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Bradley L. Hardy
Department of Public Administration and Policy
American University

Daniel Muhammad
Office of Revenue Analysis
Office of the Chief Financial Officer
District of Columbia Government

Marcus D. Casey
The Brookings Institution and
University of Illinois at Chicago

Rhucha Samudra
Department of Public Administration
The College of Brockport
State University of New York

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Author correspondence
Bradley Hardy, hardy@american.edu

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Corresponding Author: Bradley Hardy, Department of Public Administration and Policy, American University, 4400 Massachusetts Avenue, NW, Washington, DC 20016-8070.
Email: hardy@american.edu.

Abstract: We use longitudinal administrative tax data from Washington DC (DC) to study how EITC expansions undertaken by Washington DC affect income and inequality in the city. We find that DC EITC credit expansions between 2001 and 2009 are associated with recipient pre-tax earnings growth of roughly 3-4 percent, primarily among single mothers. Together these credits reduce post-tax inequality for the 10th percentile relative to median households. However, composition changes in the city and growing overall inequality mitigates this inequality reduction towards the end of the period. Overall, these results complement existing research showing that the EITC has a positive effect on labor market outcomes and household well-being.

1. Introduction

The Earned Income Tax Credit (EITC) is the largest federal cash transfer program for poor and near-poor families. It represents a principal component of an important three-legged work-based safety net that includes the Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) (e.g. Ben-Shalom et al. 2012; Hardy et al. 2018; Schmidt et al. 2016). A number of studies demonstrate the EITC's success in fostering increased labor force participation and reducing poverty among low-income single mothers and other disadvantaged groups; related work shows it contributes to improved childhood outcomes and decreased after-tax income inequality (Hoynes and Patel 2018; Nichols and Rothstein 2016).

In light of this success, Washington, D.C. (DC) and 29 other states now run state-level EITCs that supplement the federal credit (Ben-Shalom, Moffitt, and Scholz 2012; CBPP 2015). Qualifying families in DC, the focus of this study, receive 40 percent of the federal credit—among the nation's largest refundable local EITCs.[1] Federal and state legislatures are considering further EITC expansions, yet given the parallel purposes of the two credits, it is important to understand better what effect the introduction and expansion of these state-level EITCs in

[1] Some states offer refundable EITCs above or near the DC credit, which is 40 percent of the federal EITC, though with provisions that render the effective refund as smaller. http://www.ncsl.org/research/labor-and-employment/earned-income-tax-credits-for-working-families.aspx

concert with the federal EITC will have on pre-tax incomes and economic wellbeing (Guzman, Pirog, and Seefeldt 2013; Nichols and Rothstein 2016).

We exploit longitudinal administrative tax data from DC for the period between 2001 and 2014 to examine how changes in the generosity of the DC EITC in concert with the federal EITC affect pre-tax earnings, income, and inequality. We document several interesting facts. First, our descriptive analysis shows that the total (DC and federal) EITC raises after-tax incomes substantially—approximately 15-20 percent on average. This relatively large transfer to poor and near-poor families has distributional consequences at the lower tail of the distribution. The EITC reduces the ratio of after-tax earnings between the median household relative to households at the 10th percentile roughly 15 percent in 2002; the corresponding reduction in the 50-10 ratio of earnings in 2013 was approximately 13 percent. The corresponding change for the 50-25 ratios from those two sets of years was roughly 6 percent for each of these example years. Further, when comparing the position of EITC recipients in the pre and post-tax earnings distributions we find that, on average, federal and DC EITC receipt moves these households the equivalent of 2-5 percentile points in the overall earnings distribution. This level decrease in inequality driven by EITC receipt, however, does little to mitigate trends in overall city inequality. We find that inequality between the median household and households at the 10th percentile rose sharply after 2009.

Our analysis of the EITC's impact on pre-tax earnings confirms existing work showing that earnings and income rise in response to EITC expansions. Specifically, we exploit variation in the credit induced by changes in the generosity of the DC and federal credits over the observation period. Beginning in 2001 the DC government enacted and then expanded the supplemental credit several times in the 2000s; the last of these coincided with expansion in the federal EITC because of provisions in the American Recovery and Reinvestment Act (ARRA).

These federal changes included, in 2009, a new category and higher potential credit amount for families with 3 or more dependents. Exploiting city-level sources of policy variation in DC yields several results. First, there is strong evidence that single-parent families, on average, experience statistically significant gains in their pre-tax/transfer earnings. Like earlier research, however, we find little evidence of such an earnings effect among married families. Second, the federal and DC EITC have considerable inequality-lowering impacts, and especially so in the city's poorest neighborhoods. In sum, taken together with other results in the literature, expansions in the EITC seem to induce heterogenous effects among DC residents depending on the subgroup, but generally positively affects labor force behavior as inferred from earnings and income changes.

This paper complements existing research focusing on the impact of EITC expansions on economic outcomes during the 2000s by conducting among the first comprehensive evaluations of the consequences of expanding a local EITC. This issue is particularly germane in Washington DC, where gentrification of the city has driven increased housing and other living costs. Ultimately, more can be done to understand the role of government transfers in mitigating extreme inequality; this paper contributes to understanding how federal, state, and local governments can tackle these problems together. In a period of tepid wage growth among less educated workers, the EITC appears to operate as a backstop for low-and-moderate income workers, albeit a delayed one.

2. Background: The Federal and DC EITC

The EITC supplements earnings for low-income families through the tax system, wherein households typically receive a lump-sum payment as a tax refund in the spring. EITC refunds are calculated as a proportional share of earnings capped at an annually established maximum.

Eligibility for the credit varies by marital status, adjusted gross income, and the number of qualified dependent children (Marr, Huang, and Sherman 2014; Nichols and Rothstein 2016). The subsidy or "phase-in" rate replaces anywhere from 7 cents on each dollar earned for qualifying workers without children to 45 cents on each dollar earned for qualifying workers with 3 or more children.

A substantial body of evidence shows that EITC receipt contributes to a range of direct and indirect social and economic benefits. These studies typically exploit changes in eligibility and\or expansions in the cash value of the federal EITC using standard difference–in–difference methods or using simulated instrument approaches (Currie and Gruber 1996; Hoynes and Patel 2018; Jones and Michelmore 2018). Direct benefits of EITC expansions include increased monetary returns to employment (Bishop, Heim, and Mihaly 2009; Bollinger, Gonzales, and Ziliak 2009; Chetty, Friedman, Saez 2012; Eissa and Hoynes 2004; Hotz and Scholz 2003; Meyer and Sullivan 2004; Meyer 2002; Meyer and Rosenbaum 2001), presumably by inducing labor supply responses primarily on the extensive margin especially among households headed by single mothers. Researchers report evidence of lower welfare participation, reductions in poverty (Grogger 2004), and increased savings behavior (Gundersen and Ziliak 2004; Neumark and Wascher 2001, Jones and Michelmore 2018) among recipients. Indirect benefits of the EITC include but are not limited to higher educational achievement (Dahl and Lochner 2012) and more liquidity (Bitler, Kuka, and Hoynes 2017; LaLumia 2013; Smeeding, Ross Phillips, and O'Connor 2000).

Few studies to this point, however, comprehensively consider how the introduction of state supplements to the federal credit affect recipients. Some existing evidence suggests that state supplements have independent effects on recipient labor market outcomes (Cancian and Levinson 2006; Neumark and Wascher 2001) while other work finds that state supplements may

impact savings behavior (Michelmore and Jones 2018). This work generally uses household surveys such as the Current Population Survey (CPS), Panel Study of Income Dynamics (PSID), or Survey of Income and Program Participation (SIPP) to study this question. The administrative data used in this paper provides a rare opportunity to examine individual and spatial outcomes related to these policy changes, and the DC EITC is the largest supplement to the federal credit in the nation. After three rate increases as well as eligibility expansions, by 2009 eligible households could potentially receive 40 percent of the federal credit (Kerstetter 2008; Lakin and Lazere 2002) (see Appendix Table 1 for a summary of DC EITC expansions). Importantly, in an era of stagnant earnings among less-educated U.S. workers and growing inequality over the preceding decades, this credit has effectively helped increase the living standards of many poor and moderate-income DC residents.

In the subsequent section, we first describe the administrative tax data used in the study. We then provide a snapshot of how the state and federal credit combine to improve economic conditions among poor and moderate-income DC residents relative to non-EITC recipients.

3. District of Columbia Administrative Tax Data

Our data are drawn from individual income tax records for DC tax filers between 2001 and 2014. These rarely-available administrative tax data include information typically available on an individual 1040: income, taxes owed and paid, exemptions, and other tax-related variables. Tax filer identifiers allow us to follow households longitudinally; we use these data to construct two panel datasets: a balanced panel that restricts the sample to all residents that filed a tax return each year over the observation period and an unbalanced panel dataset that includes all tax filer households. We closely follow the approach of Heim (2009), among others, and restrict our data sample to tax filers reporting positive, non-missing federal adjusted gross income and earnings

(wages, salaries, and tips) in each year. In some cases, tax filers drop out of the sample if they change filing status. We also drop observations with negative or missing values for wages, salaries, and tips, adjusted gross income, or number of dependents, a rough proxy for the number of children. We acknowledge that, especially for non-EITC households, dependents may include elderly or disabled adults but, in general, these cases are rare. Finally, most of the analyses focus on the balanced panel, as it excludes people such as transient residents and those for whom entry and exit are difficult to account for, though we also include results using the unbalanced sample.

Table 1 provides a descriptive picture of the DC tax filer sample we study in this paper. The table presents these statistics for the full sample in the top panel, then stratified by filing status of the household in the remaining panels. Here and in our forthcoming inequality estimates and regression models, we stratify by household filing type: either married filing jointly or head of household; we refer to married filing jointly households as "married" and head of household filers as "single" parents. In a nod to the comparisons presented below, we report descriptive statistics overall and focus on the bottom half of the earnings distribution among those who appear in the balanced sample. The final columns provide descriptive information for the unbalanced sample.

Beginning with the top panel, we see that the tax filer population in DC is relatively affluent: the average and median incomes of DC residents appearing in the balanced sample are quite high, at almost 120 thousand and nearly 72 thousand, with corresponding earnings at just above 101 thousand at the mean and roughly 66 thousand at the median. Only 16 percent of the overall balanced sample received the EITC over our observation period; the average DC EITC payment among this sample is 137 dollars while the corresponding federal EITC payment is just over 400 dollars. The average household has just under one child, and roughly 31 percent of this sample consists of single-parent households while 29 percent are married.

Turning to the bottom 50th percentile of the pooled balanced sample, incomes in this segment of the income distribution are just above 30 thousand at the mean and 28,108 at the median. Mean earnings are roughly 25,650 and median earnings are just a little higher, at 26,688. The typical household in this subsample is a single-parent EITC recipient; only 8 percent of this group filed their taxes jointly. Unsurprisingly, this segment of the population receives relatively large EITC payments: average and median DC EITC payments are 578 and 422 dollars, respectively; the corresponding federal EITC payments to these households are 1,712 dollars at the mean and 1,282 dollars at the median.

The last columns of Table 1 consist of the same measures for our unbalanced panel. This sample differs considerably in character from our more restricted, balanced sample. In particular, the unbalanced sample features individuals with substantially lower mean and median income and earnings levels: roughly 89 thousand and 48 thousand dollars in mean and median adjusted gross income, respectively, and roughly 74 thousand and 45 thousand in mean and median earnings. Notably, while the fraction in the unbalanced panel receiving EITC rises to 19 percent, the average amounts they receive from DC (163 dollars) and the federal government (463 dollars) do not change much relative to the pooled balanced sample. Finally, a much smaller fraction of the unbalanced panel files as either a head of household or married compared to the balanced panel, and they report fewer dependents, as seen by an average of .5 dependents per household.

The bottom two panels stratify our two samples by married and single-headed households. Comparing the two groups, it is unsurprising to see that income and earnings levels among single-parent headed households are substantially lower than those for married joint filers. Mean and median income and earnings levels are just above 50 thousand dollars and 40 thousand dollars for single-headed households. By contrast, married households had adjusted

gross incomes of over 219 thousand at the mean and nearly 151 thousand at the median. Similarly, married couples had mean earnings of nearly 174 thousand and median earnings just above 126 thousand dollars a year.

Given relatively high earnings among married filers, it is unsurprising that only 4 percent of married couples in the balanced sample received the EITC over the observation period, whereas 45 percent of single-parent households received the EITC during that time. Hence, there are substantial differences in the average EITC received between the two groups. Single-headed households in this group received, on average, 380 dollars from the DC EITC and 1137 dollars from the federal EITC. Married households, on average, received only nominal amounts from these programs: 39 dollars from the DC EITC and 113 dollars from the federal EITC. Single-parent households in the balanced sample had roughly 1.5 dependents, on average, per household whereas married households had less than 1 dependent per household on average. Of course, this discrepancy may simply reflect central-city/suburban living choices among relatively wealthier households with children.

Turning lastly to a comparison of single-parent and married households in the unbalanced sample, many of the differences across household types that we observed in the balanced sample are exacerbated in the unbalanced sample. Single-headed households in this sample averaged in the neighborhood of 40 thousand dollars in income and earnings whereas median earnings for this group were roughly 31 thousand dollars. By comparison, married households in the unbalanced sample had mean adjusted gross income above 217 thousand, with average earnings at roughly 154 thousand. Median income and earnings were somewhat lower at 120,593 and 101,703 dollars. Further, while single-headed households averaged essentially the same number of children as in the balanced sample, the average DC and federal EITC amounts were higher, at

around 560 and 1,646 dollars. Only 5 percent of the married households in the unbalanced sample received any EITC and the payments, on average, were quite small.

Given the high levels of inequality both across households and across space that characterize DC, it is, by and large, uninformative and likely inappropriate to compare households near the right tail of the distribution to individuals receiving the EITC. As such, we focus much of the remaining descriptive and analytical discussion in the paper to households that fall within the 50th percentile of the earnings distribution. By restricting the sample to this set of households, the comparisons will more likely consist of households who have either received the EITC or are potentially at risk of receiving the EITC at some point in the future.

To get a better sense of the share of income attributable to the EITC, Figure 1 provides a graphic decomposition of post-tax income for EITC recipients. The EITC raises the post-tax incomes and potential consumption of recipients considerably. Average pre-tax earnings are roughly flat in real terms over our observation period, hovering just above 25 thousand per year. The addition of the DC and federal EITC raises this sum considerably such that average post-tax earnings for EITC recipients surpasses 30 thousand dollars. Importantly, this graph indicates the consequences of the EITC expansions undertaken over the 2000s: despite little change in average earnings, the area of the graph representing the two EITCs in concert grows, indicating that post-tax income rose after implementation of a more generous EITC by DC. Figure 2 breaks out these trends focusing on single-headed households. We see, in this case, that the share of post-tax income composed of the EITC is even greater and, consequently, the increases in household income after the implementation of EITC expansions were largely allocated to these households.

4. The Distributional Consequences of the Combined EITC in DC

Our descriptive assessment begins by measuring how the DC and federal credit in combination affects the distribution of post-tax earnings in the city and to understand to what degree the EITC mitigates growing inequality in DC. We focus this analysis on the balanced panel sample.

We turn first to Figures 3 and 4, which plot pre- and post-EITC earnings ratios that compare the 50th percentile household to those at the 25th percentile and the 10th percentile. The distribution of earnings in the city is quite unequal: the median household in the city has roughly 2.5 to 3 times the earnings of the 10th percentile household and between 1.5 and 2 times the earnings of the 25th percentile household. Interestingly, 50-10 inequality declines during the post-9/11 recession until about 2007. Inequality then rises sharply after 2008. By comparison, 50-25 inequality rises only slightly over the entire period, and seems relatively unaffected by the EITC. These trends may reflect specific composition changes in the city as it gentrified over the period. Higher income households have entered whereas lower-income households—but perhaps not those with the lowest income as they often have access to subsidized housing—have been displaced from the city due to rising rents.

The EITC substantially mitigates inequality between those at the 50th percentile and the 10th percentile; it does very little to reduce 50-25 inequality in comparison. Visually, these differences are readily apparent for the overall balanced sample in Figure 3. A significant level difference emerges in between the pre- and post-EITC 50-10 trend lines and remains throughout our observation period. Numerically, in 2002, for example, the combined DC and federal credits reduced 50-10 earnings ratios by roughly 15 percent. The corresponding reduction in earnings ratios for 50-25 comparisons in 2002 was roughly 5 percent. Near the end of the period, the inequality-mitigating effect of the combined EITC declines somewhat. In 2013, the EITC

reduces the 50-10 ratio by roughly 12 to 13 percent. The earnings ratios for the 50-25 comparisons, however, were reduced less than 2 percent when including the combined credit.

Of course, the previous discussion focuses on the entire city. Demographic changes in the city, because of gentrification and growing inequality, have led to increased spatial stratification across various quadrants of the city. Particularly striking are the differences that have emerged between Wards 7 and 8 east of the Anacostia River (parts of NE and SE DC) and Wards 1-6 of the city as presented in Appendix Figure 1. Over time, the share of EITC recipients has grown in the east and decreased in the west. Wards 7 and 8 stand out, as these areas are the poorest in the city; these areas also have the highest concentration of EITC recipients.

Figures 4 and 5 stratify our inequality discussion across this divide; Figure 4 replicates Figure 3 for the areas in the city west of the Anacostia River (Wards 1-6) while Figure 5 focuses solely on Wards 7 and 8 east of the river. Both figures reflect the overall trends of the city: a slight decline in 50-10 inequality at the outset of the 2000s and then a sharp increase in 50-10 inequality after 2007, where 50-25 inequality increases slightly over our entire observation period. Furthermore, while the earnings ratios for both the 50-10 and 50-25 ratios are similar to their overall levels, the 50-10 and 50-25 ratios are somewhat smaller—around 2 versus 3 in Wards 7 and 8—reflecting the generally lower earning population residing in these areas.

More importantly, the EITC reduces inequality more sharply in Wards 7 and 8 than the rest of the city. Focusing first on Figure 4, inclusion of the EITC in income reduces the 50-10 ratios 9 percent in Wards 1-6 from just under 3 to roughly 2.5 in 2002. By 2013, pre-EITC 50-10 earnings ratios were over 3; inclusion of the EITC lowered the ratio 7 percent from nearly 3.3 to roughly 3. Figure 4, notably, demonstrates that the 50-25 ratios are almost unaffected by EITC receipt in these areas. In Figure 5, however, the EITC reduces inequality substantially for residents in Wards 7 and 8. In 2002, inclusion of the combined EITC reduces the 50-10 ratio

around 19 percent from roughly 2.5 to 1.9. In 2013, inclusion of the EITC still reduced these ratios nearly 15 percent from 2.3 to just about 2. Unlike the western parts of the city, however, the EITC has appreciable effects on 50-25 ratios as well. In 2002, inclusion of the EITC reduces the 50-25 ratios in Wards 7 and 8 roughly 10 percent; by 2013, this effect was somewhat reduced, but inclusion of the combined EITC reduced 50-25 ratios by roughly 6 percent. This difference in the EITC's inequality-reducing impact within the city raises the importance of considering whether and how policies can be targeted to areas where needs are greatest (Shambaugh and Nunn 2018).

To understand better how the EITC affects the potential consumption of recipient households, we delve a bit more deeply into the distributional consequences of the credit in Table 2. This table splits the distribution of EITC receivers into four quartiles for both the balanced and unbalanced versions of our analysis dataset, by size of EITC credit. The second column gives the average combined credit received for households located in that quartile. The final two columns present the percentile rank of the average household in that quartile in the overall earnings distribution prior to inclusion of the EITC and afterward.

Focusing first on these measures for the balanced sample in the top panel of Table 2, we see that in the bottom quartile of the distribution of EITC recipients, the EITC has only a minor impact on the relative rank of households. However, as we move up the distribution by size of credit, it becomes apparent that the EITC raises the earnings rank and thus consumption potential of households in the lower tail of the earnings distribution. In quartiles 2 and 3 we see that receipt of the EITC moves those households up an average of one percentile in the earnings distribution. For households in quartile 4 of EITC credit size, receipt of the EITC moves them up an average 3 percentile points in the post-tax earnings distribution.

In the unbalanced panel, we see similar effects of the EITC on the earnings ranks of EITC recipients. Specifically, we find that the larger EITC again moves households up the post-EITC distribution by 5 percentile points, and from a higher relative initial position, given the somewhat less-advantaged unbalanced sample, as shown in Table 1.

Table 3 replicates this exercise for our sample restricted to the bottom 50th percentile of the earnings distribution. In this case, the relative ranks are defined on this restricted sample. We consider first the balanced sample in the top panel. As we saw previously, while the households with the lowest combined credit did not move up the earnings distribution, on average, the EITC has substantial impacts on the earnings distribution at higher EITC credit levels. Specifically, households in the second quartile of EITC credit receipt (a higher EITC) saw their ranks increase 1 percentile point, on average. Households in the 3rd quartile experienced a more substantial increase in their earnings rank as they moved up the distribution 3 percentile points. Finally, we observe the most substantial effects on the ranks of the highest quartile of EITC recipients. The earnings rank of these households rises 5 percentile points, on average, among those in the bottom 50th percentile of the overall earnings distribution.

Turning to the bottom panel, which presents these statistics for the unbalanced version of the sample**,** we find that across the balanced and unbalanced samples, the EITC has the same general magnitude of impact with respect to moving households up the post-tax earnings distribution, though now from a higher position in the income distribution. That is, the unbalanced sample is relatively less advantaged—as was the case in Table 2—so that the largest post-tax movement, occurring in Quartile 4, is an 11 percentile point change in rank from 0.40 to 0.51.

Taken together, the analysis above suggests two related conclusions. First, the combined EITC in DC raises the income of many of the poorest households substantially. It reduces

relative inequality for households near the bottom of the earnings distribution—roughly raising potential consumption levels for households in the lowest quartile of earnings to the level of those making net incomes more than 400 dollars greater. However, this analysis is descriptive; an important question in this literature is whether these expansions in the EITC drive earnings and income growth. That is, in our context, did the expansions in the DC credit in concert with those at the federal level change labor supply behavior. In the subsequent section, we study this outcome by exploiting the EITC schedule changes in DC within a regression framework.

5. Earnings Responses to the Combined EITC

In this section, we study how pre-tax earnings and income respond to increased generosity in the DC credit. Specifically, we exploit policy variation driven by expansions of the DC credit over the 2000s in concert with the 2009 ARRA federal EITC expansion. The impetus for these expansions by DC and the federal government was partly recognition, by policy makers, of the EITC's success in fostering labor force participation and decreased poverty, and specifically in the case of the ARRA, the scale and severity of the recession after the financial crises of 2008.[2] Occurring in conjunction are the various DC-level expansions over this period (see Appendix Table 1), first to 35 percent of the federal EITC in 2006 from a previous rate of 10 and 25 percent,[3] and then to 40 percent of the federal EITC in 2009. Using this variation, we estimate individual panel regressions of the following form:

[2] The ARRA established, in 2009, a new federal EITC 45 percent top phase-in rate for families with three or more children. This expansion represented a 5-percentage point increase from the 2001-2008 subsidy for this group, when families with 2 or more dependent children shared the top phase-in subsidy rate of 40 percent (Tax Policy Center 2014). This jump in the EITC rate for families with 3 or more children introduces additional variation in the size of the EITC benefit over time by family size, both across the nation and for DC residents.

[3] The DC EITC was initially enacted in 2001, equal to 10 percent of the federal EITC. In 2002 the credit then rose to 25 percent of the federal credit.

$$Ln(Y_{i,t+1}) = \alpha_i + \gamma_1 EITC_{it} + \gamma_2 DC35 + \gamma_3 DC40 + \gamma_4 DC35 \times EITC_{it} + \gamma_5 DC40 \times EITC_{it} + \beta X_{it} + \theta_t + \epsilon_{it}.$$

Our primary outcome of interest $Y_{i,t+1}$ denotes either earnings (wages, salaries, and tips) or income (adjusted gross income) for individual filing unit *i* in year *t+1*. Here, $EITC_{it}$ refers to whether an individual filer *i* receives any EITC payments in year *t*. DC35 and DC40 are binary policy variables denoting whether the respective 35 percent or 40 percent policies were implemented. These are measured relative to the initially implemented DC rate of 10 percent in 2001 and immediate increase to 25 percent, again in place until 2006. We include individual fixed effects α_i, a full set of time effects δ_t, and control for potentially time-varying characteristics in the vector X_{it} such as number of dependents. ϵ_{it} represents unobservable determinants of earnings and income. Standard errors are clustered at the individual household level.

Our coefficients of interest are essentially $\gamma_4$and γ_5, which measure the change in earnings (income) among EITC-recipients after implementation of the EITC expansions over the 2000s. Note that because the DC40 change was implemented in roughly the same time period as the ARRA, these effects are a composite of both the DC credit and federal credit expansions. We estimate these regression models by household filing type: either married filing jointly or head of household; as noted previously, we refer to those households that are married filing jointly as "married" and head of household as "single" parents (Smeeding, Ross Phillips, and O'Connor 2000), and we restrict the regression sample to the bottom 50th percentile of the earnings distribution to facilitate reasonable comparisons.

Tables 4-7 present these regression results for both the balanced and unbalanced panels. Turning first to the results on changes in FAGI in Table 4, we organize the columns by

household filing status and the various controls we include in the models such as household fixed effects and group-specific trends. We include a full set of time effects in each model.

We see that in the balanced sample, the income responses were generally positive. The results for our baseline specification with household tax filer fixed effects are presented in columns 1 for singles and 4 for married filers. In both cases, the estimated income responses are positive, statistically significant and large. However, these large coefficients may reflect differential trends in earnings among households who are eligible to receive the EITC, namely parallel expansions in the DC minimum wage over this time period. When we include group-specific time trends in columns 2 and 5, the coefficients on the policy variables become smaller and statistically insignificant in this sample for both singles and marrieds. Accordingly, when estimating these models with both individual household fixed effects and group-specific time trends, the policy variables of interest are again smaller and statistically insignificant.

In Table 5, we estimate these models for pre-tax earnings from labor. Unsurprisingly, since income and earnings largely coincide for this group, the results track similarly. Estimating these models with only individual fixed effects results in large, statistically significant positive policy effects on earnings for both singles (column 1) and married (column 4). When including group-specific time trends with no household fixed effects in columns 2 and 5, these results largely go away: the coefficients become small and statistically insignificant. Including household fixed effects in columns 3 and 5 has little effect as well. Overall, in the results for the balanced sample, accounting for group-specific time trends, we estimate small-to-no response to expansions of the EITC. Of course, these results should be taken with several caveats. The balanced samples are somewhat small, as the restrictions are quite severe. Consequently, Tables 6 and 7 revisit these regressions using the full unbalanced sample.

Turning first to Table 6, we find smaller but positive policy effects on singles (column 1) and married households (column 4) when including household fixed effects. However, unlike in the balanced sample, including group-specific time trends in column 2 leads the single-parent income response to decrease slightly, while remaining positive and statistically significant. For married households (column 5) these positive effects remain; however, only the coefficient on DC35 remains statistically significant. When we include household fixed effects in columns 3 and 6, we find that the estimated income response for single households remains positive and statistically significant; by contrast, the effect for married households is no longer statistically significant.

Finally, Table 7 presents earnings results for the unbalanced sample. Similarly, exclusion of the group-specific time trends, in columns 1 and 4, leads us to estimate large and positive policy effects. When we exclude household fixed effects and include group-specific trends in columns 2 and 5, we estimate positive effects on earnings for both the DC35 and DC40 policy regimes for singles; for married households, the positive effects do not persist. In the final results that include household fixed effects and group-specific time trends, we see that for singles (column 3) and marrieds (column 6), the policy effects are no longer statistically significant.

Taken together these results suggest that the EITC generates positive to no earnings responses among the DC sample. There is little evidence, however, of any negative effect of the EITC on earnings and income. Taken in the context of broader U.S. earnings and income trends of EITC-eligible low-income populations, the program impacts look better. Several studies (e.g. Autor 2014; Hardy et al. 2018) note that earnings growth among less-educated workers throughout the 1980s, 1990s, and 2000s is relatively flat, or even negative in real terms. Thus, net-positive earnings—even if small—have potentially impactful policy ramifications.

6. Conclusion

This paper exploits administrative tax data to study how local EITC expansions in concert with the federal EITC affect household earnings, income, and inequality in Washington DC. Within the bottom half of the earnings distribution the median single-parent mother earns 26 thousand dollars annually, and the combined DC and federal EITC provides over 3 thousand dollars for this household. This increase in income therefore has substantial implications for inequality in the left tail of the distribution. Specifically, the combined EITC transfer changes household distributional positions substantially and reduces the level of inequality between families on the lower tail of the distribution and the middle. The typical household in the 25th percentile of the pre-tax earnings distribution moves as high as the 35th percentile after accounting for the EITC. Consequently, the EITC reduces the ratio of post-tax household earnings between the median and 35th percentile from roughly 3.5 to 2.5 at the end of the observation period.

We also confirm earlier work showing that increases in the EITC drive increases in pre-tax earnings. Exploiting changes in the DC EITC between 2001 and 2014, we find evidence that the EITC leads to relatively large increases in pre-tax earnings for recipients. However, these increases may be overstated by compositional changes among the populations at-risk for receiving the EITC. When we add controls for trends in earnings among those in the EITC group and those that did not receive EITC, the size of the earnings effect, while still positive and statistically significant, is somewhat reduced. Importantly, the largest inequality-reduction occurs in the city's poorest and more affordable Wards, highlighting the importance of considering how sub-regional and neighborhood-level socioeconomic factors, many of which are persistent (Casey and Hardy 2018; Shambaugh and Nunn 2018; Ziliak 2018), operate when formulating effective anti-poverty and economic development policy for individuals and families.

Together these findings suggest that the DC EITC effectively complements its federal counterpart in increasing liquidity and both potential consumption and savings among families with working adults at the bottom of the income distribution. Notwithstanding this aspect of the DC EITC, however, the introduction of a state-level EITC program does little to mitigate some key limitations of the program. Payment receipt still occurs as a lump-sum in April, meaning that families may have difficulty effectively smoothing their consumption throughout the year, though many families positively view this as an earned bonus (Tach and Halpern-Meekin 2014).

More germane to Washington DC and similar urban areas facing housing shortages and large increases in both rental and owner-occupied housing prices: even with state-level EITC top offs, without concomitant increases in wages, the EITC may not be enough to help families keep up. Regional prices, inclusive of housing, in Washington DC are consistently among the highest in the nation (BEA 2018), while the incomes of low-income and less-educated workers, including many EITC recipients, have been largely stagnant (Autor 2014; Autor et al. 2008; Hardy et al. 2018). This accounts for the increasing concentration of EITC recipients in Wards 7 and 8 of the city, areas of high concentrated poverty. It is also likely why, as shown in Appendix Figure 2, the share of DC taxpayers who are recipients of the EITC has been declining monotonically, due to out-migration into lower-cost suburban areas (Allard 2018).

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Table 1. Descriptive Statistics, 2001-2014

Full Sample	Balanced		Balanced<50th		Unbalanced	
	Mean	Median	Mean	Median	Mean	Median
FAGI	118892	71842	30020	28108	88865	47984
Earnings	101372	66047	25651	26688	73964	45185
DC EITC	137	0	578	422	160	0
Federal EITC	411	0	1712	1282	463	0
No. Dependents	0.78	0.00	1.18	1.00	0.50	0.00
EITC	0.16	0.00	0.62	1.00	0.19	0.00
Single Parents (Head of Household)	0.31	0.00	0.62	1.00	0.21	0.00
Married	0.29	0.00	0.08	0.00	0.19	0.00
Single-Parent Head of Household	Mean	Median	Mean	Median	Mean	Median
FAGI	52374	41430	27082	27524	40917	31445
Earnings	50441	40880	26241	27096	39331	30893
DC EITC	380	0	813	789	563	314
Federal EITC	1137	0	2404	2404	1646	1019
No. Dependents	1.54	1.00	1.67	2.00	1.49	1.00
EITC	0.45	0.00	0.86	1.00	0.58	1.00
Married Household	Mean	Median	Mean	Median	Mean	Median
FAGI	219235	150668	48390	32680	217293	120593
Earnings	173853	126176	24691	26363	154329	101073
DC EITC	39	0	410	0	50	0
Federal EITC	113	0	1184	0	145	0
No. Dependents	0.96	1.00	0.91	0.00	0.70	0.00
EITC	0.04	0.00	0.38	0.00	0.05	0.00

Notes: Balanced panel is restricted to observations in sample for each year between 2001-2014. Balanced<50th represents regression analysis sample, where observations are further restricted by being in-sample 14 of 14 years and lie below 50th percentile of earnings distribution in each year. Unbalanced panel allows for taxfilers to enter and exit over the 2001-2014 period.

Table 2. Distributional Impacts of EITC Receipt, 2001-2014

Percentile of EITC Distribution	Average Total EITC	Average Earnings Rank (0 to 1)	Average Earnings Rank w/ EITC (0 to 1)
Balanced Panel			
Quartile 1	836	0.21	0.21
Quartile 2	2419	0.17	0.18
Quartile 3	4008	0.11	0.12
Quartile 4	6209	0.09	0.12
Unbalanced Panel			
Quartile 1	500	0.18	0.18
Quartile 2	2267	0.28	0.29
Quartile 3	4142	0.19	0.22
Quartile 4	6505	0.20	0.25

Notes: Percentile of EITC distribution divides the sample by size of total EITC credit (Federal + DC EITC) received. Average Earnings Rank is constructed as the average rank along the earnings distribution, where earnings equals wages, salaries, and tips. Average Earnings Rank w/ EITC presents rank along the earnings distribution after accounting for the total EITC credit.

Table 3. Distributional Impacts of EITC Receipt, Bottom 50%, 2001-2014

Percentile of EITC Distribution	Average Total EITC	Average Earnings Rank (0 to 1)	Average Earnings Rank w/ EITC (0 to 1)
Balanced Panel			
Quartile 1	836	0.42	0.42
Quartile 2	2419	0.35	0.36
Quartile 3	4008	0.22	0.25
Quartile 4	6209	0.19	0.24
Unbalanced Panel			
Quartile 1	502	0.35	0.34
Quartile 2	2270	0.55	0.57
Quartile 3	4142	0.39	0.44
Quartile 4	6506	0.40	0.51

Notes: Percentile of EITC distribution divides the sample by size of total EITC credit (Federal + DC EITC) received. Average Earnings Rank is constructed as the average rank along the earnings distribution, where earnings equals wages, salaries, and tips. Average Earnings Rank w/ EITC presents rank along the earnings distribution after accounting for the total EITC credit.

Table 4. Log-Level Estimates of Income, Bottom 50 Pct. of Distribution, Balanced Sample

DEP. VARIABLES	FAGI HH	FAGI HH	FAGI HH	FAGI Married	FAGI Married	FAGI Married
EITC (0/1)	-0.1109***	-23.1479*	26.3659**	-0.0390	-13.9500	-14.3448
	(0.019)	(12.403)	(12.404)	(0.036)	(18.767)	(18.751)
35% DC Credit	0.0088	-0.0005	0.0002	-0.0031	-0.0102	-0.0104
	(0.022)	(0.031)	(0.031)	(0.025)	(0.031)	(0.031)
40% DC Credit	-0.0028	-0.0306	-0.0208	-0.0284	-0.0424	-0.0430
	(0.025)	(0.051)	(0.051)	(0.028)	(0.046)	(0.046)
35% DC Credit×EITC	0.0956***	0.0431	0.0432	0.0746**	0.0464	0.0463
	(0.023)	(0.032)	(0.032)	(0.036)	(0.051)	(0.051)
40% DC Credit×EITC	0.1038***	0.0098	0.0003	0.0475	-0.0076	-0.0080
	(0.026)	(0.053)	(0.053)	(0.040)	(0.076)	(0.076)
Year		0.0035	0.0021		0.0015	0.0018
		(0.006)	(0.006)		(0.006)	(0.006)
No. of Dependents	0.0493***	0.0484***	0.0490***	0.0255	0.0154	0.0263
	(0.006)	(0.006)	(0.006)	(0.017)	(0.016)	(0.017)
Constant	10.1041***	3.2140	5.8354	10.5828***	7.6456	6.9479
	(0.021)	(11.687)	(11.682)	(0.026)	(11.722)	(11.762)
Tax Filer Fixed Effects	Yes	No	Yes	Yes	No	Yes
EITC×Year Trend	No	Yes	Yes	No	Yes	Yes
R-squared	0.032		0.036	0.006		0.007
Number of Observations	1,511	1,511	1,511	242	242	242

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. FAGI denotes federal adjusted gross income in the DC tax data.

Table 5. Log-Level Estimates of Earnings, Bottom 50 Pct. of Distribution, Balanced Sample

DEP. VARIABLES	Earn HH	Earn HH	Earn HH	Earn Married	Earn Married	Earn Married
EITC (0/1)	-0.1373***	39.9330***	43.4459***	0.1303***	55.8377**	-56.3200**
	(0.026)	(15.358)	(15.363)	(0.044)	(22.609)	(22.706)
35% DC Credit	-0.0134	0.0014	-0.0031	-0.0851**	0.0140	0.0146
	(0.028)	(0.038)	(0.039)	(0.035)	(0.040)	(0.040)
40% DC Credit	-0.0427	-0.0257	-0.0215	-0.1766***	0.0233	0.0240
	(0.033)	(0.063)	(0.063)	(0.040)	(0.059)	(0.059)
35% DC Credit×EITC	0.1405***	0.0489	0.0545	0.1436***	0.0321	0.0321
	(0.029)	(0.040)	(0.041)	(0.045)	(0.060)	(0.060)
40% DC Credit×EITC	0.1613***	-0.0070	-0.0105	0.1759***	-0.0485	-0.0488
	(0.034)	(0.066)	(0.066)	(0.058)	(0.099)	(0.100)
Year		-0.0013	-0.0027		-0.0245***	-0.0250***
		(0.007)	(0.007)		(0.007)	(0.007)
No. of Dependents	0.0512***	0.0508***	0.0507***	0.0352	0.0428**	0.0311
	(0.007)	(0.007)	(0.008)	(0.022)	(0.021)	(0.022)
Constant	10.0769***	12.6115	15.5052	9.8899***	59.0232***	59.9145***
	(0.027)	(14.471)	(14.462)	(0.030)	(14.699)	(14.756)
Tax Filer Fixed Effects	Yes	No	Yes	Yes	No	Yes
EITC×Year Trend	No	Yes	Yes	No	Yes	Yes
R-squared	0.030		0.034	0.031		0.036
Number of Observations	1,511	1,511	1,511	242	242	242

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. Earn denotes wages, salaries, and tips in the DC tax data.

Table 6. Log-Level Estimates of Income, Bottom 50 Pct. of Distribution, Unbalanced Sample

DEP. VARIABLES	FAGI HH	FAGI HH	FAGI HH	FAGI Married	FAGI Married	FAGI Married
EITC (0/1)	-0.1311***	14.0814***	24.4962***	-0.0941***	1.0324	-9.9941
	(0.005)	(3.081)	(3.262)	(0.012)	(6.033)	(6.500)
35% DC Credit	0.0140***	-0.0310***	0.0080	-0.0415***	0.0432***	-0.0415***
	(0.005)	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)
40% DC Credit	-0.0255***	-0.0747***	-0.0390***	-0.0763***	0.0669***	-0.0763***
	(0.006)	(0.011)	(0.011)	(0.009)	(0.013)	(0.014)
35% DC Credit×EITC	0.0537***	0.0331***	0.0072	0.0469***	0.0417**	0.0290*
	(0.006)	(0.008)	(0.008)	(0.013)	(0.016)	(0.017)
40% DC Credit×EITC	0.1137***	0.0527***	0.0220*	0.0528***	0.0272	0.0167
	(0.006)	(0.012)	(0.013)	(0.014)	(0.024)	(0.025)
Year		-0.0001	0.0022		0.0016	0.0000
		(0.001)	(0.001)		(0.002)	(0.002)
No. of Dependents	0.0548***	0.0620***	0.0535***	0.0488***	0.0443***	0.0486***
	(0.002)	(0.002)	(0.002)	(0.005)	(0.004)	(0.005)
Constant	10.0184***	10.3219***	5.6960**	10.6736***	7.5750**	10.5815***
	(0.005)	(2.694)	(2.862)	(0.006)	(3.371)	(3.705)
Tax Filer Fixed Effects	Yes	No	Yes	Yes	No	Yes
EITC×Year Trend	No	Yes	Yes	No	Yes	Yes
R-squared	0.012		0.014	0.005		0.005
Number of Observations	105,245	105,245	105,245	37,617	37,617	37,617

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. FAGI denotes federal adjusted gross income in the DC tax data.

Table 7. Log-Level Estimates of Earnings, Bottom 50 Pct. of Distribution, Unbalanced Sample

DEP. VARIABLES	Earn HH	Earn HH	Earn HH	Earn Married	Earn Married	Earn Married
EITC (0/1)	0.1559***	22.0565***	35.9719***	-0.2034***	43.1146***	77.3643***
	(0.006)	(3.921)	(4.229)	(0.016)	(8.131)	(9.210)
35% DC Credit	-0.0055	-0.0258***	0.0020	-0.1473***	-0.0146	-0.0140
	(0.007)	(0.009)	(0.009)	(0.012)	(0.013)	(0.015)
40% DC Credit	0.0718***	-0.0822***	-0.0582***	-0.2932***	-0.0199	-0.0240
	(0.008)	(0.014)	(0.015)	(0.016)	(0.021)	(0.023)
35% DC Credit×EITC	0.0721***	0.0179*	0.0041	0.1430***	0.0093	0.0056
	(0.007)	(0.010)	(0.010)	(0.019)	(0.022)	(0.024)
40% DC Credit×EITC	0.1512***	0.0345**	0.0166	0.2273***	-0.0283	-0.0481
	(0.008)	(0.016)	(0.017)	(0.020)	(0.033)	(0.035)
Year		-0.0016	-0.0014		-0.0233***	-0.0385***
		(0.002)	(0.002)		(0.003)	(0.003)
No. of Dependents	0.0521***	0.0632***	0.0505***	0.0537***	0.0705***	0.0512***
	(0.002)	(0.002)	(0.002)	(0.007)	(0.005)	(0.007)
Constant	9.9636***	13.1263***	12.7985***	10.1532***	56.9619***	87.2441***
	(0.006)	(3.474)	(3.773)	(0.010)	(5.156)	(6.120)
Tax Filer Fixed Effects	Yes	No	Yes	Yes	No	Yes
EITC×Year Trend	No	Yes	Yes	No	Yes	Yes
R-squared	0.008		0.009	0.017		0.020
Number of Observations	105,245	105,245	105,245	37,617	37,617	37,617

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. Earn denotes wages, salaries, and tips in the DC tax data

Figure 1. Earnings and EITC Trends, all EITC Recipients, Balanced Panel

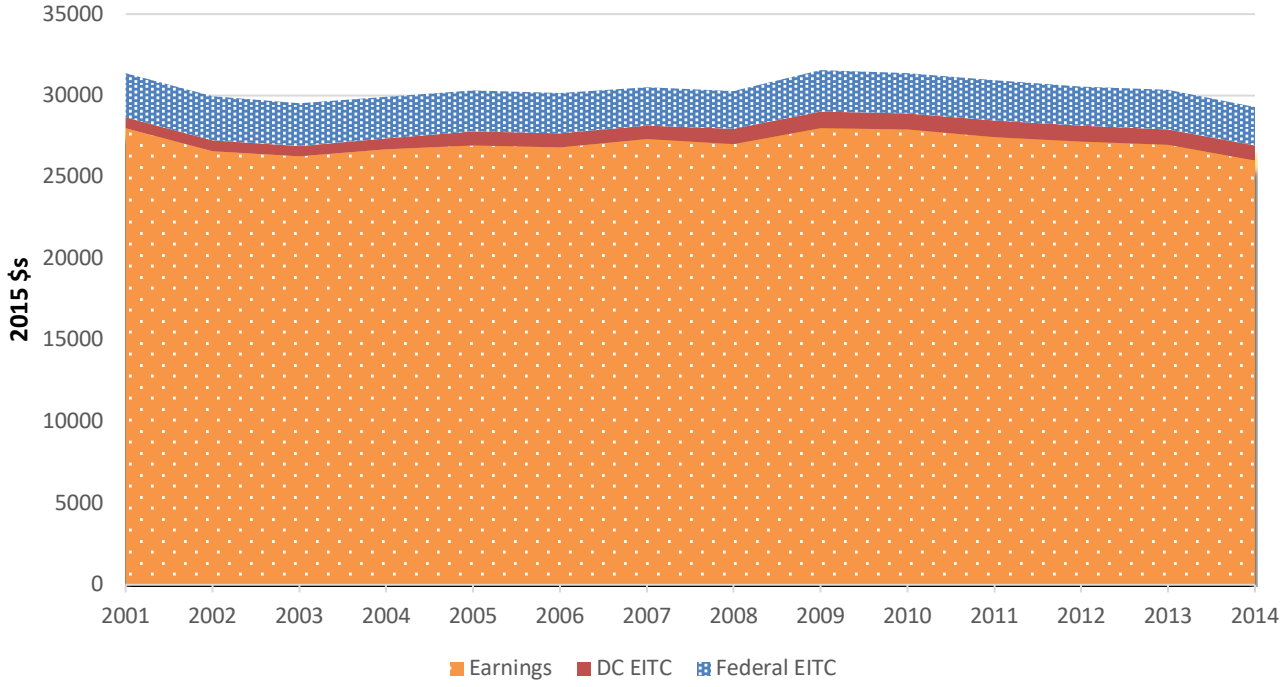
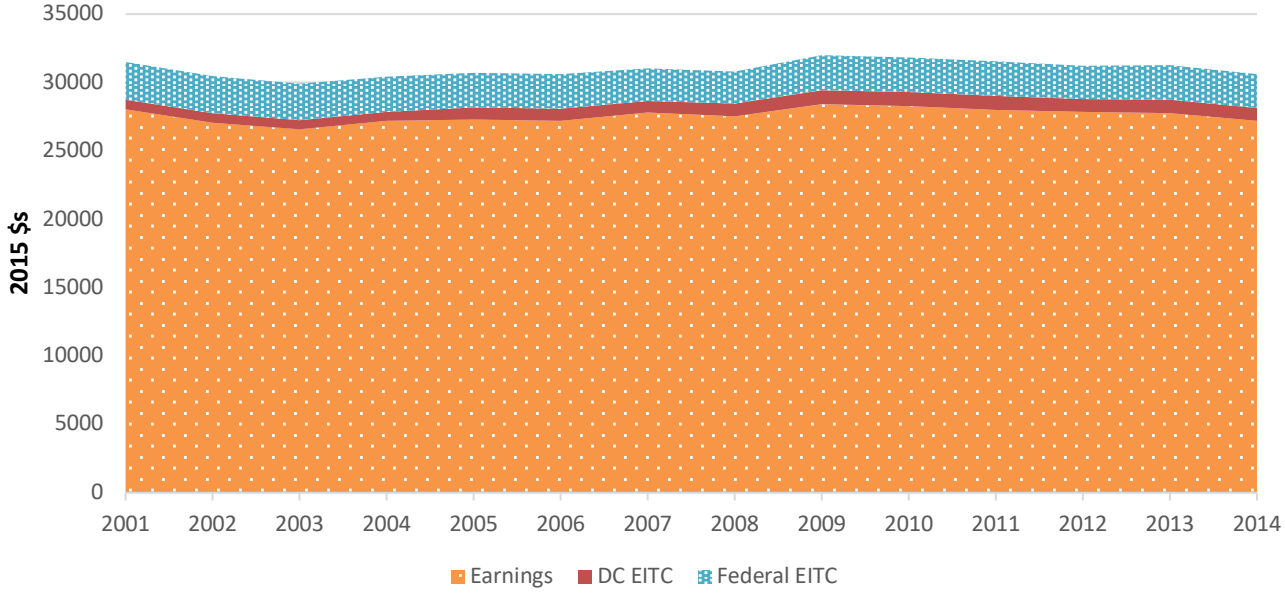


Figure 2. Earnings and EITC Trends Among Head of Householders, Balanced Panel



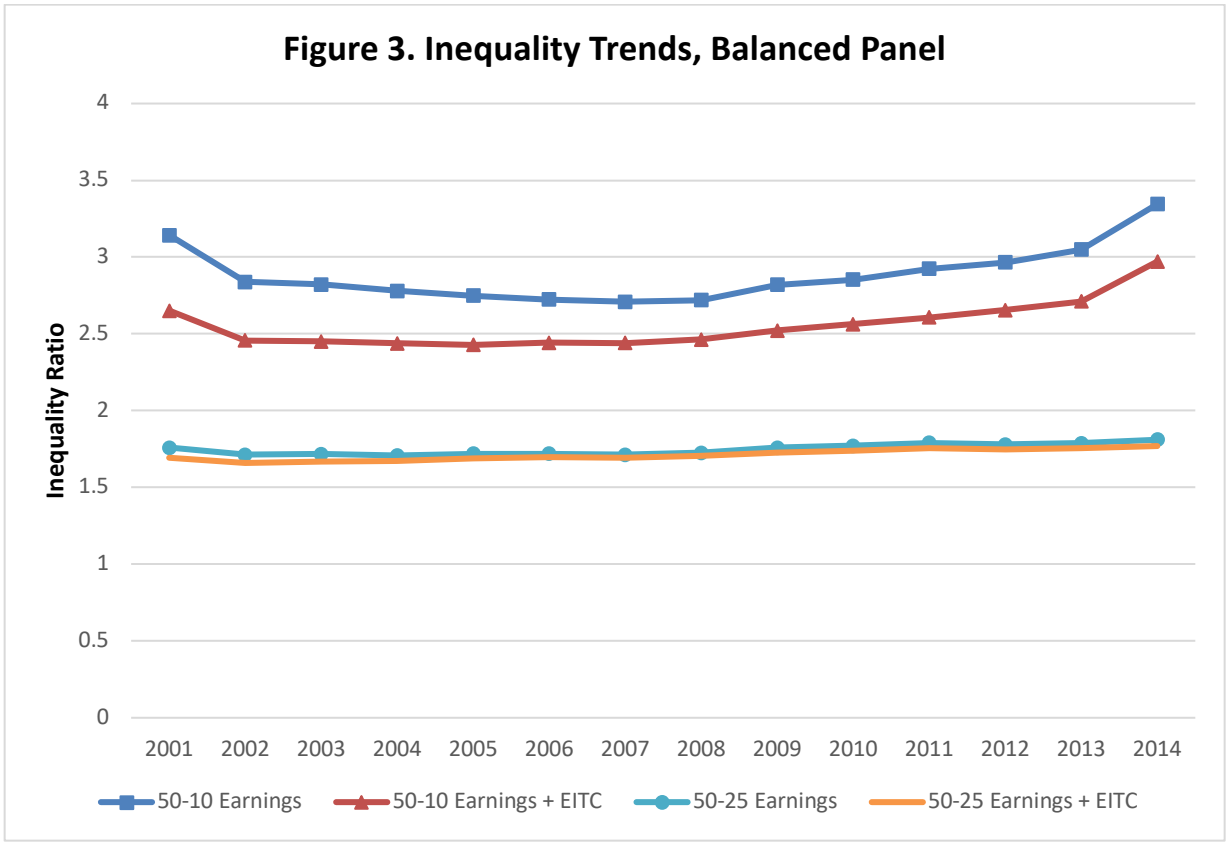


Figure 3. Inequality Trends, Balanced Panel
Inequality Ratio
4
3.5
3
2.5
2
1.5
1
0.5
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
50-10 Earnings
50-10 Earnings + EITC
50-25 Earnings
50-25 Earnings + EITC

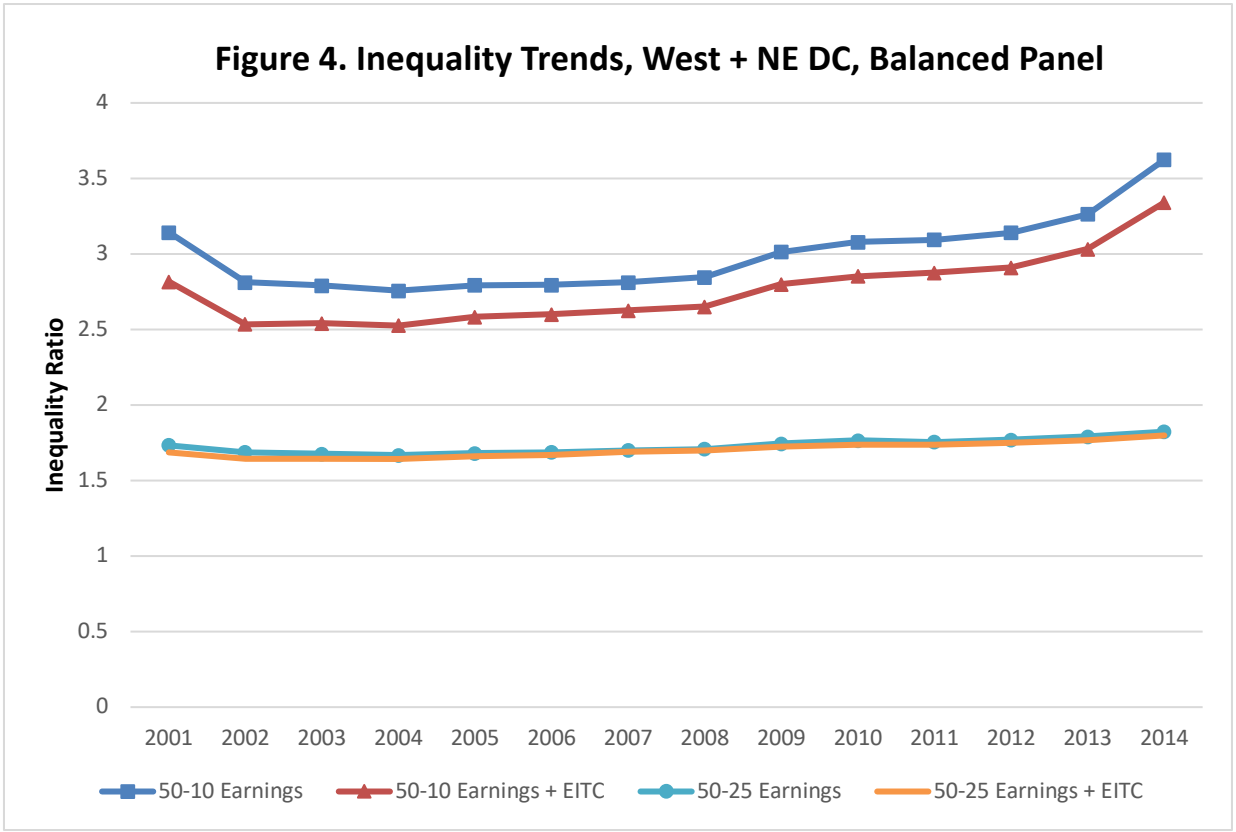


Figure 4. Inequality Trends, West + NE DC, Balanced Panel
Inequality Ratio
4
3.5
3
2.5
2
1.5
1
0.5
0
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
50-10 Earnings
50-10 Earnings + EITC
50-25 Earnings
50-25 Earnings + EITC

Figure 5. Inequality Trends, Wards 7 & 8, Balanced Panel

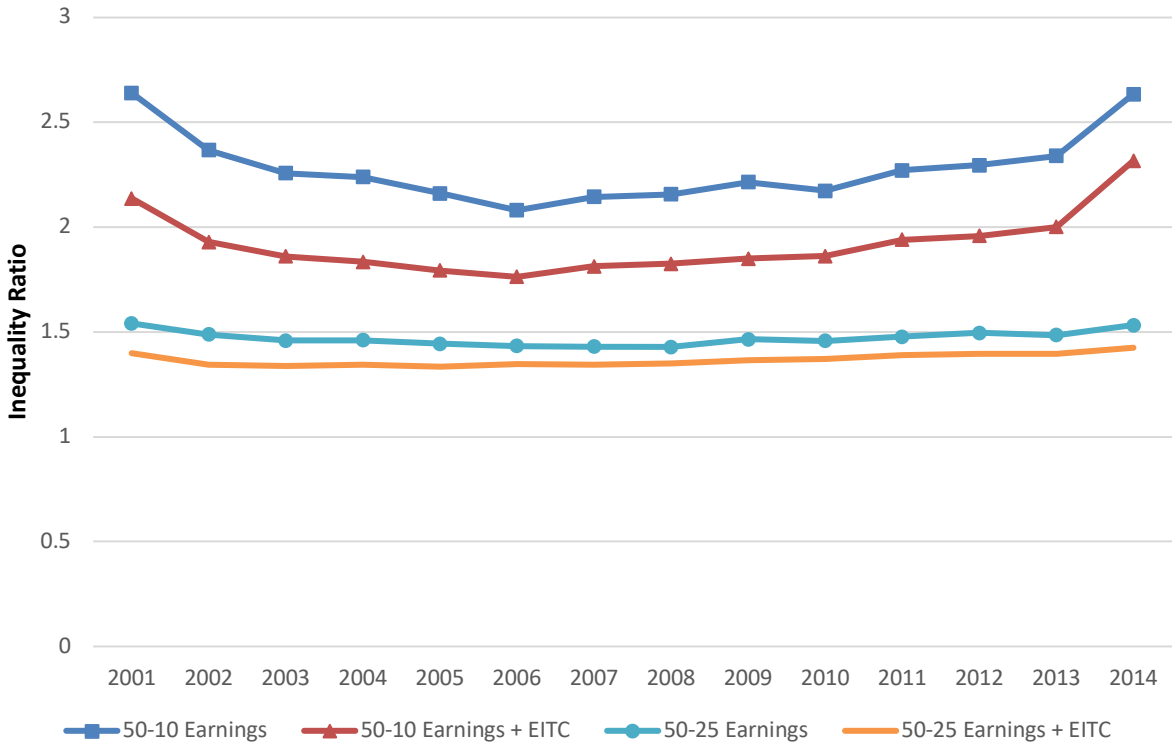
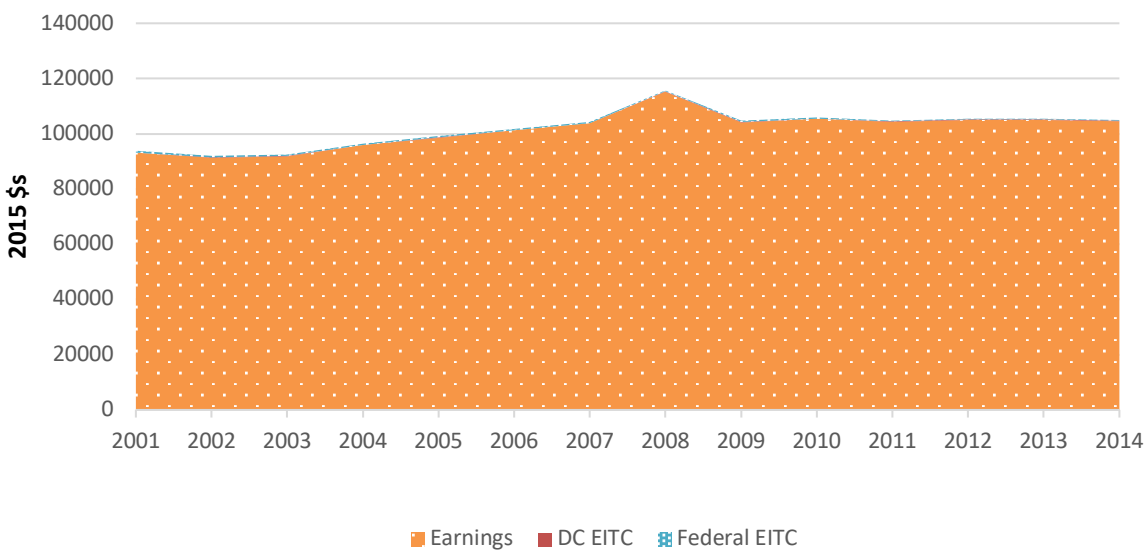


Figure 6. Earnings and EITC Trends, Balanced Panel



APPENDIX

Appendix Table 1. DC Refundable Earned Income Credit Policy Changes, 2000–2014

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: DC Tax Facts, 2012.

Appendix Table 2. Log-Level Estimates of Income, Bottom 50 Pct. of Distribution, Unbalanced Sample, Year Effects.

VARIABLES	FAGI HH	FAGI Married
EITC (0/1)	-0.1271***	-0.0942***
	(0.005)	(0.012)
35% DC Credit	0.0400***	-0.0698***
	(0.006)	(0.012)
40% DC Credit	0.0386***	-0.0380***
	(0.008)	(0.014)
35% DC Credit×EITC	0.0506***	0.0484***
	(0.006)	(0.013)
40% DC Credit×EITC	0.1108***	0.0530***
	(0.006)	(0.014)
Constant	9.9896***	10.6606***
	(0.006)	(0.010)
Year Fixed Effects	Yes	Yes
R-squared	0.014	0.008
Number of Observations	105,245	37,617

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. FAGI denotes federal adjusted gross income in the DC tax data.

Appendix Table 3. Log-Level Estimates of Earnings, Bottom 50 Pct. of Distribution, Unbalanced Sample, Year Effects.

DEP. VARIABLES	Earn HH	Earn Married
EITC (0/1)	-0.1525***	-0.2035***
	(0.006)	(0.016)
35% DC Credit	0.0363***	-0.2539***
	(0.008)	(0.020)
40% DC Credit	0.0072	-0.4113***
	(0.010)	(0.023)
35% DC Credit×EITC	0.0696***	0.1450***
	(0.007)	(0.019)
40% DC Credit×EITC	0.1489***	0.2307***
	(0.008)	(0.020)
Constant	9.9225***	10.2262***
	(0.008)	(0.016)
Year Fixed Effects	Yes	Yes
R-squared	0.009	0.020
Number of Observations	105,245	37,617

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. Earn denotes wages, salaries, and tips in the DC tax data.

Appendix Table 4. Log-Level Estimates of Income, Bottom 50 Pct. of Distribution, Balanced Sample, Year Effects.

DEP. VARIABLES	FAGI HH	FAGI Married
EITC (0/1)	-0.1096***	-0.0404
	(0.019)	(0.036)
35% DC Credit	0.0498**	-0.0173
	(0.024)	(0.035)
40% DC Credit	0.0407	0.0069
	(0.027)	(0.034)
35% DC Credit×EITC	0.0932***	0.0772**
	(0.023)	(0.036)
40% DC Credit×EITC	0.1016***	0.0481
	(0.026)	(0.040)
Constant	10.0483***	10.5558***
	(0.022)	(0.031)
Year Fixed Effects	Yes	Yes
R-squared	0.043	0.013
Number of Observations	1,511	242

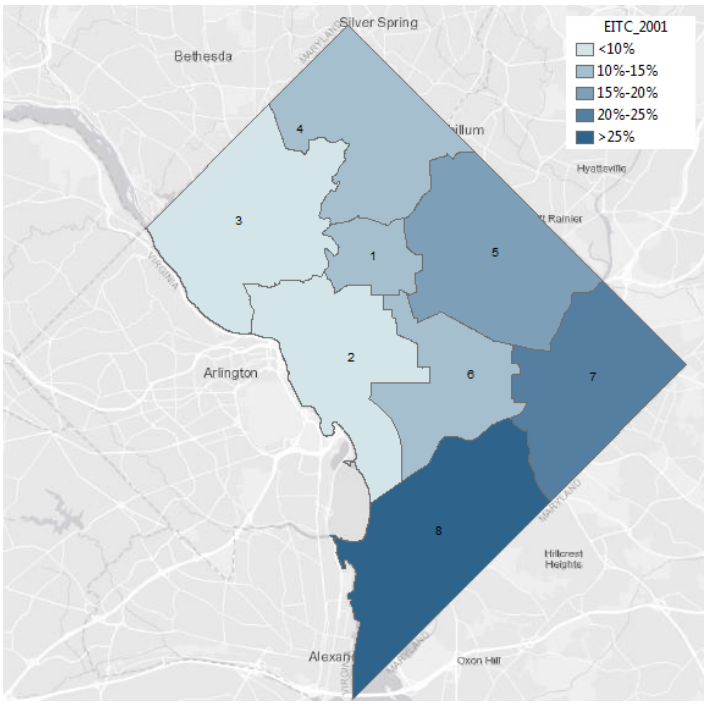
Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. FAGI denotes federal adjusted gross income in the DC tax data.

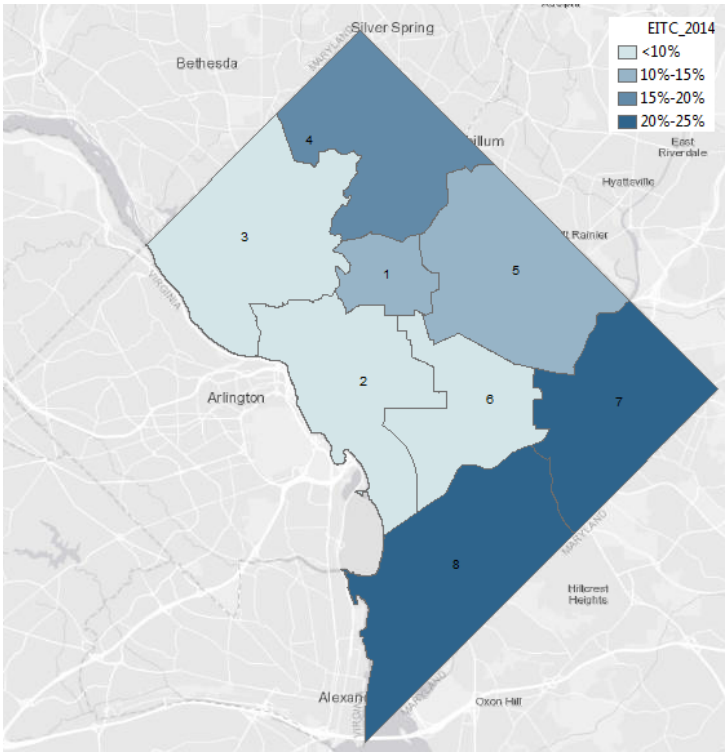
Appendix Table 5. Log-Level Estimates of Earnings, Bottom 50 Pct. of Distribution, Balanced Sample, Year Effects.

VARIABLES	Earn HH	Earn Married
EITC (0/1)	-0.1363***	-0.1330***
	(0.027)	(0.044)
35% DC Credit	0.0519*	-0.1089**
	(0.030)	(0.048)
40% DC Credit	0.0282	-0.1339***
	(0.036)	(0.050)
35% DC Credit×EITC	0.1391***	0.1434***
	(0.029)	(0.045)
40% DC Credit×EITC	0.1590***	0.1700***
	(0.034)	(0.058)
Constant	9.9998***	9.9056***
	(0.028)	(0.037)
Year Fixed Effects	Yes	Yes
R-squared	0.042	0.038
Number of Observations	1,511	242

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Number of observations represents individual tax filing units. HH denotes single parent headed households, and Married represent married households. Earn denotes wages, salaries, and tips in the DC tax data.

Appendix Figure 1: Changes in the Spatial Concentration of EITC Receipt





Appendix Figure 2