Changes in EITC Eligibility and Participation, 2005–2009

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[1] This paper is released to inform interested parties of ongoing research and to encourage discussion of work in progress. The views expressed on technical, statistical, or methodological issues are those of the author and not necessarily those of the Census Bureau.

1 Introduction

Participation in the Earned Income Tax Credit (EITC) has long been of interest to economists and policy-makers. Over the program's lifespan, several estimates of take-up have been produced, all of which relied on survey data for an estimate of the eligible population. Under a data sharing agreement with the Internal Revenue Service (IRS), the Census Bureau has undertaken the calculation of EITC take-up using linked survey and tax data, with estimates produced and reported to the IRS for years 2005 to 2009. An IRS report (Plueger, 2009) was published describing the data linkage and modeling used to produce the estimates for 2005. The current work takes these estimates a step further, examining changes in eligibility and take-up over the five years in question. The purpose of the work is threefold. First, because estimates of EITC eligibility and take-up are scarce, one purpose is simply to publish general information about eligibility and take-up estimates for years not currently available. A second purpose is to describe changes in eligibility for the program and its take-up, broken out by demographic group, over what has become known as the Great Recession. The final purpose is to assess, from these changes, the extent to which the EITC as a policy targeted those groups most affected by the recession.

This work contributes to the literature by providing more precise estimates of EITC take-up than have been available previously. It also is unique in that it describes the program's availability to its intended target populations during a deep economic down-turn. As in all recessions, the latest downturn affected types of skill and family groups differently, and the work presented here makes an attempt to assess the effectiveness of the EITC in reaching these groups. These assessments are essentially descriptive in nature, and further work is needed to assess the dynamic connection between eligibility and unemployment.

The paper proceeds as follows: Section 1 provides background on the EITC and

summarizes some previous literature regarding its take-up, as well as key literature on the take-up of social programs in general during hard economic times. Section 2 describes the data used, including details on the linking of records, the sample selection, and outside sources of data; it also provides details on the generation of summary statistics and their presentation. Section 3 describes the difference-in-differences model used to analyze differential eligibility and take-up among key demographic and skill groups, going into detail on the model used. Section 4 presents the results, and section 5 concludes.

2 Background

2.1 The EITC

The EITC has become the largest cash-transfer program in the United States. It is a refundable tax credit, meaning that it provides a credit to taxpayers even if they have no federal income tax liability. The vast majority of participants receive the credit upon filing their taxes; less than 2 percent take advantage of a program that allows employers to distribute an expected credit over the course of the tax year in an employee's paycheck.

Lawmakers' original intent for instituting the credit was as an offset to payroll taxes, which represent a disproportionately high percentage of the earnings of low-income workers. At its inception in 1975, credit rates were quite low, but the program has seen substantial expansions over the subsequent decades. In particular, the Clinton administration's revamping of the credit in the mid-1990s, in tandem with welfare reform, greatly expanded the phase-in rate and the maximum credit a family could receive. The credit formula currently takes the shape shown in Figure 1. The credit phases in at a percentage of earnings until leveling off; it then phases out as a percentage of income until the credit reaches zero. Phase-in percent, phase-out percent, and

maximum credit level are determined by family structure.

As shown in Figure 1, a person must have some earned income to be eligible for the credit, and having total income above a certain amount results in ineligibility. Thus labor-force participants may become ineligible through one of two major pathways: either they have zero earnings over the entire tax year (and are not married to a spouse who had earnings), or they earn too much. There are other eligibility requirements that earners must meet, including a limit on investment income. Expansions to the credit, discussed further below, changed the program cutoffs for married families (in 2005) and those with three or more children (in 2009). Table 1 lists the program parameters for Tax Year 2009.

Figure 1. EITC Schedule for Tax Year 2009

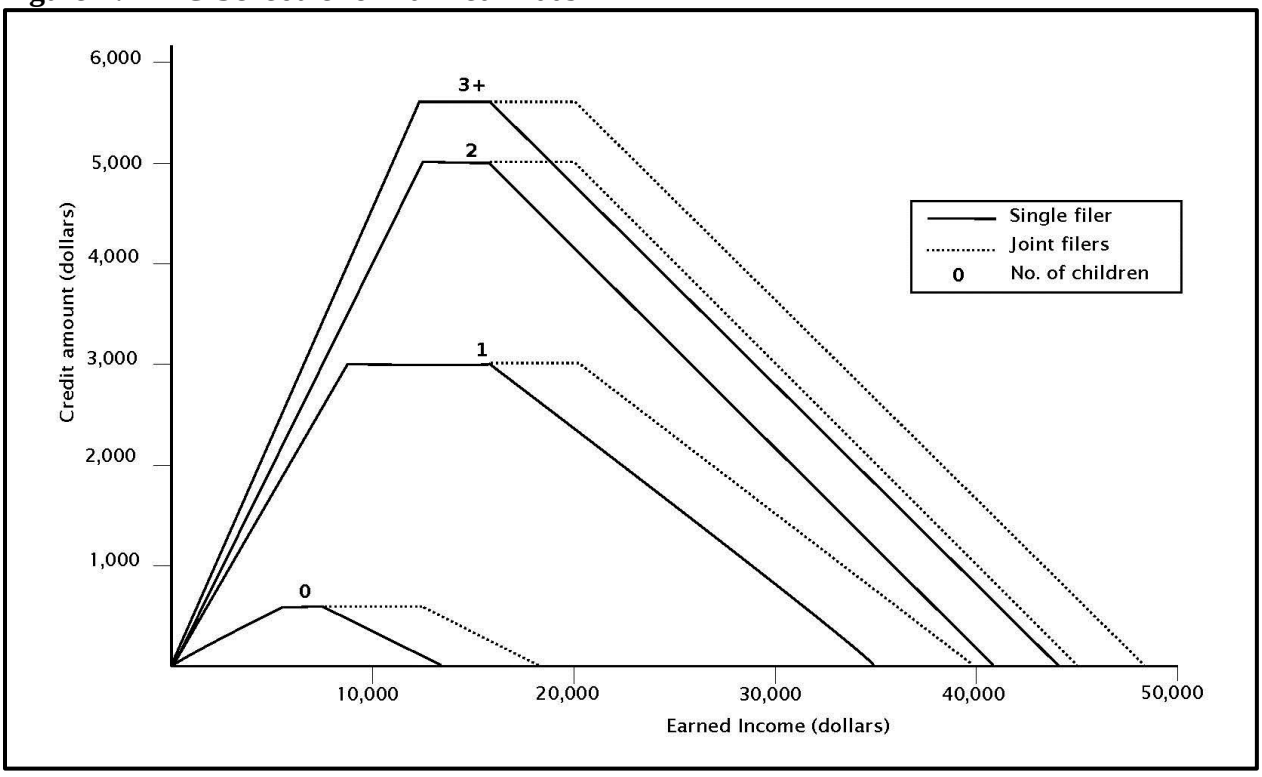


Table 1. Earned Income Tax Credit Parameters, Tax Year 2009

Family type	Phase-in rate (%)	Minimum income for maximum credit	Maximum credit	Phase-out rate (%)	Phaseout range	
					Beginning income	Ending income
No children	7.65	5,970	457	7.65	7,470	13,440
Married	7.65	5,970	457	7.65	12,470	18,440
One child	34.00	8,950	3,043	15.98	16,420	35,463
Married	34.00	8,950	3,043	15.98	21,420	40,463
Two children	40.00	12,570	5,028	21.06	16,420	40,295
Married	40.00	12,570	5,028	21.06	21,420	45,295
Three children	45.00	12,570	5,657	21.06	16,420	43,279
Married	45.00	12,570	5,657	21.06	21,420	48,279

Source: Urban-Brookings Tax Policy Center summary

2.2 Previous research

The rate of EITC participation among eligible earners has received some attention, but its calculation has presented a challenge. Most previous studies of EITC participation have focused on cross-sectional data. The first paper to estimate and report on EITC participation was Scholz (1990). This work immediately identified the challenges involved in calculating a precise participation rate, in that the calculation of the denominator—eligible earners—involved using self-reported information on earnings and family structure from the CPS ASEC and the Survey of Income and Program Participation (SIPP). Scholz's estimate is in the neighborhood of 70 percent for 1979 and 1984, early years for the program and during a time when credits were comparatively low. In later work, Scholz (1994) examined rates for 1990, finding participation in that year to be between 80 percent and 86 percent.

Two recent calculations of EITC take-up rates are Plueger (2009), who calculated an overall take-up of 75 percent (with a confidence interval between 73 percent and 77 percent) for Tax Year 2005, and Caputo (2011), who used the National Longitudinal Survey of Youth (NLSY) to examine eligibility and take-up for Tax Years 1999 to 2005. Plueger's work is of particular interest because it used the same data source and methodology for eligibility calculation as used

in this paper. Plueger estimated that 16 percent of eligible EITC claimants do not receive the credit because they do not file taxes, while 9 percent filed taxes but did not claim the credit. Caputo's estimates of take-up overall are much smaller, ranging between 53 percent and 64 percent for the NLSY79 sample. This is possibly due to the fact that the NLSY relies on asking the participant if he or she filed, while the tax data used in Plueger reflects true filings, including that done by tax preparers. Caputo (2011) also looks at predictors of take-up, finding that women, food stamp recipients, those with more children, and those separated, divorced, or widowed were all more likely to participate in the program. Caputo considers this evidence that the EITC reaches its target population relatively well.

The question addressed in this paper is the effect of the economic downturn on EITC eligibility and take-up. There is a wide-ranging literature on what happens to social-program eligibility and caseloads over the business cycle, although not much exists on the relationship of the EITC to economic downturns. Hotz et al. (2003) analyzed the income dynamics of families to look at how much "churning" existed in EITC receipt, finding that 74 percent of new EITC recipients lose eligibility within two years. Moreover, the main reason why families become ineligible is that their earnings increase beyond the eligibility range. There is a significant probability of families returning to eligibility, however, with approximately 35 percent of families becoming eligible five years after the end of an EITC spell. The results are suggestive of the sensitivity of previously low-income families to economic conditions.

This suggestion is further supported by studies of participation in other social programs, such as Aid to Families with Dependent Children (AFDC) or Temporary Assistance to Needy Families (TANF) and the Supplemental Nutrition Assistance Program (SNAP). Blank (1997) and Blank (2001) examine take-up rates for AFDC, finding a long-term increase in eligibility between 1977

and 1995. Increases in caseloads overall were related to economic conditions that increased eligibility, although changes were also induced by state-level policy changes and changes in demographics. Similarly, Grogger (2003) finds economic conditions explain much of the initial entry onto welfare rolls during the era of welfare reform; using SIPP data from 1993–1999, Grogger also finds that policy changes to welfare and the EITC also explain much of initial entry and, for the EITC, reentry into welfare. When changes in caseloads were decomposed, welfare reform explained 12 percent of the decline in welfare participation, the EITC 10 percent, and the unemployment rate 5 percent over years 1993 to 1999.

Finally, because EITC receipt is linked to the labor market, recent work on the effect of recessions on workers is relevant. Specifically, the use of the EITC during recessions is of interest, although the only work on this matter (Williams and Maag, 2008) indicates that EITC use may increase or decrease. Clearly, if a worker loses his or her job entirely for a tax year, the lack of earnings would make him or her ineligible for the EITC. However, cases exist in which previously-ineligible earners may enter eligibility: two-earner families may become single-earner, earners may be employed part of the year, and earners may become underemployed either through fewer hours worked or lower-paid employment. A feature of the recent recession discussed by Elsby et al. (2010) is the way in which loss of total labor input (defined as the product of employment and hours per worker) is split between "bodies" (that is, number of employed individuals) and "hours" of work time. For the most recent recession, the ratio of the first to the second is approximately 70:30. Elsby et al. (2010) and Hoynes et al. (2012) each examine which demographic groups are hardest hit during recessionary periods. Each considers the latest recession the "deepest" downturn since the Great Depression, but considers the recession similar to past recessions in terms of its differential impact on certain groups. These include

young, male, and minority workers as well as those with less educational attainment.

3 Data and Methods

The data and matching process used to generate the file studied in this analysis is described at length for Tax Year 2005 in Plueger (2009). The matching process changed little between 2005 and 2009, and any differences are discussed below.

The study uses data from the CPS ASEC-IRS matched file for Tax Years 2005 to 2009. IRS data sets include the universe of Form 1040 filers ("1040 data"); the subset of Form 1040 filers who received the EITC,[2] combined with a subset of filers who received a notice that they were potentially eligible for the EITC ("EITC data"); and the universe of Form W-2 earnings records ("W2 data"). Census data includes the CPS ASEC, as well as data for earners who were in modeling files used previously by the IRS and Census to calculate take-up. These original modeling files reflect modeling algorithms that used only CPS data.

Records were linked using a process whereby individuals in each data set are given a unique key, called a Protected Identification Key (PIK), based on comparing name, address, and date of birth to the same variables in a master reference file. All data were then merged using this unique identifier, with other identifying information (such as name and Social Security number) stripped. Only those observations that received the unique key are used in the analysis. Furthermore, a match is used only if CPS earnings were not imputed or allocated. Table 2 gives an account of the quality of the records match for each year. The final count is the total number of records used in the analysis for all years, and reflects the universe of CPS earners who could be matched to a unique identifier in the master file and who had modeled data from the original CPS

[2] Note that some of these EITC recipients had their EITC claim disallowed in full or in part by the IRS during the return filing process or later, and others presumably made errors related to eligibility that were not detected by the IRS. This paper does not account for the impact of noncompliance on the take-up rate.

modeling.

Table 2: *Sample Construction*

	2005		2006		2007		2008		2009	
Total CPS sample	208,562	100%	206,639	100%	206,404	100%	207,921	100%	209,802	100%
Imputed earnings	19,450	9%	20,204	10%	18,243	9%	18,926	9%	20,458	10%
Edited earnings	19,587	9%	20,490	10%	20,831	10%	19,698	9%	20,154	10%
Not PIKed	16,131	8%	15,150	1%	18,473	9%	18,547	9%	16,801	8%
In analysis sample	153,394	74%	150,795	73%	148,857	72%	150,750	73%	152,389	73%
Earners	72,447	35%	71,044	34%	71,629	35%	72,318	35%	72,603	35%
Earners with modeled data	67,289	32%	65,919	32%	66,116	32%	72,318	35%	72,603	35%
Modeled number, all years	344,245									

The number of EITC recipients in a given tax year is easy to estimate from the 1040 and EITC data; this number, however, tells us nothing about how many people were eligible for the credit. Eligibility modeling has relied on other data sources, and in this case relies on the CPS ASEC. The CPS ASEC provides important pieces of information for a tax unit that, if the same information is used when filing taxes, helps determine EITC eligibility for the unit. This includes the number of children in a household, their ages, and their relationship to the unit filer; and the unit's adjusted gross income and earnings for individuals and spouses (if married).

However, the CPS data lack certain key elements necessary for determining whether a tax unit meets the eligibility rules for the EITC. The first concerns who in a household claims a child for tax purposes. While family relationships can be established, there is no variable in the CPS that reliably assigns a child to dependency on an adult or married couple. In households where there are two related earners who file separate taxes and otherwise meet eligibility requirements (a mother and grandmother, for example), the CPS provides no information on who claims any children in the household.

The second issue concerns income and earnings. The accuracy of CPS ASEC earnings has

been widely studied, with a general finding that earnings are reported with error (Bollinger (1998); Bound and Krueger (1989)). This error can be attributable to rounding or ball-parking—an error that does not vary with other variables—or to systematic under-or overreporting, an error that is negatively associated with earnings level for men.

The analysis file, therefore, was refined to update and improve EITC eligibility modeling. Part of this process involved substituting in values from 1040, W2, or EITC data when available and appropriate. These included values for earnings, adjusted gross income, and investment returns and dividends; and variables related to household structure, filing status, and claimed children. Married persons filing separately were removed from eligibility to be consistent with EITC rules. Qualifying children who were modeled as being dependent on one adult, but were claimed by another in the tax data, were reassigned to the claimant. Finally, using the matched data allowed for checking when a possible eligible was actually claimed on someone else's tax return, which would disqualify him or her from EITC participation. Table 3 lists the variables used in this analysis and their source.

In the CPS ASEC, person weights sum to the population level for the civilian, non-institutionalized U.S. population. With the sample restrictions outlined above, the weights no longer sum to the population count. A major restriction is the removal of observations with allocated or imputed earnings data. To handle this issue, the missing data were assumed to be missing at random,[3] and weights on the remaining sample were inflated accordingly. All summary tables report the population-level estimates.

This report addresses two main questions regarding the EITC: did more people become eligible for the credit, either due to program expansion or economic forces, between 2005 and

[3] That is, the methodology implicitly assumes that EITC eligibles and EITC claimants are represented among the omitted people the same way they are represented among the included people (and, hence, in the entire population).

Table 3: *Sources of variables*

Variable	Source
Eligibility determination	
Wages/Earnings	W2; 1040* if W2 missing; CPS for non-filers
Adjusted Gross Income	1040; CPS for non-filers
Dependents	1040; CPS for non-filers
Filing type/Marital status	1040; CPS for non-filers
Sanction status & 1040	1040
Cohabitation & CPS \\	CPS
Grandparents & CPS \\	CPS
State economic variables	
Unemployment rate	Bureau of Labor Statistics
Federal/state minimum wages	U.S. Department of Labor
Control variables	
State	CPS
Year	IRS/CPS (survey given in March of next year)
Supplemental Security Income	CPS
TANF	CPS
SNAP	CPS
Sex	CPS
Race	CPS
Hispanic origin	CPS
Education	CPS

**1040 data include 1040 files, EITC recipient files, and CP09/27 files for each year. The last is a record of 1040 filers who did not claim the EITC, but were sent a notice about their potentially being eligible for it.*

2009; and did take-up rates change? A higher raw number of EITC eligibles might be due to an increased number of taxpayers overall or due to a higher proportion of taxpayers moving into credit eligibility. Therefore, any EITC eligibility increases over time were examined within the population that are possible 1040 filers (who are referred to here occasionally as "earners"). These include both those who were required by law to file for the tax year and those who were not. Those with positive earnings for a tax year, but who were not required to file a 1040, likely had earnings that placed them within EITC eligibility. Those who chose not to file represent a substantial portion of the population who forego the credit.[4]

[4] Note that both of these groups may include people who had non-wage income not reported to the IRS or to Census

Possible 1040 filers were determined using CPS ASEC data, supplemented by earnings reported on W2 forms. Based on this overall sample population of possible 1040 filers, the population of interest are those who were modeled as eligible for EITC receipt in a given tax year based on income, earnings, investment income, and number of dependents ("EITC eligibles"). The "overall participation rate'" is the proportion of all eligibles who actually received a credit. "Eligible non-filers" are those modeled as eligible for the EITC who either did not file a 1040 or filed a 1040 but did not file for the credit. Since this analysis deals only with EITC eligibles, other populations of possible interest were not examined--for example, the population who were not modeled as eligible but who did receive an EITC.

4 Results

4.1 Increases in Eligibility and Participation[5]

In the summary tables that follow, all estimates are reported using the population weights from the CPS. Standard errors for these estimates were calculated using the CPS replicate weights. Table 4 shows increases between 2005 and 2009 in EITC eligibility and EITC participation. By way of comparison, the IRS estimates that the number of required returns grew by about 1.2 percent between 2005 and 2009, and the number of required returns actually filed increased by about 2.8 percent.[6]

Meanwhile, changes in EITC eligibility and take-up outpaced the 1040 rate, with an increase of 14.1 percent in participants and a 12.7 percent increase in EITC eligibility. While the rate of 1040 participation did not increase significantly, the take-up rate for the EITC increased to about 79 percent in 2009 from about 77 percent in 2005. The highest rate of take-up occurred in

(and so not in our data), which may have made them ineligible for the EITC.

[5] All comparative statements in this report have undergone statistical testing, and, unless otherwise noted, all comparisons are statistically significant at the 5 percent significance level or less.

[6] These numbers were calculated using the official estimates from the IRS.

2007, with about 81 percent of those eligible filing for the EITC.

Table 4: *Change in EITC eligibility and take-up, 2005-2009*

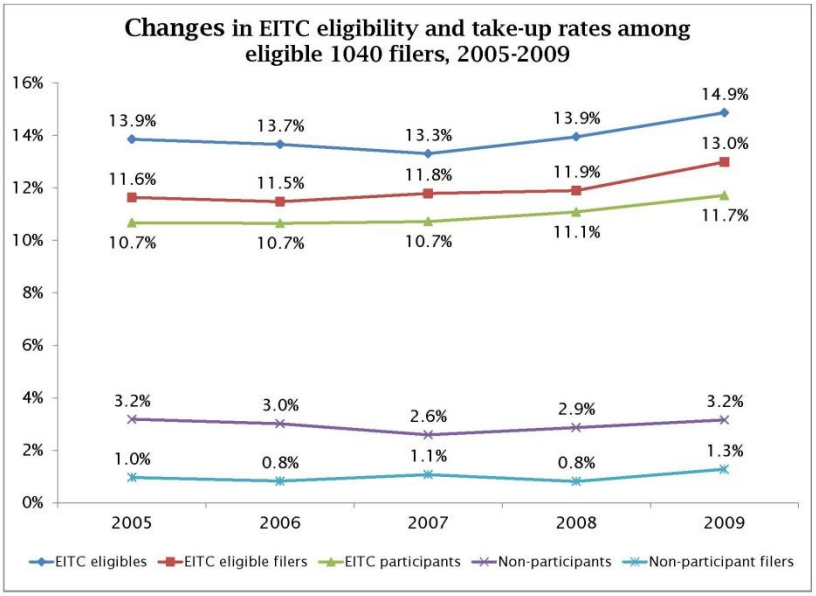
	Participants (Thousands)	Eligibles (Thousands)	Take-Up Rate (Standard Error)
2005	15,547	20,185	77.03 (0.51)
2006	15,642	20,062	77.97 (0.51)
2007	15,967	19,827	80.53 (0.52)
2008	16,678	20,992	79.45 (0.49)
2009	17,913	22,742	78.77 (0.47)
% change 05-09*	14.1	11.9	

**Computed as* $(N_t - N_{t-1}) / (N_t + N_{t-1})$

Figure 2 shows eligibility, take-up, and non-participation rates in the EITC for those who were possible 1040 filers. The top line displays the proportion of all earners who were eligible for the EITC, which increased from 13.9 percent in 2005 to 14.9 percent in 2009. The second line shows the proportion of actual 1040 filers who were eligible for the EITC, who had a more marked increase, going from 11.6 percent in 2005 to 13 percent in 2009. Rates for EITC take-up followed a similar trend, increasing from 10.7 percent in 2005 to 11.7 percent in 2009.

Meanwhile, the proportion of all earners (possible 1040 filers) who were nonparticipants in the EITC remained steady over time, ranging between 2.6 percent and 3.2 percent. Nonparticipants who filed a 1040 also showed little change over time, remaining at about 1 percent over the time period. These percentages, when translated into population-level estimates, correspond to between 3.9 million and 4.8 million non-participants each year who appeared to be eligible. Of these, 1.2 to 1.9 million filed 1040s.

Figure 2. Trends in EITC Eligibility and Participation, 2005-2009



4.2 Changes in Eligibility: Program Expansion or Economics?

Any analysis of changes in EITC eligibility and take-up in this time period must take into account the fact that a non-trivial proportion of earners were made eligible for the credit due to expansions to the program, which occurred in 2005, 2008, and 2009. Beginning in 2002, the start-point for the phase-out range was extended by $1000 for those filing "Married Filing Jointly" (relative to other filers); further extensions occurred in 2005, in 2008, and again in 2009. Table 5 lists the year and the extension amount. Table 5 also lists a credit expansion that occurred for all filers with three or more children in 2009, for whom the phase-in rate increased from 40 percent (the rate for families with two or more children in previous years) to 45 percent. This phase-in change affected the maximum credit a filer could receive, from $5,028 to $5,657. Any filers who fell into the expanded program parameters were identified in the data.

Table 5: *Changes in program parameters, 2005-2009*

Year	Expansion category	Expansion Amount*
2005	Married filing jointly	$2,000
2006	Married filing jointly	$2,000
2007	Married filing jointly	$2,000
2008	Married filing jointly	$3,000
2009	Married filing jointly	$5,000
2009	Three-child expansion	45% phase-in rate; $5,657 max credit

* Difference relative to other filers in the range of income eligible for the maximum credit

Any other changes in participation rates over this period are assumed to be due to economic forces, although this term is being used in a broad sense. The recession that began in December 2007 and ended in June 2009 was associated with high rates of unemployment, which in turn might be reflected in lower end-of-year earnings, either through job loss or underemployment in terms of hours or weeks worked.

For the results that follow, the full sample of possible 1040 filers was used, in recognition that earners can move into the expanded eligibility region through program expansion or through economic forces (although these groups are certainly not mutually exclusive). Later, when I analyze eligibility using fixed-effects regressions, the subsample of earners covered by expansions is recoded as non-eligible to examine changes in eligibility when program parameters are held constant except for inflation changes.

Table 6 shows the change in the rate of EITC eligibility between 2005 and 2009 among eligible 1040 filers, decomposing the percent change into two components: that which occurred due to expanded program parameters and that which occurred due to other (presumed to be economic) forces. Each rate was calculated using the person weights to arrive at a population-level estimate. Standard errors for the estimates were calculated using the CPS replicate weights. The first three columns show the probability for all earners in 2005 and 2009 and the change between

the two years; columns 4 through 6 calculates the same statistics for only those earners who fell into the expansion category (in other words, in each case the denominator is the same: the universe of possible 1040 filers).

In general, most subgroups saw increases in eligibility over the period, with the exception of female earners and earners eligible to file "single." Black alone earners experienced a decrease, but the change was not statistically different from 0. Some increases were more marked than others. Male earners experienced a change in rate of eligibility of 17 percent, with a nearly 12 percent change attributable to economic forces. Both lower and more highly educated earners experienced greater increases. Those with a BA or BS degree or higher saw an overall percentage change of nearly 20 percent, with 14 percent attributable to other forces. Joint filers experienced the highest increase in eligibility, with a nearly 24 percent change, split almost evenly between program expansion and other forces. Finally, earners with children experienced higher percent changes over the period than did those with no children: about 10 percent for those with one child and 16 percent for those with more than one. Other groups' changes were not statistically significant.

Table 6: *Changes in rates of EITC eligibility due to program expansion and other forces, by demographic characteristics, 2005-2009*

	All			Expansion				
	2005 Total	2009 Total	change 05-09	2005 Total	2009 Total	change 05-09	% change expansion	% change other
Female	20.16	19.72	-0.44	0.13	0.39	0.26	1.32	-3.51
	(0.30)	(0.29)		(0.02)	(0.04)			
Male	9.87	11.78	1.92	0.37	1.03	0.66	6.09	11.62
	(0.17)	(0.18)		(0.03)	(0.06)			
White alone	12.14	13.47	1.33	0.27	0.78	0.51	3.99	6.42
	(0.16)	(0.16)		(0.03)	(0.04)			
Black alone	23.65	23.05	-0.60	0.31	0.74	0.43	1.86	-4.42
	(0.58)	(0.52)		(0.07)	(0.10)			
Other race	13.29	13.85	0.56	0.30	0.98	0.68	5.01	-0.87
	(0.63)	(0.62)		(0.10)	(0.20)			
Non-Hispanic	12.15	12.81	0.66	0.22	0.66	0.44	3.50	1.79
	(0.16)	(0.16)		(0.02)	(0.04)			
Hispanic	25.15	27.19	2.04	0.63	1.51	0.88	3.35	4.46
	(0.60)	(0.49)		(0.10)	(0.12)			
Less than HS	20.03	22.22	2.19	0.31	1.12	0.81	3.84	6.54
	(0.50)	(0.49)		(0.06)	(0.12)			
H.S. graduate	16.98	17.97	0.99	0.34	0.89	0.55	3.16	2.50
	(0.32)	(0.30)		(0.04)	(0.06)			
Some college	15.11	16.17	1.07	0.34	0.82	0.48	3.05	3.78
	(0.30)	(0.30)		(0.05)	(0.07)			
BA/BS or more	5.38	6.55	1.18	0.13	0.47	0.34	5.68	14.04
	(0.21)	(0.20)		(0.03)	(0.05)			
No children	5.70	5.95	0.25	0.09	0.23	0.14	2.42	1.89
	(0.14)	(0.13)		(0.02)	(0.03)			
One child	32.67	36.23	3.56	0.55	1.38	0.84	2.43	7.91
	(0.54)	(0.60)		(0.07)	(0.12)			
More than one child	30.33	35.59	5.26	0.79	2.69	1.90	5.75	10.20
	(0.48)	(0.46)		(0.09)	(0.17)			
Single filer	16.31	15.98	-0.33	{NA}	0.03	0.03	{NA}	-2.27
	(0.23)	(0.22)			(0.01)			
Joint filer	10.38	13.19	2.80	0.67	1.93	1.25	10.69	13.12
	(0.22)	(0.21)		(0.22)	(0.09)			

Each column shows the rate specified, with the percent change in the rate reported in the last two columns, first for those who became eligible due to the expansions in the program and then for all others. Standard errors for each rate (shown in parentheses) were calculated using the CPS replicate weights.

Table 7 shows a similar analysis for changes in EITC take-up contingent upon eligibility. In this case, the denominator for each column is the universe of those modeled as EITC eligibles. For take-up rates, differences between those in the expansion range and those not is not particularly relevant. Take-up is determined based on the choice of an individual to file for the credit, rather than on parameters that may have opened up eligibility. Moreover, cell sizes for certain demographic groups became too small for reporting purposes when looked at within program expansion. Therefore Table 7 reports only the overall take-up for the different demographic groups.

Take-up rates increased for most groups, with statistically significant changes for the following: male, Black alone and other race, non-Hispanic, some college and college educated, no children, single filers, and those in the phase-in region of the benefit. Those with less than a high school education saw a drop of 10 percent over the period, and Hispanics experienced deep decreases in participation (both statistically significant). Other groups' changes were not statistically significant.

Of particular interest is the rate of take-up by credit amount. However, because of the "U" shape of the EITC benefit function, looking only at amount of credit gives an incomplete picture. Figure 3 shows the rate of take-up for the EITC based on credit amount and according to whether the earner is in the phase-in, plateau, or phase-out region. The lowest participation rate occurs where the credit is extremely low and the earner is in the phase-in region. This likely reflects earners who do not file taxes for the tax year in question. Slightly higher rates are seen for those in the plateau region and those in the phase-out for the same credit amount. Interestingly, a drop-off in participation occurs for those in the phase-out and plateau at the maximum credit amount, while those in the phase-in close to the maximum amount exhibit

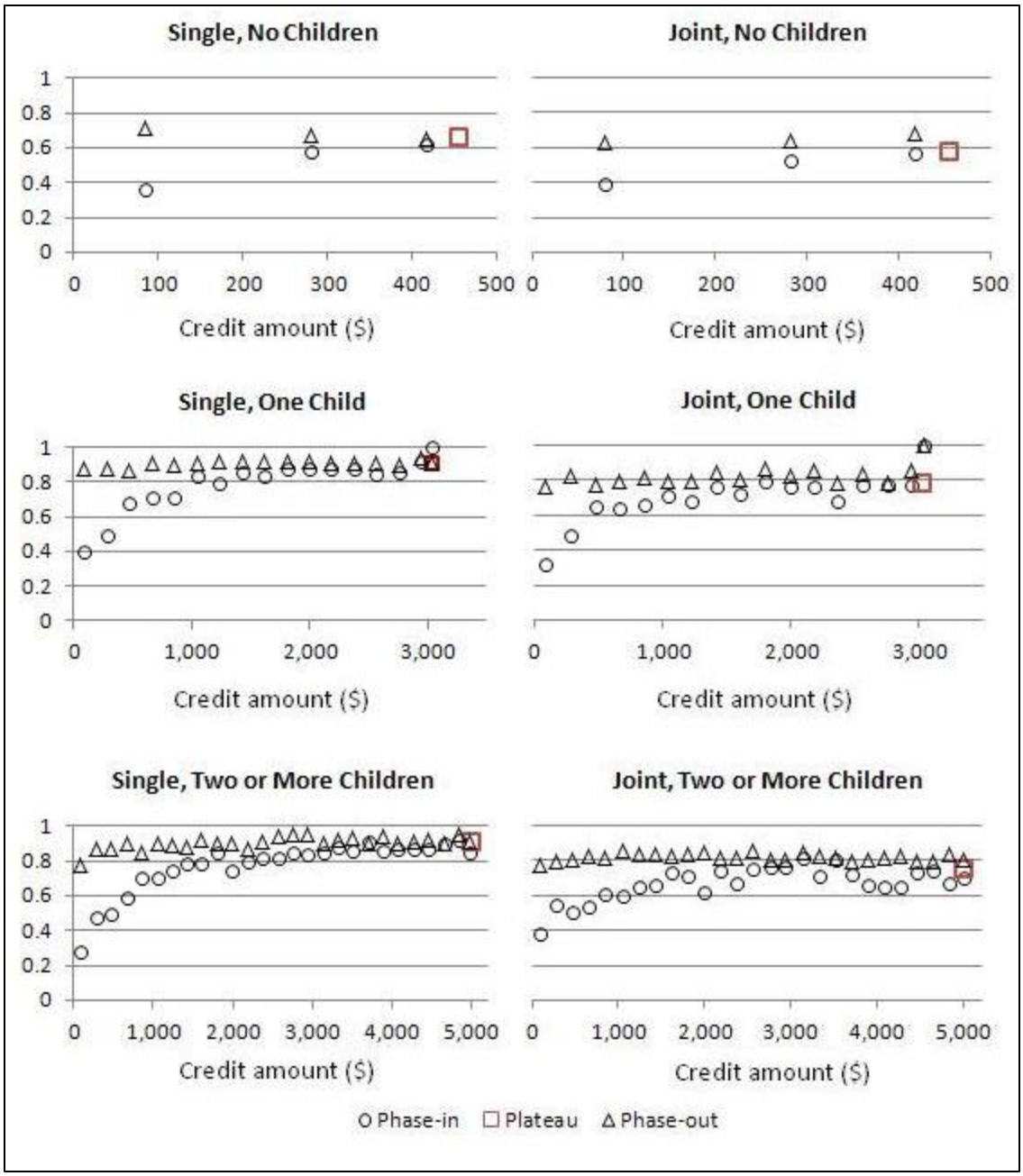
increasing participation. These patterns are beyond the scope of this paper, but will be examined more closely in later work.

Table 7: *Changes in EITC take-up by demographic characteristics, 2005-2009*

	2005 Total	2009 Total	change 05-09	% change
Female	80.81	81.75	0.94	1.16
	(0.64)	(0.60)		
Male	72.13	75.59	3.46	4.69
	(0.83)	(0.69)		
White alone	76.85	77.76	0.91	1.17
	(0.63)	(0.57)		
Black alone	78.29	81.91	3.63	4.53
	(1.15)	(0.98)		
Other race	74.17	81.58	7.42	9.52
	(2.39)	(1.69)		
Non-Hispanic	75.63	81.09	5.46	6.97
	(0.60)	(0.48)		
Hispanic	81.51	72.21	-9.30	-12.10
	(0.93)	(1.05)		
Less than High School	79.51	72.16	-7.35	-9.69
	(1.11)	(1.14)		
High School graduate	78.57	81.44	2.87	3.59
	(0.80)	(0.74)		
Some college	77.52	82.11	4.59	5.75
	(0.92)	(0.76)		
BA/BS or more	64.60	73.47	8.87	12.85
	(1.99)	(1.52)		
No children	56.10	65.23	9.13	15.05
	(1.21)	(1.15)		
One child	86.15	85.33	-0.82	-0.96
	(0.70)	(0.67)		
More than one child	84.33	82.94	-1.39	-1.66
	(0.71)	(0.66)		
Single filer	75.45	78.39	2.93	3.81
	(0.69)	(0.56)		
Joint filer	80.52	79.47	-1.04	-1.30
	(0.79)	(0.75)		
Phase-in	64.15	68.23	4.08	6.16
	(1.06)	(0.95)		
Plateau	83.11	81.31	-1.80	-2.19
	(1.40)	(1.11)		
Phase-out	83.13	84.39	1.26	1.50
	(0.64)	(0.53)		

Rates are based on the population-level estimate of EITC eligibles (denominator) and those paid the EITC (numerator).

Figure 3: *Rate of take-up for the EITC, 2005–2009, based on credit amount and according to whether the earner is in the phase-in, plateau, or phase-out region* †



†The charts for Two or More Children exclude rates beyond the plateau for those with 2 children ($5,028), since these credit amounts are only available to those claiming three or more children. Take up rates looked similar when eligible earners with 3 or more children were graphed separately. All credit amounts are in 2009 dollars.

To sum up: higher rates of eligibility were seen for nearly all groups, with particularly marked increases for male earners (who were hit hard by the recession), those with more

education, and those with a family structure (married and more children) which fall under more generous EITC parameters. Looking further into these changes is covered in the next section.

5 Fixed-effects models

Assessing relative changes over time between a "treatment" and "control group" (or multiple groups) can be tackled using fixed-effects regressions. In a two-period situation, such a model reduces down to difference-in-differences. With more than one time period and repeated cross-sectional data, dummy variables are generated for each period and group, with further variation often handled using place fixed effects.

The main question to be addressed is the impact of the recession on EITC eligibility rates. Among the major impacts of the recession of 2007–2009 was local unemployment. The overall U.S. unemployment rate increased substantially over this period, but some states and counties were affected more than others. To examine the association between the recession and increased eligibility for and participation in the EITC, I use state unemployment rates as a source of variation in economic conditions. Economic conditions by state may also be reflected in the wage distribution of workers; therefore I also include the state value for the median wage and the 20th percentile of wage by year. These controls take into account differences between states that are relatively stable over time (the overall wage distribution), as well as a time-varying economic factor (the unemployment rate) that may have increased at a greater pace for some states compared with others.

Also worth examining is how eligibility rates changed over time by demographic group. To address this question, I add to models of eligibility dummy variables for each characteristic of interest multiplied by a linear time term. This captures the year-by-year change for the group

in question over the time period, using 2005 as the base year. As an alternative, I could have pooled pre- and post-recession years and used a difference-in-difference model. Doing so leads to similar results once the time-trend coefficients are summed over the four years. However, in terms of unemployment, deciding on a pre- and post-period is problematic. While the recession officially began in December 2007, unemployment lagged slow economic growth. For example, the national monthly unemployment rate at the end of 2007 was 5 percent, and it increased gradually over 2008 to end at 7.3 percent. The highest rates of unemployment—greater than 9 percent—occurred in 2009.

The baseline model, regressing state economic indicators on eligibility in a fixed-effect framework, is

$$y_{ist} = \alpha + \beta z_{st} + \gamma x_{ist} + \sigma_s + \tau_t + \epsilon_{ist}$$

where y takes on a 1 if an individual[7] in state s and in year t is eligible for the EITC and 0 otherwise. This model is run first parsimoniously—with just the economic indicators—and then with the full set of individual characteristics, group dummies, and group-specific trends. Individual characteristics include age and age squared, and binary terms indicating race (White alone, Black alone, Other race[8]); Hispanic origin; education (four categories); filing type (Joint or Single); and number of dependent children (none, one, or more than one).

Adding individual characteristics tells us only the contribution of each characteristic to the "after" rate, not how rates change for a given characteristic over time. Therefore, I run a fixed-effects model using characteristic-specific linear time terms, which captures the year-by-year change in eligibility for each characteristic. The equation for this model can be expressed as

$$y_{ist} = \alpha + \beta z_{st} + \gamma x_{ist} + T_\tau + \left(X_{ist} \times T_\mu\right) + \sigma_s + \epsilon_{ist}$$

[7] This work focuses on individual characteristics, so each CPS sample would have to be viewed as a year panel. This is why the standard errors are clustered on the state level.

[8] Included in Other race are American Indian/Alaska Native alone, Asian alone, and Other.

where T is a linear time term and $X_{ist} \times T_{\mu}$ refers to binary characteristics multiplied by the linear term for time. The interaction between time and the characteristic in question can be interpreted as the additional change in eligibility experienced by this group year-by-year, holding other characteristics constant. Using a linear probability model rather than a probit or logit allows for a straightforward interpretation of the interaction (Ai and Norton, 2003)[9].

Take-up was examined using a similar model, with inclusion of individual-level measures of other program use, including the log values of Supplemental Security Income (SSI), Temporary Assistance to Needy Families (TANF), and Supplemental Nutrition Assistance Program (SNAP) benefits. Moreover, since the benefit level of the EITC may affect take-up, I included dummy variables for being in the phase-in or phase-out region (with eligibility for the maximum benefit forming the comparison group).

Each model was weighted using the CPS ASEC population weights, corrected as described earlier. For each model, standard errors were corrected for both the "dimension" problem (the use of state-level variables with individual level units of observation) and autocorrelation by clustering the standard errors at the state level (Bertrand et al., 2000). Models were also run with the standard errors corrected using the CPS ASEC replicate weights. Standard errors were smaller using the weights, so the more conservative results using clustered standard errors are reported. No coefficient moved from significant to nonsignificant (or vice versa) at the 5 percent level between models.

5.1 Predicting eligibility

Table 8 displays the results for eligibility. The first three models are results when all

[9] Other models were examined, with similar results: A logit yielded marginal effects very similar to the coefficients reported in the linear model. Models were also run using each characteristic in turn as the "difference-in-differences" estimator. The coefficients yielded by this method did not differ significantly from those in the joint specification.

those estimated to be eligible for the EITC are coded "1" for the dependent variable. The second three models are results when those estimated to have become eligible due to program expansion are recoded to "0," thus holding constant the EITC program parameters. The overall eligibility rate for the first three columns is 13.3 percent, and for the second three columns, 13.0 percent. For the full population of eligibles, unemployment rate is not a predictor of eligibility unless the linear trend and the interaction effects are included in the model. For the more restricted population, unemployment is a predictor of eligibility when characteristics are included. Depending on which population one considers and the model in question, a one percent increase in the unemployment rate predicts a change in probability of approximately 0.2 percent. Median wage influences EITC eligibility in a way one would expect, with a higher median associated with a lower probability of eligibility.

The interaction effects appear in columns 3 and 6. In each case, the constant term reflects the rate in 2005 for single, White alone, female, non-Hispanic earners with a high school degree and no children. The coefficient on the time trend indicates the change per year, averaged over the time period, that this base group experienced. For male earners, the average year-by-year growth in EITC eligibility is 0.4 percent whether the full or more restricted population is used. Those with less than a high school education experienced a year-by-year change in eligibility of -0.5 percent regardless of which sample was used. Those with one child saw a growth rate of about 0.7 percent using either population, while those with more than one child experienced a nearly 1 percent year-by-year increase for the full population. The latter effect drops by nearly a third once the population is restricted to non-expanders. Similarly, joint filers experienced a 0.6 percent year-by-year change in the full population, but only a 0.4 percent change in the restricted population. These results are not surprising given that the target

Table 8: *Linear probability models: Dependent variable is eligibility for the EITC.*

	model 1 *β*, *(SE)*	model 2 *β*, (SE)	model 3 *β*, (SE)	model 4 *β*, (SE)	model 5 *β*, (SE)	model 6 *β*, (SE)
Unemployment rate	0.04	0.18	0.22 **	0.10	0.24 *	0.15 *
	(0.14)	(0.12)	(0.07)	(0.11)	(0.09)	(0.07)
Minimum wage (log)	1.59	0.66	0.44	1.11	0.20	0.19
	(1.23)	(1.13)	(1.18)	(1.17)	(1.07)	(1.14)
Median wage (÷100)	-0.02 *	-0.02 **	-0.02 *	-0.02 **	-0.02 **	-0.01 *
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
20th %tile wage (÷100)	0.00	0.00	0.01	-0.01	-0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Time			-0.57 ***			-0.46 **
			-0.14			-0.13
Interactions of Variable X Time						
Male			0.36 **			0.37 **
			(0.12)			(0.11)
Black alone			0.00			0.00
			(0.11)			(0.11)
Other race			-0.32			-0.34
			(0.23)			(0.23)
Hispanic			0.09			0.02
			(0.19)			(0.19)
Less than HS			-0.50 **			-0.54 ***
			(0.14)			(0.14)
Some college			-0.20			-0.18
			(0.11)			(0.10)
BA/BS or more			-0.01			0.06
			(0.10)			(0.09)
Joint filer			0.58 ***			0.35 **
			(0.14)			(0.12)
One child			0.77 ***			0.68 ***
			(0.16)			(0.16)
More than one child			0.99 ***			0.70 ***
			(0.15)			(0.13)
Constant	14.65 ***	18.62 ***	18.88 ***	15.15 ***	18.99 ***	18.81 ***
	(2.72)	(2.46)	(3.06)	(2.52)	(2.31)	(3.03)
X variables	No	Yes	Yes	No	Yes	Yes
Year	Yes	Yes	No	Yes	Yes	No
State	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.01	0.21	0.21	0.01	0.21	0.21
F test			22.17			17.44
Observations			344,245			

***p ≤ .001, **p ≤ .01, *p ≤ .05

Population comprises those who were modeled as eligible 1040 filers from 2005 to 2009 in the CPS ASEC. Eligibility is defined as "1" for those who appear eligible for the EITC and "0" for those not. Coefficients and standards errors are multiplied by 100. Regressions weighted by CPS ASEC population weights. Standard errors clustered at the state level in parentheses. F-tests report the joint significance of the interaction terms.

populations for the expansions were married filers and those with three or more children. It should be noted that in all cases for which a coefficient term was statistically significant for the full population, the same coefficient derived when holding the 2005 parameters constant was statistically different from the first. However, the inclusion of expanders changes only the magnitude of the coefficients, not the direction.

It is interesting to examine the extent to which families with children differed in terms of their status. A triple interaction term indicating any children times filing jointly times time was added to the full regression. The coefficient on the interaction term indicates that joint filers with children experienced increasing rates of eligibility compared with single filers with children (marginally significant at $p < 0.07$). However, the coefficient is not different from zero when those who were in the expansion category were recoded to ineligible. Thus, the increasing eligibility for those with children seen in the main results appears to be largely driven by married earners, although much of this occurred due to program expansion.

Men and low-education earners of both sexes were at higher risk for unemployment during the Great Recession, but while male earners experienced increasing eligibility over time compared to the base group, those with less than a high school education experienced decreasing rates. When looking within the population of only those with less than a high school degree, men were increasingly more likely to report not working at all for the entire year compared with women with otherwise the same characteristics. The results lend support to the "underemployment" hypothesis—that families entered eligibility due to the retention of one spouse's earnings, thus leading to an increase overall in the eligible population. The increasing eligibility of men also provides some evidence for the underemployment hypothesis; the interaction term expresses the year-by-year change in eligibility experienced by single, white,

male workers with a high school degree and no children. This population reported decreasing weeks of work each year over the same time period (-0.57 weeks each year, $p < 0.001$). The analysis provides suggestive evidence regarding those who received benefit from the EITC, and those whose labor-market experience was negative enough to leave them out of eligibility. Earners were protected by marriage, and working any amount during the course of a tax year ensured that male earners benefited from eligibility. Those with the least amount of education experienced a drop-off in eligibility due to a complete lack of earnings and of weeks worked over entire tax years. These dynamics between employment and eligibility will be further examined in future work.

5.2 Predicting participation

Table 9 shows results when participation is examined. The sample is restricted to those who were modeled as eligible, thus the results can be interpreted as rates of change in take-up contingent upon eligibility. The sample is therefore smaller in models 4 through 6, since I have removed from eligibility those who became eligible due to program expansion.

Table 9: *Linear probability models: Dependent variable is participation in the EITC.*

	model 1 *β* (SE)	model 2 *β* (SE)	model 3 *β* (SE)	model 4 *β* (SE)	model 5 *β* (SE)	model 6 *β* (SE)
Unemployment rate	-0.49	-0.20	-0.50 *	-0.50	-0.21	-0.54 **
	(0.59)	(0.61)	(0.20)	(0.56)	(0.58)	(0.19)
Minimum wage (log)	3.33	3.39	6.90 *	1.75	1.93	5.47
	(4.19)	(4.18)	(3.31)	(4.38)	(4.38)	(3.41)
Median wage (÷100)	-0.02	-0.01	0.01	-0.02	-0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
20th %tile wage (÷100)	0.05	0.02	0.03	0.04	0.02	0.03
	(0.04)	(0.04)	(0.02)	(0.04)	(0.03)	(0.02)
Unemployment comp (log)	0.77 ***	0.69 ***	0.71 ***	0.78 ***	0.70 ***	0.71 ***
	(0.08)	(0.10)	(0.11)	(0.08)	(0.11)	(0.12)
Supplemental Security Income (log)	-1.77 ***	-1.10 ***	-0.70 ***	-1.79 ***	-1.12 ***	-0.72 ***
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
TANF (log)	-0.35	-0.82 ***	-0.27	-0.38	-0.85 ***	-0.29
	(0.20)	(0.19)	(0.18)	(0.20)	(0.19)	(0.19)
SNAP (log)	0.55 ***	0.05	0.62 ***	0.57 ***	0.05	0.62 ***
	(0.10)	(0.09)	(0.10)	(0.10)	(0.10)	(0.10)
Time			2.28 ***			2.37 **
			(0.64)			(0.68)
Interactions of Variable X Time						
Male			0.49			0.48
			(0.43)			(0.43)
Black alone			-0.30			-0.35
			(0.39)			(0.40)
Other race			0.58			0.49
			(0.57)			(0.57)
Hispanic			-2.62 ***			-2.55 ***
			(0.38)			(0.39)
Less than HS			-1.56 ***			-1.64 ***
			(0.36)			(0.36)
Some college			0.56			0.53
			(0.36)			(0.37)
BS/BA or more			0.56			0.66
			(0.64)			(0.60)
Joint filer			-0.37			-0.35
			(0.42)			(0.41)
One child			-1.67 ***			-1.62 ***
			(0.44)			(0.43)
More than one child			-1.69 **			-1.67 **
			(0.49)			(0.49)
Phase-in			0.72 *			0.76 *
			(0.36)			(0.35)
Phase-out			0.4			0.42
			(0.27)			(0.25)
Constant	73.54 ***	63.49 ***	63.77 ***	77.11 ***	65.82 ***	66.44 ***
	(10.43)	(12.38)	(8.91)	(10.91)	(12.92)	(9.11)
X variables	No	Yes	Yes	No	Yes	Yes
Year	Yes	Yes	No	Yes	Yes	No
State	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.01	0.09	0.13	0.01	0.09	0.13
F test			18.9			18.45
Obs.	48,148			46,661		

***p ≤ .001, **p ≤ .01, *p ≤ .05. *Population comprises those who were eligible for the EITC from 2005 to 2009. Take-up is defined as ``1'' for those who filed for and received the EITC and ``0'' for those who did not. Coefficients and standards errors are multiplied by 100. Standard errors clustered at the state level in parentheses. F-tests report the joint significance of the interaction terms.*

State unemployment rates negatively affected participation rates, with a 1 percent increase in the rate associated with a 0.5 percent drop in the probability of take-up in both the full and restricted population of eligibles. While this is not a surprising finding, it is unclear what mechanism is at work to lead to this result. The receipt of unemployment insurance has a positive effect on take-up, with a 10 percent increase in benefit equating to a 0.7 percent increase in take-up. Food stamp receipt has a similar effect on participation. Meanwhile, other program participation had a negative effect on take-up, although these results are significant across the board only for SSI. Greater TANF receipt is associated with negative take-up only in models 2 and 5, which do not include the full set of time interactions.

These findings are somewhat consistent with other analyses of EITC take-up. For example, Caputo (2006) found that any food stamp receipt tripled the odds of filing for the EITC. He did not, however, find significant effects for SSI or TANF. Caputo hypothesized that, because food stamps and SSI have higher income eligibility thresholds than TANF, the latter two programs were more likely to have an influence on take-up (since higher income people are, in general, more likely to participate). However, the findings here indicate that SSI receipt is negatively correlated with EITC take-up. Because I include the value of the variable rather than a simple indicator, the case may be that a higher level of SSI—rather than any participation—discourages EITC take-up. The log minimum wage is also a predictor of EITC take-up, but only in the full sample and with the full set of interaction terms. This is likely due to the fact that states with a state-level EITC, which may induce higher take-up, tend to also have higher minimum wages.

For demographic predictors, increasing eligibility did not necessarily translate into

increasing take-up. Those with children experienced decreasing take-up rates compared with those without children, both in the full and restricted models. Men and joint filers, however, did not see a year-by-year change in take-up that was statistically significant. Those with less education experienced not only a year-by-year decline in eligibility, but a year-by-year decline in take-up, as well. The results may reflect new EITC eligibles not yet correctly negotiating the program, an idea that will be taken up in future work.

Finally, those in the phase-in range of the EITC experienced year-by-year participation increases compared with those at the plateau. Historically, take-up in this region of the credit has been low, which is of concern for policy-makers as this is the lowest-earning group of eligibles. Many in this group do not file a 1040, and may not know that the EITC is available to them.

6 Conclusion

The work presented in this paper was intended to provide descriptive information on the changes experienced in eligibility for the EITC and its take-up over the Great Recession. The objective of the work is twofold: to report on general estimates of eligibility and take-up over the years in question and to break down changes in eligibility and take-up by demographic groups that experience labor-market downturns differentially. The paper contributes to the literature by: providing information on eligibility and take-up using administrative records linked to survey data, which improves the accuracy of estimates; and analyzing changes in eligibility over a large-magnitude change in the health of the economy.

Findings indicate that eligibility for the credit increased overall during the recession, and most demographic groups experienced increases in eligibility for the EITC over the time period when looked at individually. Take-up contingent upon eligibility, however, remained constant. Two

groups—men and the low-skilled—are of particular interest in the analysis, since they experienced disproportionately negative labor market outcomes. While men overall experienced increases in eligibility, those with low education experienced decreases when other characteristics are held constant. This finding gives some suggestive evidence that low skill simultaneously predicts particularly poor labor market outcomes and EITC eligibility. Because those with less education are also less likely to be married, it is probable that the combination of total loss of earnings and zero spouse earnings conspire to lower eligibility for this group.

Work remains to be done on the dynamics of employment versus eligibility. The descriptive information presented here indicates that groups that were affected more strongly by the economic downturn (male and low-skilled workers) experienced either increasing or decreasing rates of eligibility over the time frame compared with a base group. Since an individual may become ineligible either by having zero earnings over a tax year or by having too much earnings, aggregate eligibility may change for certain family and skill groups based on full unemployment or underemployment. The evidence presented here gives an indication that there may be groups within the target population for the EITC that do not benefit in an economic downturn because of the program's tie to work. Further study on the EITC during recessions is necessary to understand the full impact of the credit.

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