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Labor Supply Effects of the District of Columbia Earned Income Tax Credit

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Abstract

The District of Columbia Earned Income Tax Credit is one of the most generous state-level transfer programs in the United States. The DC EITC has been found to reduce poverty and improve mobility. This study adds to this empirical literature by examining the effects of the DC EITC on the labor supply of resident tax filers. Previous studies of the effects of the federal EITC have found positive effects on the extensive margin (does one work?) and mixed evidence on the intensive margin (how much does one work?). Newer studies have highlighted the tendency of tax payers to bunch at kink-points of the EITC, and exploited bunching to directly elicit intensive margin elasticities. I first take a similar approach to show that the DC EITC causes individuals to bunch at the first kink of the EITC schedule. The bunching estimates reveal greater earnings responsiveness to tax rates among those self-employed who have dependents and are thus eligible for greater credit. A 1% change in the net-of-tax rate leads up to a 2.28% change in self-employed earnings forgone at the kink, but only up to 0.26% for wage earners. I then examine whether the DC EITC expansions are associated with a greater number of people reporting self-employed earnings. Difference-in-difference estimates are positive and significant, the expansions in the EITC schedule induce more people to report self-employed income. Including individual fixed effects to this specification reveals both positive and negative effects. These results indicate that the DC EITC has modest labor supply effects conditional on household size and type of earnings.

JEL codes: H2, H3, H7, J2

Keywords: Taxation, State and Local Taxation, Labor Supply, Labor Force Participation, Bunching

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Views expressed, and errors made in this paper are entirely of the author.

1. Introduction

The Earned Income Tax Credit (EITC) is a refundable tax credit geared towards individuals with low to moderate earnings, particularly those with children. Interest in the policy began as a modest alternative to negative income taxes, partly due to concerns of adverse labor supply effects inherent in the then-popular negative income tax (NIT) (Hotz & Scholz 2003). The NIT in discussion among prominent economists of the1960s, along with many anti-poverty programs, imposed substantial marginal tax rates on additional income, dis-incentivizing work beyond thresholds in the policy schedule (Moffit 2002). In contrast to the NIT, which provided the largest benefits to those who do not work and gradually phase out the benefit, the EITC provided an alternative that *phased in* with income, rewarding most the people who work some amount. The EITC became law in 1975, and saw several major expansions in the late eighties and early nineties, as well as in 2009. It has been a stable centerpiece of federal anti-poverty legislation with bipartisan support since 1995. Many states including the District of Columbia administer their own supplemental credit as well, typically by matching various percentages of the federal credit.

The labor supply effects of the federal EITC have been widely studied. There is substantial evidence that EITC expansions encourage labor force participation especially among single women with children (Eissa & Liebman 1996, Meyer & Rosenbaum 1999, Eissa & Hoynes 2005). These studies typically relied on a quasi-experimental approach exploiting variations in the eligibility or generosity of the EITC. Evidence on whether and to what extent the EITC affects how much people work, however, has been mixed (Eissa & Liebman 1996). Theoretical innovations combined with the growing availability and use of administrative data have allowed researchers to exploit non-linearity in the EITC schedule to directly elicit the intensive response to tax rates (Kleven 2016). Economic theory suggests that the non-linearity of the EITC schedule creates incentives for people to "bunch" at kink points to maximize net return to working (Saez 2010). As a whole, the literature has found the EITC to encourage more people to work, but incentivize some of those who work to cluster around specific kink-point(s).

In this paper, I use administrative tax data from the District of Columbia Government to examine the effects of the EITC on the labor supply of resident taxpayers. EITC in the District of Columbia is interesting for several reasons. First, filers in D.C. get up to an additional 40% of the federal credit, making it one of the most generous state-level EITC policies in the United States. Second, the District's EITC has been gradually expanded over a decade, lending itself suitably to a quasi-experimental study. Third, the EITC constitutes a considerable and growing expense to the DC government, and a comprehensive study of its intended effects may prove useful to policymakers. While some studies have looked at the effects of the DC EITC on poverty and social mobility, an examination of its labor supply effects in particular is yet to be conducted (Hardy 2015, Wilcher 2015). Such an investigation will better frame policy discussions regarding the EITC in terms of the tradeoff between positive anti-poverty effects and negative labor supply effects.

On the intensive margin, the first kink in the EITC schedule causes some individuals to forgo additional earnings. This effect is more visible for the self-employed. This suggests that while individuals will reduce (increase) the amount the work when the tax rate they face increases (decreases), flexibility in adjusting those hours is key. On the extensive margin, I find that EITC expansions are associated with increased likelihood of eligible individuals reporting positive self-employed earnings. Since almost all eligible tax filers in the data report some positive wage, a similar difference in difference approach for wage earners is not reported here. Nonetheless, the results point to the importance of flexibility in any behavioral response to the EITC. On the whole the DC EITC may induce more people to report some positive self-employed earnings, but each expansion makes filers more likely to report earnings exactly at the kink.

The remainder of this paper proceeds as follows. I first provide a brief description of the structure of the EITC schedule and its expansion over time in DC. In the section that follows, I use the relatively recent "bunching" approach to examine the effects of the EITC on the labor supply intensity of single parents. This section attempts to answer the question "Does the EITC encourage people to work more?" Next, I present a difference-in-difference estimation of the effects of the DC EITC expansions on self-employment of single parents. This section deals with the question "Do EITC expansions encourage more people to work?" In this way, I examine both extensive and intensive labor supply effects of the EITC.

2. Background

The labor supply effects of the EITC can be understood intuitively if we consider a simple model where an individual derives utility from leisure time and consumption. Giving up more leisure for work earns more income and therefore more consumption. The individual allocates hours of work such that the utility gain from earning an additional unit of consumption (or after-tax income) is equal to the utility cost of giving up leisure time to do so. In addition there is some reservation wage such that below that wage, working *any* amount is not worth giving up *any* leisure time.

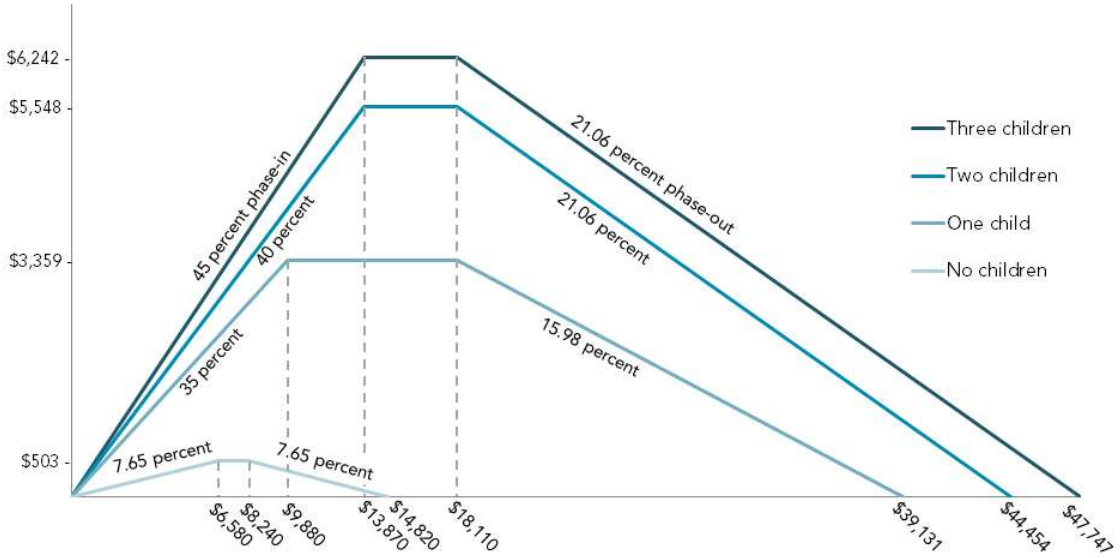
Consider someone who is on the fence about joining the labor force. For this person, a higher credit (lower tax rate) rate can raise after-tax income past their reservation wage, making it worthwhile to work some amount. To observe whether tax credits have such an effect, we would need to examine whether or not individuals are more likely to work *any* amount when the credit (tax) rates they face rise (fall). The DC EITC expansions provide exactly such a scenario. Section 3 empirically examines the extent of this extensive margin effect of the DC EITC.

For the individuals who are already working, a higher credit rate increases their after-tax income from the same amount of work, now making them able to "afford" more leisure time and derive a higher level of total utility. This is the income effect. On the other hand, a higher credit for work increases the marginal benefit of giving up leisure time and working instead, encouraging individuals to work more. This reallocation is the

substitution effect. I focus on the compensated elasticity of labor supply – which is the rate at which people change their work-leisure allocation with respect to wage, if we could 'compensate' them for the income effect. Since the substitution effect is negative with respect to price (tax), the compensated elasticity should reflect the tendency to work more when the credit rate is high, and less when it is low. The kink points in the EITC present scenarios where such reallocations can be observed – individuals disproportionately bunch around the first kink of the EITC schedule, where the marginal credit rate falls substantially. In Section 4, I exploit this bunching à la Saez (2010) to obtain the compensated elasticity of labor supply among DC tax filers. For now, let us turn to the structure of the EITC.

Figure 2.1 presents the EITC schedule for 2015. Those with no dependents (Singles) have the lowest rates of credit, while those with dependents (Head of Households) get substantially larger amounts. For a head-of-household filer with two dependents, for example, the 2015 EITC credit phases in at 40% for each dollar earned, up until $13,870 in earned income. This is the first kink in the schedule, and generates $5,548 in EITC. The credit then plateaus at $5,548 until $18,110 is earned at the second kink. Finally, it phases out at 21.06% for each additional dollar earned, until the credit reaches zero when earned income is $44,454. For every dollar earned in the phase-in region this head-of-household filer gets 40 cents in refund. In the plateau, the filer no longer gets 40 cents for each additional dollar. Instead she gets $5,548 for any earnings in that region. In the phase-out region, the filer gets 21.06 cents less than $5,548 for each dollar earned beyond $18,110.

Figure 2.1: EITC Schedule 2015



Source: Tax Policy Center, 2015.
Figures correspond to single or head-of-household filers.

For each filing entity, the DC EITC matches a certain percentage of the federal credit. Table 2.1 presents the historical parameters for DC EITC. The DC match rate has been expanded from ten percent of the federal credit in 2001 to twenty-five percent in 2002, to

thirty-five percent in 2006 and finally to forty percent in 2009. For a head-of-household filer in DC with two dependents after 2009, every dollar earned in the phase-in region therefore yields 56 (140% of 40) cents in credit. In the plateau, she earns $7,767 and in the phase out region she gets approximately 29.5(140% of 21) cents less in credit for each additional dollar earned.

Table 2.1: Historical parameters for DC EITC

Year	Match rate/policy change
2000	Legislative approval of refundable DC EITC
2001	DC EITC initiated; level at 10% of federal credit
2002	DC EITC level at 25% of federal credit
2006	Expansion of EITC to noncustodial parents
2006	DC EITC level at 35% of federal credit
2009	DC EITC level at 40% of federal credit

Source: Hardy et al., 2015; DC Tax Facts, 2012.

In this study I treat the 25% level as the baseline and consider the two expansions in 2006 and 2009. I do this because there are not many years before 2002 in my sample, limiting the amount of pre-treatment time if I were to consider the 2002 expansion. With 2002 as the baseline, there are 4 years of data before the first expansion. Then there are three more before the second expansion, and four more after the second expansion. Note that each expansion is modest in size. A change from 25% to 35% of the federal credit is, at the plateau region, about $600 for those with three dependents in 2015. From 35% to 40% is a change of roughly $300 for the same group, and other groups face smaller absolute changes in each case.

3. EITC, Bunching, and Intensive margin

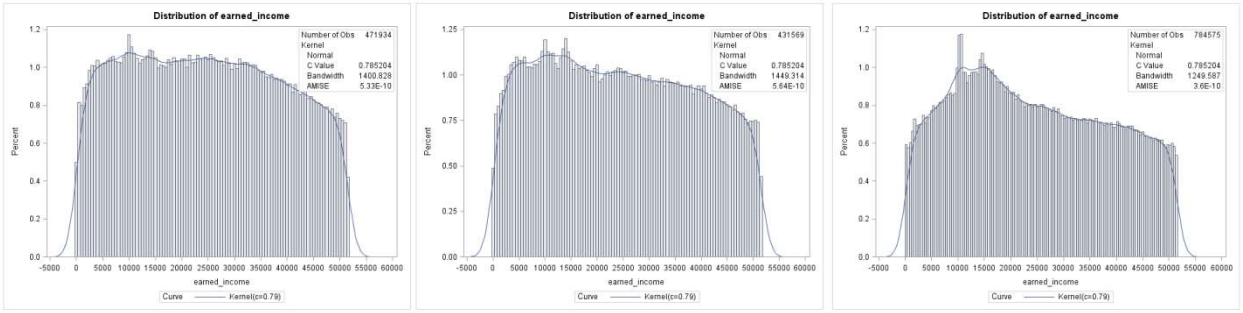
a. Data

I now turn to examining the effects of the EITC on how much people work. The bunching approach is a relatively new method of analyzing people's behavior when faced with non-linear budget set, first developed by Saez (2010). The piece-wise linear structure of the EITC schedule creates two kinks where the phase-in and plateau regions end, respectively. The underlying intuition is that under a standard framework for labor supply, a decrease in the after-tax earnings derived from an additional hour worked should cause some people to trade-off that additional hour's earnings for an hour of leisure instead. In other words, individuals that would work more in a linear schedule (e.g., if the phase-in never ended), but forgo some amount of earnings due to the increased tax rate past the kink in the piecewise linear schedule, bunch at the kink. Since bunching represents a behavioral response to changes in tax rates, the EITC kink points present fertile ground for

estimating the responsiveness of tax-filers' before-tax income to marginal tax rates. A formal presentation of this line of reasoning is presented in the Appendix.

Such bunching is evident among taxpayers in the District of Columbia, as presented in Figures 3.1 through 3.3. These data contain 2.1 million person-year observations of head-of-household or single tax filers from D40 Tax Form records between 2002 and 2013. Figure 3.1 presents histograms of tax filers in the time periods 2002-2006, 2007-2009 and 2010-2013. I present them separately because the marginal tax rates created by the District of Columbia's EITC match rate varies. For example, the phase-in rate for single and head of household filers with two dependents was 40% in all time periods relevant to this analysis. But since the DC match rate went from 25% in 2002 to 35% in 2006 to 40% in 2009, a DC resident with the same characteristics faces a 50% phase-in from 2002 to 2006, 54% in the period 2007-2009 and 56% in the period 2010-2013. Intuitively, then, there should be higher bunching in later periods.

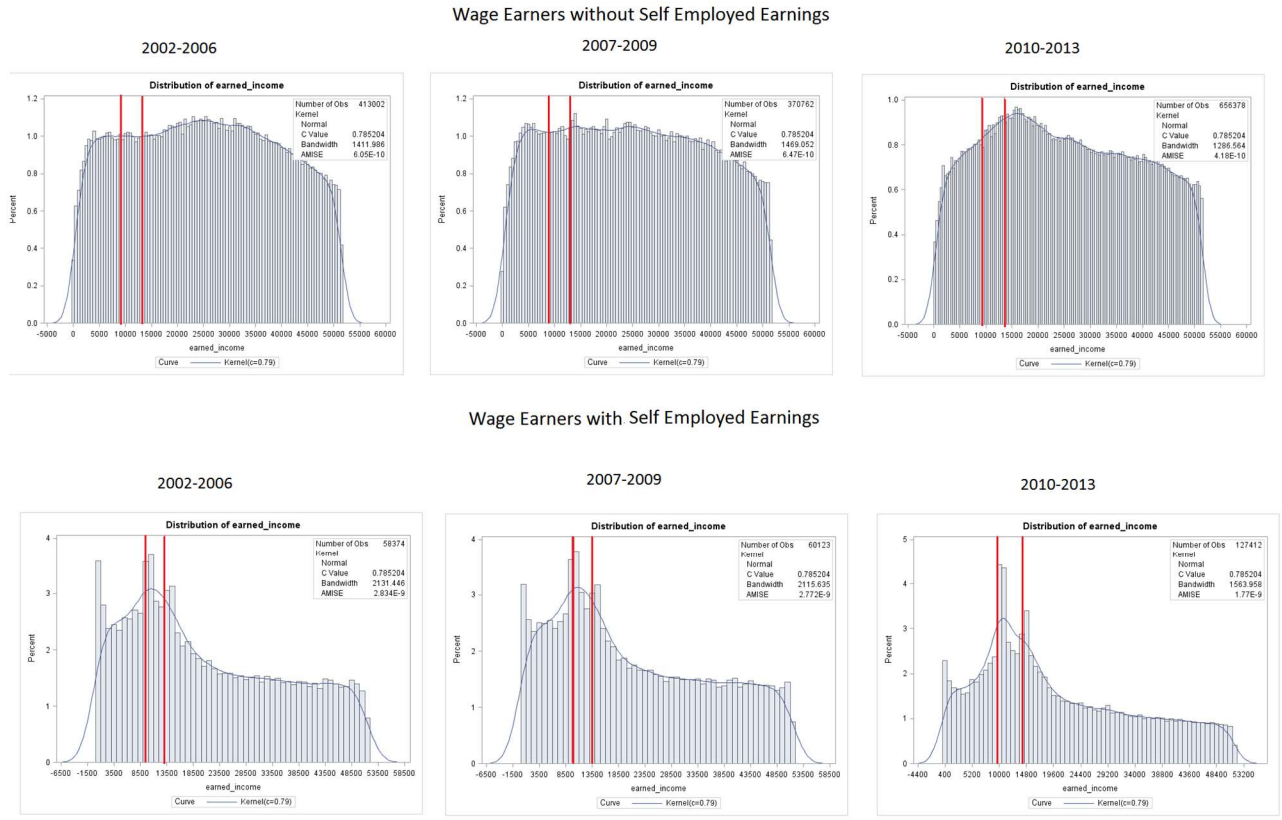
Figure 3.1: Earnings distribution over time (2002-2006, 2007-2009, 2010-2013 left to right)



Bunching among all filers around the first kink is noticeable only between 2010 and 2013. This could reflect two things. First, bunching may have become more obvious because the District of Columbia EITC rates were highest in this time period so that there is a greater incentive to report earnings around the kink. Second, as Saez (2010) notes, it is possible that information about the EITC spreads over time. The latter is a point further developed by Chetty, Friedman and Saez (2012), who find evidence that variation in bunching among the self-employed is driven by information about the EITC schedule diffusing over time.

Figure 3.2 presents the distribution separately for those with business income and those without. Those with non-zero business income constitute 13.41% of the sample. It is evident that those with business income are responsible for most of the observed bunching, while those without business income bunch only in the period 2010-2013, and very slightly at that. This is consistent with Saez's (2010) finding. Those with business income may have more flexibility in the hours they work than do filers with salaried earnings. They also have flexibility in reporting their earnings to maximize their returns, something wage-earners do not have due to employer reported W-2s.

Figure 3.2: Earnings distribution among those with and without business income, over time.

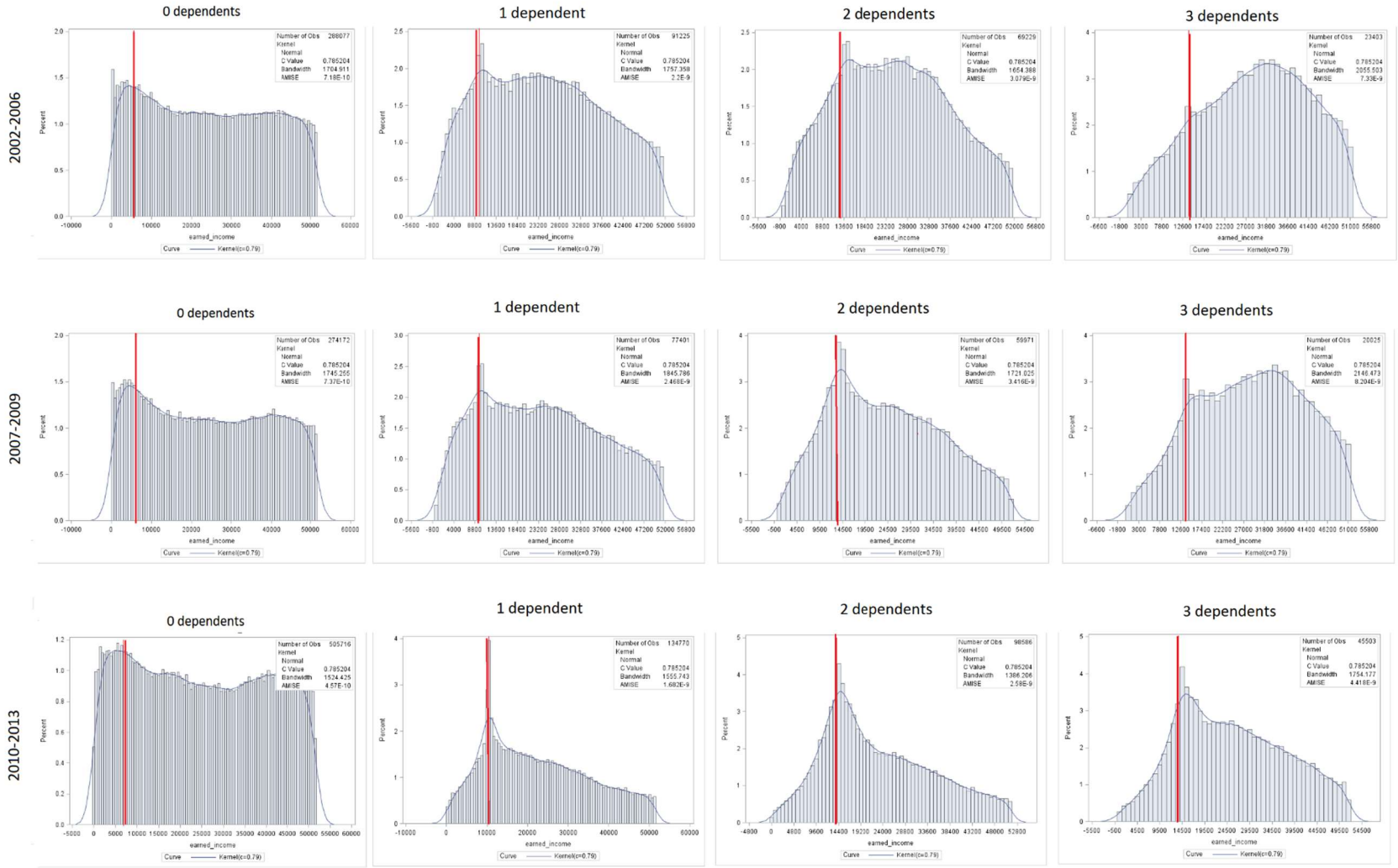


Since EITC rates and kink-points vary with the number of qualifying children, I separate this analysis by the number of dependents. Figure 3.3 presents histograms for each time period among filers with different numbers of dependents. Those with no dependents show no tendency to bunch around either kink in any time period. For singles with no dependents, the EITC phases in at a rate of 7.65% and has a maximum credit of $487 at the plateau. The income threshold for this group is $14,340 where the credit ceases. The credit is substantially larger for those with dependents. For filers with one dependent the phase-in rate is 34%, the maximum credit is $3,250 and the income threshold is $37,870. Those with two or more dependents face a schedule with a phase-in rate of 40%, maximum credit of $5,372 and a threshold of $43,038. For both groups, bunching around the first kink ($9,550 for one dependent and $13,400 for two) grows sharper over time, and is especially clear in the period 2010-2013. Consistent with Saez's findings, no bunching is evident around the second kink ($17,550 for one or two dependents).

Until 2009, the schedule only distinguished between zero, one, and two or more dependents. In 2009, a new schedule was introduced for those with three or more children, with a phase-in rate of 40%, maximum credit $6,044 and threshold of $46,227. The kink points remained the same as for those with two dependents. Interestingly, there is no

significant bunching among this group at either kink except for the period 2010-2013 despite facing the same schedule as those with two dependents in the years prior.

Figure 3.3: Distribution of Earned Income by Number of Dependents and Time Period

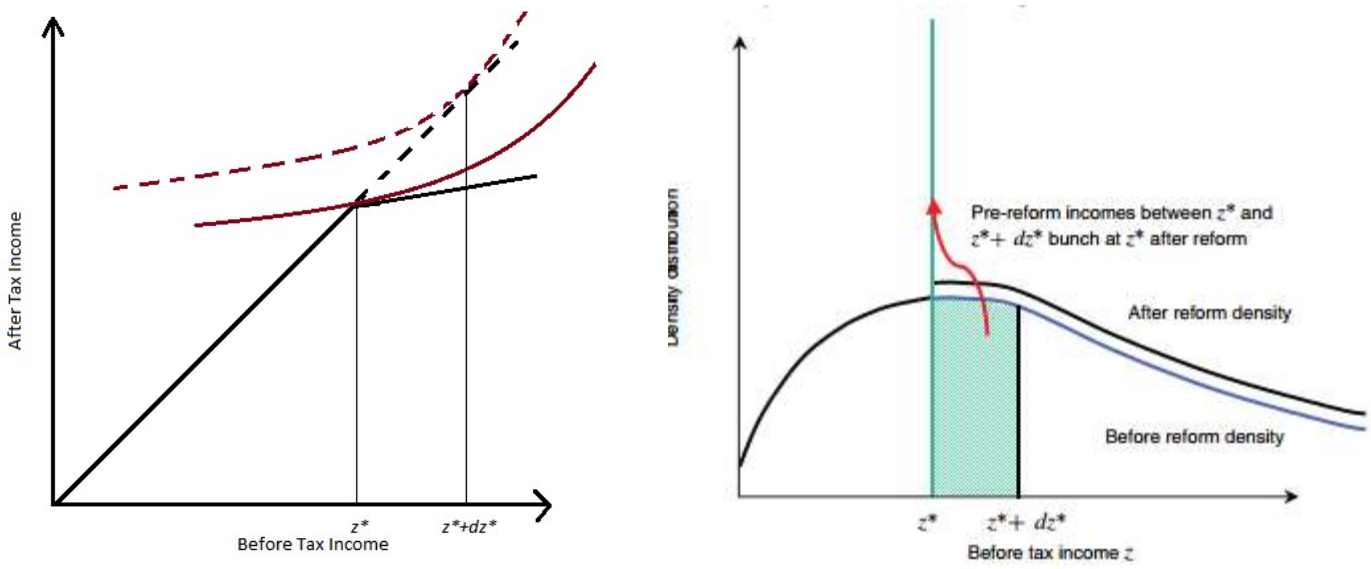


This may speak to dissemination of information specific to this group, the magnitude of the incentive involved, or the flexibility to adjust earnings (Chetty 2012). Bunching overall is the clearest among those with one or two dependent(s), which suggests that they are most responsive to the incentives created by the EITC. Those with three or more dependents seem slightly less responsive, and those with no dependents display virtually no bunching with roughly the same distribution in all periods. To quantify bunching and corresponding elasticities among tax filers, I proceed as in Saez (2010).

b. Empirical Framework

Bunching results from individual optimization over a kinked budget constraint. The EITC schedule creates such a non-linearity. The first panel of Figure 3.4 presents indifference curves of such an individual with utility $u(c,z)$, where after-tax income is denoted by c and before tax income is denoted by z. The individual derives positive utility from after-tax income (more consumption) and negative utility from before-tax income (more effort). More consumption or less work, holding one constant, would allow the individual to attain higher utility and therefore be on a higher indifference curve. The dotted lines represent a scenario where the EITC phase-in region never ends and thus there is no kink and the marginal tax rate is always t_0. The solid lines represent the case where a kink is introduced at z^*. The marginal tax rate is t_0 before z^* and $t_1 = t_0 + dt$. For example, ignoring other tax schedules, a head of household filer with two dependents faces marginal rates of $t_0 = -0.40$ and $t_1 = 0$ at the first kink and $t_0 = 0$ and $t_1 = 0.21$ at the second kink under the Federal EITC schedule.

Figure 3.4: Non-linear budget constraints and bunching



Source: Saez, "Do Taxpayers Bunch at Kinkpoints?" p184 AEJ 2010

When there is no kink, the individual chooses earnings at $z^* + dz^*$, where the dotted line and dotted indifference curve in the first panel are tangent. It is worthwhile for her to work more to consume more, when her income is taxed at t_0. Once the kink is introduced, she chooses z^*, where the solid line segment is tangent to the solid curve. In this example, it is no longer worth it for her to work as much when facing a higher tax rate $t_1 = t_0 + dt$, so she cuts back on work until she is facing t_0 again. Such individuals with earnings within $[z^*, z^*+dz^*]$ bunch at the kink z^*. The second panel shows the mass of such filers bunching at z*. In our data we saw similar bunching at the kink-point, albeit diffused. We also know the tax rates t_1 and t_0, and the income thresholds z^* at which the EITC schedule has kinks.

I specify the utility function(corresponding to the indifference curves) as in Saez(2010) and use the same method to arrive at the following formula relating the number of people bunching and the compensated elasticity of earnings e (A formal derivation is in the appendix):

$$B = z^* \left(\left(\frac{1 - t_0}{1 - t_1} \right)^e - 1 \right) * \frac{h(z^*)_- + \frac{h(z^*)_+}{\left(\frac{1 - t_0}{1 - t_1} \right)^e}}{2}$$

Where the number of people bunching B is identified by taking the number of people within $2000 of the kink, and subtracting from this the number of people in the two adjacent $2000 bins H^*_- and H^*_+(the densities of which are $h(z^*)_-$ and $h(z^*)_+$ respectively). The number of individuals bunching around the first kink as a proportion of total people in the middle bin around that kink is given in Table 4.1. Since all the parameters in the equation above are now identified, we can then back out the compensated elasticity of earnings with respect to the net-of-tax rate. This gives us the degree to which individuals respond to changes in tax rates, if income changes were compensated for.

Table 3.1: Percent of people around the first kink that are bunching

Kink 1												
Number of Dependents	0	1	2	3	0	1	2	3	0	1	2	3
2002-2006	2%	15%	12%		5%	58%	50%		1%	2%	1%	
2007-2009	3%	19%	21%		0%	61%	44%		3%	3%	13%	
2010-2013	5%	34%	21%	21%	10%	67%	43%	27%	4%	8%	9%	18%
Kink 2												
Number of Dependents	0	1	2	3	0	1	2	3	0	1	2	3
2002-2006	3%	2%	-7%		5%	-5%	70%		2%	2%	1%	
2007-2009	0%	-1%	-6%		2%	3%	38%		1%	-2%	-15%	
2010-2013	4%	1%	-7%	-5%	7%	-1%	-53%	-5%	3%	1%	6%	-5%

c. Results

Table 4.2 presents elasticities from bunching around the first kink. Since a separate schedule for three or more children was introduced in 2009, I present separate elasticities for this group only in the third period. The elasticities among all filers increase over time. For those with zero and one dependents, the elasticity in the third time period is more than double that in the first period. For those with two dependents, there is an 80% increase. Since the computation of elasticities accounts for the different EITC rates, this increase indicates that bunching constitutes a response to factors that are not limited to the specific magnitude of the credit. As Saez suggests, more individuals may come to learn about the EITC over time.

Table 3.2: Elasticities computed from bunching around the first kink[1]

Sample:	**All filers**				**Self-employed only**				**Wage-earners only**			
Number Of Dependents:	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
2002-2006	0.11	0.21	0.10		0.34	1.67	0.75		0.06	0.03	0.01	
N	39447	16027	15730		7388	2790	2876		32059	13237	12854	
2007-2009	0.17	0.26	0.18		0.01	1.74	0.55		0.22	0.03	0.11	
N	38219	14473	16514		7435	3021	3446		30784	11452	13068	
2010-2013	0.34	0.57	0.18	0.16	0.66	2.28	0.51	0.23	0.26	0.09	0.07	0.14
N	70606	31604	28503	9955	14206	11312	9049	2597	56400	20292	19454	7358

[1] I am currently resolving some bootstrapping issues. The table will have standard errors in the final paper.

When the analysis is restricted to wage earners with no business income, the elasticities are much smaller. This is particularly true for those with dependents. Nevertheless, the elasticities' magnitudes are still greater in each subsequent time period. This suggests that despite the lack of flexibility in adjusting and reporting their earnings, wage earners without business income do become more responsive to tax rates around the first kink of the EITC over time. There is a possibility that changes in the population may affect bunching, for example via an influx of inherently more responsive people. To check whether this is driving the results, I create a panel of individuals who filed taxes in DC for the entire duration in the sample. While this reduces the sample size considerably, bunching around the first kink increases over time, confirming that individuals respond more to the EITC over time.

Elasticities computed from bunching around the second kink tell a different story than the first. Table 3.3 presents these elasticities. Only those with no dependents show any substantial responsiveness to the change in tax rates at the second kink. For others, a 1% increase in the marginal tax rate w.r.t the net-of-tax would produce less than 0.02% decrease in income. In fact, among filers with two dependents, the elasticities are uniformly negative though small.

Table 3.3 Elasticities computed from bunching around the second kink

Sample:	**All filers**				**Self-employed only**				**Wage-earners only**			
Number Of Dependents:	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
2002-2006	0.24	0.02	-0.06		0.41	-0.07	1.89		0.20	0.03	0.68	
N	39794	15546	16849		7274	1117	2262		32520	14429	11451	
2007-2009	0.01	-0.02	-0.05		0.15	0.05	0.58		0.09	-0.02	-0.12	
N	38608	13299	21997		7164	1255	3112		31250	12044	18885	
2010-2013	0.37	0.01	-0.06	-0.04	0.67	-0.01	-0.32	-0.04	0.29	0.01	0.06	-0.04
N	72114	25805	27584	10905	14097	3475	7374	2649	58017	22330	20210	8256

Such figures likely stem from a smaller number of people with two dependents falling in the earnings bin at the kink than around it, and may even be an artifact of people bunching at the first kink. Recall that for unmarried filers with two dependents, the first kink is at $13,400 and second kink is at $17,550. Recall also that the measure of bunching at each kink is based on the numbers of people in a $4000 bin centered at the kink, and two adjacent $2000 bins. This means excess clustering near the first kink, as far away as $15,400, would exert a downward effect on bunching measured at the second kink, as long as more people bunch around the first kink.

Given the elasticities, we can also back out the estimated reduction in earnings at the kink given the decreased credit rate. Table 3.4 presents these figures. Again, the self-employed forgo the most income in response to the increased tax rate past the kink.

Table 3.4 Percent change in earnings at the first kink

Kink 1												
Number of Dependents	0	1	2	3	0	1	2	3	0	1	2	3
2002-2006	7.00	20.29	14.07		21.52	161.21	100.76		3.72	2.83	1.12	
2007-2009	11.10	24.72	17.51		0.33	168.22	52.76		13.75	3.32	10.24	
2010-2013	21.63	54.81	24.68	21.77	42.45	220.93	69.50	31.22	16.54	8.57	8.94	18.68
Kink 2												
Number of Dependents	0	1	2	3	0	1	2	3	0	1	2	3
2002-2006	15.31	1.42	-3.55		26.14	-4.32	121.61		12.91	1.88	43.40	
2007-2009	0.79	-1.13	-2.99		9.53	3.10	37.38		5.62	-1.56	-7.43	
2010-2013	23.40	0.72	-3.61	-2.26	42.60	-0.79	-20.49	-2.32	18.83	0.95	3.76	-2.24

4. EITC and Self-employment

a. Data

To examine whether EITC expansions affect the self-employment decisions of single parents, I adopt a quasi-experimental approach widely used in the literature (Eissa and Liebman, 1996; Eissa and Hoynes, 1998; Ellwood, 2000; Hotz, Mullin, and Scholz, 2002b). The intuition is that the effect of the EITC on employment can be examined by observing employment behavior of single parents before and after the expansion of the EITC. Any unobserved characteristics that may also result in similar behavior can be differenced out by looking at single parents *relative* to singles without children.

Eissa and Liebman (1996) adopt a difference in difference approach to examine the effect of the 1986 expansion of the EITC on labor force participation of single women with children. They use data from repeated cross-sections of the 1985-1987 and 1989-1991 Current Population Surveys. Compared to single women with no children that comprise their primary control group, they find a 2.8 percent increase in the likelihood of employment among single mothers post-expansion. Among women with less than a high school education, they observed a 6.1 percentage point increase. Similarly Elwood (2000) finds that the combination of the EITC changes in the 1990s, welfare reform, and the strong

economy led to an unprecedented rise in labor market activity of single parents with low incomes. The author notes however, that the relative effects of the three factors may be impossible to decompose. Eissa and Hoynes (1998) find that the EITC expansions between 1984 and 1996 *reduced* the likelihood of labor market participation of married women by around 1.2 percentage points.

I use administrative income tax data from the District of Columbia covering tax years 2001 through 2013, which contain 1,956,486 individual-year records. In particular I use repeated cross sections of individual income tax data from the D40 and D40EZ tax forms over this time period. I focus on those who file taxes as Head of Households or as Single. The former are unmarried parents without domestic partners, and the latter are simply unmarried without children, also without partners. Self-employed earnings are defined as the reported business income. During this time period, the proportion of single filers with children has moderately declined, as shown in Figure 4.1. This point is further broken down by Figure 4.2. While the number of singles with children has stayed relatively constant, the number of singles without children has doubled.

Figure 4.1: Proportion of Unmarried Filers with Children in DC, 2001-2013

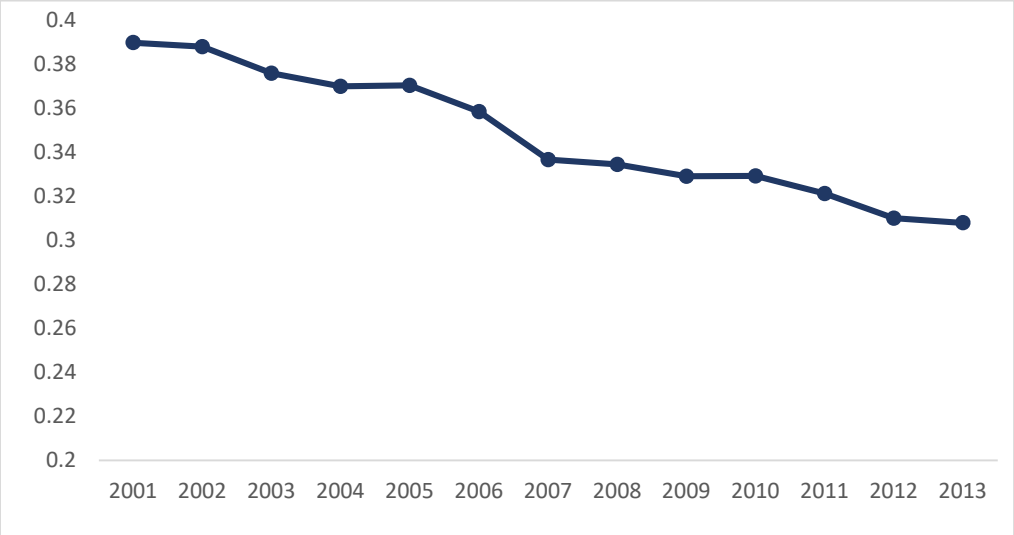
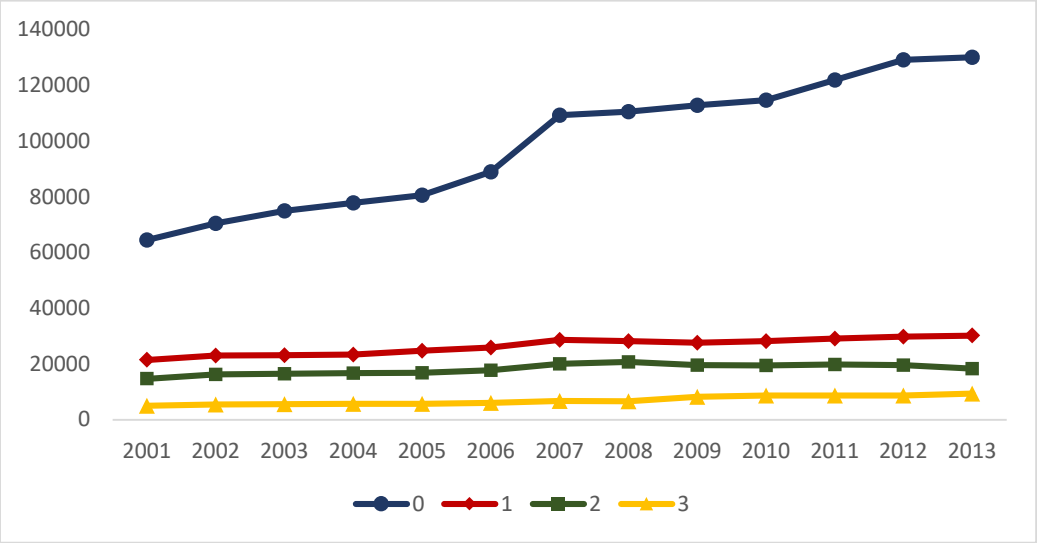


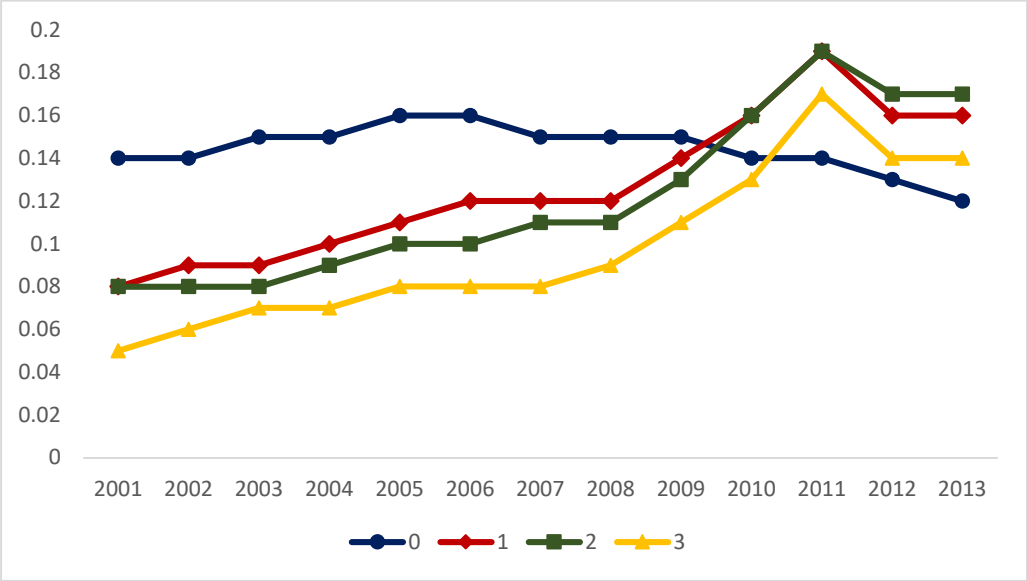
Figure 4.2: Number of Unmarried Filers in DC, by number of dependents, 2001-2013



I follow Eissa and Liebman (1996) and use childless single filers as a control group and those with children as the treated group. Childless single taxpayers form an intuitive control group since they are not eligible for significant amounts of credit. For simplicity, I treat childless single households as ineligible for the EITC. There are some limitations of using such a control group. It is not clear that baseline employment and earnings behavior of those with and without dependents are comparable. For example, Eissa and Liebman's (1996) control group had 95% employment while the group to be treated only had 72% employment prior to treatment. The issue is that if the control group is much closer to full-employment to begin with, it is conceivably less likely to experience improvements in employment from EITC expansions than the treatment group, which starts much at a much lower level of employment. Any observed changes in behavior of single women with children *relative* to childless single women, therefore, is likely to be overstating the true effect.

The opposite is true in the context of the data used in this study. In contrast to Eissa and Liebman's data, a higher proportion of head-of-household filers with children report positive earnings relative to single filers with no children. This is shown in Figure 4.3. Virtually all single filers with children report some positive earnings. The proportion of single filers without children reporting positive earnings is also very high but somewhat lower than the former group. Therefore any impact of the EITC expansions observed on singles with children *relative* to those without is likely to be *understating* the true effect. Furthermore many individuals that do not earn any income may not file taxes. I therefore avoid comparing the general earnings of head of households relative to singles and instead focus on their self-employment. Also, findings from the previous section indicate that self-employment may be where most of the responsiveness is coming from.

Figure 4.3: Proportion of Unmarried Filers with Positive Self-Employed Earnings, by Number of Dependents



Singles are the most likely to have self-employed earnings in 2001. As shown in Figure 4.3, 14% of singles have positive self-employed earnings while only 4%-8% of those with dependents do. These proportions rise steadily until 2006, after which the proportion of singles reporting self-employed income declines while the proportion of head-of-households doing so accelerates. After 2010, singles are less likely than head-of-households to report self-employed earnings. In this case as well as for wage earners, trends before 2006 were similar for singles and head-of-households, although levels of employment were different. The turning points in the trends, at a glance, seem to occur around the EITC expansions. The 2009 expansion however coincided with the recession, so we cannot yet rule out possible consequence on employment, separate from the EITC, which affects these trends. Furthermore there could be a variety of underlying structural changes that could be driving differential trends. To account for these factors, I turn to regression analyses.

b. Empirical Framework

The key question is whether or not Head of Households, relative to Singles, are more or less likely to have positive earnings after each DC EITC expansion. The main difference in difference approach takes the regression form presented in equation 1 below.

$$Earning_{it} = \beta_0 + \boldsymbol{\beta_1}\, \boldsymbol{Kid_{it}} + \boldsymbol{\beta_2}\, \boldsymbol{Policy_t} + \boldsymbol{\beta_3}\, \boldsymbol{Child_{it}} * \boldsymbol{Policy_t} + \beta_4 \boldsymbol{X}_{it} + \varepsilon_{it} \quad \ldots (1)$$

Where $Earnings_{it}$ is a binary variable indicating whether or not individual *i* has positive earnings at time *t*. $\boldsymbol{Kid_{it}}$ is a vector of binary variables each indicating whether the individual *i* has 1 child at time *t*, whether or not they have 2 children, and whether or not

they have 3 children respectively. Only those with dependents are considered eligible, and those with more children are eligible for more, so this group serves as the 'treatment' group. $\boldsymbol{Policy_t}$ is a vector of dummies each indicating whether or not a particular expansion is in effect at time *t*. Specifically these represent the time periods 2002-2006 (set to zero), 2007-2009, and 2010-2013, and the coefficients represent the likelihood of self-employment for the control group over these time periods. The corresponding EITC rates for these periods are given in Table 1. $\boldsymbol{Kid_{it} * Policy_t}$ is a vector whose elements are interactions of each element of the vector $\boldsymbol{Kid_{it}}$ with each element of vector $\boldsymbol{Policy_t}$. Each coefficient in $\boldsymbol{\beta_3}$ represents the effect of the respective expansion on those with the respective number of children, relative to the effect on those without children. If the EITC expansions promote work among the eligible, we would expect the interaction terms in $\boldsymbol{\beta_3}$ to yield positive and significant marginal effects.

$\boldsymbol{X}_{it}$ is a vector of controls including state and federal minimum wage, gross state product, and dummies for each year. These variables control for state-level and time-varying effects. Since there were multiple expansions over the sample time period, and credit amounts vary by the number of children, I account for these by including multiple indicators.

Since the data does not contain information on individuals' education, sex or race, which may be pertinent to labor supply as well as family size, I also employ a fixed effects specification. To do so, I first limit the sample to only those who resided in DC throughout the course of the sample, i.e. 2002-2013. This leaves 346,119 person-year observations in the sample. While this has the advantage of removing time-invariant heterogeneity at the individual level, it also changes the interpretation of the coefficients. The fixed effect intercept absorbs any effect that may be present due to variation in initial number of dependents, thereby excluding between-person variation from the coefficients in $\boldsymbol{\beta_1}$ and $\boldsymbol{\beta_3}$. Instead, the coefficients now reflect only the effect of within-person variation across time (i.e the average effect for people who became eligible in a particular policy period).

Results

Table 4.1 presents three sets of odds ratios. The first column in each panel presents coefficients from a repeated cross-section regression of the full sample. Odds ratios in the second column are obtained by limiting the sample to those with earnings below $50,000, which is just above the EITC eligibility limit. In these two columns, the coefficients pertain to the number of EITC dependents, since the tax forms for years prior to 2006 do not contain information on children. To see whether the effects of eligible dependents is different from the effects of eligible children, I compare the two in columns 3 and 4. Column 3 uses dependents while 4 uses kids.

Odds ratios in the first two rows are associated with the baseline effects of expansions of the EITC. The next three rows present coefficients for one, two or three or more

dependents. The next six rows present odds ratios for interactions between these expansions and households with one, two and three or more dependents. The self-employment effects of EITC eligibility are larger across the board when I limit dependents to children.

Table 4.1: Odds ratios

	Dependent variable = 1 for self-employment			
	1	2	3	4
ex06	0.974 (0.13)	1.166 (3.37)		
ex09	0.963 (3.02)	0.911 (12.86)	0.812 (38.57)	0.846 (25.01)
1kid	0.583 (2369)	0.505 (2987.28)	0.742 (621.06)	0.785 (265.48)
2kids	0.513 (2433.01)	0.46 (2821.24)	0.688 (691.8)	0.739 (402.31)
3kids	0.406 (1338.37)	0.345 (1517.41)	0.507 (653.95)	0.4 (116.37)
ex06x1	1.274 (220.46)	1.264 (161.33)		
ex06x2	1.343 (225.24)	1.288 (142.18)		
ex06x3	1.249 (37.62)	1.235 (27.76)		
ex09x1	1.681 (1299)	1.741 (1176.28)	1.681 (1299)	2.052 (1698.67)
ex09x2	1.84 (1278.14)	1.824 (1067.63)	1.84 (1278.14)	2.039 (1545.76)
ex09x3	2.043 (559.37)	2.071 (488.54)	2.043 (559.37)	3.244 (183.45)
Federal_Minimum_Wage	0.797 (52.89)	1.057 (2.28)	1.415 (36.89)	1.422 (37.85)
State_Minimum_Wage	1.21 (243.82)	0.994 (0.16)	0.824 (174.47)	0.832 (156.19)
Gross_State_Product	1 (2.12)	1 (0.07)	1 (15.45)	1 (17.51)

5. Conclusion

The DC EITC is one of the most generous state-level transfer programs in the United States. Previous policy studies have found the DC EITC to have significant anti-poverty and economic mobility effects. This study adds to these studies by examining the labor supply effects of the EITC. On the extensive margin, I find that EITC expansions are associated with increased relative likelihood of eligible individuals reporting self-employed earnings. However, individuals with dependents are less likely to report positive wage earnings after EITC expansions. This points to the importance of flexibility, and the importance of separate analyses of wage earners and self-employed filers, which were treated as an aggregate in previous extensive-margin studies. The inclusion of fixed effects make some coefficients for the self-employed negative and some coefficients for wage-earnings positive. Overall, this suggests that when considering only within-person variation, EITC expansions may have a positive effect for wage earnings and a slightly negative effect on the likelihood of reporting self-employed earnings. On the intensive margin, the kink in the EITC causes some individuals to forgo earnings. This effect is more visible for the self-employed. This suggests that while individuals will reduce(increase) the amount the work when the tax rate they face increases(decreases), flexibility in adjusting those hours is key.

The EITC has very different effects on taxpayers based on whether or not they have dependents, whether or not they are self-employed, and based on the size of the kink that is imposed in their budget constraint by the kink in the EITC. Since DC EITC simply matches the federal EITC, expansions entail matching greater proportions of the EITC. This increases the likelihood of reporting positive earnings among most filers, especially when considering the fixed-effects results. However this type of expansions also magnifies the kink, increasing the amount by which credit rates change. The bunching results suggest that this will hold some people back from working past the kink. Policymakers should be aware of the tradeoff between getting more people to work up to the kink, and getting people to work beyond the kink. Lastly, the likely role of flexibility and information diffusion as important constraints on the impact of the EITC also need to be considered.

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Theory Appendix

Saez's approach proceeds as follows. Individuals are distributed along z according to some smooth density function $h(z)$ of earnings and are characterized with a quasi-linear and iso-elastic utility function described in 1:

$$u(c, z) = c - \frac{n}{1 + 1/e}\left(\frac{z}{n}\right)^{1+1/e}$$ *(1) (Saez ,2010),*

where n represents potential earnings with some distribution $f(n)$ and e is the elasticity of income with respect to marginal tax rates. Maximization subject to the constraint $c = (1 - t)\, z + R$ yields the familiar relationship

$$z = n(1 - t)^e \qquad \textit{(2) (Saez ,2010).}$$

Individuals' before tax earnings z is a multiple of their potential earnings n and the net-of-tax rate $1\text{-}t$, scaled by their elasticity e to the tax rate. Without the kink, this would imply the relationship $z = n(1 - t_0)^e$. Let the cumulative density without the kink be represented by $H_0(z) = P(n(1 - t_0)^e \leq z) = F(z/(1 - t_0)^e)$ and the density distribution by $h_0(z) = H'_0(z) = f(z/(1 - t_0)^e)/(1 - t_0)^e$. These are represented in figure 1 below.

With the kink in place we have $z = n(1 - t_0)^e$ before the kink and $z = n(1 - t_1)^e$ after. After the kink, the distribution now becomes $h(z) = H'(z) = f(z/(1 - t_1)^e)/(1 - t_1)^e = h_0(z((1-t_0)(1-t_1))^e)*((1-t_0)(1-t_1)^e$. Let $h(z^*)_+$ denote the left limit of this distribution when $z \to z^*$. The distribution before the kink is the same as the distribution without the kink, $h_0(z)$. Let $h(z^*)_-$ denote the right limit of this distribution as $z \to z^*$. Bunching occurs over a certain segment Δz^* of the earnings distribution, and the highest ability person who bunches at z^* has $n = z^*/(1-t_1)$. Without the kink, they would therefore choose earnings $z^*((1-t_0)(1-t_1))^e$. So we have

$$\Delta z^* = z^*\left(\frac{1-t_0}{1-t_1}\right)^e - z^*;$$

$$\frac{\Delta z^*}{z^*} = \left(\frac{1-t_0}{1-t_1}\right)^e - 1 \qquad (3)\ \textit{(Saez ,2010)}$$

Saez approximates the fraction of individuals bunching by $\Delta z^* \left(\frac{h_0(z^*)+h_0(z^*+\Delta z^*)}{2}\right)$, which can be written as

$$B = z^* \left[\left(\frac{1-t_0}{1-t_1}\right)^e - 1\right] \frac{h(z^*)_- + h(z^*)_+}{2} \Bigg/ \left(\frac{1-t_0}{1-t_1}\right)^e, \quad \textit{(4) (Saez, 2010).}$$

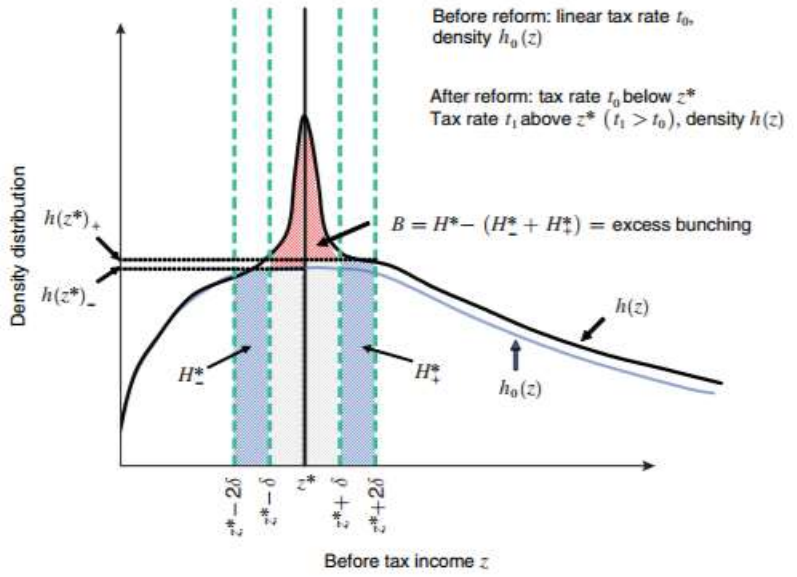

Figure 1: Bunching and density distributions

The elasticity can be obtained from the following parameters in equation 4: the kink threshold z^*, the net-of-tax ratio $(1-t)$ associated with the kink, the density of the distribution around the kink and the degree of bunching B. The first two are directly observable, while the latter two need to be estimated from the data available.

To estimate these values, I again use Saez's approach. I define a $4000 bin centered at the kink as H^*, and two $2000 bins before($H^*_-$) and after ($H^*_+$) it. Bunching ($B$) is interpreted as the number of filers in H^* that are in excess of those in H^*_- and H^*_+, i.e. $B = H^* - (H^*_- + H^*_+)$. We can interpret $h(z^*)_+$ and $h(z^*)_-$ as simply the density of H^*_+ and H^*_- respectively e.g. $h(z^*)_- = H^*_-/2000$. This is presented in Figure 1. We can finally solve Equation 4 for e.