parents. Numerous empirical studies have found evidence that the EITC does, in fact, encourage work among single mothers, especially those with less education. For example, using a methodology similar to that used in DDS (2009), Hotz, Mullin, and Scholz (2010) employ a difference-in-differences strategy in which the changes in the

[1] In 1993, the credit was extended to workers without children. However, the maximum credit available to that group is small.

[2] Neither SNAP nor the EITC has any direct effect on a family's official poverty status, as defined by the Census Bureau, as neither is counted as income.

employment of single mothers with two or more children during the mid-1990s are compared with changes in the employment of single mothers with only one child. Examining welfare recipients in California, they find that the EITC expansion of the early 1990s increased the employment of single mothers with two or more children relative to those with one child in the late 1990s.

Social Security

Social Security provides retirement benefits based on average pre-retirement earnings. To qualify for Social Security retirement benefits based on one's own earnings history, a worker must earn 40 quarters of coverage over the course of his or her lifetime. Beginning in 1978, the amount of earnings needed for a quarter of coverage increases each year with the average wage index (AWI). In 2007, the amount of earnings required for a quarter of coverage was $1,000; thus, a worker who earned at least $4,000 that year earned four quarters of coverage.[3]

A person can also qualify for Social Security retirement benefits based on the earnings history of a spouse. One can also qualify on the benefits of an ex-spouse if that marriage lasted for 10 years or longer. Effectively, a person receives his or her own benefit or half of a spouse's benefit, whichever is higher.

For the purposes of calculating one's retirement benefit, lifetime earnings are represented by the Average Indexed Monthly Earnings (AIME) amount. The AIME is the average of the highest 35 years of earnings (divided by 12 to generate a monthly amount), indexed to compensate both for inflation and for real growth in earnings across the

[3] Prior to 1978, earnings were reported to SSA on a quarterly basis. Beginning in 1978, earnings are reported on an annual basis and thus the qualifying amount, though still referred to as a quarter of coverage, is actually an annual amount.

United States.

The Primary Insurance Amount (PIA) is the basic benefit that is paid to a retiree if he or she claims benefits at the Social Security program's full retirement age (age 66 for people born between 1943 and 1954). In 2007, a retiree would have received 90 percent of the first $680 of average monthly earnings, 32 percent of earnings between $680 and $4,100, and 15 percent of earnings above $4,100. (See Figure 1.)

People may also be eligible for certain auxiliary Social Security benefits even if they do not have a work history sufficient to qualify for retirement benefits: survivor benefits may be paid to the surviving widow(er) of a qualified spouse; spousal benefits may be paid to the spouse of a living qualified spouse; children may be eligible for benefits if a qualifying parent is deceased or disabled; and, in addition, Disability Insurance (DI) benefits are paid to qualified disabled individuals. The availability of those benefits, while not the focus of this paper, bolsters the argument that the EITC may be associated with future economic well-being in addition to the direct effect on increased earnings. Any increases in employment and earnings that positively affect a worker's retirement benefits would also have positive effects on their DI benefits (were they to become disabled) or the benefits paid to any dependents or survivors in the future.

DATA AND METHODOLOGY

We briefly describe the data and method used in DDS (2009) to estimate the effect of the EITC expansion in the early 1990s on the employment and long-term growth in earnings of single mothers. We then describe the data and method used in this study to determine whether those long-term earnings and employment effects lead to more

quarters of coverage and higher Social Security retirement benefits for less-educated women.

Effects of the EITC on Employment and Earnings Growth

In our earlier work, in which we estimated the impact of expansions in the EITC in the early 1990s on employment and earnings growth, we used the 1993 and 1996 panels of the Survey of Income and Program Participation (SIPP)—which include data from 1993 to 1999—matched with longitudinal earnings records from the Social Security Administration's Detailed Earnings Records (DER). Use of the matched SIPP–SSA data allowed us to combine detailed demographic information on a large sample of single mothers with their earnings from 1984 to 2005.[4]

The sample for that analysis was unmarried (widowed, divorced, or never married) women, age 19 to 44, who were not disabled (according to their survey response), were not in school, and had at least one child. The sample comprised single mothers in January 1993, 1994, and 1995; March 1996 (January 1996 is not available); January 1997, 1998, and 1999; and November 1999 (January 2000 is not available).[5] Within the 1993 and the 1996 panels, some women appeared more than once. The standard errors were adjusted accordingly. Earnings were adjusted for inflation using the CPI-U-RS.

Not all women in the SIPP sample were matched to their administrative earnings record—the match rate varied from 83 percent to 87 percent between 1993 and 2000.

[4] The earnings records used in that analysis included income from self-employment. More detail can be found in DDS (2009).

[5] March 1996 is the first month in which all four rotation groups of the 1996 SIPP panel are available, and it is used to represent the 1996 calendar year. November 1999 is the last month of the 1996 SIPP in which all four rotation groups are available, and it is used to represent the 2000 calendar year.

Observations that were not matched to administrative earnings records were not included in the analysis. Cristia and Schwabish (2009) show that the roughly 80 percent match rate in the 1996 panel does not introduce significant bias to the sample.

The strategy used in DDS (2009) to identify the effects of the EITC on the employment and earnings growth of single mothers over a five-year time frame hinges on the differential expansion in the EITC for single mothers with one qualifying child and for those with two or more qualifying children between 1994 and 1997.[6] Prior to the EITC expansions of the early 1990s—specifically, those legislated in the Omnibus Budget Reconciliation Act of 1993—the treatment of filers with one child was virtually identical to that of filers with two or more children. In 1994 the EITC increased for both groups, but more so for those with two or more children (see Figure 2). And between 1994 and 1997 the EITC continued to increase for those with two or more children while remaining relatively unchanged (in real terms) for those with one child (see Figure 3). In 1994 the maximum credit available to single mothers with one child was $2,819 (in 2007 dollars), and that available to single mothers with two or more children was $3,497. By 1997, the maximum credit available to single mothers with one child increased by $27 to $2,847 (in 2007 dollars), and the maximum credit available to single mothers with two or more children increased by $1,212 to $4,709.

DDS (2009) used that differential change in the EITC to identify the effect of the EITC on labor market outcomes for single mothers using two separate difference-in-differences models. Because from 1994 to 1997 the EITC did not change appreciably for single mothers with only one child, any observed changes in their employment or

[6] That is the same identification strategy used by Hotz, Mullin, and Scholz (2010).

earnings growth should not be attributable to changes in the EITC. And because single mothers with only one child and single mothers with two or more children are likely very similar (both on observable and unobservable characteristics), we posit that the employment and earnings growth of single mothers with two or more children would have followed the same trend as it did for those with one child if the EITC expansion had not occurred. To the extent that trends in the employment and growth in earnings of single mothers with two or more children deviated from that of single mothers with one child, we attribute those differences to the effect of the EITC on employment and growth in earnings. (This assumes that there were no other changes occurring over the 1994 to 1997 timeframe—policy or otherwise—that were differentially affecting single mothers with two or more children and single mothers with only one child.)

DDS (2009) estimated models such as:

$$(1) \quad \left(E_{i,t} - E_{i,t-1}\right) = \beta_0 + \sum_{t=1993}^{2000} \gamma_t \left(year_{i,t} = t\right) \times \left(kids_{i,t} \geq 2\right) + \sum_{t=1993}^{2000} \beta_t \left(year_{i,t} = t\right) + \gamma_0 \left(kids_{i,t} \geq 2\right) + X_{i,t}\Theta + \varepsilon_{i,t}$$

where:

- $E_{i,t}$ is log annual earnings of person *i* in year *t*;
- $year_{i,t}$ is an indicator variable for the year in which demographics are measured;
- $kids_{i,t \geq 2}$ is an indicator variable for having two or more children (versus only one child); and
- $X_{i,t}$ is a vector of individual-level controls, including marital status (widowed, divorced, never married), race and ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic other), education (less than high

school, high school, beyond high school), presence of children under age 6, mother's age, and mother's age squared.

Also estimated by DDS (2009) and used in the simulations that follow is the effect of the EITC on employment.

The coefficients on the interactions between the year variables and the indicator for having two or more children yield the difference-in-differences estimates. These estimates yield two quantities: the effect of the EITC on employment over a seven-year period and the effect of the EITC on growth in earnings over a seven-year period. (See Table 1).

Effect of the EITC on Social Security Retirement Benefits

In order to simulate the labor supply effect of the EITC on Social Security retirement benefits, we use data from the Continuous Work History Supplement (CWHS), a longitudinal administrative earnings data set provided by SSA. The CWHS is a random 1 percent sample of people who have been issued Social Security numbers; the sample contains longitudinal earnings records from workers' W-2 statements. Earnings, as defined in the CWHS, include wage and salary earnings, tips, and some other forms of compensation. For this analysis, earnings exclude self-employment income and deferred compensation such as contributions to 401(k) accounts.[7] Earnings are available from 1978 to 2007 and are inflated to 2007 dollars using the CPI-U-RS.

Aside from age and sex, the CWHS contains very little demographic information. In particular, the CWHS does not include the information necessary to identify single

[7] The DER administrative earnings used to estimate the earnings and employment effects of the EITC in DDS (2009) do include self-employment earnings. Because very few women in that sample report self-employment earnings, we think that the differences in measure of earnings will not affect our results.

mothers (because it does not include information on marital status or on the presence of children). Because we cannot identify single mothers explicitly, we instead identify less-educated women in the CWHS and apply our estimates of the effects of the EITC on the employment and earnings growth of single mothers to all less-educated women. However, the CWHS does not explicitly include education. As a result, we impute education using a procedure that we discuss in more detail below.

For the simulation, the CWHS is restricted to women who were born in 1953; those women were 25 years old in 1978 (the first year of data available) and 54 years old in 2007 (the last year of data available). Although the simulation tracks the earnings patterns of a single birth cohort, we are able to capture 30 years of earnings data for that cohort.

There exists the distinct possibility of recording error in administrative data, including the CWHS. In fact, previous research has found that some records between 1978 and 1982 are multiples of 100 relative to other earnings fields (see Schwabish, 2011, and Kopczuk, Saez, and Song, 2010).[8] However, there are two advantages to using the CWHS over survey data: First, it contains a sufficiently long history to estimate close proxies of lifetime earnings patterns and to estimate Social Security benefits that would result from those earnings. Second, the CWHS contains a large number of observations—more than 8,000 women in the less-educated group alone.

The simulation of Social Security benefits for less-educated women requires four separate steps: First, we impute educational attainment in the CWHS; second, we

[8] Some of the multiples appear to be due to recording errors by the SSA, where for certain records the decimal place was accidentally moved two spaces to the right. We cannot fully account for these errors, so we adjust the sample by dropping people in the top 1% of the earnings distribution in 1978 and 1979. Further, after this 1 percent trim, earnings above $60,000 in both 1978 and 1979 are divided by two. That affects an additional 0.5 percent of the sample. With access to more data and larger samples, Kopczuk, Saez, and Song (2010) and, to a similar extent, Schwabish (2011) employ a more complex method to adjust earnings in these early years.

simulate the employment effects of the EITC; third, we simulate the post-employment earnings growth; and fourth, we estimate the Social Security retirement benefits associated with the simulated earnings. We then compare the calculated benefits for less-educated women before and after the application of the employment and earnings effects to assess the following questions: If the EITC had increased from 1980 to 1983 in the same way it increased from 1994 to 1997 for single mothers with two or more children compared with single mothers with one child, how would the lifetime earnings of the affected women differ from their actual and observed earnings from 1980 to 2007? And would those differences in earnings translate to differences in eligibility for Social Security retirement benefits or the amount of monthly benefit received?

Imputing Educational Attainment

First we impute educational attainment to identify the group of women potentially eligible for the EITC (the less-educated) and the group not likely to be eligible for the EITC (the more-educated). To do so, we follow the procedure that the Congressional Budget Office (CBO) uses in its long-term microsimulation model (Congressional Budget Office, 2008) and compare age-earnings profiles generated from repeated cross-sections of March Current Population Survey data to the age-earnings profiles in the CWHS. The methodology enables us to generate less- and more-educated groups. A full description of the approach can be found in the Appendix.

Simulating the Employment Effects

Second, we simulate the employment effects of the EITC. Having assigned educational attainment in the CWHS, the employment effects estimated in DDS (2009) are used to adjust the employment rate among the sample of less-educated women. In that

paper, we generated estimates of the effects of the EITC on employment for seven years (1994 to 2000). In this paper, we apply those estimates to the CWHS data from 1980 to 1986.

The employment reassignment method randomly reassigns enough unemployed less-educated women to employment so that the resulting employment rate matches that of the original employment rate in the CWHS plus the increase in employment estimated by DDS.[9] (See Table 2.) We assign the newly employed women earnings between the 40th and 60th percentiles of the distribution of earnings among the less-educated women who moved from unemployment to employment at that same time. When targeting the employment rate in 1983, for example, we pull from the distribution of earnings of less-educated women who were unemployed in 1982 and employed in 1983. The 40th percentile of earnings is above the cutoff to obtain four quarters of coverage in each year. Our employment reassignment method therefore forces the newly employed woman to have at least four quarters of coverage.

Simulating Growth in Earnings

Third, we simulate post-employment growth in earnings. As with employment reassignment, the effects of the EITC on growth in earnings as estimated by DDS $\{\gamma_{1994}, \gamma_{1995}, \ldots, \gamma_{2000}\}$ are used to adjust earnings of less-educated women from 1980 to 1986, inclusive. The year-over-year earnings growth rates for less-educated women are derived from the difference-in-difference estimates calculated in DDS. The estimated earnings growth rate for less-educated women between 1979 and 1980 is 9.8 percentage points

[9] We use the point estimates as estimated, not the upper and lower bounds of the 90 percent or 95 percent confidence intervals. One implication of this is that we use point estimates that are not significantly different from zero.

higher than the individual's observed earnings growth rate. For example, if we observe a less-educated woman's earnings increasing from $10,000 in 1979 to $11,000 in 1980 to $12,100 in 1981 (that is, at a rate of 10 percent a year), we adjust the 1980 earnings to $11,980. For that woman, the growth rate in earnings increased from 10 percent to 19.8 percent (9.8 percentage points higher, corresponding to the point estimate of 0.098) between 1979 and 1980. We then adjust the 1981 earnings to $14,376. That growth rate in earnings increased from 10 percent to 20 percent (10 percentage points higher, corresponding to the point estimate of 0.10). Put differently, adjusted earnings from 1980 to 1986 are calculated by multiplying the sum of the observed growth rate and the estimated increase in the growth rate from DDS by the earnings in the base year.

The simplified example above does not address the possibility that a woman's earnings may decline from one year to the next. However, the methodology does not change if we observe a decline in earnings. If a woman's earnings decline from $10,000 in 1979 to $0 in 1980 and then increase again to $5,000 in 1981, we adjust the -100 percent growth in earnings between 1979 and 1980 to -90.2 percent (so the adjusted growth rate is 9.8 percentage points higher than the observed) and earnings in 1980 are recoded as $980. The difficulty that arises is how to handle the observed increase from $0 in 1980 to $5,000 in 1981 (undefined in percentage terms). One can, of course, add $1 to income in 1980 and then define the percentage change off of a base of a $1. But applying that large percentage change to a base of $980 is inappropriate (in this particular instance, it would mean calculated earnings of about $4.9 million in 1980). Instead adjusted earnings ($e_t^{adjusted}$) in time *t* for 1980 to 1986 are calculated as:

(2) $if\ (e_{t-1} > 0)$

$$e_t^{adjusted} = e_{i,t-1}^{adjusted} \times \left(1 + \gamma_t + \frac{\left(e_{i,t} - e_{i,t-1}\right)}{e_{i,t-1}}\right)$$

else

$$e_{i,t}^{adjusted} = e_{i,t}$$

The result of this formulation is that zero earnings in year *t-1* are not carried through to replace original, positive earnings in year *t*.

For year-over-year earnings growth between 1987 and 2007—that is, when the estimates from DDS no longer apply—we allow earnings to increase in two different ways. In the first, we calculate the median percent change in earnings among more-educated women, M_t. (See Table 3.) Then, for each year from 1987 to 2007, we adjust earnings among less-educated women such that earnings in time *t* are the maximum of her original earnings in time *t* or of her original earnings in time *t-1* multiplied by the median percent change adjustment factor. That is:

(3) $$e_{i,t}^{less,adjusted} = max\left[e_{i,t}^{less}, e_{i,t-1}^{less} \times M_t\right]$$

where the superscript *less* refers to the level of educational attainment. In doing this, we force earnings growth among the less-educated to look more like those among the more-educated.

In the second scenario, we calculate the year-to-year percent change in each less-educated woman's earnings from 1987 to 2007 as observed in the original CWHS data. Beginning in 1987, we then apply those percent changes, effectively increasing earnings at the same observed year-to-year rate, but the base from which the earnings grow is now higher because of the application of estimates from DDS. For example, suppose a woman

has actual earnings of $50 in 1986 and $75 in 1987 (a 50 percent increase in earnings between those two years). After applying the estimates in the first few years of the simulation, that woman's estimated earnings are equal to $100 in 1986. We then apply the original 50 percent increase between 1986 and 1987 (the original increase from $50 to $75) to this new $100 base, which yields a new earnings level of $150 in 1987. Subsequent earnings are calculated in a similar way and thus the annual percent change in earnings for each woman is the same as it is originally observed in the data, but now generates a higher level of earnings because of the application of the estimates through 1986.

The path of earnings growth outside the seven-year window in which we are able to rely on the estimates from DDS is not obvious to us. The two methods discussed here are meant to be representative and to serve as an informal sensitivity analysis. In the first method, we force the earnings growth of less-educated women to look more like that of more-educated women. In the second, we force the earnings growth of less-educated women to remain as observed in the data. Because less-educated women tend to have lower earnings than more-educated women, the earnings growth rates for less-educated women tend to be larger (in part, because they are calculated from a smaller base) than rates for their more-educated counterparts. Thus, the lifetime earnings of less-educated women tend to be higher under the second option than under the first.

Estimating Social Security Retirement Benefits

Finally, to calculate expected Social Security retirement benefits for the women in our sample, we construct modified Average Indexed Monthly Earnings (AIME) amounts and use the modified AIME to construct a Primary Insurance Amount (PIA). Because we

do not have 35 full years of earnings with which to estimate the true AIME, we use a modified AIME calculation that uses all of the 30 years of earnings (including years of zero earnings) available in the CWHS (1978 to 2007). Not only does the calculation of the AIME require 35 years of data (which we do not have), but also, under current law, earnings are indexed to the average wage index in the year in which the worker turns 60. Our cohort turns 60 in 2013; we cannot yet know the average wage index for that year. Therefore, we use the average wage index to index earnings to the most recent year of observed earnings (2007). We then use the PIA formula in 2007 to determine the final monthly benefit amount (the bendpoints for that formula are at $680 and $4,100; see Figure 1). We do not adjust the monthly benefit amount for cost-of-living adjustments (COLAs). Although failing to adjust for COLAs will not result in true Social Security benefits, the relative values of the AIME and PIA will be maintained.

The modified AIME that we calculate probably underestimates the true AIME. We do not take into account five years of earnings toward the end of one's career. Those are likely to be years with relatively high earnings. We do not index earnings to the wage index at age 60; rather, we index to the wage index at age 54, thus missing several years of wage growth in the indexing. And we do not adjust the benefits for COLAs. Each of these three choices will result in an underestimate of the AIME, compared with the actual AIME for the women in our sample. However, we implicitly assume that these women claim their Social Security retirement benefits at their full retirement age. Because more than half of people claim their benefits before their full retirement age, this assumption

implies an overestimate of the true AIME.[10] On net, we believe that the first set of factors dominates and that the AIME estimated here is an underestimate of the true AIME.

RESULTS

As we described above, we use the DDS (2009) estimates to simulate the impact of EITC expansions on a sample of less-educated women from the CWHS, all of whom were born in 1953. We use the DDS estimates reported in Table 1 to increase the employment rates and earnings growth rates of these women from age 27 (in 1980) to 33 (in 1986). Thereafter, from 1987 to 2007, we use two different methods to increase earnings. In the first method, we use the median growth rate of more-educated women and in the second method, we use the observed earnings growth rate of the person.

The simulated increase in the employment rates of our sample of less-educated women is presented in Table 2. As an example, the EITC expansions between 1994 and 1997 are estimated to have increased the employment rate of single mothers with two or more children by 1.7 percentage points more than they would have otherwise increased in the first year of the expansion and to have increased the employment rate of single mothers with two or more children by 6.2 percentage points more than they would have otherwise increased seven years later. For our simulations, this translates to an increase in the employment rate from the observed rate of 44.7 percent to 46.4 percent in 1980 and an increase in the employment rate from the observed rate of 46.4 percent to 52.6 percent in 1986.

The impact of the EITC on earnings growth between 1980 and 1986 is reported in

[10] In 2009, 61 percent of people were awarded benefits prior to age 65 (Table 6.A4 in Social Security Administration, 2010).

Table 3. Between 1980 and 1986, we use the estimates from DDS (reported in Table 1) to construct a modified earnings stream. After that, we increase earnings either by the median increase in earnings in that year for more-educated women or by the observed increase in earnings for each individual woman (though applied to the new, higher level of earnings in 1986).

The effects of the increases in employment and in earnings growth on average annual earnings over the lifetime of less-educated women are reported in Table 4. We report the differences at each decile as well as at the mean, and we report the observed distribution of average annual earnings over the lifetime for more-educated women as a point of comparison. The differences between using the median percent change for more-educated women and using the observed percent change in earnings are solely due to how earnings growth for less-educated women is treated in the out-years—years 7 through 27. Using the observed earnings growth of each person tends to yield higher lifetime earnings.

In Table 4, the average of annual earnings over the lifetime (hereafter called "average annual earnings") among less-educated women has a mean of $7,790, compared with a mean of $31,730 for more-educated women. For the 10^{th} percentile of less-educated women (ranked by their average annual earnings), average annual earnings over the lifetime are $400. They are $6,250 at the median and $17,700 at the 90^{th} percentile for less-educated women (see Table 4, column 2). In column (3), we report the distribution of average annual earnings among less-educated women after we adjust for the effects of the EITC, allowing earnings to grow in the later years as they grew for more-educated women. In column (4) we report the percentage difference between the observed earnings

and the simulated earnings. In column (5), we report the distribution of average annual earnings among less-educated women after we adjust for the effects of the EITC and allow earnings to grow in the later years as they were observed to grow for each woman. Column (6) reports the percentage change between that adjustment and the unadjusted observed results.

Allowing earnings for less-educated women to grow at the median of the growth rates observed for more-educated women results in a mean increase of 6.5 percent in average annual earnings. Those increases are largest in the bottom half of the earnings distribution and are substantially larger in the bottom 10 percent to 20 percent of the distribution. For example, the 10^{th} percentile of average annual earnings increased by 32.5 percent while the median increased by 9.3 percent.

Allowing earnings for less-educated women to continue to grow at the rate observed results in a mean increase of 16.8 percent in average annual earnings. Again, the increases across the distribution are larger toward the bottom of the distribution, though the effect is not quite as pronounced under this method as it is when the median growth rate for more-educated women is used.

The top panel of Table 4 examines all women; the bottom panel is restricted to those who have a sufficient number of quarters of coverage to qualify for Social Security benefits based on their own earnings history. Roughly 60 percent of less-educated women in our sample qualify for retirement benefits on their own earnings record; 92 percent of more-educated women do.

In the bottom panel of Table 4, conditioning on eligibility for Social Security, the impact of the EITC on earnings is smaller. The mean of average annual earnings over the

lifetime for less-educated women increased by 3.1 percent when we allow earnings to grow at the median of the growth rate for more-educated women (columns 3 and 4). Those increases rise across the distribution from 1.5 percent at the 10th percentile to 3.6 percent at the 90th percentile. When we allow earnings to grow at the observed rate, the mean of average annual earnings over the lifetime increased by 13.5 percent; again, those changes rise as average annual earnings increase.

Our estimate (17 percent) of the effect of the EITC on the mean of average annual earnings over the lifetime (Table 4, top panel) is roughly equivalent to the percent difference in average annual earnings of women with a high school degree ($22,468 in 2009) and women with some college but no degree ($26,833 in 2009).[11]

The AIME is closely related to our measure of lifetime earnings. The lifetime earnings measure is an annual measure of earnings, and the AIME is a monthly measure. We report the impact of the EITC on the AIME in Table 5. The table shows that the EITC impact on the AIME is similar to the EITC impact on the average of annual earnings over the lifetime.

The impact of the EITC on quarters of coverage and, therefore, on eligibility for Social Security is reported in Table 6. The earnings and employment effects increase the percentage of less-educated women who qualify for Social Security based on their own earnings histories by 2.3 percentage points when we allow earnings to grow at the median growth rate for more-educated women and by 2.6 percentage points when we allow earnings to grow at the observed growth rate of the individual.

The impact of the EITC on the PIA (the benefit amount) for less-educated women

[11] See http://www.census.gov/hhes/www/cpstables/032010/perinc/new03_253.htm.

is complicated slightly by the non-linear relationship between the AIME and the PIA (see Figure 1 and Table 7). Our results suggest that there is a 5 percent to 10 percent increase in the PIA as a result of the EITC for all less-educated women. Restricting the sample to those who qualify for retirement benefits on their own earnings record (one's PIA is usually meaningless if one does not qualify for retirement benefits), there is a more modest increase of 1.7 percent in the mean PIA when we allow earnings to grow at the median growth rate for more-educated women, but a larger increase of 6.9 percent when we allow earnings to grow at the observed growth rate for the individual. The percentage increases in the PIA are roughly equal across the distribution of average annual earnings.

CONCLUSION

The EITC contributes to the financial security of less-educated women as they age and retire. Our estimates and simulation show that the EITC leads to an immediate increase in employment coupled with relatively high earnings growth for single mothers. Our results suggest that those effects translate into a moderate increase in the share of less-educated women who qualify for Social Security retirement benefits—from about 60 percent to about 62 percent (an increase of about 2 percentage points). Among those who qualify for benefits, our results suggest that the average increase in monthly benefits is about 2 percent to 7 percent, up from $677 to $688 or $723 (depending on how earnings growth is handled in the later years of the simulation). That is an extra $130 to $550 a year in Social Security retirement benefits.

The study shows that the boost in employment and earnings growth from the EITC also results in an increase in the share of single parents (usually mothers) who will

be eligible for disability or survivors' benefits through the Social Security program. Estimating those effects are beyond the scope of this paper, but we do not believe that incorporating those types of benefits into the model would significantly change the results regarding retirement benefits.

As noted, we cannot identify single mothers in the administrative data. Furthermore, we do not explicitly model the share of the less-educated women in our sample that will ultimately receive a retirement benefit based on a spouse's or ex-spouse's earnings history rather than on their own earnings history. A spouse's earnings history would lower the effect of the EITC on benefits, because the retirement benefit for women who continue to receive half of their spouse's benefit is necessarily zero (we assume that the husband's employment is not sensitive to the EITC). Thus our estimates likely overstate the effect of the EITC on Social Security retirement benefits. However, we believe the estimates indicate that the EITC is likely to have a positive effect on Social Security retirement benefits.

Appendix: Imputing Educational Attainment to the CWHS

To estimate the effect of the Earned Income Tax Credit (EITC) on Social Security retirement benefits, we must first identify women who are likely to be affected by the EITC. The Continuous Work History Sample (CWHS) contains limited demographic information: it does not indicate marital status, number of children, or educational attainment. So we use each woman's longitudinal earnings record in the CWHS to impute educational attainment and then consider less-educated women as the treatment group and more-educated women as the control group. We do not explicitly take into account behaviors associated with claiming the EITC; previous research has suggested that there is significant volatility in EITC receipt from one year to the next (Ackerman, Holtzblatt, and Masken, 2009), which could be correlated with levels of educational attainment.

The method to impute educational attainment to the CWHS compares the longitudinal earnings patterns in the CWHS to average age-earnings profiles estimated from pooled March Current Population Survey (CPS) files. The procedure is similar to that presented in Congressional Budget Office (2008), which was used to impute educational attainment to CBO's long-term microsimulation model. The imputation method proceeds in three steps:

- Estimate age-earnings profiles from the CPS;
- Compare earnings in the CWHS at each age to the CPS age-earnings profiles; and
- Make a final adjustment to people not yet assigned a level of educational attainment.

In the first step, we estimate four regressions of earnings on a quadratic in age for

women born in 1953, one for each of four education levels: less than high school, high school graduate, some college, and college graduate. Those regressions are based on pooled CPS data from calendar years 1978 to 2008 and are weighted using the CPS sample weights. Topcoded earnings have been adjusted using draws from a Pareto distribution, parameters from which are estimated in the CWHS.[12] From these regressions, we calculate the predicted earnings and the standard error at each age for each level of educational attainment. These parameters enable us to generate an average age-earnings profile for each age and educational attainment category, and to build a band around each at a standard error of ±6. (See Appendix Figure 1.)[13]

In the second step, we compare the earnings for each person in the CWHS to the predicted earnings from the CPS regressions at each age. Each time the person's CWHS earnings falls within an education–earnings band, we assign them a value of 1 for less than high school, 2 for high school graduate, 3 for some college, and 4 for college graduate. We then take the mean of this series for each individual and assign ultimate educational attainment accordingly.[14]

Finally, there are some people whose earnings never fall within an education-earnings band, because their earnings are too high, are too low, or fall between the bands. Such people are reassigned as high school graduates, because doing so makes the distribution of educational attainment similar to the distribution observed in the CPS.

To illustrate how the educational attainment imputation works, consider a worker

[12] See Schwabish (2010).
[13] We make some further adjustments to the bands for people ages 25 to 28 who had some college education or were college graduates because the standard error bands overlapped between those groups.
[14] We also tried a variety of different estimation methods, including using the median or mode across the educational attainment values. We also modified whether we round the mean or median. For this sample, rounding the mean seems to best approximate the distribution found in the CPS.

who earns $6,500 at age 25; that amount falls within the range of earnings for high school dropouts ($6,123-$10,544) and thus, at age 25, that person is assigned the value of 1, a high school dropout. At age 26, her earnings rise to $13,000, which falls within the high school graduate range ($12,036 to $14,937); thus she is imputed to be a high school graduate at age 26. Continue this process for each age—notice that years of zero earnings are included—and then take the mean across all of those imputations. That final number is this worker's imputed level of educational attainment.

Overall, the imputation method generates a distribution of educational attainment that is fairly close to that found in the pooled March CPS file, and the average age-earnings patterns are, at least ordinally, as expected. (See Appendix Figure 2.) In addition, because we aggregate the two less-educated groups and the two more-educated groups, the distribution of educational attainment is within about 2 percentage points of the CPS distribution. (See Appendix Table 1.)

REFERENCES

Ackerman, Deena, Janet Holtzblatt, and Karen Masken. 2009. "The Pattern of EITC Claims Over Time: A Panel Data Analysis," Internal Revenue Service, Washington, D.C.

Congressional Budget Office. 2008. "Assigning Education Status in CBO's Long-Term Microsimulation Model," Congressional Budget Office Background Paper, October.

Congressional Budget Office. 2012. "The Budget and Economic Outlook: Fiscal Years 2012 to 2022," January.

Cristia, Julian and Jonathan A. Schwabish. 2009. "Measurement Error in the SIPP: Evidence from Matched Administrative Records," *Journal of Economic and Social Measurement.*

Dahl, Molly, Thomas DeLeire, and Jonathan Schwabish. 2009. "Stepping Stone or Dead End? The Effect of the EITC on Earnings Growth." *National Tax Journal,* 62(2): 329–346.

Eissa, Nada and Jeffrey B. Liebman. 1996. "Labor Supply Response to the Earned Income Tax Credit." *Quarterly Journal of Economics,* May: 605–637.

Hotz, V. Joseph, Charles H. Mullin, and John Karl Scholz. 2010. "Examining the Effect of the Earned Income Tax Credit on the Labor Market Participation of Families on Welfare." Unpublished paper, Duke University, http://public.econ.duke.edu/~vjh3.

Kopczuk, Wojciech, Emmanuel Saez, and Jae Song. 2010. "Earnings Inequality and Mobility in the United States: Evidence from Social Security Data since 1937," *Quarterly Journal of Economics,* February: 91-128.

Meyer, Bruce D. and Dan T. Rosenbaum. 2000. "Making Single Mothers Work: Recent Tax and Welfare Policy and Its Effects." *National Tax Journal,* 53(4, Part 2): 1027–1061.

Meyer, Bruce D. and Dan T. Rosenbaum. 2001. "Welfare, the Earned Income Tax Credit, and the Labor Supply of Single Mothers," *Quarterly Journal of Economics,* 116 (3): 1063–1114.

Schwabish, Jonathan A. 2010. "Comparing Methods of Imputing Topcoded Earnings in the March Current Population Survey Using Administrative Data." Presented at the Brookings Institution, February 23, 2010.

Schwabish, Jonathan A. 2011. "Identifying Rates of Emigration in the United States Using Administrative Earnings Records," *International Journal of Population Research,* vol. 2011.

Social Security Administration. 2010. *Annual Statistical Supplement, 2010.* U.S. Social Security Administration, Office of Retirement and Disability Policy.

Table 1

The Effects of the EITC on Earnings Growth and Employment of Single Mothers

	Year-over-Year Earnings Growth	Employment
2 or More children in 1994	0.098	0.017
	(0.094)	(0.024)
2 or More children in 1995	0.100	-0.015
	(0.090)	(0.028)
2 or More children in 1996	0.099	0.036
	(0.075)	(0.027)
2 or More children in 1997	0.191	0.081
	(0.072)**	(0.027)**
2 or More children in 1998	0.133	0.035
	(0.073)+	(0.027)
2 or More children in 1999	0.084	0.086
	(0.072)	(0.027)**
2 or More children in 2000	0.135	0.062
	(0.072)+	(0.027)*
2 or More Qualifying Children	-0.050	-0.077
	(0.062)	(0.023)**
Demographic controls	Yes	Yes
Year dummy variables	Yes	Yes
State dummy variables	No	No
Observations	10,414	12,923
R-squared	0.02	0.08

matched to the Social Security Administration Detailed Earnings Record data. See Dahl, DeLeire, and Schwabish (2009) for full discussion of these regression results.

Notes: Robust standard errors are in parentheses:

+ significant at 10%; * significant at 5%; ** significant at 1%

Employment is defined as those with positive annual earnings.

Year-over-Year Earnings Growth is the difference in log annual earnings.

Sample: Single women, age 19 to 44, not in school, not disabled, with a child age 18 or younger in the household or a child age 19 to 24 and enrolled in school. Sample drawn in January 1993, 1994, and 1995; March 1996; January 1997, 1998, and 1999; and November 1999.

Demographic controls include marital status (widowed, divorced, never married [excluded]), race/ethnicity (non-Hispanic white [excluded], non-Hispanic black, Hispanic, non-Hispanic other), education (less than high school [excluded], high school, beyond high school), presence of children under age 6, mother's age, and mother's age squared.

Table 2
Employment Rates Among Less-Educated Women Before and After Assignment of Employment Elasticities

Year Post-Expansion in Simulation	Year in CWHS	Estimated Employment Elasticity from Table 1	Original Employment Rate	Adjusted Employment Rate
1	1980	0.017	44.7	46.4
2	1981	-0.015	43.1	41.6
3	1982	0.036	39.6	43.2
4	1983	0.081	41.5	49.6
5	1984	0.035	43.3	46.8
6	1985	0.086	45.8	54.4
7	1986	0.062	46.4	52.6

Sources: Authors' calculations from the Continuous Work History Sample and regression results from the Survey of Income and Program Participation matched to the Social Security Administration Detailed Earnings Record data.

Table 3
Earnings Elasticities and Median Percent Change in Earnings, 1980 to 2007

Year Post-Expansion in Simulation	Year *t*	Year *t+1*	Estimated Earnings Elasticity from Table 1	Median Percent Change in Earnings Among More-Educated Women
1	1979	1980	0.098	----
2	1980	1981	0.100	----
3	1981	1982	0.099	----
4	1982	1983	0.191	----
5	1983	1984	0.133	----
6	1984	1985	0.084	----
7	1985	1986	0.135	----
8	1986	1987	----	3.04
9	1987	1988	----	2.33
10	1988	1989	----	1.83
11	1989	1990	----	1.47
12	1990	1991	----	1.85
13	1991	1992	----	3.20
14	1992	1993	----	1.39
15	1993	1994	----	1.95
16	1994	1995	----	2.17
17	1995	1996	----	1.55
18	1996	1997	----	2.31
19	1997	1998	----	3.28
20	1998	1999	----	2.02
21	1999	2000	----	1.25
22	2000	2001	----	1.31
23	2001	2002	----	1.85
24	2002	2003	----	0.92
25	2003	2004	----	0.48
26	2004	2005	----	-1.09
27	2005	2006	----	-0.02
28	2006	2007	----	0.43

Sources: Authors' calculations from the Continuous Work History Sample and regression results from the Survey of Income and Program Participation matched to the Social Security Administration Detailed Earnings Record data.

Table 4
Distribution of Average Annual Earnings over the Lifetime in 2007 Average Wage Indexed Dollars

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Using Median Growth in Earnings for More-Educated Women to Increase Earnings in Later Years		Using Less-Educated Individual's Observed Earnings Growth to Increase Earnings in Later Years		
Percentile	Less-Educated, Pre-Adjustment	Less-Educated, Post-Adjustment	Percent Difference	Less-Educated, Post-Adjustment	Percent Difference	More-Educated
All Workers						
10	400	530	32.5	550	37.5	10,090
20	1,320	1,590	20.5	1,580	19.7	16,270
30	2,680	3,080	14.9	3,110	16.0	21,220
40	4,360	4,760	9.2	4,880	11.9	25,220
50	6,250	6,830	9.3	7,030	12.5	29,450
60	8,350	8,930	6.9	9,300	11.4	33,900
70	10,810	11,470	6.1	12,070	11.7	39,030
80	13,650	14,410	5.6	15,360	12.5	46,200
90	17,700	18,540	4.7	20,310	14.7	56,460
Mean	7,790	8,300	6.5	9,100	16.8	31,730
Workers With Sufficient Work History to Qualify for Social Security						
10	5,190	5,270	1.5	5,330	2.7	14,650
20	6,640	6,810	2.6	6,950	4.7	19,460
30	7,950	8,170	2.8	8,420	5.9	23,480
40	9,370	9,610	2.6	9,980	6.5	27,200
50	10,880	11,180	2.8	11,670	7.3	31,120
60	12,470	12,910	3.5	13,580	8.9	35,370
70	14,400	14,920	3.6	15,910	10.5	40,690
80	16,750	17,410	3.9	18,960	13.2	47,460
90	19,880	20,600	3.6	23,150	16.4	57,550
Mean	11,860	12,230	3.1	13,460	13.5	33,960

Sources: Authors' calculations from the Continuous Work History Sample and regression results from the Survey of Income and Program Participation matched to the Social Security Adminstration Detailed Earnings Record data.
Note: All earnings are adjusted to 2007 dollars using the Average Wage Index.

Table 5
Distribution of Average Indexed Monthly Earnings (AIME)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Using Median Growth in Earnings for More-Educated Women to Increase Earnings in Later Years		Using Less-Educated Individual's Observed Earnings Growth to Increase Earnings in Later Years		
Percentile	Less-Educated, Pre-Adjustment	Less-Educated, Post-Adjustment	Percent Difference	Less-Educated, Post-Adjustment	Percent Difference	More-Educated
All Workers						
10	30	40	33.7	50	38.9	840
25	160	190	16.8	190	17.8	1,570
50	520	570	9.3	590	12.5	2,450
75	1,010	1,070	5.5	1,130	11.4	3,530
90	1,470	1,550	4.8	1,690	14.8	4,700
Mean	650	690	6.6	760	16.9	2,640
Workers With Sufficient Work History to Qualify for Social Security						
10	430	440	1.6	440	2.7	1,220
25	610	630	3.2	640	5.6	1,800
50	910	930	2.8	970	7.3	2,590
75	1,290	1,340	3.6	1,440	11.8	3,650
90	1,660	1,720	3.6	1,930	16.4	4,800
Mean	990	1,020	3.1	1,120	13.5	2,830

Sources: Authors' calculations from the Continuous Work History Sample and regression results from the Survey of Income and Program Participation matched to the Social Security Adminstration Detailed Earnings Record data.
Note: All earnings are adjusted to 2007 dollars using the Average Wage Index.

Table 6
Percent of Workers Covered by Social Security

(Percent above minimum quarters of coverage threshold)

Using Median Growth in Earnings for More-Educated Women to Increase Earnings for Less-Educated in Later Years

	Less-Educated	More-Educated	All
Before Reassignment	59.6	92.0	78.7
After Reassignment	61.9	92.0	79.6
Difference	2.3	0.0	1.0

Using Individual's Observed Earnings Growth to Increase Earnings for Less-Educated in Later Years

	Less-Educated	More-Educated	All
Before Reassignment	59.6	92.0	78.7
After Reassignment	62.1	92.0	79.7
Difference	2.6	0.0	1.1

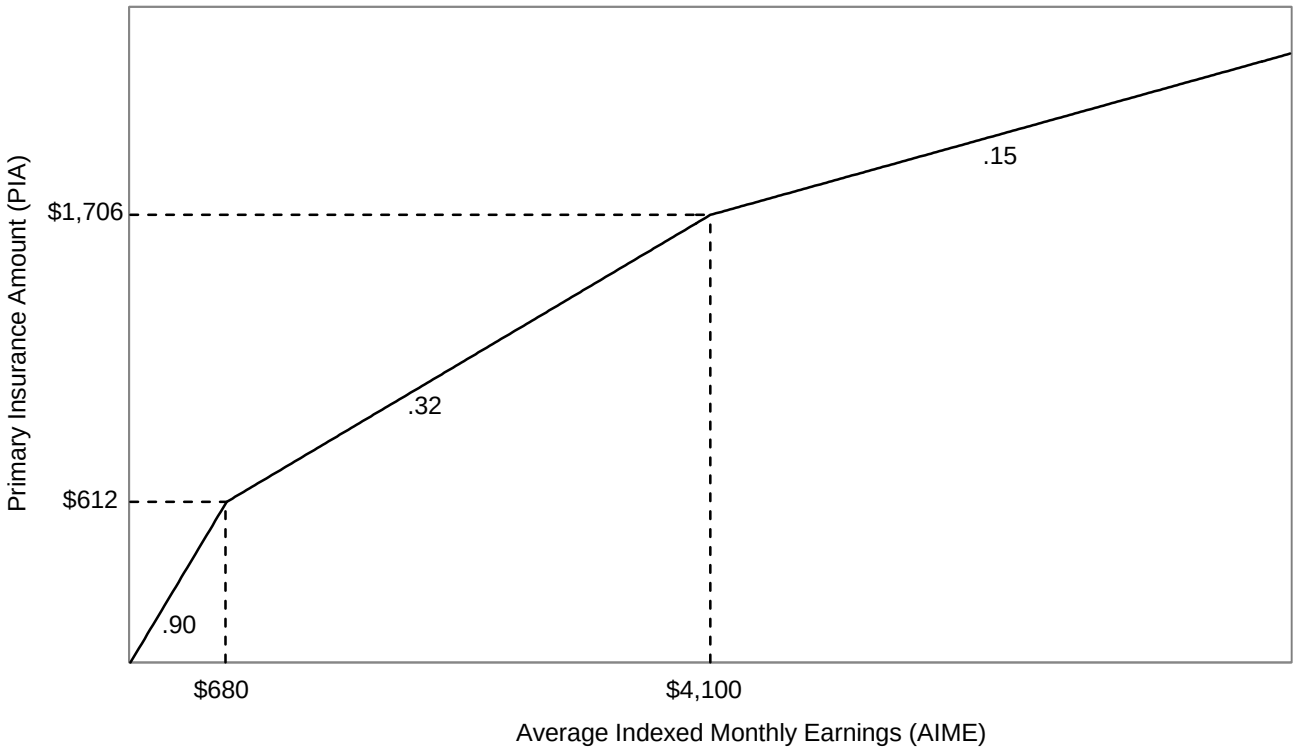
Sources: Authors' calculations from the Continuous Work History Sample and regression results from the Survey of Income and Program Participation matched to the Social Security Administration Detailed Earnings Record data.

Table 7
Distribution of the Primary Insurance Amount (PIA)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Using Median Growth in Earnings for More-Educated Women to Increase Earnings in Later Years		Using Less-Educated Individual's Observed Earnings Growth to Increase Earnings in Later Years		
Percentile	Less-Educated, Pre-Adjustment	Less-Educated, Post-Adjustment	Percent Difference	Less-Educated, Post-Adjustment	Percent Difference	More-Educated
All Workers						
10	30	40	33.9	41	38.9	664
25	148	173	16.8	174	17.8	897
50	469	512	9.3	527	12.5	1,180
75	719	736	2.5	756	5.1	1,525
90	866	889	2.6	936	8.1	1,991
Mean	457	480	5.1	504	10.3	1,253
Workers With Sufficient Work History to Qualify for Social Security						
10	389	396	1.6	400	2.7	785
25	546	564	3.2	577	5.6	972
50	684	693	1.2	706	3.1	1,224
75	808	823	1.9	857	6.1	1,563
90	925	944	2.1	1,012	9.4	2,034
Mean	677	688	1.7	723	6.9	1,327

Sources: Authors' calculations from the Continuous Work History Sample and regression results from the Survey of Income and Program Participation matched to the Social Security Administration Detailed Earnings Record data.

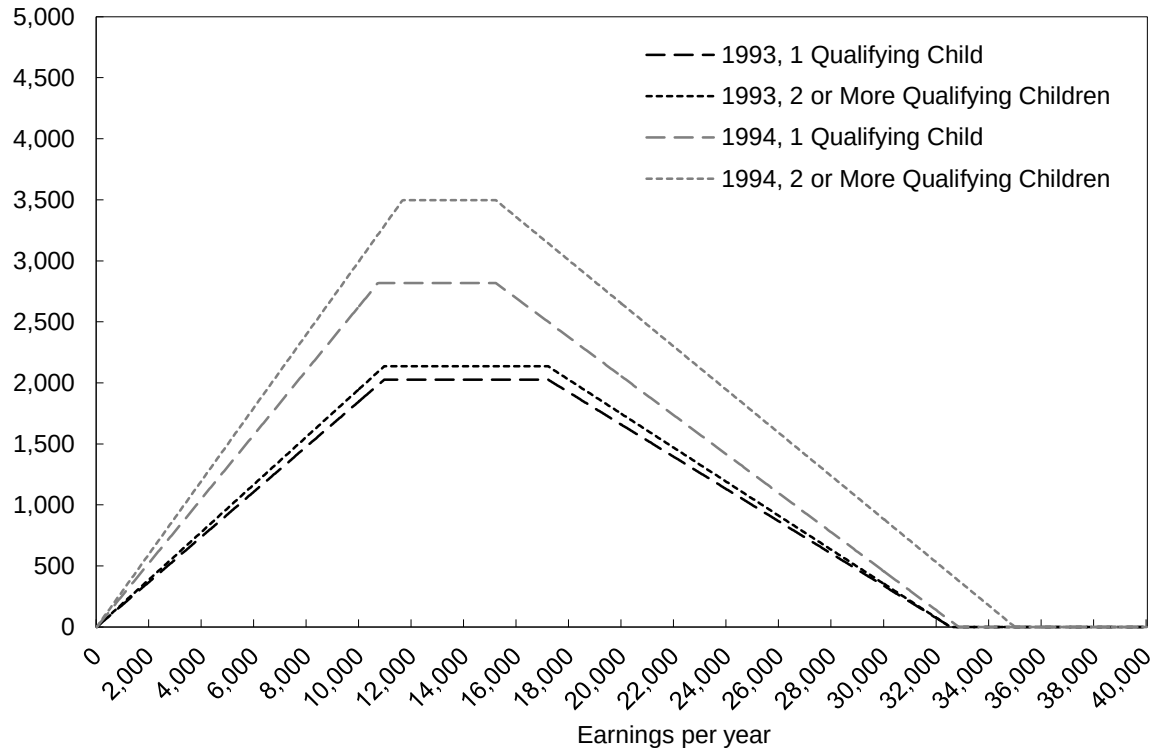
Figure 1.
Average Indexed Monthly Earnings and the Primary Insurance Amount, 2007



Source: Social Security Administration.

Figure 2
EITC for Non-Joint Filers with One Child or with Two or More Children, 1993 and 1994

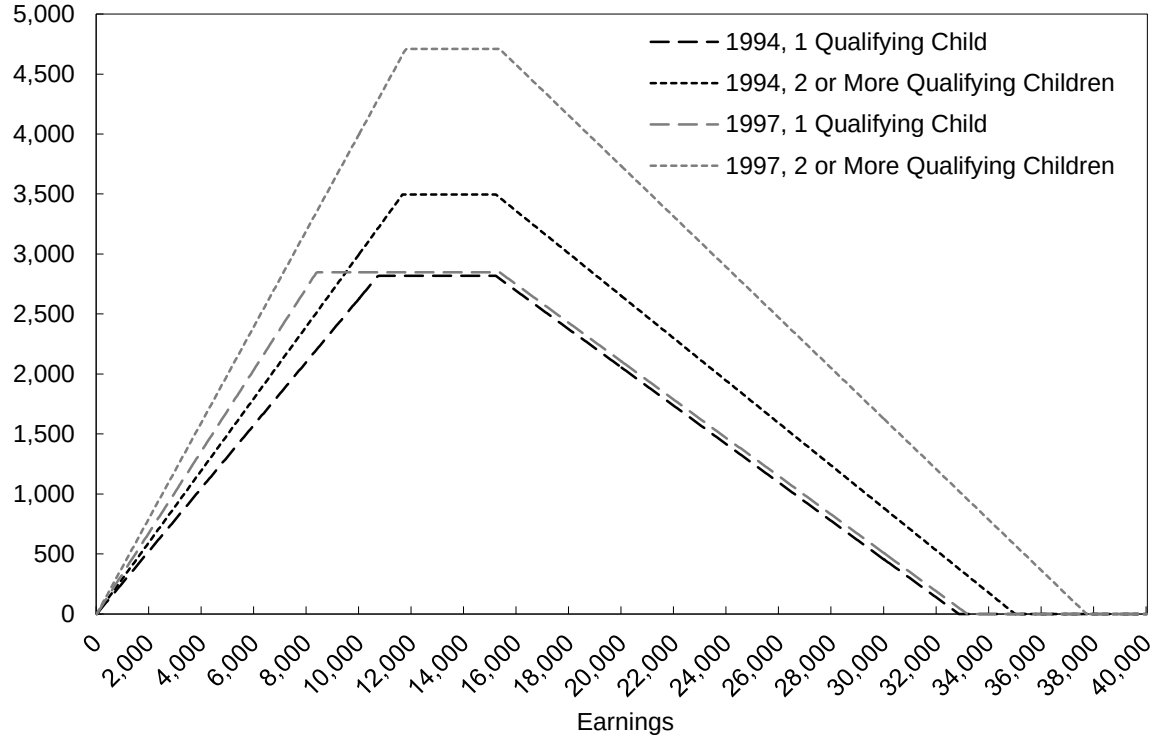
(2007 Dollars)



Source: Urban–Brookings Tax Policy Center.

Figure 3
EITC for Non-Joint Filers with One Child or with Two or More Children, 1994 and 1997

(2007 Dollars)



Source: Urban-Brookings Tax Policy Center.

Appendix Table 1.
Imputed Distribution of Educational Attainment, Current Population Survey and Continuous Work History Sample for Women in the 1953 Birth Cohort

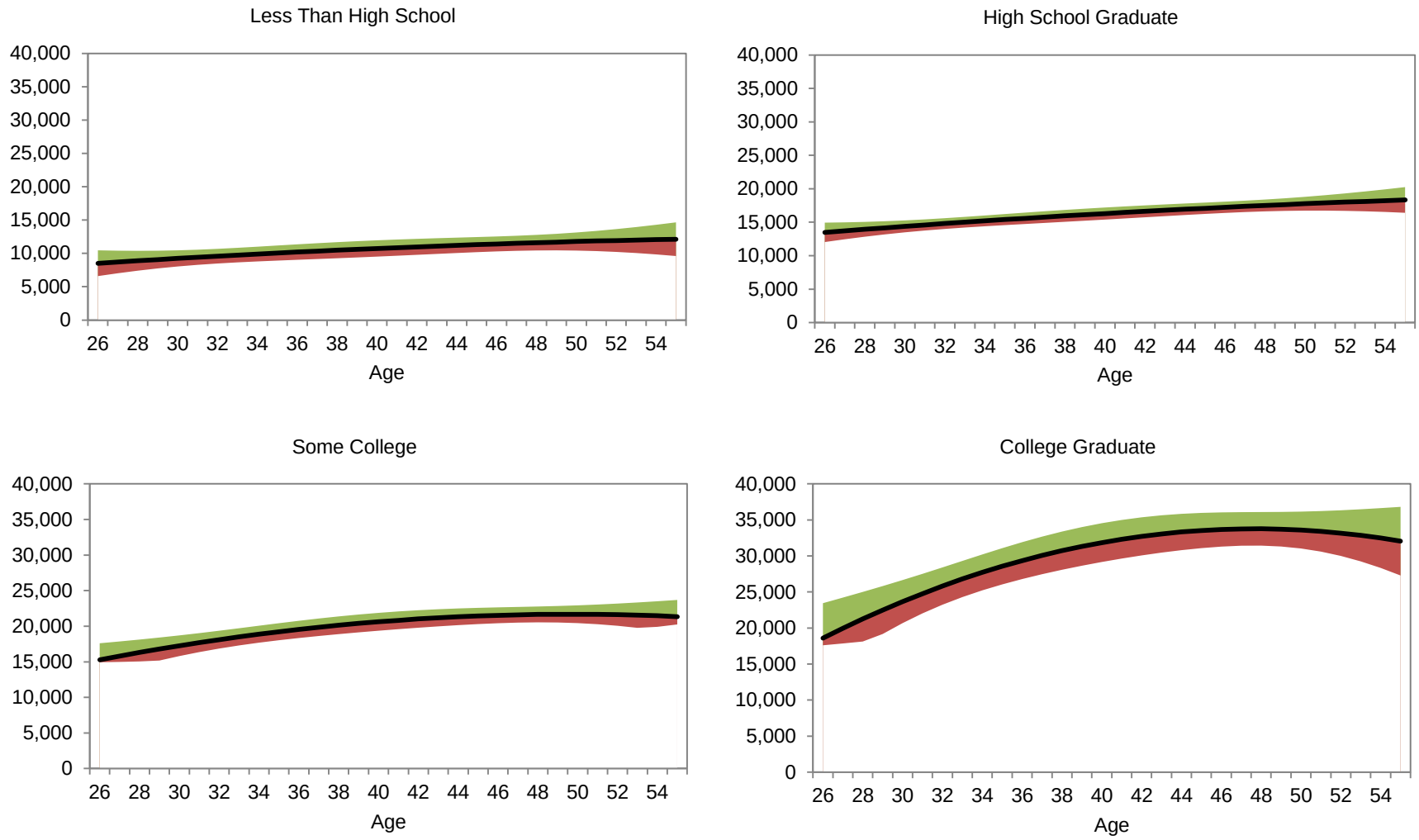
Education Level	March CPS, 1978 to 2008	Imputation to the CWHS	Difference
Less Than High School	7.4	10.3	2.9
High School Graduate	35.9	30.9	-5.0
Some College	27.6	22.6	-5.0
College Graduate	29.0	36.3	7.3
Less-Educated			
Less Than High School or			
High School Graduate	43.3	41.2	-2.1
More-Educated			
Some College or			
College Graduate	56.6	58.8	2.2

Source: Authors' calculations from the Continuous Work History Sample (CWHS) and 1979 to 2009 March Current Population Survey (CPS) data.

Appendix Figure 1

Estimated Average Earnings-Age Profiles by Educational Attainment for Women in the 1953 Birth Cohort

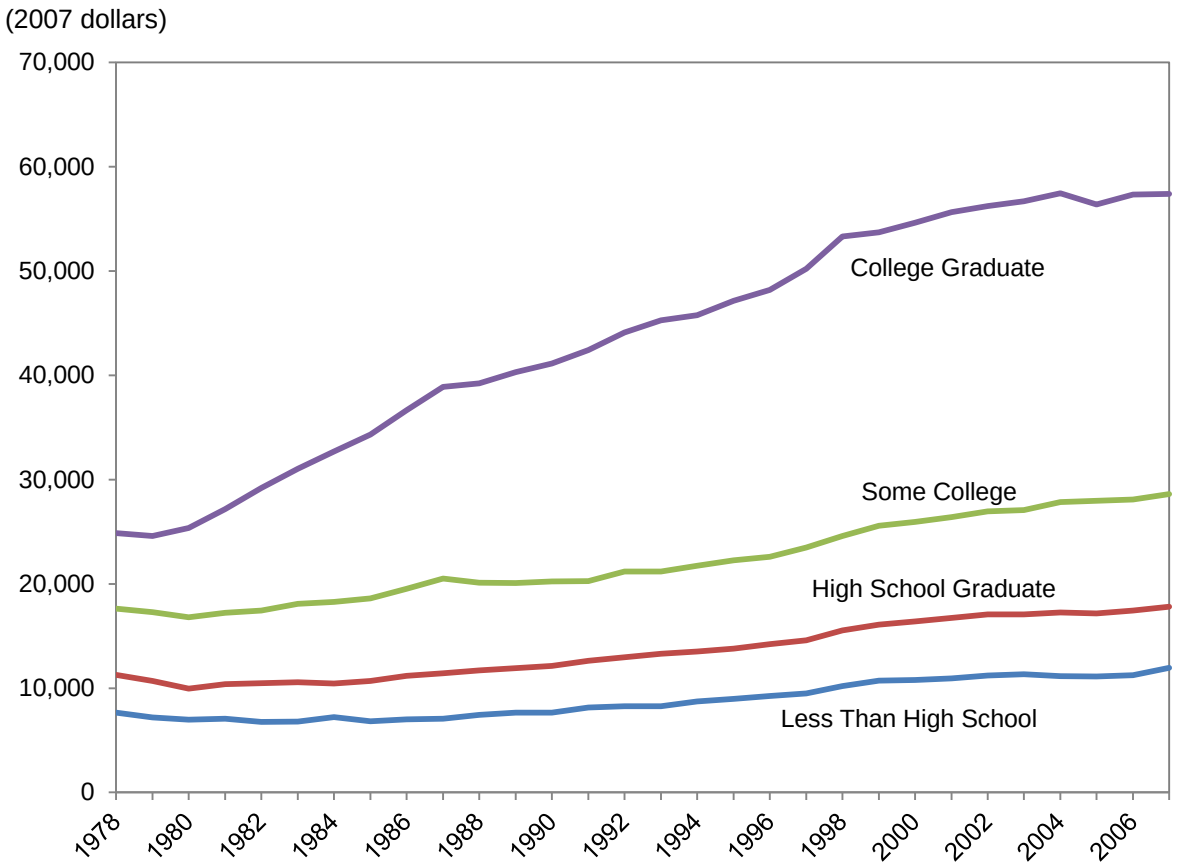
(2007 Dollars)



Sources: Estimated profiles from pooled 1979–2009 March Current Population Survey (CPS) data. Estimates are derived from separate earnings regressions for each level of educational attainment.

Notes: All regressions are weighted using the CPS person-weights. Earnings are adjusted to 2007 CPI-U-RS dollars. Earnings bands around each profile represent ±5 standard errors for each estimated coefficient.

Appendix Figure 2
Average Age Earnings and Imputed Level of Education Profiles



Source: Authors' calculations from the Continuous Work History Sample and 1979–2009 March Current Population Survey data.