

Hiring Subsidies for the Disadvantaged: Evidence from the Work Opportunity Tax Credit*

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Abstract

The US spends billions of dollars annually on policies to promote upward economic mobility. This paper studies the effectiveness of one such approach: targeted wage subsidies. We examine a large federal program, the Work Opportunity Tax Credit (WOTC), which covers up to 40% of wages for certain categories of disadvantaged workers and subsidizes over two million hires annually. Using linked administrative data, we apply four complementary quasi-experimental approaches to assess WOTC's impact on labor market outcomes, including age-based eligibility discontinuities, eligibility expansions, and changes to program participation costs. We find precise null effects on hiring, employment, and earnings across all specifications, where we can rule out effects on employment as small as 0.2 percentage points. Instead, employers hire the same workers as in the absence of subsidies, and subsidies operate as a pure transfer to the firms, where most of the benefits accrue to a small number of large firms. To understand these results, we collect original data on the hiring processes of WOTC-utilizing firms. These data suggest that firms often silo information on candidates' subsidy eligibility from managers making hiring decisions, with some evidence that this is due to concerns about legal liability.

Keywords: wage subsidies, economic mobility, Work Opportunity Tax Credit, SNAP

JEL codes: J38, M51, H25

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1 Introduction

The US spends billions of dollars each year on policies to promote employment and upward economic mobility among disadvantaged groups. Much of these efforts go to programs and policies focused on providing incentives to individuals to find work, such as the Earned Income Tax Credit and vocational training programs (Barnow and Smith, 2015). An alternative demand-side approach is wage subsidies, in which the government subsidizes the wages paid to certain types of workers to encourage firms to hire them (Katz, 1996).

This paper studies the largest such program in the US, the federal Work Opportunity Tax Credit (WOTC), which provides wage subsidies to encourage the hiring of groups typically disadvantaged in the labor market. Firms can apply for WOTC when making new hires and receive tax credits for up to 40% of the hire’s wages in their first year in a job. WOTC was created in 1996 and initially subsidized the wages of approximately 400,000 individuals annually, most of whom were recipients of cash welfare. Over time, eligibility has expanded and now includes ten categories of individuals, the largest of which is Supplemental Nutrition Assistance Program (SNAP) recipients. The number of jobs subsidized by WOTC has grown to over 2.5 million annually (Department of Labor, 2023b), and in 2022, approximately 4% of all new hires in the US had their wages subsidized by WOTC (Bureau of Labor Statistics, 2023b). That is more than double the number of workers earning at or below the federal minimum wage (Bureau of Labor Statistics, 2023a), a policy that has received considerably more academic and policy attention.

In standard economic models, wage subsidies increase employment or wages by lowering the effective cost of labor to employers. If targeted to particular groups, they may encourage the hiring of workers from those groups by lowering the cost of these workers as compared to workers ineligible for subsidies. Temporary wage subsidies like WOTC can encourage firms to accept the risks of hiring workers whom they might otherwise be unwilling to hire (Pallais, 2014). Targeted wage subsidies may also affect non-employment outcomes, such as reducing reliance on public benefit programs or the likelihood of engaging in criminal activity.

While promising in theory, many have voiced concerns that subsidies do not encourage hiring or retention of workers in practice. Instead, employers may only apply for wage subsidies for workers whom they would have hired anyway, and so the subsidies have minimal effects on the employment of targeted populations (Bartik, 2001; Hamersma, 2005). Others have expressed concern that hiring subsidies may lead to “churning” of workers, in which subsidized employees are fired after the subsidy is exhausted (GAO, 2001), or that targeted wage subsidies may stigmatize eligible workers and make them less likely to be hired (Burtless, 1985).

To estimate the effect of WOTC on labor market outcomes, we use administrative data from over 13 million individuals in the state of Wisconsin over the past two decades. Our data links quarterly employment and earnings records to a host of social program data, including SNAP, TANF, unemployment insurance, and criminal justice records. We additionally link this to individual-level application and certification data from the WOTC program, which allows us to characterize which types of firms and workers receive WOTC benefits.

Our empirical focus is SNAP recipients, which comprise approximately two-thirds of all workers whose wages are subsidized by WOTC (Department of Labor, 2024).¹ We use four complementary empirical approaches to establish the effects of WOTC on labor market outcomes. Each approach provides insights into different elements of the program, but the results are remarkably similar, reinforcing the robustness of the findings. The first strategy is based on a major WOTC expansion among SNAP recipients in 2007. Prior to 2007, SNAP recipients aged 18-24 had been eligible for wage subsidies, while in 2007, eligibility was expanded to ages 18-39. We use a difference-in-differences approach, measuring how labor market outcomes change for SNAP recipients just below the new age threshold of 40 (newly eligible) as compared to those just above (ineligible).

Second, we exploit these sharp age-based eligibility criteria for WOTC among SNAP recipients: prior to 2007, SNAP recipients below age 25 were eligible, and after 2007, there is a similar cutoff at age 40. Using a regression discontinuity design around those age thresholds, we test whether labor market outcomes differ for those who are just eligible for the subsidies as compared to those who are just ineligible. This approach provides a larger sample for exploring potentially heterogeneous effects of eligibility and allows us to estimate the consequences of WOTC eligibility throughout the sample period rather than just around 2007.

Third, Wisconsin instituted electronic filing of WOTC applications in June 2017. This decreased the (implicit) cost to firms of applying for WOTC subsidies and led to a large increase in WOTC utilization. We examine the effect of e-filing on labor market outcomes by using the same age-based treatment and control groups among SNAP recipients as in the first empirical approach, but with a difference-in-differences approach around June 2017. This approach provides a conceptually different treatment effect estimate, as it evaluates the effect of a policy change that lowers the cost of firm access to wage subsidies rather than individual-level eligibility.

Across all three approaches, we find no evidence that WOTC increases employment of eligible workers. These estimates are extremely precise, where even the upper bound of the 95% confidence interval around the (null) estimates is as small as 0.2 percentage points. These results hold even when we focus on employment at firms that are the largest users of WOTC. This implies that WOTC eligibility is not influencing firm hiring decisions, and so firms are receiving subsidies for workers whom they would have hired in the absence of WOTC, a phenomenon known as “windfall wastage” (Bartik, 2001). To quantify the extent of windfall wastage, we revise each specification so that the outcome is whether the worker is in a WOTC-subsidized job; this measures the effective difference between the eligible and ineligible group in program uptake. We divide the bounds on our employment estimates by these uptake estimates to establish bounds on the fraction of WOTC-subsidized hires whose hiring could be attributable to WOTC. Taking the 95% confidence intervals around our most precise estimates, between 87 and 100% of WOTC-subsidized hires appear to be windfall wastage.

¹Other categories include Temporary Aid to Needy Families (TANF), and Supplemental Security Income (SSI) recipients, ex-felons, and the long-term unemployed, among others. SNAP is by far the largest target group: the next largest group (long-term unemployed) comprised only 6.8% of WOTC certified hires in 2023 (Department of Labor, 2024).

Even if hiring decisions are unchanged by wage subsidies, they could still benefit targeted workers if passed through in the form of higher wages or if employers retain workers for longer to receive subsidies. Either of these channels would imply that eligibility conveys higher earnings. Using the same empirical approaches, but instead using earnings as the outcome variable, we find no evidence of this. These null estimates are again quite precise, where the upper bound of the estimated confidence interval implies that we can rule out positive effects on quarterly earnings as little as \$19 per quarter.

Proponents of wage subsidies suggest that wage subsidies could reduce usage of public benefit programs and discourage engagement in criminal activity. Indeed, WOTC lobbyists claim that these effects are meaningful and results in WOTC creating a large net savings for the government (Cappelli, 2012). Using administrative data on these outcomes and the same empirical approaches, we find no evidence of WOTC eligibility affecting the dollar value of public benefits received or any of a broad set of outcomes related to criminal activity.

Our fourth empirical approach analyzes the data at the firm rather than worker-level. We exploit the staggered adoption of WOTC by firms over time in a triple-differences design, examining how firm hiring practices changes around the time of WOTC adoption relative to firms that have not yet adopted WOTC. In particular, we focus on changes in the difference between firm hiring of individuals who are eligible for WOTC (receive SNAP benefits and just below age 40) relative to those who are just ineligible (received SNAP and above age 40). After adoption, there is an immediate and persistent spike in firms' receipt of WOTC subsidies for eligible hires relative to ineligible ones, meaning that the firm faces a lower wage bill when hiring a WOTC-eligible worker. However, as in the previous three analyses, we find that they do not respond to this incentive, where they are no more likely to hire eligible workers relative to ineligible workers.

While we find little effects on hiring, an oft-cited concern with capped wage subsidy programs is that firms may fire subsidized employees after the subsidy is exhausted to hire a new batch of subsidized workers, a phenomenon labeled as "churning" (GAO, 2001). If this were the case, hiring subsidies may reduce the availability of stable jobs in low-wage labor markets. We investigate this possibility using discontinuities in the WOTC subsidy schedule, checking for bunching or kinks in termination after subsidy exhaustion or other discontinuous changes in subsidy amount. We find no evidence of churning, including when we focus on particular categories of firms that are more attentive to WOTC or within particular time periods.

Put together, our results imply that hiring subsidies through WOTC are a pure transfer to firms. Moreover, we find that these transfers are heavily concentrated, with half of WOTC subsidies in Wisconsin going to just 48 firms, far in excess of these firms' share of employment (9% of all hires). Independently acquired data from Freedom of Information Action requests provides more details on these firms (Corwin, 2022). Of the top 50 firms in WOTC certifications, 52% are temporary staffing services agencies. Most of the rest are very large firms: among those that are publicly listed (24%), the median market capitalization is over \$30 billion, whereas most of the privately held firms are large franchisees of national fast food chains (16%). Thus, in stark contrast to the

stated objectives of aiding disadvantaged workers, the wage subsidies appear to instead benefit a small set of firms.

The final section of the paper examines the puzzle of why firm hiring practices do not respond to this relatively sizable subsidy. We first test and rule out conventional explanations related to standard models of labor supply and demand or the negative signal value of WOTC eligibility. We then collect data on firm hiring processes for a representative sample of WOTC-using firms. These data provide a clear and stark explanation: hiring decisionmakers almost never know who is WOTC eligible. Among these firms, less than 15% of initial job applications collect information that would allow firms to determine WOTC eligibility, and even among those that do, the information is often explicitly siloed from individuals making hiring decisions. To understand why firms do not integrate WOTC status into hiring, we conduct a separate survey of individuals with hiring experience at firms that receive WOTC subsidies. We find that firms are concerned that preferring WOTC-eligible applicants could risk lawsuits over hiring discrimination, and that explicit screening may discourage applications due to imperfect information on the applicant side. These channels are typically absent from models of hiring and job search, but appear to generate important deviations from predictions of standard theory.

This paper contributes to three main literatures. First, our results bring new estimates to the literature on hiring and wage subsidy policies in the United States. An older literature studied early US federal wage subsidy programs such as the New Jobs Tax Credit (e.g., Perloff and Wachter, 1979; Bishop, 1981) and the Targeted Job Tax Credit (e.g., Burtless, 1985; Hollenbeck and Wilke, 1991; Bishop and Montgomery, 1993; Lorenz, 1995; Katz, 1996), but Katz (1996) suggests concerns with the empirical designs of many of these studies, concluding that there “exists much uncertainty [about the efficacy of wage subsidies].” More recent papers have studied smaller state tax credits (e.g., Bartik, 2001; Bartik and Erickcek, 2014; Neumark and Grijalva, 2017), typically finding that these programs create jobs but at a very high cost, test how employers respond to wage subsidies in a survey or experimental context (Hunt et al., 2018; Cullen et al., 2023; Bushway and Pickett, 2024), or examine subsidies packaged with other interventions (e.g., Bell and Orr (1994); Gelber et al. (2016)).² We provide estimates for a much larger federal program, and for wage subsidies that are targeted at individuals with disadvantages in the labor market.

Second, our paper contributes to the literature on how frictions often absent in classic models of labor markets turn out to be quite important in understanding their functioning. A recent literature has shown, for example, that equity pay constraints can explain the lack of within-firm pass-through of payroll taxes (Saez et al., 2019) and worker-side information frictions and misperceptions in job negotiations can impact wage gaps (Cullen and Pakzad-Hurson, 2023; Roussille, 2024; Jäger et al.,

²Outside of the US, Cahuc et al. (2019) finds that hiring credits for French firms during the Great Recession increased employment without affecting wages, Boockmann et al. (2012) finds that hiring subsidies for older workers in Germany only increase the hiring of some types of workers, and studies in other European countries have found modest or no effects (e.g., Huttunen et al., 2013; Schünemann et al., 2015). There have also been a number of recent evaluations of wage subsidy programs in developing countries using randomized controlled trials, which typically find short-term employment gains without longer term effects (e.g., Galasso et al., 2004; Groh et al., 2016; Abel et al., 2021).

2024). Our results show that firm-side information frictions are also important in determining labor market outcomes, and even that these frictions can be self-imposed in response to legal institutions.

Third, we contribute to a smaller literature that has studied WOTC specifically. These papers either focus on an earlier time period at which point the program was relatively small and focused on TANF recipients (Hamersma, 2008) or are descriptive in nature (Gunderson and Hotchkiss, 2007; Hunt et al., 2018; Hamersma and Heinrich, 2008). The lack of academic consensus on WOTC is well-illustrated by a February 2023 release by the Department of Labor containing a list of open questions about the program such as “does the tax credit influence employer hiring decisions?” (Department of Labor, 2023a). Our results expand and often differ from the findings in existing work, providing an overall more negative assessment of the program.³ While our empirical results focus on SNAP recipients (the largest target group) and thus we cannot definitively speak to the effects of WOTC on other target groups, the informational constraints that we identify will also apply to those groups. The Work Opportunity Tax Credit will be up for renewal by Congress in December 2025, at which point there may even be attempts to expand the scope of the program (Congress, 2023). Overall, our results imply that either reforms are needed to make WOTC actually benefit targeted groups or that the billions spent annually on WOTC could be more impactful if allocated to other programs.

2 Institutional Background

Active labor market policies, such as job search assistance, job training, and job subsidies, are a large part of government spending in most developed countries: OECD countries spend an average of 0.58% of GDP on these policies annually (Crépon and Van Den Berg, 2016). While a large literature on job search assistance and job training programs suggests that the former can sometimes be helpful and the latter is often not, there is much less evidence on employment subsidies, particularly in the US context.⁴

The US has a long history of experimenting with wage subsidy programs, including Job Opportunities in the Business Sector in the late 1960s, the WIN tax credit in the 1970s for AFDC recipients, and the New Jobs Tax Credit from 1977-1978 (see, e.g., Perloff and Wachter, 1979; Bishop, 1981). The most extensive of these programs was the Targeted Job Tax Credit, which was in effect between 1979 to 1994 and primarily subsidized the employment of beneficiaries of public assistance. This program was eventually phased out after criticism over implementation issues, namely “employer windfalls for hiring employees that they would have hired anyway and too many credit-eligible employees leaving their jobs before receiving much work experience” (Government

³The only other paper that attempts to causally identify the labor market consequences of WOTC, Hamersma (2008), estimates that WOTC generates a meaningful (5.9 percentage point) increase in short-run employment, but not in long-run employment. Our findings may differ due to sample, timing, or empirical strategy: Hamersma (2008) uses data from approximately 3,500 TANF recipients between 1997-2002 and compares labor market outcomes of individuals who stopped receiving TANF benefits after 6-8 months (just ineligible for WOTC) to individuals who received TANF for 9-18 months (eligible).

⁴See Card et al. (2010), Crépon and Van Den Berg (2016) and Card et al. (2018) for meta-analyses and summaries on job search assistance and job training programs.

Accountability Office, 2002). This paved the way for reforms to the design of federal targeted wage subsidies that resulted in the Work Opportunity Tax Credit.

2.1 The Work Opportunity Tax Credit

The Work Opportunity Tax Credit was established by Congress on August 20, 1996 by P.L. 104-188. The current WOTC differs from past wage subsidy programs in both design and target populations. As discussed in a 2002 GAO report on WOTC, the most important change was introducing a requirement that employers confirm applicants' WOTC eligibility prior to making hiring decisions to avoid windfall wastage (Government Accountability Office, 2002): on IRS form 8850, which firms submit when filing for WOTC, both the hire and firm must sign to confirm that "under penalties of perjury, I declare that the applicant provided the information on this form [indicating eligibility for WOTC] on or before the day a job was offered to the applicant." This contrasts with the Targeted Job Tax Credit, under which employers "may claim the tax credit even though they have made no specific effort to recruit, hire, or retain workers targeted by the program" (Government Accountability Office, 1991). There were also changes to the minimum employment length requirements to encourage longer stints of employment, as well as reforms to eligibility target groups to focus on the neediest job seekers (Government Accountability Office, 2002). Finally, as discussed more below, the number of subsidized workers has expanded substantially: the Targeted Job Tax Credit cost around \$300 million in 1994 (U.S. Department of Labor Office of Inspector General, 1994), while we estimate that WOTC currently costs over \$2 billion annually. These changes have the potential to make WOTC significantly more effective than its predecessors, but it is an empirical question whether this potential manifests in actual gains.

The main groups of individuals eligible for WOTC are those: (1) aged 18 to 39 and whose family has received SNAP benefits for at least 3 of the 5 months prior to hiring; (2) whose family has received assistance under TANF for at least 9 of the 18 prior months; (3) convicted of a felony and hired within one year of their conviction or release from incarceration; (4) who are long-term TANF recipients, including those who exhausted their TANF benefits in the past two years; (5) who have received Supplemental Security Income (SSI) over the past three months; or (6) unemployed for at least 27 consecutive weeks and who received unemployment compensation during at least part of the unemployment period.⁵ SNAP recipients are by far the largest category, making up around two-thirds of all WOTC certifications in recent years (Figure 1). These populations typically have low rates of labor force participation: for example, only 52% of non-disabled, working-age SNAP participants are employed in a typical month (Keith-Jennings and Chaudhry, 2018).

All firms are eligible to apply for WOTC and there is no limit on the number of hires for whom they can receive subsidies, but they can only receive the subsidy for a particular worker once.⁶

⁵A few other categories are also eligible, such as qualified veterans, residents of "designated communities", and employees of summer youth programs.

⁶Taxable employers can claim WOTC against income taxes, while eligible tax-exempt employers can only claim WOTC against payroll taxes on wages paid to qualified veterans rather than the full set of eligible individuals listed above (Internal Revenue Service, 2024).

Employers need only submit two one-page forms for each worker within 28 days of hiring to the relevant state agency to claim the tax credit.⁷ This agency verifies that the worker is eligible and certifies or denies the application.⁸

When applications are approved, the firm receives tax credits for wages over the worker’s first 12 months of employment in a job. The firm can claim 25% of wages for workers who worked between 120-400 hours and 40% for employees who worked at least 400 hours, up to a limit of \$6,000 of earnings (or \$2,400 in tax credits) per worker for most categories of workers (Appendix Figure A1).⁹ These tax credits are non-refundable and so require tax liability to be claimed, but they can be carried backward up to one tax year and forward up to 20 tax years. Even if another firm has received WOTC for a particular worker in the past, the worker’s current employer can still claim the full subsidy amount as long as the worker satisfies the eligibility criteria at the time of hiring. The firm also continues to receive the subsidy even if the worker does not remain in the eligible category after hiring.

WOTC primarily subsidizes low-wage employment. Appendix Figure A2 plots a histogram of the starting hourly wage for WOTC workers, using administrative micro-data on all WOTC applications in Wisconsin between 2009 and 2020. Most jobs are at or just above the minimum wage, which was equal to \$7.25 in Wisconsin over this period.¹⁰ Combining this data with administrative quarterly earnings data, we find that for each certification, firms receive an average of \$1057 in subsidies.¹¹ 34% of certified workers work less than the minimum number of hours for eligibility for WOTC (120 hours), 24% work at a 25% wage subsidy rate (120-400 hours), and 42% work enough hours to qualify for the 40% subsidy rate, with 31% of all certifications yielding the maximum subsidy amount of \$2400. As these numbers indicate, these jobs are typically short-term, with a median estimated hours worked of 265 hours and only 23% of jobs lasting for more than three quarters.

2.2 History of the Work Opportunity Tax Credit

In its early years, WOTC subsidized the wages of approximately 400,000 individuals annually, where the majority were recipients of TANF. Over time, eligibility criteria have expanded to include additional groups, such as SNAP recipients between the ages of 25 to 39 (in 2007) and the long-term

⁷The form also requires applicants to supply some evidence of eligibility; for example, for those eligible based on TANF or SNAP receipt, applicants need to provide their case number identifier and/or a signed statement from an Authorized Individual with a description of months of benefits that were received.

⁸While there is an option for workers to get “pre-certified”, so that they can present their eligibility to potential employers and avoid this application process, this accounts for a minuscule fraction of certifications in our data (0.65%), almost all of which are eligible due to a past felony conviction.

⁹The limit is \$4,800 in tax credits for disabled veterans who meet other criteria, but this is a very small fraction of all WOTC hires.

¹⁰Data from administrative records in seven other states between 2018 and 2020 (Corwin, 2022) suggest that this is also true outside of Wisconsin.

¹¹To calculate total hours worked for the employer, we take the starting hourly wage reported in the WOTC application and divide total earnings for the worker from that employer in this work stint. This could be incorrect if workers receive a raise in their hourly wage, but that is quite unlikely since 400 hours is still only 10 weeks of full-time work and so workers are unlikely to receive a raise so quickly.

unemployed (in 2015). As a result of these extensions and greater awareness of the program, the number of workers whose wages are subsidized by WOTC has grown sixfold, reaching 2.5 million in 2022 (Department of Labor, 2023b). Figure 1 shows that most of this growth came between 2008 and 2015, and is due to certifications for WOTC through SNAP.¹²

To understand the reasons for this massive growth, we leverage individual-level data on all WOTC applications in the state of Wisconsin between 2005 and 2019, a dataset described in greater detail in Section 3. We match this to employer-employee earnings records, as well as TANF, SNAP, and criminal justice records to measure which new hires are potentially eligible for WOTC subsidies. The expansion could be the result of: (i) an increased number of job applicants who are eligible for WOTC; (ii) firms becoming more likely to apply for WOTC subsidies for a given hire, such as if screening technology improves; or (iii) greater success in the application process, such as a higher fraction of applications being accepted.

Panel (a) of Appendix Figure A3 plots the total number of new hires who are potentially eligible for WOTC over time as a result of the three eligibility criteria that are our observable in our data: SNAP receipt, TANF receipt, and having a recent felony conviction.¹³ We then match these employment stints to WOTC micro-data to check what fraction of eligible hires have an associated WOTC application, which we plot in panel (b). Panel (b) also plots the fraction of all applications that result in a certification. Over the main period of expansion from 2008 to 2015, there is a tripling in the number of hires who qualify for WOTC. The fraction of eligible hires for whom firms apply for WOTC also increased meaningfully from 11.2% in 2007 to 17.1% in 2015, though this is less important than the increase in eligibility. Finally, application success rates are fairly steady, and so do not explain the change. We thus conclude that the growth of WOTC is mostly due to an increase in the number of hires who would be eligible, largely due to the expansion of the SNAP program.

3 Data

The major difficulty with studying WOTC is that the necessary administrative data on eligibility and outcomes are typically siloed within many different state government agencies. We overcome this challenge by using linked administrative data from the state of Wisconsin through the Institute for Research on Poverty (IRP) at the University of Wisconsin-Madison, which contains information on over 13 million individuals. We use linked data from quarterly earnings records, SNAP benefits, TANF benefits, criminal justice records, unemployment insurance benefits, WOTC application and certification data, and a data core that compiles individual demographic information from various state databases. Wisconsin is a good state in which to study WOTC because it is fairly typical in its implementation of the program: for example, Appendix Figure A4 shows that per capita

¹²Federal law places limits on SNAP eligibility for able-bodied adults without dependents (3 months in a 36 month period). Wisconsin had these requirements waived between 2002 and 2015 due to high unemployment, and we do not see evidence of differences in the effects of WOTC during the waiver/non-waiver periods.

¹³These eligibility criteria account for over three-quarters of WOTC subsidized hires.

utilization is almost exactly the national average.

Quarterly earnings records: We use quarterly earnings records between 2004 and 2020 that are collected for Wisconsin’s Unemployment Insurance (UI) program from the Department of Workforce Development.¹⁴ These records include quarterly earnings for each worker from each of their employers, along with worker and employer identifiers.

SNAP records: We use monthly FoodShare (the name of Wisconsin’s SNAP program) benefit records between 2003 and 2020 from the Department of Health Services. These records include benefit amounts for the household and individual identifiers of each eligible member of the household. We use this to measure eligibility for WOTC as well as whether access to WOTC makes an individual less likely to utilize SNAP benefits.

TANF records: We use monthly TANF benefit records between 2003 and 2019 from the Department of Children and Families. These records include benefit amounts and individual-level identifiers. We use this to measure eligibility for WOTC as well as whether access to WOTC makes an individual less likely to utilize TANF benefits.

Criminal justice records: These data, which cover the years 2004 to 2020, consist of court records, state Department of Corrections data on entry/exit from prisons, and data on entry and exit from Milwaukee jails. For the purposes of this study, we combine these to observe whether an individual has been convicted of a misdemeanor or felony, type of crime, incarceration status, date of conviction, and dates of entry and exit from incarceration. We use this to measure eligibility for WOTC as well as whether access to WOTC makes an individual less likely to engage in criminal activity.

Work Opportunity Tax Credit application and certification data: We use WOTC certification data between 2005 and 2020 from the Department of Workforce Development. These records include the date of the WOTC application, starting hourly wage, whether the application was certified or denied, and starting in 2009, the target group under which the certification qualified. It also includes individual and firm identifiers which allows us to link the WOTC certification data to the other data sources.

Demographic data: For individuals who receive a social service such as SNAP, we also observe demographic information such as age, gender, and race.

¹⁴While this data excludes some workers, including those who work in a neighboring state, those who have moved out of state, Federal employees, and self-employed workers and independent contractors, these are a small fraction of total employment.

4 Effects of WOTC eligibility on individual outcomes

In this section, we use the linked administrative data to estimate the effects of WOTC eligibility on labor market outcomes – employment, new hires, and earnings – as well as spillovers to usage of social assistance and criminal activity. We use three separate identification strategies based on individual-level data: first, we exploit a 2007 expansion in eligibility among the SNAP recipient target group to older ages in a difference-in-differences design; second, we exploit sharp age cut-offs in WOTC eligibility in a regression discontinuity design; and third, we leverage a 2017 change in the application process that implicitly decreased the cost of applying for WOTC.

4.1 SNAP expansion

We first examine a large expansion of eligibility among SNAP recipients. SNAP recipients are the largest target group for WOTC, comprising around two-thirds of WOTC certifications in recent years. Prior to 2007, individuals who were between the ages of 18-24 and had received SNAP benefits in three of the previous five months were eligible for WOTC. In 2007, this target group was expanded to include SNAP recipients between the ages of 25 to 39. Figure 2, which graphs total WOTC certifications by application date in our data, shows that total certifications increased from an average of 3,000 per quarter for hires in 2005-2006 to an average of over 5,000 per quarter for hires in 2007-2008 after the SNAP expansion.¹⁵

To study the impact of this expansion, we construct a sample of individuals who have received SNAP benefits in three of the last five months. We then compare individuals in the sample who are slightly younger than 40 (eligible for WOTC after 2007) before and after the policy change to individuals above age 40 (ineligible for WOTC). This design works well because to the best of our knowledge, this age cutoff was not used as a cutoff for other programs experiencing reforms around this time.¹⁶ We focus on the sample period between July 2005 through December 2008 and run event studies and difference-in-differences regressions.

The event study specification is:

$$Y_{i,t} = \sum_{s=2005q3, s \neq 2006q4}^{2008q4} \beta_s 1\{age_{i,t} < 40\} + \eta_t + \gamma_a + \varepsilon_{i,t} \quad (1)$$

where $Y_{i,t}$ is an outcome for individual i measured in quarter t , η_t are year-quarter fixed effects,

¹⁵Our data on WOTC certifications only includes the reason for eligibility after 2009. Thus we focus on total certifications rather than only certifications due to SNAP eligibility here. A similar uptick is observed for SNAP-specific certifications using aggregate national data in Figure 1.

¹⁶One concern with this strategy is that WOTC could have spillovers across workers, whereby subsidized employment for workers in the treatment group may displace employment in the control group. Such spillovers would tend to *increase* any differences in employment outcomes that wage subsidies produce between treatment and control rather than bias estimates towards zero. Thus the fact that we find null effects would tend to dispel this concern. Furthermore, substitution is unlikely to come purely from the control group: for example, in the SNAP expansion research design, it could be that employment of the treatment group (SNAP recipients aged 38-39) displaces someone not from the control group (SNAP recipients aged 42-43) but SNAP recipients aged above age 43 or non-SNAP recipients in any age range.

and γ_a are age (in months) fixed effects. $age_{i,t}$ measures individual i 's age at the start of quarter t , and the indicator is equal to one for individuals whose age is less than 40 (the treatment group) and zero for individuals whose age is 40 or over (the control group). The treatment group consists of individuals with ages between 38 years and 39.75 years at the start of a quarter: we select this cutoff as those individuals will be eligible for WOTC for the entirety of quarter t after 2007. Our control group consists of individuals aged between 42 and 43.75. We exclude individuals aged 40-41 so that the control sample consists fully of those who were not previously eligible for WOTC over the 8 quarters after WOTC eligibility expansion in the first quarter of 2007. For example, an individual who turns 40 in the second quarter of 2007 would have been 39 (and thus treated) in the first quarter of 2007.

We also estimate the corresponding difference-in-differences specification that collapses the β_s coefficients into one coefficient post-policy change relative to all time periods prior to the policy change:

$$Y_{i,t} = \beta^{DD} \times 1\{age_{i,t} < 40\} \times 1\{t \geq 2007q1\} + \eta_t^{DD} + \gamma_a^{DD} + \epsilon_{i,t} \quad (2)$$

For both the event study and difference-in-differences specifications, we cluster standard errors at the individual level.

We begin by examining three main labor market outcomes. Our first outcome is employment, defined as an indicator for whether individual i had positive earnings in quarter t . Our second outcome is new hires, defined as an indicator for whether the individual had positive earnings in quarter t in a firm at which they did not have positive earnings in the prior quarter. An advantage of this outcome over employment is that it measures flows into employment, the target of the policy, and excludes workers who are persistently employed. Our third outcome is earnings in quarter t . This measure captures tenure in the job and wage rate, both of which might be affected by WOTC. For each outcome, we examine effects for the full sample as well as the sample of individuals who were unemployed at the start of period t , and so for whom WOTC may be particularly relevant.

Panels (a)-(c) of Figure 3 report event study coefficients from Equation (1) for these three labor market outcomes. Columns (1)-(3) of Table 1 run the analogous difference-in-differences regressions. For all three outcomes, there is no evidence of a pre-trend in outcomes prior to the policy change, and also no detectable effect of the expansion on the outcomes in the eight quarters after the expansion. The confidence intervals on β_{DD} are tight: for example, the upper bound of the 95% confidence interval on being hired would be a 0.18 percentage point increase (or 1.8% of the base new hiring rate of 10% for this population) and a \$38 increase in quarterly earnings (or 2.4% of the \$1,595 in average quarterly earnings for this population).

These results suggest that WOTC eligibility does not meaningfully improve labor market outcomes among the SNAP target group. This is not driven, however, by a lack of use of WOTC. Panel (d) of Figure 3 and Column (4) of Table 1 show event study coefficients and difference-in-differences estimates running the same specification with the outcome as being in a WOTC-certified job. There is a sharp increase in the likelihood of being in WOTC-certified jobs for the newly eligible group relative to the never eligible (control) group, and effects stabilize at an approximately 2 percentage

point difference within 4 quarters after policy roll-out.

One way of evaluating the precision of the null estimates on labor market outcomes is to compare them to this difference in WOTC-subsidized jobs between the treated and untreated groups. The difference-in-differences estimate implies the policy generated a 1.6 percentage point increase in probability of being in a WOTC certified job. We then take the upper bound of the 95% confidence interval around the estimated effect on hiring (0.18 percentage points) as a conservative upper bound on how much WOTC might have increased hiring of the treated group relative to the untreated. Putting these together, this means that we think that of the 1.6 percentage point difference between treated and untreated workers in WOTC subsidies, no more than 0.18 percentage points was caused by WOTC. In other words, between 0% and 12% (0.0018/0.016) of WOTC-subsidized hires were hired on account of WOTC, and so at least 88% of WOTC spending is windfall wastage.

Finally, lobbyists for WOTC frequently claim that the program results in net savings for the government by allowing people to obtain jobs that pull them off of public assistance and out of criminal activity (Cappelli, 2012). Our precise null estimates on labor market outcomes suggest that this is unlikely to be true, but given the policy importance of this question, we also examine those outcomes. We construct a measure of social assistance as the dollar amount of benefits the individual received from SNAP, TANF, or unemployment insurance in time t . For criminal activity, we construct an indicator equal to one if the individual has a criminal conviction at time t . Panels (e) and (f) of Figure 3 and columns (5) and (6) of Table 1 show similar null effects for these two outcomes. It is thus unlikely to be true that these wage subsidies generate any savings for the government.

All of these results are robust to alternative specifications. Appendix Figure A5 and Appendix Table A1 show that our results are similar when we narrow our sample to individuals who enter quarter t unemployed. This sample restriction provides additional precision by focusing on a population that is more likely to be seeking a job. Appendix Figure A6 also shows robustness to defining the control group as 40-41 year olds. The following sections provide further evidence of robustness with alternative empirical approaches.

4.2 Age-based discontinuities for SNAP

As a second method of evaluating the effect of WOTC, we exploit the sharp age-based discontinuities in eligibility for WOTC among SNAP recipients. Prior to 2007, SNAP recipients just below age 25 were eligible for WOTC, whereas those just above were not; after 2007, there is a similar discontinuity around age 40. An advantage of this approach is that we will be able to estimate the consequences of WOTC eligibility throughout the sample period rather than at just two points in time (SNAP expansion in 2007; introduction of electronic filing in 2017). It also generates a very large sample, providing excellent statistical power for our tests; we use this to explore potential heterogeneity in treatment effects.

We combine two sharp regression discontinuity designs: around age 25 for the period 1997 to 2006 and around age 40 for the period 2007 to 2019. Our estimates are based on the following

specification:

$$Y_{i,t} = \gamma_0 + \gamma_1 1\{age_{i,t} \geq A_t\} + f_1(age_{i,t}) + f_2(age_{i,t}) 1\{age_{i,t} \geq A_t\} + \epsilon_{i,t} \quad (3)$$

where $Y_{i,t}$ is the labor market outcome for individual i in quarter t , $age_{i,t}$ measures their age at the start of quarter t , and A_t is equal to 25 for years < 2007 and 40 for years ≥ 2007 . The coefficient γ_1 captures the (negative) treatment effect, while the functions f_1 and f_2 reflect a continuous but potentially non-parametric relationship between the running variable and the outcome.¹⁷ Using the data-driven approach of Calonico et al. (2014) and *rdrobust* command of Calonico et al. (2017), we apply a triangular weighting kernel in distance from the threshold, calculate a MSE-optimal bandwidth with a linear polynomial estimated within the bandwidth on either side of the cutoff, and calculate heteroskedasticity-robust standard errors clustered at individual level.¹⁸

As in the SNAP expansion analysis, we restrict the sample to individuals who have received SNAP for three of the five months preceding the start of a given quarter, i.e., the condition for WOTC eligibility through SNAP. We also drop the quarters in which $age_{i,t}$ crosses the relevant threshold, as those are difficult to interpret since individuals are partially treated.

This approach has a number of key identifying assumptions. The first is that the running variable, age, is not manipulable around the threshold, such as if individuals lie about their age when applying for SNAP benefits. We test for continuity of the density of the age distribution within our sample around the cut-offs (Cattaneo et al., 2018), as seen visually in Appendix Figure A7. The p-values are 0.25 and 0.27, indicating a lack of manipulation in both cases. This also rules out the concern that individuals may be more likely to apply for SNAP benefits when below the relevant age threshold in order to make them eligible for WOTC (and possibly increase their desirability to employers), where this would predict greater density to the left of the threshold.¹⁹

The second concern is continuity across the age threshold of covariates that may be related to the outcomes, i.e., the composition of sample individuals changes discontinuously around this age threshold. This might be true if WOTC increases employment levels, reducing SNAP utilization and thus changing the composition of SNAP recipients above and below the threshold.²⁰ We will directly test how employment varies across the threshold below. Here, we examine whether any of the covariates we can observe change discontinuously around the threshold, which could have other root causes, such as other policies using this age cut-off. We focus on gender and race, as well as employment and earnings in previous periods; the labor market variables are particularly good tests, as those are strongly correlated with labor market outcomes in time t , and so pre-existing

¹⁷Crossing the age threshold entails a change from treated to untreated, and so γ_1 is equal to the treatment effect multiplied by negative 1.

¹⁸The MSE-optimal bandwidth and polynomial will vary for each outcome Y , following Calonico et al. (2018).

¹⁹We also use the full WADC data on Wisconsin residents to test this directly, finding that likelihood of receiving SNAP benefits does not vary around the age threshold.

²⁰It is not clear whether changes in employment would change SNAP utilization since WOTC jobs are typically quite low wage. The SNAP income limit for a family of 3 in 2010 was \$36,620 annually, which means that a household with two adults working full-time at the median WOTC wage in our sample (\$9 per hour) would still qualify for SNAP.

discontinuities in those variables are most likely to generate bias. Pooling the pre- and post-2007 data, Appendix Table A2 and Appendix Figure A8 find no evidence of any of these variables varying discontinuously across the age threshold.

We first examine how WOTC eligibility affects labor market outcomes in Table 2 and Figure 4. This analysis combines both the age 25 (pre-2007) and age 40 (post-2007) discontinuities by defining the running variable as distance from the relevant age cut-off; Appendix Tables A3 and A4 report the results separately for the pre- and post-2007 periods. Column (1) of panel (a) of Table 2 shows that employment does not respond to WOTC eligibility, while column (3) finds no effect on earnings. These null estimates are even more precise than the estimates based on SNAP expansion – with standard errors that are roughly three times smaller – reflecting the significantly greater sample size in the RD analysis.

Column (2) focuses on new hires. We prefer this outcome because it isolates flows into jobs, removing relatively persistent employment that we would not expect to respond to WOTC. The estimate is close to zero (-0.03 percentage points) and non-statistically significant ($p = 0.7389$), with the upper bound of the 95% confidence interval equal to a 0.22 percentage point increase in hiring in response to WOTC.

These results broadly support the findings of the previous section that WOTC eligibility does not meaningfully improve labor market outcomes among targeted workers. To put these estimates in context, we estimate the extent to which individuals above and below the threshold differ in their likelihood of being in a WOTC subsidized job. Column (4) of Table 2 and panel (d) of Figure 4 show that individuals below the discontinuity are 0.99 percentage points more likely to be in a WOTC subsidized job.²¹ Comparing this to the bounds of the 95% confidence interval for effects on hiring, we conclude that the vast majority of WOTC subsidized jobs are infra-marginal, where between 78 to 100% of WOTC subsidized jobs are windfall wastage.

One concern with this analysis is that individuals may remain in a job for multiple quarters. An individual who receives a WOTC job at age 39 may still be employed in that job at age 40, which would tend to bias our estimates towards zero. In Panel B of Table 2 and Appendix Figure A9, we overcome this concern by restricting the sample to individuals who are unemployed at the start of the quarter t , and so would not experience job holdover. We find that all of the estimates are quite similar to those in panel (a), so this does not appear to be a major concern. That is likely because most WOTC-subsidized jobs are very short-lived, as we will show in Section 5, reducing the extent of holdover.

Even though our estimates suggest that firms on average do not respond to WOTC eligibility in their hiring decisions, it could be that there is a subset of firms that do. We check for differential responses among three types of firms that are most likely to respond to WOTC. First, we focus on employment in the 50 firms with the largest number of WOTC certifications over the sample period; these presumably may have the best WOTC screening procedures. Second, we refine the

²¹Note that some individuals to the right of the threshold may still be hired into WOTC jobs by virtue of other eligibility criteria, such as a felony conviction or receipt of TANF.

measure of attentiveness to WOTC by calculating the fraction of WOTC eligible hires for which each firm actually applies for WOTC. We then focus on employment in firms whose application rate is in the top 25% of WOTC-using firms, as these are the firms that appear to pay the most attention to WOTC. Finally, employment services agencies, which provide temporary employees to businesses, are the biggest category of firms utilizing WOTC, and so may be most attentive to the policy. In columns (1) to (3) of Appendix Table A5, we re-estimate the main RD specification, but redefine the outcome variable to be whether the individual is hired in each of these three categories of firms. Even among these active users of WOTC, we still see no response for either employment (panel a) or new hiring (panel b).

One concern with the approach in Section 4.1 is that it was based on an expansion in 2007, but the WOTC program has grown considerably since then. It could be that as part of this growth, HR departments have implemented screening for WOTC-eligible job applicants such that WOTC now has an effect on hiring. An advantage of our RD approach is that we can re-estimate the discontinuity at different points in time. The remaining columns of Appendix Table A5 subset the data to different periods of time: column (4) restricts to the pre-2007 period (with the age 25 cut-off), column (5) focuses on the period during which there was significant growth in WOTC (2007 to 2013), and column (6) examines a more recent period (2014-2019), in which number of WOTC certifications stabilized. However, we find no evidence of differential effects over time.

Another concern with the RD approach is that other policies may use the same age thresholds; for example, if there were labor market support policies targeted at individuals above age 40, this could bias our estimates downwards, and potentially explain the null effect. As a final robustness check, we conduct a placebo analysis examining how labor market outcomes vary across the age thresholds during years when the threshold were not relevant for WOTC: i.e., look at the age 40 discontinuity in the pre-2007 data and the age 25 discontinuity in the post-2007 data. If there were other policies targeting these age thresholds that also affected labor market outcomes, we should observe these effects in this placebo analysis. Appendix Table A6 finds no differences over the placebo age thresholds, consistent with the RD approach cleanly identifying the effect of WOTC.²²

4.3 Effects of reducing WOTC application costs

The previous analyses examined the effect of expanding eligibility for wage subsidies under WOTC. This section analyzes a reduction in the cost to firms of filing for WOTC through the introduction of electronic filing (eWOTC), which occurred in June 2017. As shown in panel (a) of Figure 5, this led to a substantial increase in the number of WOTC certifications: total WOTC certifications increased 50% from an average of 8,000 per quarter from 2015 to June 2017 to an average of 12,000

²²The coefficient on WOTC certification (column 4) is just statistically significant at the 5% level for the post-2007 period. When we examined this further, we found that it was entirely due to data from 2007 – i.e., the year that the new age threshold was put into place – where the coefficient is no longer statistically significant when this year is removed. This is likely because it takes time to learn about the new age eligibility cutoff, and so some firms may have initially continued to follow an age 25 cut-off for submitting WOTC applications in 2007.

per quarter from July 2017 to 2019.²³ To check that this increase was not driven by aggregate changes to labor markets, panel (b) uses Department of Labor data on quarterly state-level WOTC applications to compare WOTC uptake in Wisconsin to the neighboring state of Minnesota, which did not adopt e-filing at this time.²⁴ Although the two are similar prior to June 2017 in both levels and trends, certifications increased markedly and persistently in Wisconsin following its adoption of eWOTC. We examine whether this increase in certifications also caused increases in employment and earnings of eligible SNAP recipients relative to ineligible.

We adopt the same event study specification as in Equation (1), but around June 2017 rather than January 2007. We again define our treatment and control group as individuals receiving SNAP in three of the past five months who were slightly younger and slightly older than 40 (i.e., aged 38-39 and 42-43, respectively). This specification estimates a fundamentally different treatment effect in that it picks up the effect of participation costs (as opposed to the effect of the existence of the program). The policy may induce responses among a different set of firms, and so have a potentially different effect on employment. This is particularly relevant for policy since one of the most commonly cited reasons for low uptake of WOTC is the cost of filing (Hunt et al., 2018); we can measure whether the natural policy response to this problem – lowering those costs – has desirable effects. Our results also serve as a policy evaluation of the consequences of switching to electronic filing, which is relevant to other states considering adoption.

Figure 6 and Table 3 analyzes the effect of electronic filing on the same set of outcomes as previously. As in the other two analyses, we find no evidence that WOTC eligibility affects labor market outcomes (columns (1) to (3)), public assistance usage (column (5)), or criminal activity (column (6)), despite an effect on WOTC certifications.²⁵ This provides further evidence against the efficacy of wage subsidies for promoting employment among this population, as well as suggesting that one policy idea for improving WOTC – lowering access costs – is unlikely to achieve desired outcomes; instead, it just makes it easier for firms to collect the subsidies.

5 Firm-level analysis

The previous analyses were conducted at the level of the worker rather than the firm. This section re-analyzes the data at the firm-level to examine dynamic effects that cannot be tested in the worker-level analysis. For example, it may take time for firms to adjust hiring practices after adopting WOTC, which could mute the estimated treatment effects when only looking at the worker side. Alternatively, it could be that there are effects on hiring immediately after adoption, when WOTC is most salient, but these fade away over time. Either dynamic would suggest policy interventions

²³The blue line in panel (a) shows that this sharp increase in Wisconsin also appears among SNAP recipients, the focus of our analysis, with a 26% increase in certifications for the SNAP target group.

²⁴This comes from state-level quarterly data from the US Department of Labor rather than WOTC micro-data as in panel (a). Within this aggregated data, we are only able to look at applications rather than certifications.

²⁵The coefficient on earnings is negative and statistically significant at the 5% level. Given the lack of effect on other labor market related variables and that the sign of the coefficient is in the opposite direction from what one would expect, our interpretation is that this is likely to be statistical noise that will naturally occur when running a large number of regressions.

that could improve the efficacy of WOTC: for example, the latter scenario would indicate that increasing salience of WOTC to hiring managers is the key to program improvement.

5.1 Triple-differences adoption design

Our main firm-level empirical approach leverages the staggered timing over which firms first adopt WOTC. We use an event-study framework, centering our estimates around the date at which firms submitted their first WOTC applications.²⁶ This allows us to measure how firms’ hiring practices evolve as they begin to receive WOTC subsidies for eligible workers. Our focus is on how adopters change their hiring of eligible workers, i.e., those receiving SNAP benefits and slightly below the age eligibility cutoff age of 40, as compared to just ineligible workers, i.e. those receiving SNAP benefits and just above the age of 40, relative to firms that had not yet applied for WOTC. This approach is effectively a triple-difference approach, exploiting differences across firm, time, and type of worker. Examining changes in the *relative* hiring of these highly substitutable sets of workers isolates variation caused by adoption of WOTC rather than other changes that adopting firms may be experiencing relative to non-adopting firms around the time of expansion.²⁷ The identifying assumption is that firms adopting WOTC do not simultaneously experience shocks to their demand for labor for SNAP recipients just below age 40 as compared to those just above age 40. We provide evidence in Section 6 that firms view these workers as highly substitutable, so this appears to be a reasonable assumption.²⁸

To analyze the dynamic effects of staggered WOTC adoption on outcomes $y_{f,t}$, we implement an event-study specification following Callaway and Sant’Anna (2021). Specifically, we estimate the average treatment effect on the treated (ATT) for firms at each year relative to adoption. The estimating equation is given by:

$$y_{f,t} = \alpha_f + \lambda_t + \sum_{\ell \neq -1} \delta_\ell D_{f,t}^\ell + \varepsilon_{f,t} \quad (4)$$

Here, α_f and λ_t denote firm and year fixed effects, respectively; this analysis aggregates the data to the year-level due to quarterly fluctuations in hiring patterns and so that we can examine dynamics over a longer time after adoption. The variable $D_{f,t}^\ell$ is an indicator that equals one if firm f adopted the policy exactly ℓ periods ago by year t , and zero otherwise. The coefficients δ_ℓ represent the dynamic average treatment effects at each period relative to adoption, capturing the temporal evolution of the policy’s impact. Standard errors are clustered at the firm level to account for serial correlation. We then estimate an overall effect that aggregates across the five years before

²⁶The WOTC micro-data begins in 2005, meaning that we cannot observe whether a firm submitted a WOTC applications prior to that. To deal with this issue, we restrict adopters to be the set of firms whose first WOTC application is filed in 2007 or later, as the lack of applications between 2005 and 2007 suggests that this was indeed their first application.

²⁷For example, firms may tend to adopt WOTC at the same time as expanding their labor force more broadly.

²⁸The most likely issue would be if firms decide to adopt WOTC because of an unrelated positive shock to their labor demand for SNAP recipients below age 40. That would tend to bias our estimates upwards (i.e., towards finding a positive effect on hiring). However, we estimate precise null effects on hiring so this is not a major problem.

and after adoption.

In panel (a) of Figure 7, we define the outcome variable $y_{f,t}$ as the number of hires by firm f in year t who are receiving SNAP and are aged 38 or 39 at the time of hiring (i.e., eligible for WOTC) minus the number of hires who receive SNAP and are aged 40 or 41 (i.e., just ineligible for WOTC). In panel (c), we instead use SNAP recipients aged 35 to 39 as the eligible group and those aged 40 to 44 as the ineligible group to test robustness to a wider age band. In both cases, we find no increase in the relative demand for WOTC eligible workers despite the economic incentive to shift hiring towards subsidized workers. Table 4 provides estimates of the aggregated ATT: the point estimates are small and precisely estimated relative to the average number of hires in a period. These results reinforce findings from the analyses in Section 4 that firms have limited responsiveness to targeted hiring subsidies.

One concern with this approach is the extent to which WOTC adoption generates a meaningful difference in labor costs when hiring eligible as compared to ineligible workers: for example, adopting firms may quickly discontinue WOTC usage or rarely file WOTC applications. To test this, we redefine the dependent variable $y_{f,t}$ to be equal to the difference in the number of WOTC certifications for just eligible hires and certifications for just ineligible workers. Using the same narrow and wide age bands, panels (b) and (d) of Figure 7 instead show that firms experience a sharp and sustained increase in WOTC usage following adoption, meaning that the subsidy indeed lowers the effective labor cost for eligible hires relative to ineligible.

5.2 Do firms churn through WOTC-eligible workers?

The short-term nature of WOTC-subsidized employment raises concerns that WOTC may give firms an incentive to “churn” workers, i.e., fire subsidized employees after the subsidy is exhausted to hire a new batch of subsidized workers (Corwin, 2022). As a result, the existence of WOTC could hinder workers from finding stable jobs, including workers who are ineligible for the subsidies. This could be true even if firms do not account for WOTC in hiring decisions, as the results of the previous sections would indicate, where WOTC status may be more salient after hiring and certification are complete.

We test for churning behavior using hours- and earnings-based discontinuities built into the program. The WOTC subsidy is exhausted at \$2400 per worker, which typically corresponds to \$6000 in worker earnings.²⁹ Churning firms would be expected to terminate workers after reaching that threshold, generating bunching in earnings just above \$6000 for WOTC-subsidized employment stints. They might also not bunch, but exhibit a change in the separation rate at around this threshold (kink): for example, if terminations are often the result of worker infractions (e.g., tardiness), the threshold for termination may drop once the subsidy is exhausted.

To test for these behaviors, we measure earnings and hours worked in WOTC subsidized job

²⁹At the 40% subsidy rate, \$6000 in earnings is binding for subsidy exhaustion. If a worker earned an hourly rate of above \$24 per hour, then they would exhaust the subsidy at the 25% rate and a higher total earnings amount, but only 0.2% of WOTC subsidized workers have hourly rates that high in our data.

stints. Panel (a) of Figure 8 plots the distribution of total earnings prior to separation for workers whose employment was subsidized by WOTC (and were eligible for WOTC through SNAP). There is no obvious discontinuity in either total separations or separation rate at \$6000. However, it could be that churning behavior is concentrated among certain types of firms that are most attentive to WOTC. Appendix Figure A10 examines the distribution of worker earnings prior to separation for WOTC subsidized workers who were employed at the top 50 WOTC-using firms (panel a), firms with high success rates in applying for WOTC (panel b), and employment services firms (panel c), but again finds no evidence of firms responding to subsidy exhaustion. The (lack of) relationship is also present when we split the sample by year of employment (panels d and e), where there is no evidence of churning within more recent years when firms may be more attentive to WOTC or have better payroll processing technology that makes churning easier. While there is no obvious bunching or change in slope visually, we test for this formally. Using a simple local polynomial density estimator from (Cattaneo et al., 2020), we do not find evidence of bunching above the threshold in full sample ($p = 0.86$) or any of the subsamples.

The design of the program also provides two additional places to test for churning. As seen in Appendix Figure A1, the subsidy amount increases discontinuously after workers have been in the job for 120 hours (subsidy increases from 0% to 25%) or 400 hours (subsidy increases from 25% to 40%): for a worker earning the median wage of \$9 per hour, firms would get \$540 more in subsidies for keeping them for 400 hours as compared to 399. Churning firms may therefore bunch around those thresholds. Panel (b) of Figure 8 plots the distribution of total hours worked in a WOTC subsidized job, with dashed lines marking 120 and 400 hours. The distribution is smooth over those thresholds, with no obvious bunching.³⁰ Appendix Figure A11 also finds this to be the case when focusing on particular firms that may be more attuned to WOTC or over more recent years.

Based on these analyses, we conclude that firms do not exhibit churning behavior in response to WOTC. It could be that managers are not aware of the benefit schedule for the firm, and so it would be difficult for them to target these discontinuities. Another possibility is that recruitment or training costs are sufficiently high that firms prefer to keep trained workers rather than churn through them for increased WOTC wage subsidies. That seems particularly plausible given that firms do not appear to target hiring towards WOTC-eligible workers, meaning that the odds of getting WOTC subsidies for a replacement worker may not even be that high.

5.3 Firm characteristics

Our analysis indicates that the benefits of WOTC accrue to employers rather than workers. This naturally raises questions about what types of firms benefit, and whether it is desirable for policy-

³⁰This second analysis is similar to a figure in Hamersma (2011), which plots estimated hours worked in WOTC-subsidized jobs between 1998 and 2003 to visually examine if there is bunching around 120 and 400 hours (although not for changes around subsidy exhaustion). We augment her analysis by including data from after 2003, conducting formal statistical tests as is permitted by our much larger sample size (over 430,000 certified work stints as compared to 2,622), and examining heterogeneity across types of firms.

makers to subsidize their operations.³¹

We begin by examining the distribution of benefits among firms. We rank all firms in the data in order of the number of WOTC certifications they receive between 2005 and 2019 in Wisconsin, with rank 1 being the firm with the most certifications, and so on. In Figure 9, the blue line plots the cumulative fraction of WOTC certifications accruing to firms of rank between 1 and N for the top 300 firms. Benefits accrue to a small number of firms, where over half of all certifications went to just 48 firms. However, it could be that this is not a disproportionate fraction of rents, but that these firms also employ a large fraction of all workers. The red line instead plots the cumulative fraction of hires for these firms, finding that they receive 4 to 5 times the amount of tax credit expected given their share of employment: for example, the top 48 firms accounted for just 9% of all hires over the period.³²

Given this high level of concentration, we focus on understanding the fifty firms with the most WOTC certifications over this period. These firms are large, where we observe an average quarterly payroll of over \$20 million in the years in which they receive WOTC certifications. For additional details, we use data from FOIA requests made to the Wisconsin Department of Workforce Development, which provide the total number of WOTC applications and certifications by firm between 2018 and 2020 (Corwin, 2022).³³ Just over half of the top 50 firms (52%) are temporary staffing services agencies.³⁴ Many (24%) are large publicly traded firms, where these firms have a median market capitalization at over \$30 billion, with only one having a market capitalization below \$1 billion. Most of the remaining privately held firms are large franchisee operators of national fast food chains (16%) or large private companies with annual revenues in excess of \$5 billion annually (4%). The high number of temporary staffing firms is notable given experimental work showing that employment in temporary-help positions may actually decrease future employment and earnings (Autor and Houseman, 2010). As a result, subsidizing those type of firms is unlikely to be desirable policy.

6 Mechanisms

These findings present a puzzle: why do profit maximizing firms fail to respond to subsidies like WOTC? This is particularly puzzling given that these firms *do* apply to receive the wage subsidies after hiring eligible workers, so lack of knowledge about the program cannot explain their lack of response. Determining the mechanisms underlying these results is essential in considering the extent

³¹Benefits could also accrue to consumers if the subsidy is passed through to prices. We are unable to measure this with our data, but it is unclear whether this would be expected given price rigidities and the typically short-run nature of WOTC employment.

³²Appendix Figure A12 calculates a Herfindahl index of the concentration of WOTC applications by firms. Concentration in WOTC benefits has declined over time and now stands at around half of where it was in 2010. Nonetheless, a large majority of the benefits continue to accrue to a relatively small fraction of firms.

³³The Wisconsin Administrative Data Core data is anonymized and so researchers using it do not have access to the identity of particular firms. We are grateful to Emily Corwin for sharing this data with us (see Corwin (2022) for details).

³⁴Because workers at temporary staffing agencies are directly employed by the staffing agency (and not the other firm), it is the staffing agency that receives WOTC subsidies, although there could be pass-through.

to which wage subsidies could benefit targeted workers in other contexts. This section evaluates three possible mechanisms.

Standard model of labor supply and demand. We first consider whether these results can be reconciled within a standard model of labor supply and demand. In this model, a wage subsidy provided to firms shifts up labor demand for subsidized workers, as firms now face a lower effective cost of their services. The lack of change in both employment and wages could only be rationalized by perfectly inelastic demand for these workers: firm labor demand is fixed, and the full value of the subsidy accrues to firms as the more inelastic side of the market.³⁵ Perfect inelasticity in demand for these workers implies a lack of substitutability between eligible and ineligible workers. That would be surprising given these workers are often quite similar: for example, our empirical approaches typically compare labor outcomes of SNAP recipients who are just above and below the age of 40. For this model to be correct, firms must not be able or willing to substitute workers just above age 40 (ineligible) with those just below (eligible), which seems unlikely.

To empirically test the substitutability of workers who are just-eligible and just-ineligible for WOTC, we examine replacement hiring after exits of WOTC-eligible and WOTC-ineligible workers. If production processes are such that WOTC-eligible workers are not substitutable with other types of workers (producing perfect inelasticity in demand for their services), the exit of this type of worker from a firm would necessitate the hiring of another of this type of worker as a replacement, as opposed to hiring other types of workers. For each firm, we measure the number of workers who exit the firm in a given quarter t who received SNAP and were between the ages of 37-39 at the time of hiring (eligible exits), as well as those who received SNAP and were between the ages of 42-44 (ineligible exits). Column (1) of Appendix Table A7 looks at how the number of new hires of eligible workers (SNAP recipients aged 37-39) in quarter t responds to these exit variables, while column (2) does the same with new hires of ineligible workers (SNAP recipients aged 42-44). We include fixed effects for quarter, firm, and total number of exits for the firm in a quarter to account for any firm-specific patterns in separation from and hiring of workers. If the two groups of workers are highly substitutable, we would expect similar coefficients in both specifications, i.e., that the exit of a 37-39 SNAP recipient can be compensated by hiring either a 37-39 or 42-44 year old SNAP recipient (or other types of workers). Unsurprisingly, the coefficients on “Eligible Exits” are quite similar across specifications, consistent with a high degree of substitutability between these types of workers such that perfectly inelastic demand does not explain our results.

Negative signal value of subsidies. Another possible model is that firms infer eligibility for wage subsidies as a negative signal of productivity, as seen in the seminal study of Burtless (1985). If this negative signal exactly offsets the value of the subsidy to the firm (in expectation), then this

³⁵If, instead, labor supply were perfectly inelastic and labor demand was downwards sloping in wages, then the subsidy would fully pass through to the worker as an increase in wages. If labor supply were perfectly elastic and labor demand were downwards sloping, the subsidy would induce an increase in employment. If labor demand were perfectly elastic or in intermediate cases, the wage subsidy should lead to an increase in both wages and employment.

could generate a lack of firm response to WOTC eligibility.

Our results point against this hypothesis. In particular, suppose that the negative signal exactly offset the net value of the subsidy prior to the 2017 introduction of e-filing. The reduction in (implicit) application costs starting in 2017 should have increased the hiring of WOTC-eligible workers among firms for whom expected benefit of the subsidy and negative signal value of WOTC eligibility were previously equal. However, our analysis in Section 4.3 does not find any employment response. The negative signaling mechanism thus does not appear to explain our results.

Information about eligibility. Another potential reason why firms may not respond to WOTC would be if hiring decisionmakers do not observe WOTC eligibility at the time of hiring decisions. To investigate this explanation and to understand how WOTC integrates into hiring processes more generally, we collected two types of original data: (1) information from job applications for openings at a sample of WOTC-using firms, and (2) an online survey of individuals conducting hiring at WOTC-using firms.

For the job applications data, we collected data from a random sample of Wisconsin firms that use WOTC. Taking data from FOIA requests to the Wisconsin Department of Workforce Development, we observe each WOTC application/certification between 2018 and 2020, including the name of the associated firm. We drew a random sample of these firms using probability proportionate to size sampling, searched for current job postings by the firm (available for 83% of firms), and completed initial applications for a position in the firm.³⁶ We recorded data on characteristics of the job application process, including whether the application asked WOTC-related eligibility questions and, if so, the specificity of the questions.

Table 5 reports summary statistics from these applications. One striking fact from this table is the relatively small number of job applications that ask questions about WOTC eligibility. Firms do not typically have access to government data that could indicate whether a potential hire is eligible for WOTC, and so must ask applicants about criteria related to eligibility (e.g., receipt of SNAP benefits) to identify WOTC-eligible hires.^{37,38} However, even among this sample of firms that do file for WOTC, only 13% of firms collect information that would allow determination of WOTC eligibility on their job applications. Furthermore, in 44% of these cases, the firm itself does not collect the information; instead, the applicant is taken to the separate website of a hired consultant or the firm’s payroll processor, which collects this information. Our discussions with firms indicate that this information is not typically shared with the person making hiring decisions, and as seen in the job application form in panel (a) of Appendix Figure A13, most of the forms collecting WOTC data explicitly note that this will not be shared with the firm. Instead, if the

³⁶In cases where it was possible to apply for multiple positions, we selected the position that seemed most likely to be relevant for WOTC based on the posted wage, desired skills, or other attributes of the job.

³⁷An exception to this is felony status, which can be determined through a criminal background check. However, individuals with a felony conviction are a relatively small share of all WOTC-eligible individuals (less than 4%). For the most common reason for eligibility – receipt of SNAP benefits – there is not a straightforward way for firms to determine this independently.

³⁸Two examples of how firms collect this information can be found in Appendix Figure A13.

worker is hired, the outside party uses this information to file for WOTC tax credits on behalf of the firm. In many cases, firms that file for WOTC collect information on eligibility after the hiring decision is made, such as during onboarding, and use this information to file for the wage subsidy. Overall, our job application data suggests that the person making hiring decisions for WOTC eligible workers is aware of their eligibility in less than a tenth of cases.³⁹

This exercise clarifies the mechanism: firm personnel decisions are not responsive to WOTC eligibility because the person making hiring decisions lacks information to do so. However, it is still puzzling why firms do not collect this information and provide it to hiring decision makers. To address this second puzzle, we conducted surveys with individuals involved in making hiring decisions at firms employing low-wage workers. Respondents were sampled through the Prolific platform and compensated at a rate of \$20-30 per hour for taking our survey.⁴⁰ Our survey asked questions about hiring practices at their company, and, if relevant, questions about practices around WOTC (e.g., their screening and application procedure) as well as how WOTC eligibility affects their decisionmaking.

We focus on respondents who work at firms that receive WOTC subsidies but state that their firms do not ask about WOTC prior to the hiring decision. We asked these respondents for the reasons why they do not ask about WOTC, and then to rank these reasons in order of importance. The most common reasons were “fear of discrimination lawsuits” (68% of respondents), “Don’t want to scare people off of applying for the position” (38%), and “Hard to explain to applicants why we are asking these questions” (32%).⁴¹ The first option refers to the concern that unsuccessful job applicants may sue the company alleging discriminatory employment practices: for example, the structure of WOTC pushes firms to favor younger applicants (under age 40), which could run afoul of age discrimination legislation. The possibility of having to face such costs as an individual firm generates a strong incentive to not to consider WOTC status at the time of hiring. That is particularly true since introducing explicit screening prior to hiring may only marginally increase the number of WOTC eligible hires relative to simply hiring from the pool of low-wage workers, many of whom will anyway be WOTC eligible.

The second and third most common reasons refer to the possibility that explicit screening for WOTC could make it more difficult to attract applicants. In follow-up phone interviews with hiring managers conducted by the authors, multiple managers noted that WOTC-eligible workers often fear replying in the affirmative to questions about their eligibility as they perceive it could lead to their being screened out. Particularly in high turnover jobs like many of those in which WOTC certifications are common, firms need to continue to attract applicants. It may be that explicit

³⁹Note that this lack of screening on WOTC eligibility does not necessarily imply WOTC will have no effect on employment of eligible workers. For example, if firms advertised more heavily to pools of potential job applicants that are WOTC-eligible, this could still increase employment of WOTC-eligible workers even if the firm does not explicitly incorporate WOTC eligibility into eventual hiring decisions.

⁴⁰Only Prolific members who reported working at a private firm and having experience hiring workers that earn less than \$20 per hour were selected for the survey.

⁴¹After these, the next most common reasons were “Don’t want to make job applications too long” (21%) and “Too time-consuming for the company to keep track of” (21%).

pre-screening on WOTC could deter applications to such an extent that it is preferable to wait until after hiring decisions are made. It may also be preferable to wait since applicants who fear being stigmatized for WOTC eligibility will have less of an incentive to lie about eligibility after the hiring decision has been made.

In countries with active employment discrimination protections, legal liability may generally present a problem for targeted wage subsidies; even if cases are unlikely, the high cost from legal proceedings could lead to expected costs outweighing expected benefits. Applicant uncertainty about screening questions may also deter potential hires from undergoing the job application process, while high turnover firms need a large pool of applicants. Both of these issues could generate problems for targeted subsidy programs outside of WOTC, but are not prominently discussed in the academic literature. Unfortunately, neither issue has a simple policy remedy. While the Equal Employment Opportunity Commission has issued an opinion that favoring WOTC-eligible applicants does not constitute discriminatory hiring, our consultations with legal experts indicate that this is not binding, particularly in light of a recent Supreme Court decision striking down “Chevron deference”.⁴² It may be that explicit legislation or judicial rulings are needed to resolve the issue, but in the absence of cases, this may not be soon forthcoming. These results suggest that legislators hoping to increase employment of those disadvantaged in the labor market may need to consider means other than targeted wage subsidies.

7 Conclusion

Hiring subsidies are a potentially important tool to promote economic mobility for disadvantaged workers, but there is a lack of evidence on their efficacy in the US context. Using data from the Work Opportunity Tax Credit and multiple complementary empirical approaches, we find that these wage subsidies do not promote hiring of target groups. We further find that they are not passed through to worker earnings in any meaningful way, but instead primarily accrue to a small set of large firms. We provide further details on the characteristics of these firms, which may be of use to policymakers in deciding whether to continue the billions of dollars in WOTC subsidies annually.

These findings suggest a need to rethink when and where subsidies can be effective in boosting employment, and in particular, how features of low-wage labor markets affects the efficacy of subsidies. In the specific case of the Work Opportunity Tax Credit, it appears that the billions of dollars spent on it annually could be better allocated to other forms of support for disadvantaged workers. Future work should investigate other means of encouraging employment among these groups, as well as whether hiring subsidy programs like WOTC can be redesigned to achieve this purpose.

⁴²This refers to the practice of deferring to the interpretation of relevant federal agencies in cases of where legislation is unclear, originating in the 1984 Supreme Court case of “Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc.”. In June 2024, the Supreme Court overruled the earlier decision in “Loper Bright Enterprises v. Raimondo”.

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Tables

Table 1: Effect of WOTC on individual outcomes, DiD analysis from SNAP expansion

	(1)	(2)	(3)	(4)	(5)	(6)
	Employed	New Hire	Earnings	Certified	Public benefit	Criminal conviction
Treat x post	0.00647 (0.00692)	-0.00405 (0.00301)	-41.60 (40.84)	0.0155*** (0.00115)	17.15 (13.21)	0.000341 (0.00110)
Dep var mean	0.387	0.101	1595.3	0.00383	763.1	0.0144
Observations	228873	228873	228873	228873	228873	228873

Note: Table reports difference-in-differences estimates of the effect of WOTC from the 2007 expansion to SNAP recipients aged 25-39 in Equation (2) on employment, new hires, earnings, employment in a WOTC-certified job, social assistance utilization, and criminal activity. Controls include monthly age fixed effects and quarter-year fixed effects. Standard errors clustered at the individual level.

Table 2: Effect of WOTC on individual outcomes, RD analysis

<i>Panel A: Full sample</i>						
	(1) Employed	(2) New Hire	(3) Earnings	(4) Certified	(5) Public benefit	(6) Criminal conviction
RD_Estimate	-0.0012 (0.0021) [0.5731]	-0.0003 (0.0010) [0.7389]	-9.8844 (12.9896) [0.4467]	-0.0099*** (0.0008) [0.0000]	1.4172 (4.3813) [0.7463]	0.0000 (0.0002) [0.9258]
Dep var mean	0.4479	0.1088	2063.8099	0.0145	1029.5041	0.0102
Bandwidth	3.0860	2.8546	4.1217	1.5234	3.6525	5.3727
Effective Obs	2918661	2639630	3824755	1380852	3399547	5081469
<i>Panel B: Unemployed Sample</i>						
	(1) Employed	(2) New Hire	(3) Earnings	(4) Certified	(5) Public benefit	(6) Criminal conviction
RD_Estimate	-0.0007 (0.0014) [0.6059]	-0.0006 (0.0012) [0.6009]	-2.5439 (7.4932) [0.7342]	-0.0084*** (0.0004) [0.0000]	-1.5944 (6.0044) [0.7906]	-0.0000 (0.0003) [0.9252]
Dep var mean	0.1351	0.0961	582.2024	0.0023	1134.3555	0.0124
Bandwidth	2.8950	2.8303	3.1969	2.4575	3.5409	5.1449
Effective Obs	1668471	1595372	1842776	1416137	2070615	3029621

Note: Table reports regression discontinuity estimates for employment, earnings, program utilization and criminal activity in the pre-2007 and post-2007 periods. Each specification uses a linear polynomial, triangular kernel, and MSE-optimal bandwidth estimated following Calonico et al. (2017). Standard errors in parentheses are clustered at the individual level; p-values are in square brackets.

Table 3: Effect of eWOTC on individual outcomes

	(1) Employed	(2) New hire	(3) Earnings	(4) Certified	(5) Public benefit	(6) Criminal conviction
Treat x post	-0.002 (0.004)	0.002 (0.002)	-61.946** (30.783)	0.004** (0.002)	1.936 (7.220)	0.000 (0.001)
Dep var mean	0.4578	0.1125	2226.4808	0.0299	807.7597	0.0102
Observations	458986	458986	458986	458986	458986	458986

Note: Table reports difference-in-difference estimates from the 2017 shift to electronic filing of WOTC applications among our SNAP sample for employment, new hires, earnings, employment in a WOTC-certified job, social assistance utilization, and criminal activity. Controls include monthly age fixed effects and quarter-year fixed effects. Standard errors clustered at the individual level.

Table 4: Effect of WOTC on firm-level outcomes

	Panel A (40-41 vs 38-39)		Panel B (40-44 vs 35-39)	
	Diff. in hires	Diff. in WOTC certs.	Diff. in hires	Diff. in WOTC certs.
ATT	0.024 (0.020)	0.100*** (0.008)	0.026 (0.041)	0.310*** (0.023)
Observations	51884	51884	51884	51884

Note: Table reports difference-in-difference estimates of the staggered firm-level adoption of WOTC on hiring and utilization of WOTC, following Callaway and Sant’Anna (2021). Panel A defines the outcome as the difference in the number of hires (WOTC certifications) who are SNAP beneficiaries aged 38 or 39 (i.e., eligible for WOTC) and SNAP beneficiaries aged 40 or 41 (i.e., just eligible for WOTC). Panel B defines the outcomes using SNAP recipients aged 35 to 39 as the eligible group and those aged 40 to 44 as the ineligible group. All regressions include firm and year fixed effects. Standard errors clustered at the firm level.

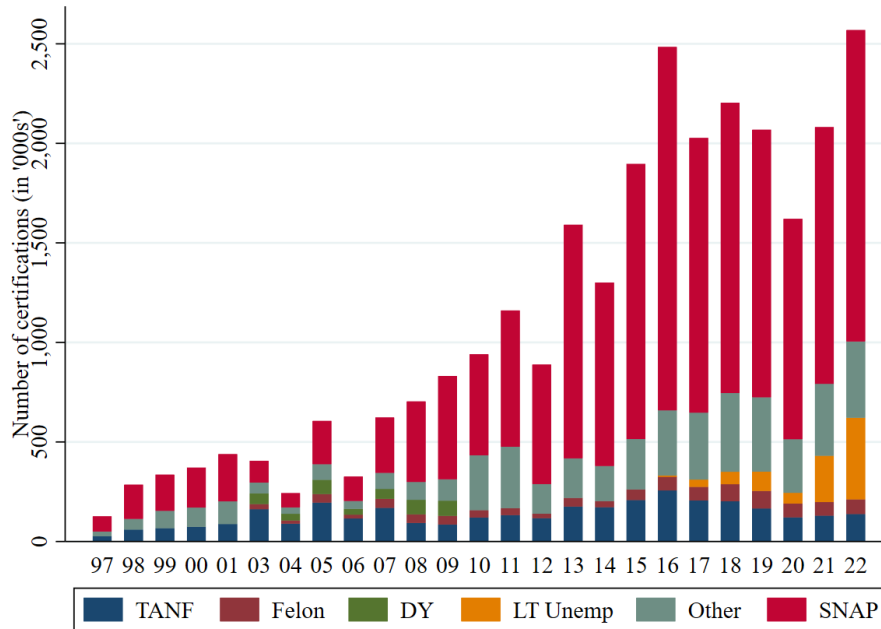
Table 5: Initial Job Applications for a Sample of WOTC-using Firms

<i>Panel A: All Applications (N=69)</i>	
Characteristic	(% of applications)
WOTC Screening Questions	13.04
EEOC Questions	42.03
SSN Required	18.84
Consent to Background/Drug Test	23.19
Submit Resume	44.93
Education History	53.62
Employment History	66.67
References	8.70
Referral	33.33
Personality Test	2.90
<i>Panel B: Applications with WOTC Screening Questions (N=9)</i>	
Characteristic	(% of applications)
WOTC questions direct to third-party site	44.44
WOTC questions stated as voluntary	88.89
WOTC questions ask about individual target group eligibility	66.67

Note: Table reports means of job application characteristics collected from a representative sample of online job applications for WOTC-using firms.

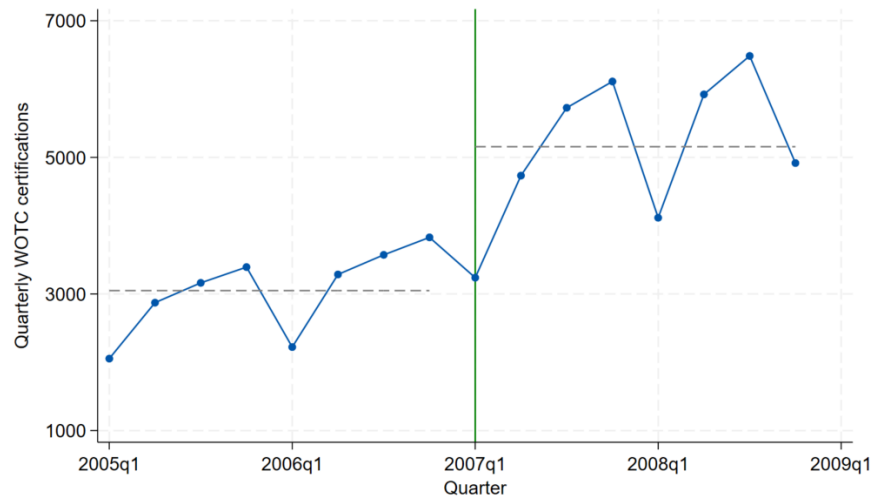
Figures

Figure 1: Number of WOTC certifications nationally (1997-2022)



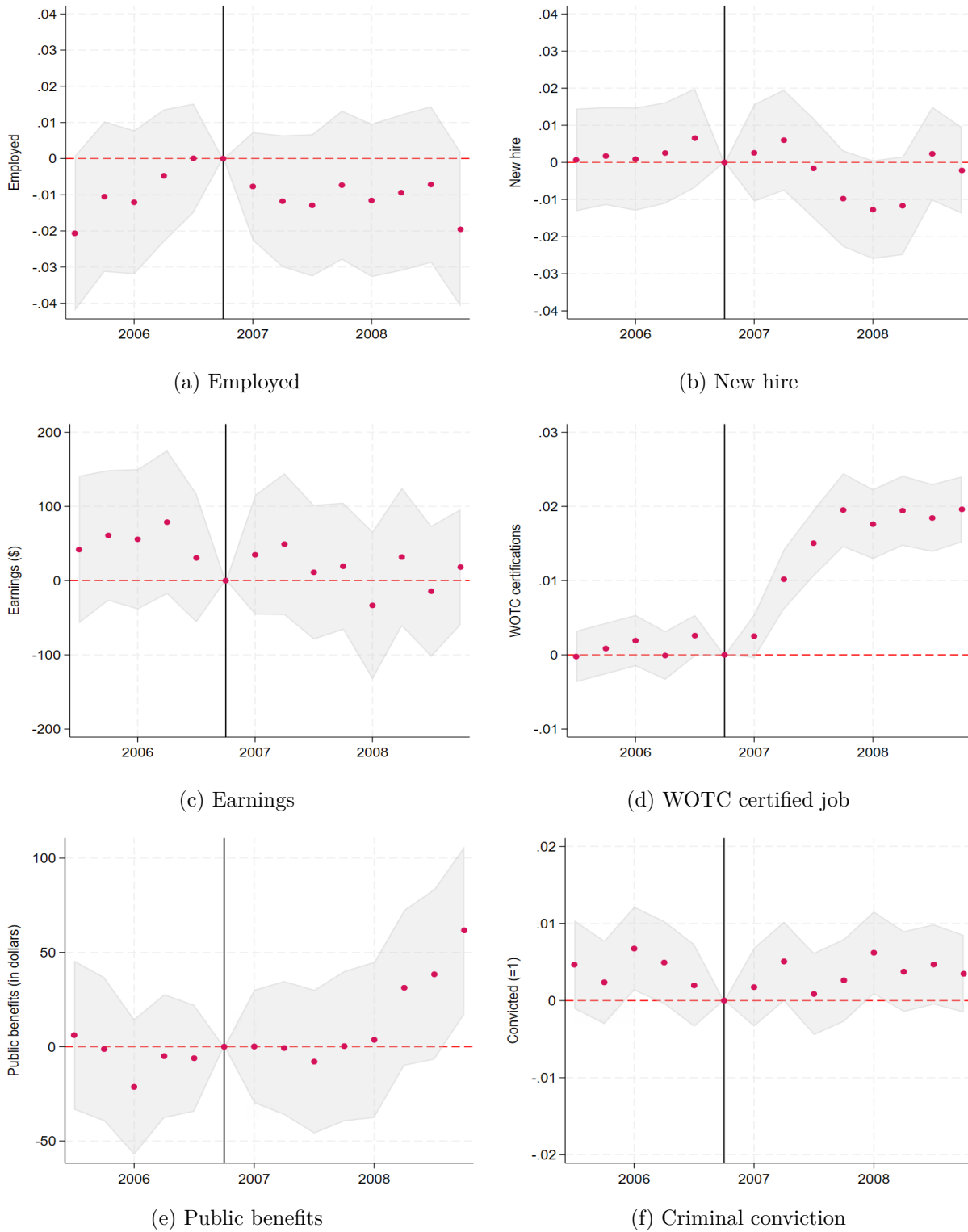
Note: This figure reports total national WOTC certifications in each year from 1997-2022. The data is from Department of Labor annual reports on WOTC certifications. It splits the certifications by the reason for eligibility, where the Other category includes smaller categories such as due to veteran status, summer jobs for youth, and long-term TANF, among other reasons. For 1997 to 2002, we do not observe the felon or disconnected youth categories separately, so this is included among “Other”. For the years 1998, 2000, and 2001, we only observe the total national numbers, so we use the category percentages from the most recent preceding year with data to estimate the breakdowns.

Figure 2: Number of WOTC certifications in Wisconsin (2005-2008)



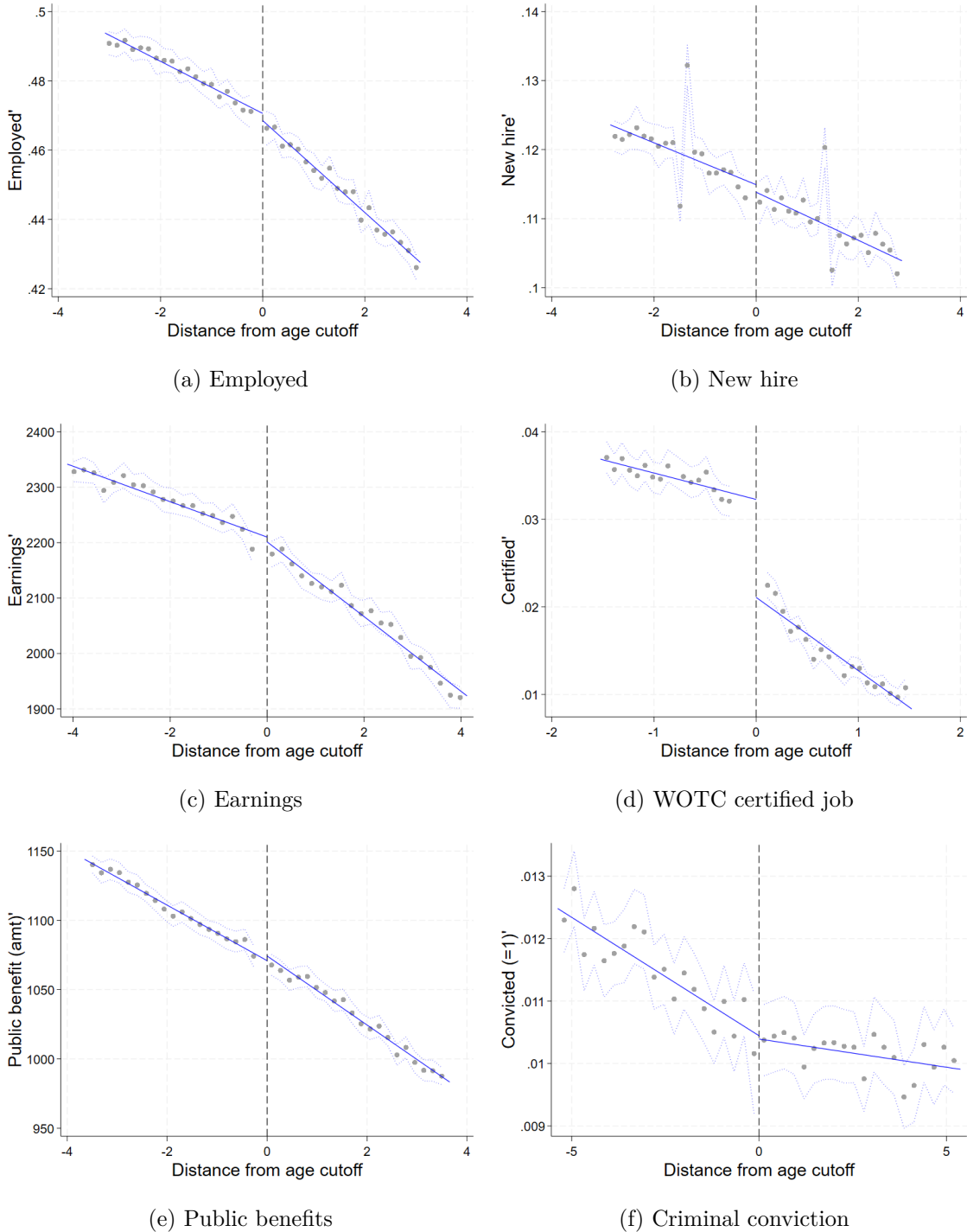
Note: This figure reports total WOTC certifications in Wisconsin by quarter of application from 2005-2009. Gray dashed horizontal lines signify average quarterly certificates over the two-year period.

Figure 3: Effect of WOTC on individual outcomes, event study analysis of SNAP expansion



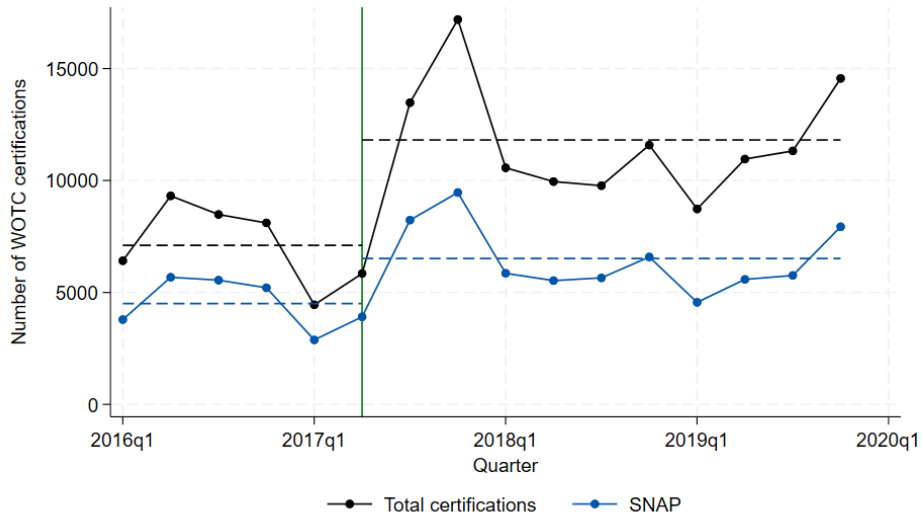
Note: Figure reports event study estimates from the 2007 expansion to SNAP recipients aged 25-39 in Equation (1) for employment, new hires, earnings, employment in a WOTC-certified job, social assistance utilization, and criminal activity. Controls include monthly age fixed effects and quarter-year fixed effects. Standard errors clustered at the individual level.

Figure 4: Effect of WOTC on individual outcomes, RD analysis

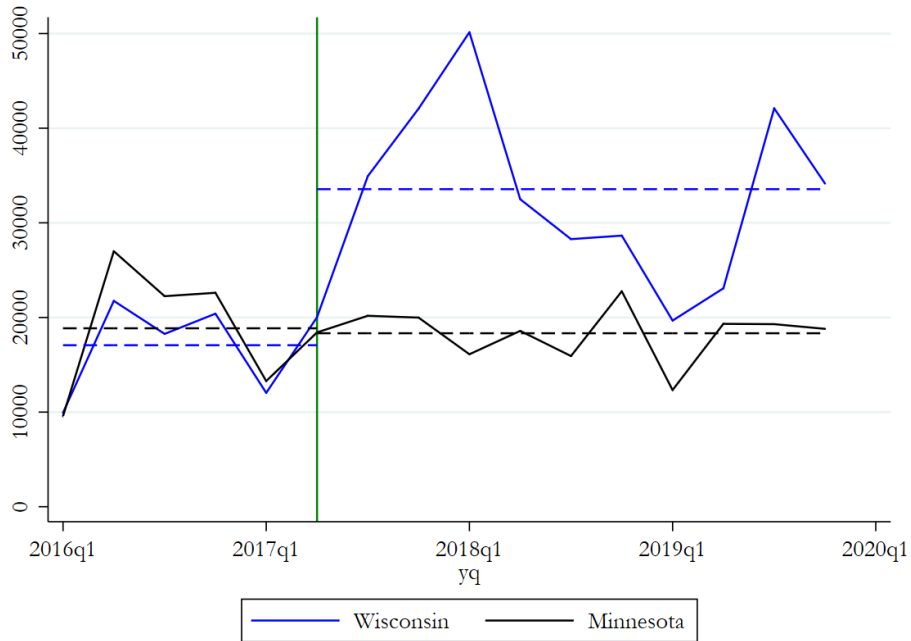


Note: These figures plot the relationship between individual-level outcomes and the difference between the individual's age and the relevant WOTC age eligibility threshold. Individuals whose age is to the left of the threshold are eligible for WOTC, while those to the right of the threshold are not. The bandwidth is based on the optimal bandwidth selection from Cattaneo et al. (2020). Panel (a) examines whether the individual is employed, panel (b) focuses on whether the individual is hired into a new job in that quarter, and panel (c) measures individual earnings in the quarter. Panel (d) plots the first stage relationship between the individual's age and whether they are working in a job with an associated WOTC certification. Panel (e) measures the relationship with the dollar value of three forms of public benefits in a quarter (TANF, Unemployment Insurance, and SNAP), while panel (f) measures if the individual is convicted of a criminal offense in the relevant quarter.

Figure 5: WOTC utilization around adoption of electronic filing in Wisconsin



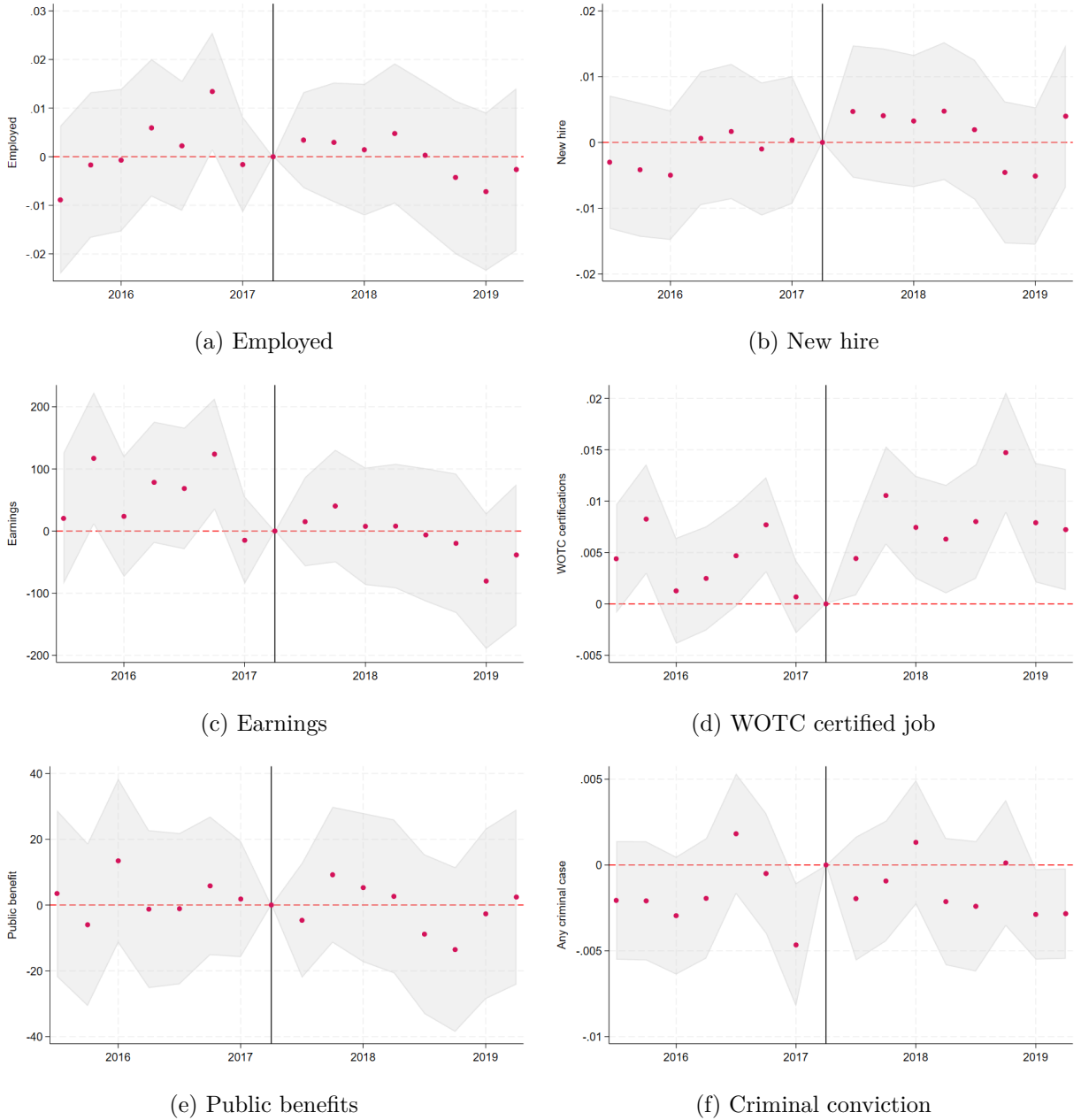
(a) Quarterly WOTC certifications in Wisconsin, 2016-2019



(b) Quarterly WOTC applications in Wisconsin and Minnesota, 2016-2019

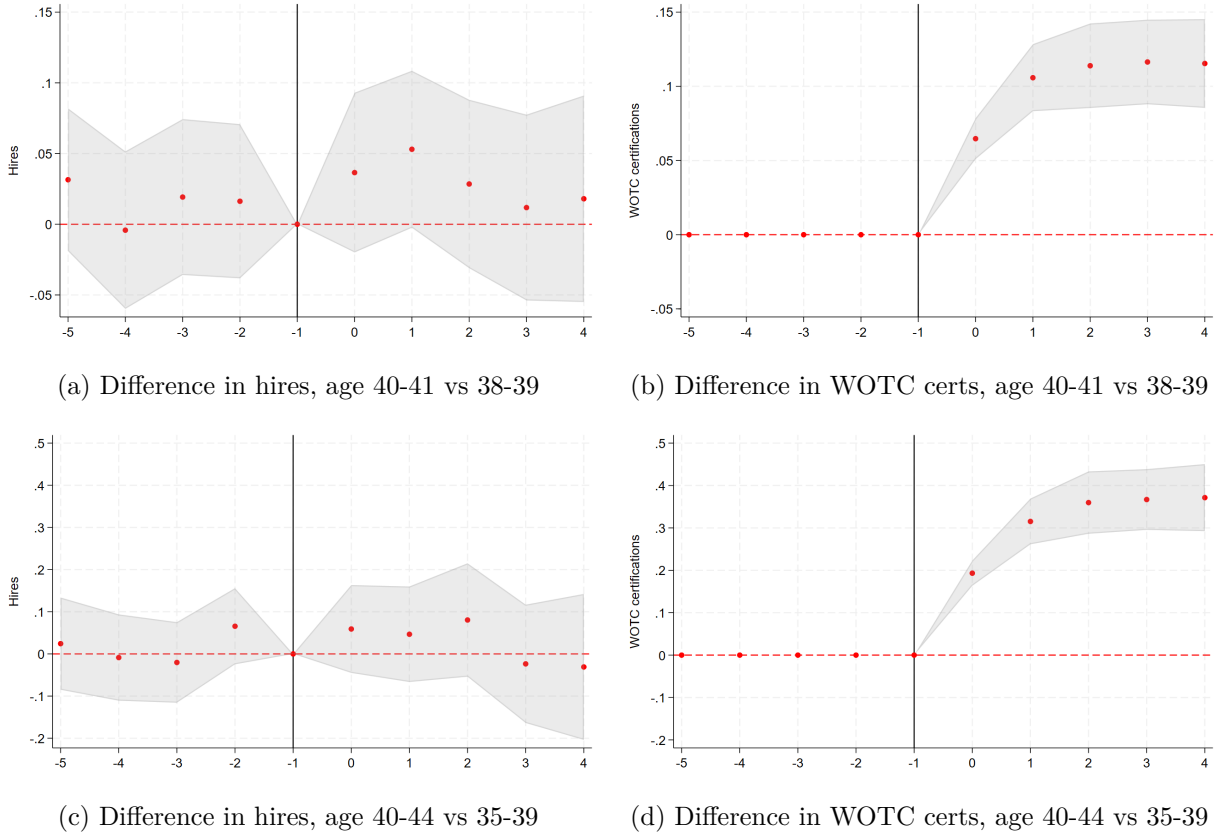
Note: Panel (a) reports total WOTC certifications in Wisconsin by quarter of application from 2015-2019. The vertical green line indicates the date of e-filing adoption. Data is taken from the WOTC micro-data provided to the researchers by the Department of Workforce Development. Panel (b) reports total WOTC applications in Wisconsin and Minnesota by quarter of application from 2016-2019. The vertical green line indicates the date of e-filing adoption in Wisconsin. Data is from the Department of Labor national WOTC data, which is based on quarterly data submitted by state workforce agencies through the the web-based Tax Credit Reporting System. The figures differ due to the different outcome variables (certifications versus applications): for using the national data, it is necessary to use applications as the dependent variable due to the reporting system.

Figure 6: Effect of eWOTC on individual outcomes



Note: Figure reports event study estimates from the 2017 shift to electronic filing of WOTC applications among our SNAP sample for employment, new hires, earnings, employment in a WOTC-certified job, social assistance utilization, and criminal activity. Controls include monthly age fixed effects and quarter-year fixed effects. Standard errors clustered at the individual level.

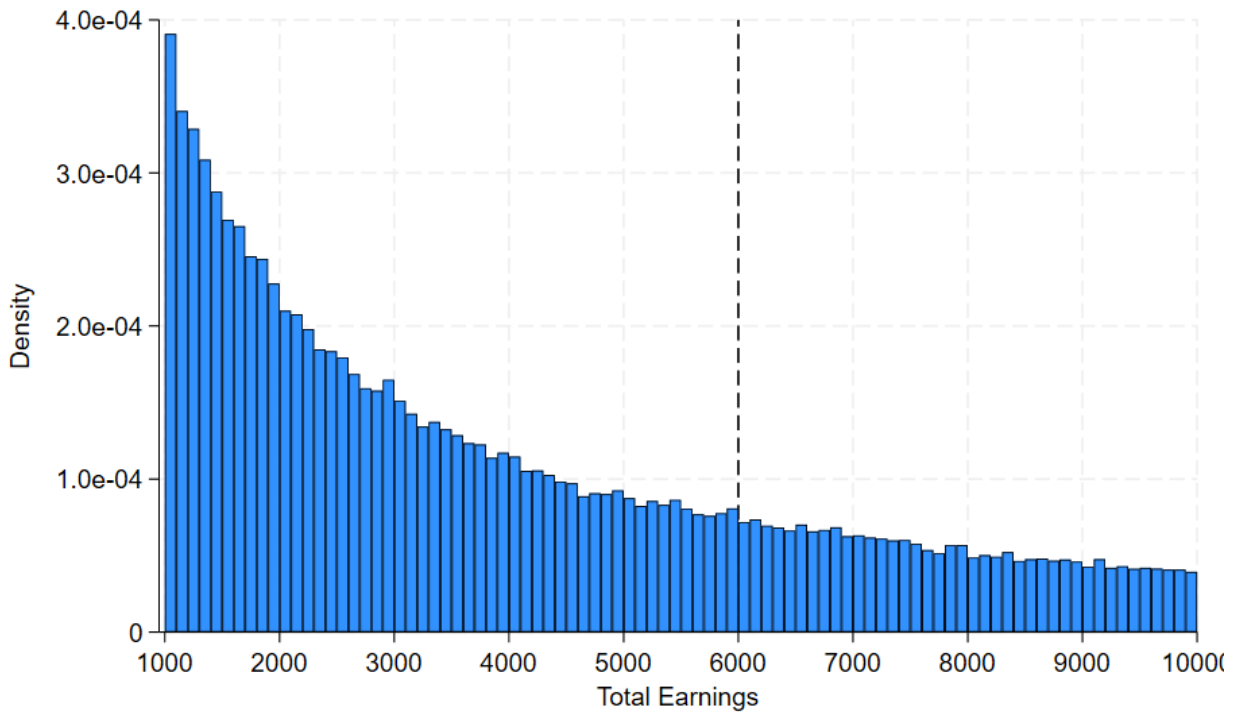
Figure 7: Effect of WOTC on firm-level outcomes



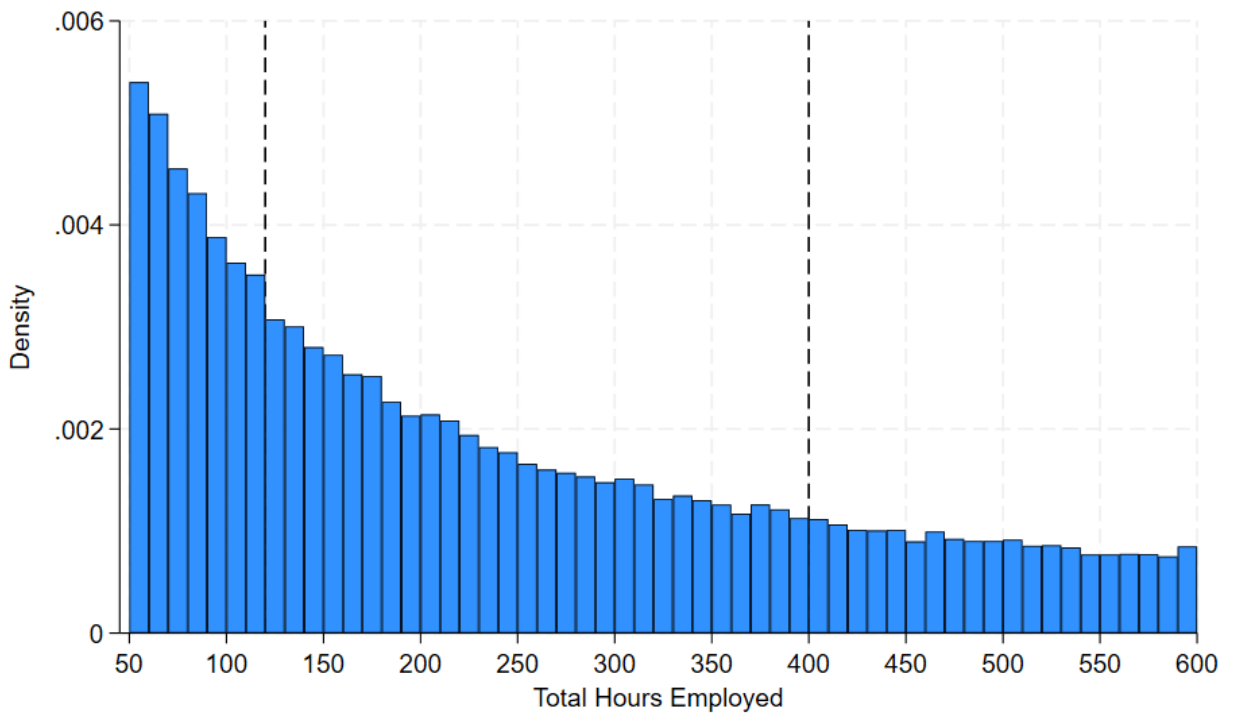
Note: This figure reports the estimated effects of firm-level adoption of WOTC on hiring and utilization of WOTC. The outcomes in the first two panels are the difference in number of hires (WOTC certifications) by the firm of people who are receiving SNAP and are aged 38 or 39 at the time of hiring (i.e., eligible for WOTC) and those who receive SNAP and are aged 40 or 41 (i.e., just ineligible for WOTC). In the third and fourth panels, we instead use SNAP recipients aged 35 to 39 as the eligible group and those aged 40 to 44 as the ineligible group to test robustness to a wider age band. To analyze the dynamic effects of staggered WOTC adoption, we implement an event-study specification following Callaway and Sant'Anna (2021). All regression include firm and year fixed effects. The coefficients estimate the dynamic average treatment effects at each period relative to adoption. Standard errors are clustered at the firm level to account for serial correlation.

Figure 8: Histograms of total earnings and hours worked for WOTC-certified workers

(a) Earnings threshold

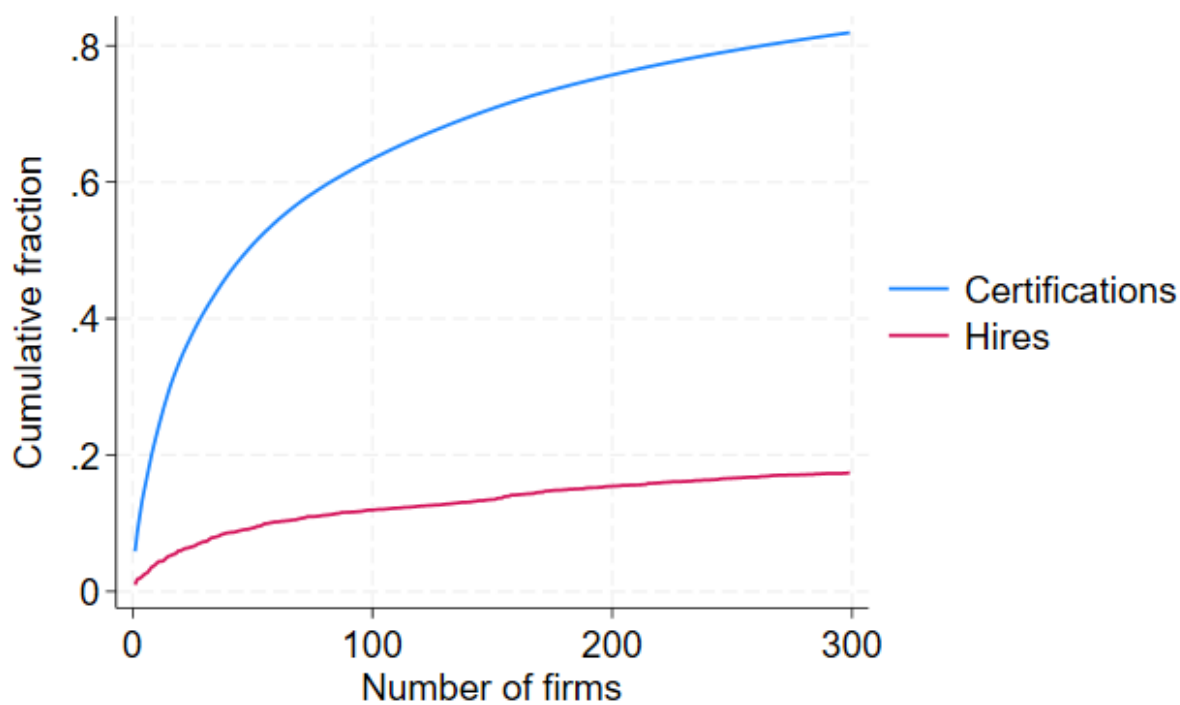


(b) Hours thresholds



Note: Figures plot the distribution of total earnings and hours worked prior to separation for workers whose hiring was subsidized by WOTC and who were eligible for WOTC through SNAP receipt.

Figure 9: Cumulative density function of WOTC certifications by firm



Note: This figure measures the concentration of WOTC certifications among firms. Ranking the firms in terms of WOTC certifications between 2005 and 2019 in Wisconsin, the blue line plots the cumulative fraction of WOTC certifications accruing to firms of rank between 1 and N for the top 300 firms. The red line plots the cumulative fraction of all hires made by those firms over 2005-2019.

Appendix Tables

Table A1: Effect of WOTC on individual outcomes among unemployed sample, DD analysis of SNAP expansion

	(1) Employed	(2) New Hire	(3) Earnings	(4) Certified	(5) Public benefit	(6) Criminal conviction
Treat x post	0.000318 (0.00398)	-0.00505 (0.00359)	-16.18 (12.77)	0.00699*** (0.000652)	26.63 (17.28)	0.000674 (0.00149)
Dep var mean	0.116	0.0945	247.0	0.00148	793.1	0.0169
Observations	150856	150856	150856	150856	150856	150856

Note: Table reports difference-in-difference estimates from the 2007 expansion to SNAP recipients aged 25-39 in Equation (2) for employment, new hires, earnings, employment in a WOTC-certified job, social assistance utilization, and criminal activity. Sample includes individuals who entered quarter t unemployed. Controls include monthly age fixed effects and quarter-year fixed effects. Standard errors clustered at the individual level.

Table A2: Balance on pre-determined characteristics, RD analysis

	Demographics		Employed		Earnings	
	Female (=1)	Black (=1)	t-1	t-2	t-1	t-2
RD Estimate	0.0012 (0.0021) [0.5844]	-0.0011 (0.0021) [0.6031]	-0.0010 (0.0021) [0.6268]	-0.0001 (0.0021) [0.9796]	4.0375 (12.4085) [0.7449]	8.9505 (12.1032) [0.4596]
Dep var mean	0.6492	0.3022	0.4791	0.4740	1991.2107	1878.0033
Bandwidth	2.5334	3.7409	3.2272	3.0156	4.1539	3.8703
Effective Obs	2355793	3470270	2850640	2617346	3592121	3356268

Note: Table reports regression discontinuity estimates testing whether pre-determined covariates vary discontinuously across the age threshold. The sample includes both the pre-2007 and post-2007 periods. Each specification uses a linear polynomial, triangular kernel, and MSE-optimal bandwidth estimated following Calonico et al. (2017). Standard errors in parentheses are clustered at the individual level; p-values in square brackets.

Table A3: Effect of WOTC on individual outcomes for the age 25 discontinuity (pre-2007)

<i>Panel A: Full sample</i>						
	Employed	New hire	Earnings	Certified	Public benefit (amt)	Convicted (=1)
RD_Estimate	-0.0039 (0.0040) [0.3362]	-0.0021 (0.0020) [0.3113]	-42.0503* (21.7102) [0.0528]	-0.0063*** (0.0009) [0.0000]	4.5988 (8.2018) [0.5750]	0.0000 (0.0005) [0.9377]
Dep var mean	0.4995	0.1532	2060.3934	0.0045	1023.1455	0.0093
Bandwidth	2.9893	3.7194	3.6274	2.4318	3.0028	3.8546
Effective Obs	675537	835786	818259	563541	693719	870689
<i>Panel B: Unemployed sample</i>						
	Employed	New hire	Earnings	Certified	Public benefit (amt)	Convicted (=1)
RD_Estimate	-0.0031 (0.0029) [0.2922]	-0.0030 (0.0023) [0.1934]	-25.7435** (12.7925) [0.0442]	-0.0041*** (0.0004) [0.0000]	4.1445 (10.8589) [0.7027]	0.0004 (0.0007) [0.5090]
Dep var mean	0.1917	0.1454	754.7819	0.0017	1192.4208	0.0108
Bandwidth	3.6737	4.3571	4.2399	4.2828	3.7430	4.3104
Effective Obs	523572	612154	590019	601255	523572	601255

Note: Table reports regression discontinuity estimates for employment, earnings, program utilization and criminal activity in the pre-2007 period. Panel A examines outcomes for the full sample, while Panel B restricts to individuals who are unemployed at the start of the quarter. Each specification uses a linear polynomial, triangular kernel, and MSE-optimal bandwidth estimated following Calonico et al. (2017). Standard errors are clustered at the individual level.

Table A4: Effect of WOTC on individual outcomes for the age 40 discontinuity (post-2007)

<i>Panel A: Full sample</i>						
	Employed	New hire	Earnings	Certified	Public benefit (amt)	Convicted (=1)
RD_Estimate	-0.0006 (0.0023) [0.7975]	-0.0001 (0.0010) [0.9308]	-8.4991 (15.9081) [0.5932]	-0.0119*** (0.0010) [0.0000]	-2.3544 (5.1929) [0.6503]	-0.0000 (0.0003) [0.9922]
Dep var mean	0.4208	0.0921	2076.4474	0.0175	1032.7704	0.0105
Bandwidth	4.3417	3.2758	3.8853	1.5884	3.5746	5.5862
Effective Obs	3147648	2287744	2717541	1095326	2518766	4107950
<i>Panel B: Unemployed sample</i>						
	Employed	New hire	Earnings	Certified	Public benefit (amt)	Convicted (=1)
RD_Estimate	-0.0002 (0.0014) [0.8986]	-0.0002 (0.0012) [0.8689]	1.4067 (7.9139) [0.8589]	-0.0101*** (0.0004) [0.0000]	-4.2790 (6.9884) [0.5403]	-0.0002 (0.0004) [0.6119]
Dep var mean	0.1143	0.0773	513.8389	0.0024	1111.4315	0.0129
Bandwidth	3.1732	3.3236	3.8996	3.0363	3.6924	5.0189
Effective Obs	1413635	1425921	1694028	1336616	1647264	2279953

Note: Table reports regression discontinuity estimates for employment, earnings, program utilization and criminal activity in the post-2007 period. Panel A examines outcomes for the full sample, while Panel B restricts to individuals who are unemployed at the start of the quarter. Each specification uses a linear polynomial, triangular kernel, and MSE-optimal bandwidth estimated following Calonico et al. (2017). Standard errors are clustered at the individual level.

Table A5: Effect of WOTC on employment and hiring by firm type and year (RDD)

<i>Panel A: Employed</i>						
	Top 50 firm	High succ firm	Staffing firm	1998-2006	2007-2013	2014-2019
RD_Estimate	-0.0004 (0.0009) [0.6413]	-0.0004 (0.0003) [0.2797]	-0.0001 (0.0009) [0.9528]	-0.0039 (0.0040) [0.3362]	0.0017 (0.0031) [0.5749]	-0.0021 (0.0032) [0.5192]
Dep var mean	0.0602	0.0085	0.0654	0.4995	0.3990	0.4403
Bandwidth	4.2116	4.7998	3.5746	2.9893	4.6504	4.6895
Effective Obs	3959626	4520407	3319703	675537	1693280	1676555
<i>Panel B: New hire</i>						
	Top 50 firm	High succ firm	Staffing firm	1998-2006	2007-2013	2014-2019
RD_Estimate	-0.0001 (0.0004) [0.7526]	-0.0002 (0.0001) [0.1440]	-0.0003 (0.0004) [0.4937]	-0.0021 (0.0020) [0.3113]	0.0010 (0.0012) [0.3956]	-0.0011 (0.0016) [0.4602]
Dep var mean	0.0168	0.0026	0.0259	0.1532	0.0811	0.1034
Bandwidth	2.6510	3.5037	3.9370	3.7194	4.3604	3.4402
Effective Obs	2436080	3319703	3719518	835786	1596542	1159243

Note: Table reports regression discontinuity estimates testing how labor market outcomes are related to WOTC eligibility. Panel A examines whether the individual is employed at one of the 50 firms that are heaviest users of WOTC (column 1), have a WOTC application success rate above the 75th percentile (column 2), or are an employment services firm, i.e. NAICS 5613 (column 3). The remaining columns examine effects on employment by year, where column (4) restricts to the period when age 25 was the cut-off, column (5) focuses on the period during which there was significant growth in WOTC, and column (6) examines the current period, in which number of WOTC certifications has roughly stabilized. Panel B focuses on the same set of outcomes, but examines whether the individual is newly hired rather than employed. The sample includes both the pre-2007 and post-2007 periods. Each specification uses a linear polynomial, triangular kernel, and MSE-optimal bandwidth estimated following Calonico et al. (2017). Standard errors in parentheses are clustered at the individual level; p-values in square brackets.

Table A6: Placebo RD analysis

<i>Panel A: Pre-2007</i>						
	Employed	New hire	Earnings	Certified	Public benefit (amt)	Convicted (=1)
RD_Estimate	-0.0050 (0.0039) [0.2046]	-0.0010 (0.0017) [0.5812]	-35.7618 (23.8756) [0.1342]	-0.0003 (0.0003) [0.3292]	-4.1644 (8.6194) [0.6290]	0.0002 (0.0004) [0.6074]
Dep var mean	0.3244	0.0914	1390.3404	0.0009	732.0424	0.0091
Bandwidth	5.3543	4.5135	4.7266	3.7060	4.4671	6.6637
Effective Obs	909355	770656	798357	632157	757995	1111903
<i>Panel B: Post-2007</i>						
	Employed	New hire	Earnings	Certified	Public benefit (amt)	Convicted (=1)
RD_Estimate	-0.0021 (0.0018) [0.2665]	0.0004 (0.0010) [0.6962]	-15.2422 (11.4645) [0.1837]	-0.0021** (0.0010) [0.0320]	-1.2009 (3.8865) [0.7573]	0.0001 (0.0003) [0.6638]
Dep var mean	0.5712	0.1527	2402.7144	0.0672	1079.7536	0.0149
Bandwidth	2.9171	3.3941	2.7079	3.6028	2.8533	3.3756
Effective Obs	2950287	3300282	2677709	3576673	2871644	3343457

Note: Table reports the relationship between individual-level outcomes and the difference between the individual's age and a placebo WOTC age eligibility threshold. For the pre-2007 period, the placebo age eligibility threshold is age 40, while for the post-2007 period, the placebo age eligibility threshold is age 25. This checks whether there is a relationship between the age threshold and the individual level outcomes during the years when this age threshold is not relevant for WOTC eligibility. Panel A examines outcomes for the pre-2007 period, while Panel B focuses on the post-2007 period. Each specification uses a linear polynomial, triangular kernel, and MSE-optimal bandwidth estimated following Calonico et al. (2017). Standard errors are clustered at the individual level.

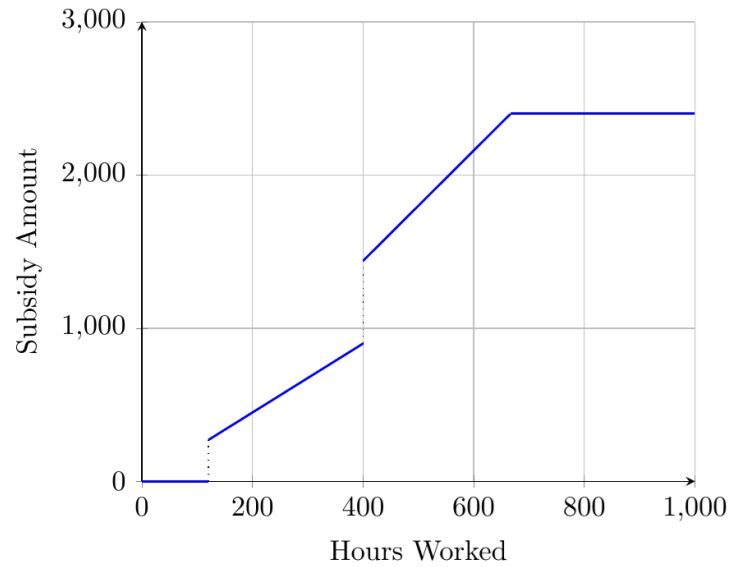
Table A7: Substitutability of WOTC-eligible and ineligible SNAP beneficiaries

	Eligible Hires	Ineligible Hires
Eligible Exits	0.0686*** (0.0009)	0.0737*** (0.0008)
Ineligible Exits	0.0886*** (0.0010)	0.0636*** (0.0009)
Firm FEs	Yes	Yes
Year-Quarter FEs	Yes	Yes
Total Exits FEs	Yes	Yes
Observations	1,694,247	1,694,247

Note: Table reports estimates of how many hires a firm made in a quarter as a function of separations from the firm in that quarter. Column 1 examines the number of hires of individuals who are between ages 37-39 and received SNAP benefits for 3 of the past 5 months (eligible for WOTC), while column 2 examines hires of those between ages of 42-44 and received SNAP benefits for 3 of the past 5 months (ineligible for WOTC). In both cases, the dependent variable is regressed on the number of exits from the firm in that quarter of individuals with those characteristics. All specifications include fixed effects for firm and year-quarter, as well as the total number of exits from the firm in that quarter. Standard errors are clustered at the firm level.

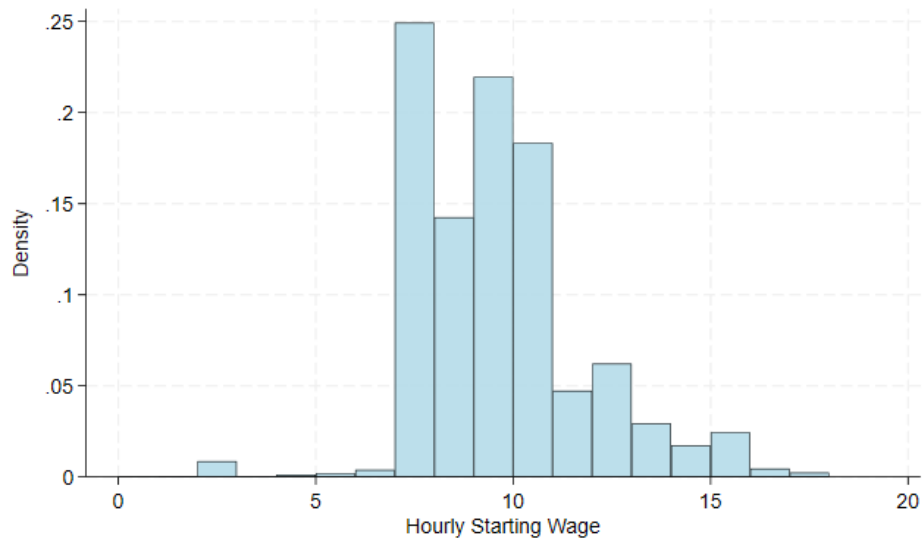
Appendix Figures

Figure A1: Example WOTC subsidy schedule



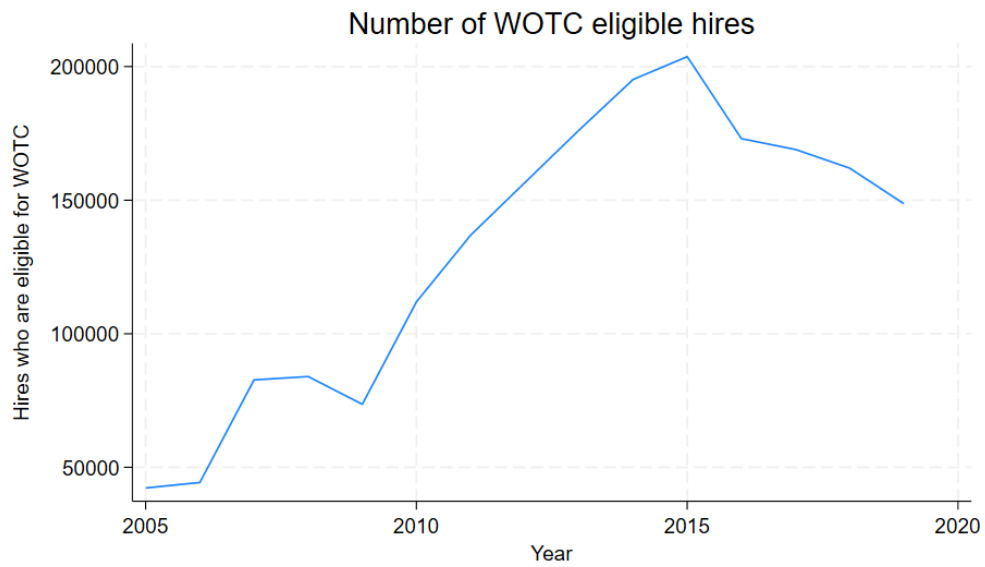
Note: Figure reports the subsidy amount by hours worked for the median worker earning \$9 per hour. For the first 120 hours, the subsidy does not pay anything. The subsidy then pays 25% of wages for hours 120 to 400 and 40% of wages for more than 400 hours, up to a cap of \$2400.

Figure A2: Hourly Starting Wage

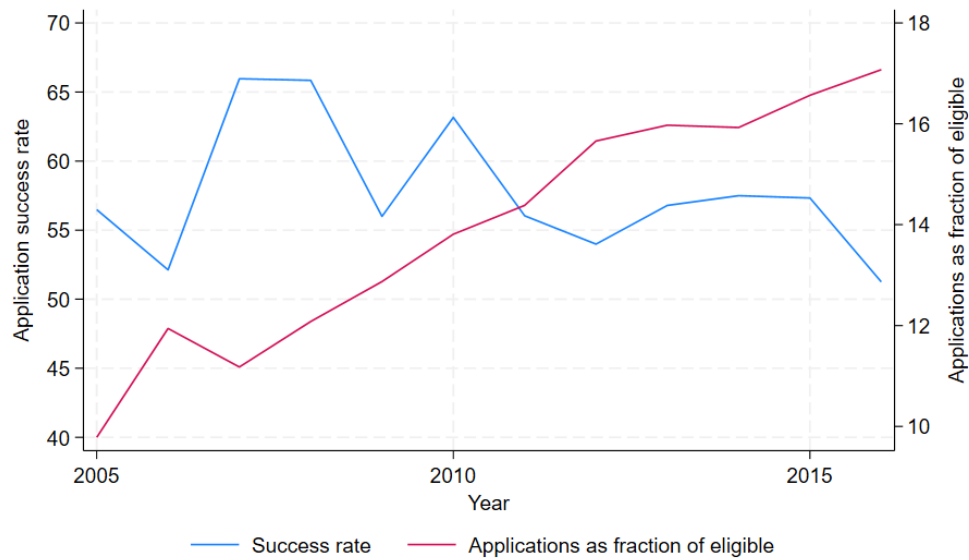


Note: Figure reports the distribution of starting hourly wage for workers in WOTC-certified jobs in Wisconsin between 2009-2020.

Figure A3: Decomposition of changes in WOTC over time



(a) Number of hires eligible for WOTC



(b) Firm application behavior

Note: Panel (a) reports the total number of new hires in Wisconsin in a given year for whom our administrative data indicates they are eligible for WOTC due to participation in SNAP or TANF, or conviction for a felony. Panel (b) reports the fraction of WOTC applications that are successful as well as the fraction of eligible individuals for whom firms apply for WOTC.

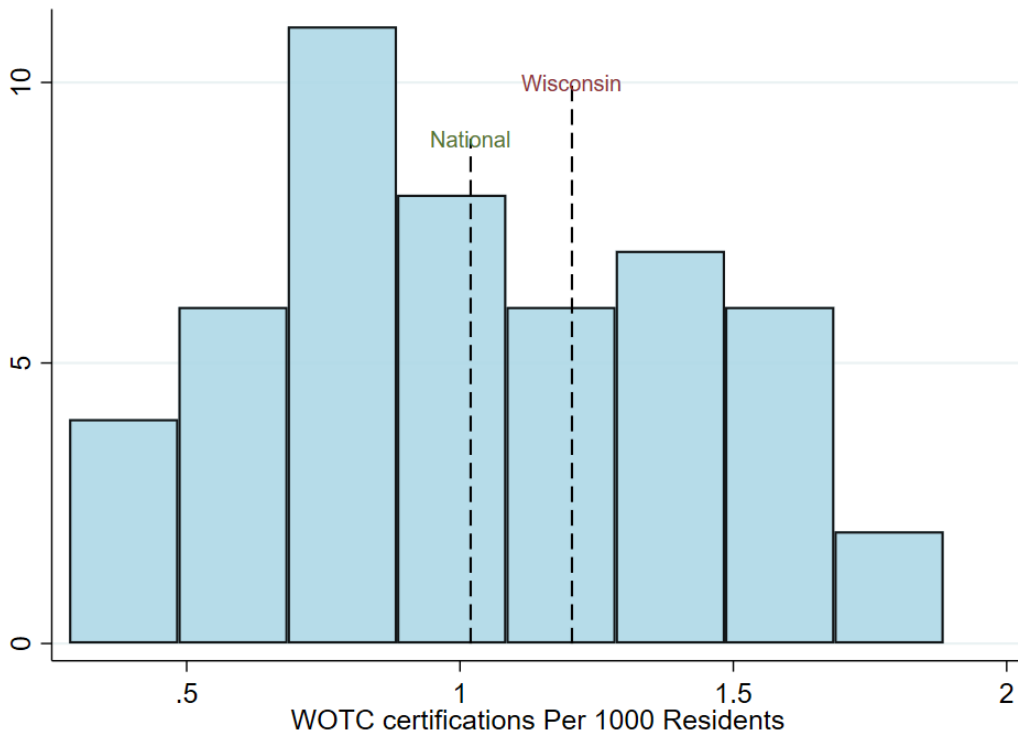
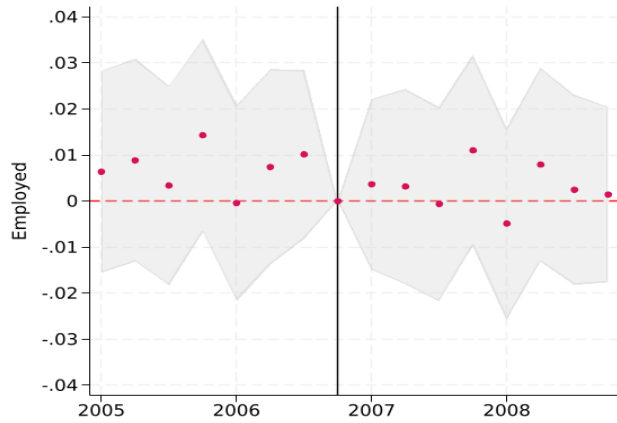


Figure A4: Average Quarterly WOTC applications by State (Per 1000 residents)

Note: Figure reports average quarterly WOTC applications per 1000 residents by state. The vertical dashed lines indicates the average applications in Wisconsin as well as averaged across all 50 states. Data is taken from the Department of Labor national Work Opportunity Tax Credit data, which is based on quarterly data submitted by state workforce agencies through the the web-based Tax Credit Reporting System.

Figure A5: Effect of WOTC on individual outcomes, event study analysis of SNAP expansion (unemployed sample)



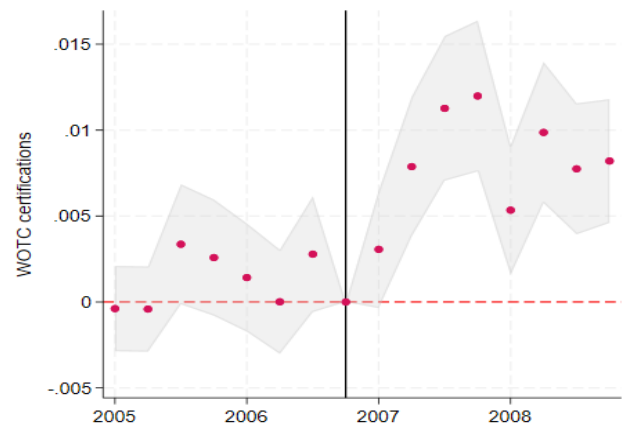
(a) Employed



(b) New hire



(c) Earnings



(d) WOTC certified job



(e) Public benefits



(f) Criminal conviction

Note: Figure reports event study estimates from the 2007 expansion to SNAP recipients aged 25-39 in Equation (1) for employment, new hires, earnings, employment in a WOTC-certified job, social assistance utilization, and criminal activity. Sample is individuals who entered quarter t unemployed. Controls include monthly age fixed effects and quarter-year fixed effects. Standard errors clustered at the individual level.

Figure A6: Effect of WOTC on individual outcomes, event study analysis of SNAP expansion (alternative control group)



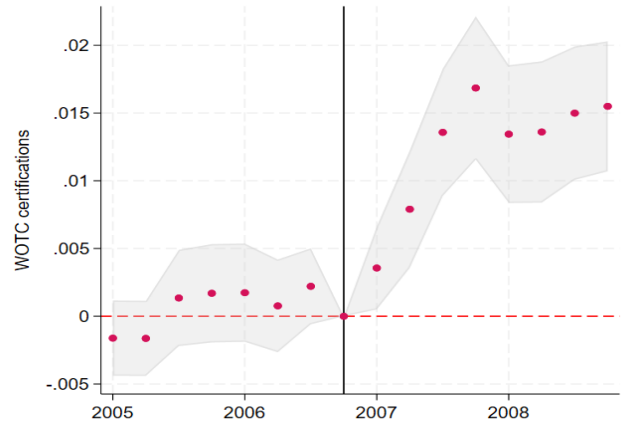
(a) Employed



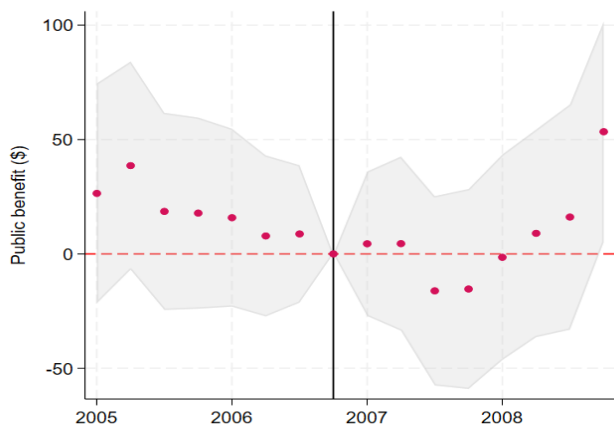
(b) New hire



(c) Earnings



(d) WOTC certified job



(e) Any public benefits

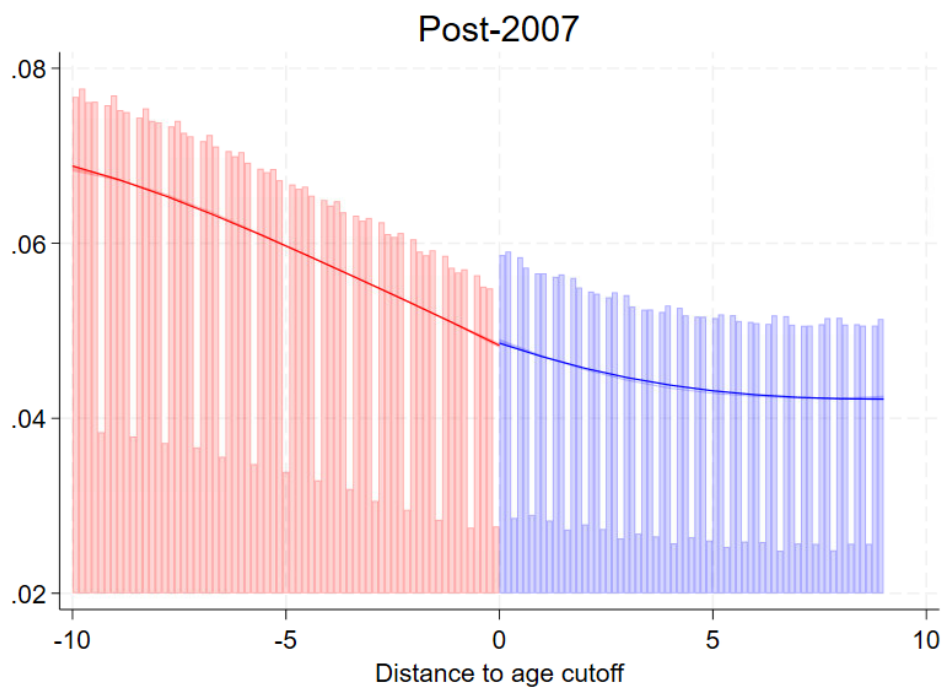
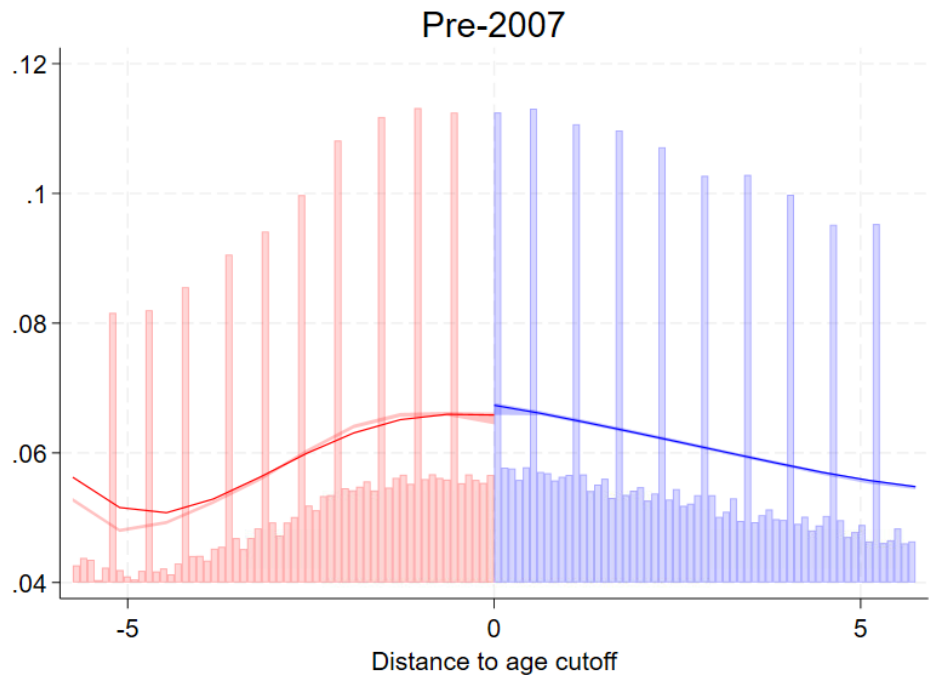


(f) Criminal conviction

Note: Figure reports event study estimates from the 2007 expansion to SNAP recipients aged 25-39 in Equation (1) for employment, new hires, earnings, employment in a WOTC-certified job, social assistance utilization, and criminal activity. The control group comprises of individuals aged 40-41. Controls include monthly age fixed effects and quarter-year fixed effects. Standard errors clustered at the individual level.

Figure A7: Distribution of the running variable, RD analysis

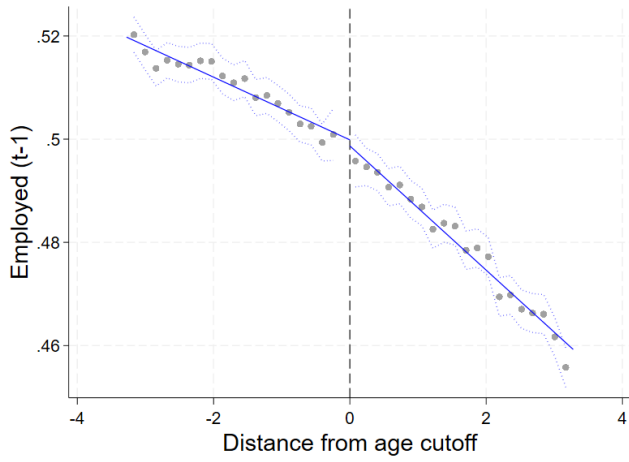
(a) Age 25 cutoff (1997 to 2006)



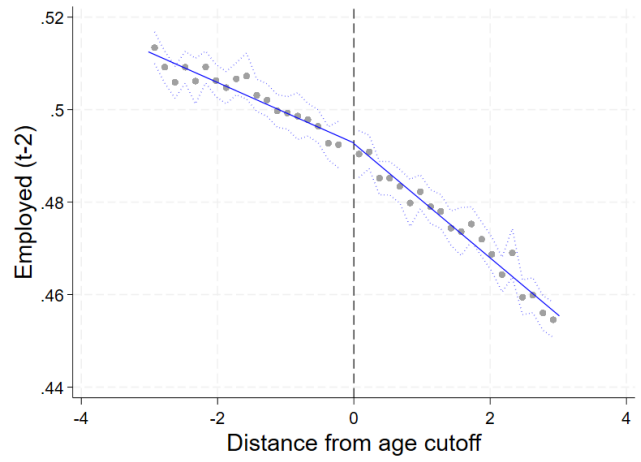
(b) Age 40 cut-off (2007 to 2019)

Note: These figures plot the distribution of age around the relevant thresholds and a non-parametric regression for each half of the distribution in order to test for a discontinuity in population density around the threshold (Cattaneo et al., 2020).

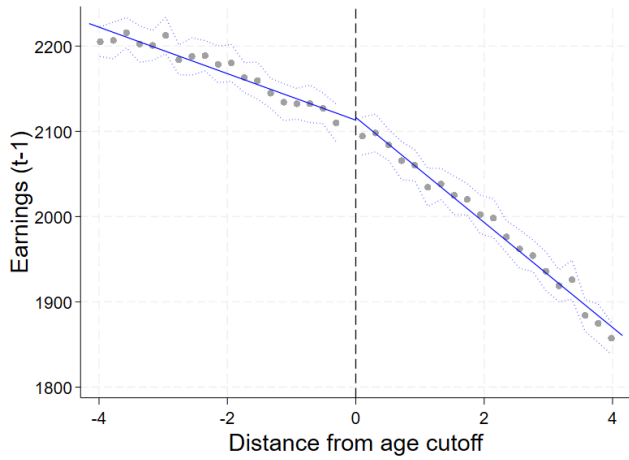
Figure A8: Balance on pre-determined characteristics, RD analysis



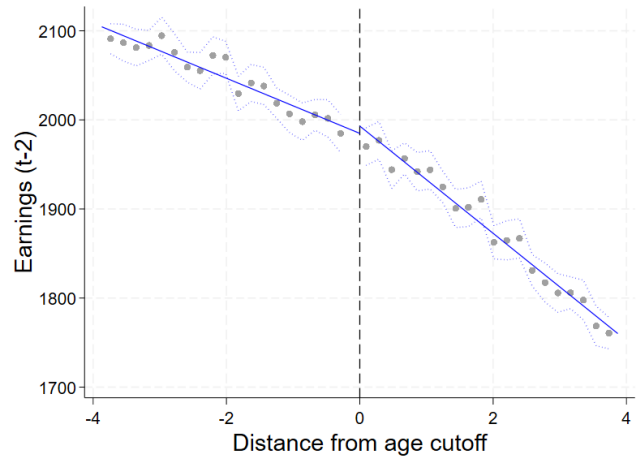
(a) Employed (t-1)



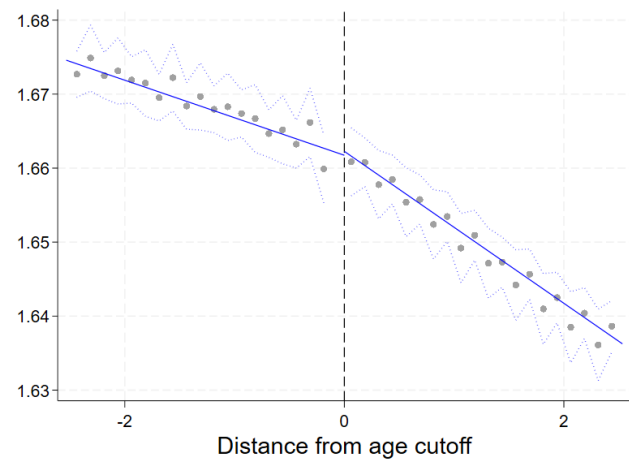
(b) Employed (t-2)



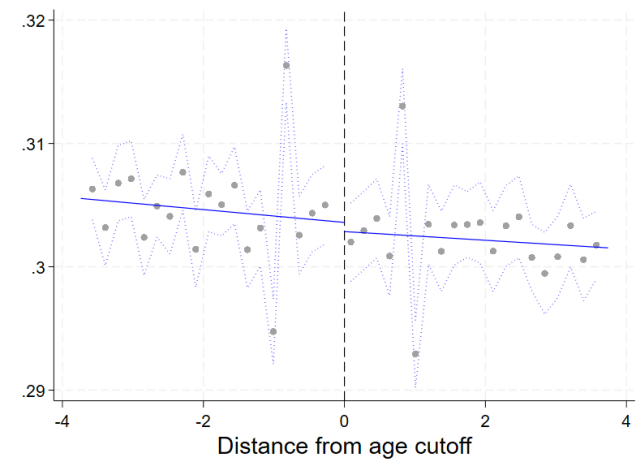
(c) Earnings (t-1)



(d) Earnings (t-2)



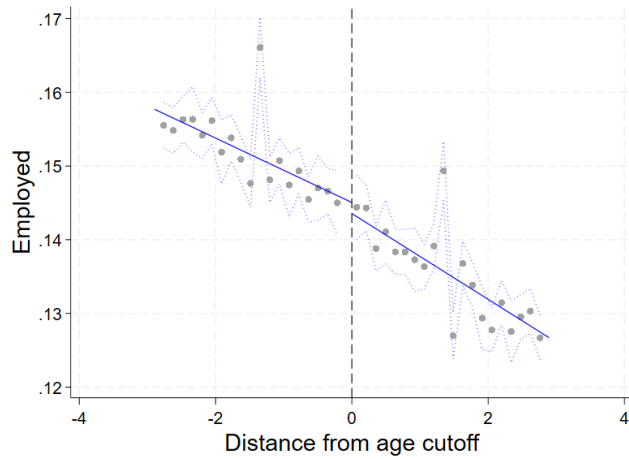
(e) Female



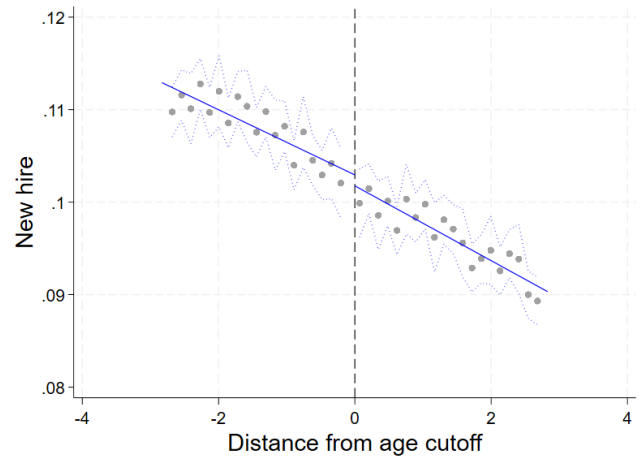
(f) Black

Note: These figures plot the relationship between various characteristics of the individual in the period prior to t and the running variable in order to test for pre-existing imbalances.

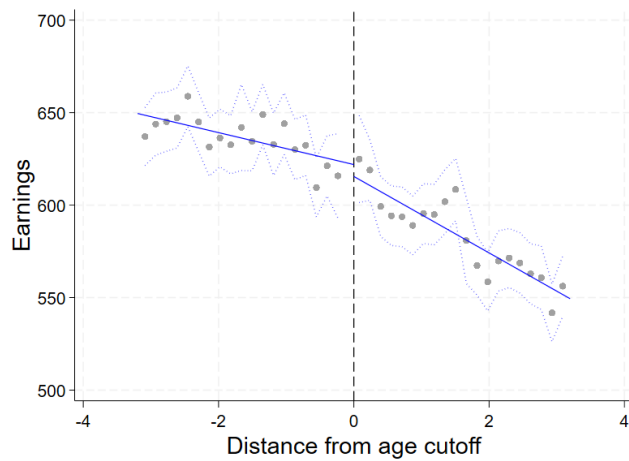
Figure A9: Effect of WOTC on individual outcomes, RD analysis (unemployed sample)



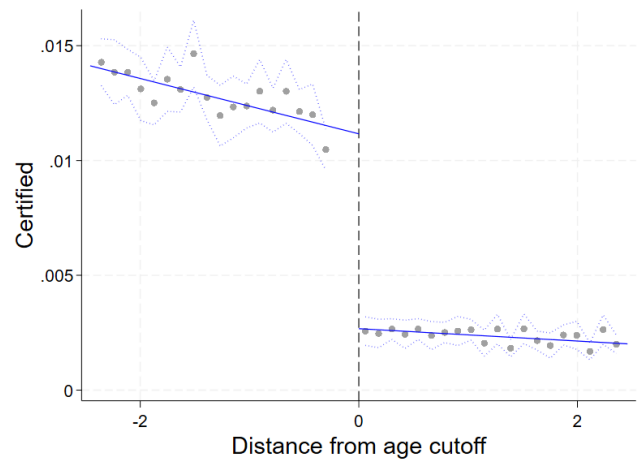
(a) Employed



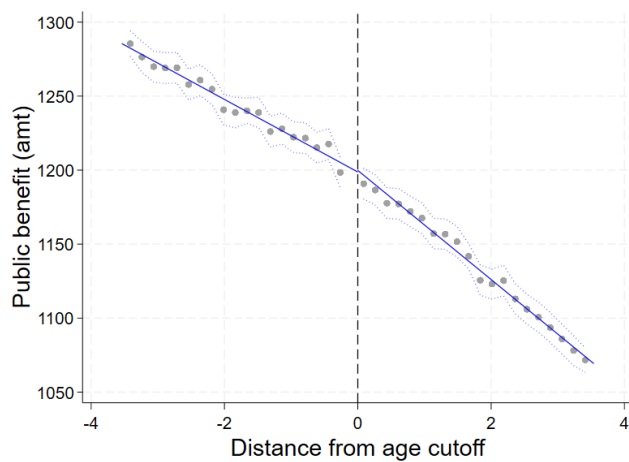
(b) New hire



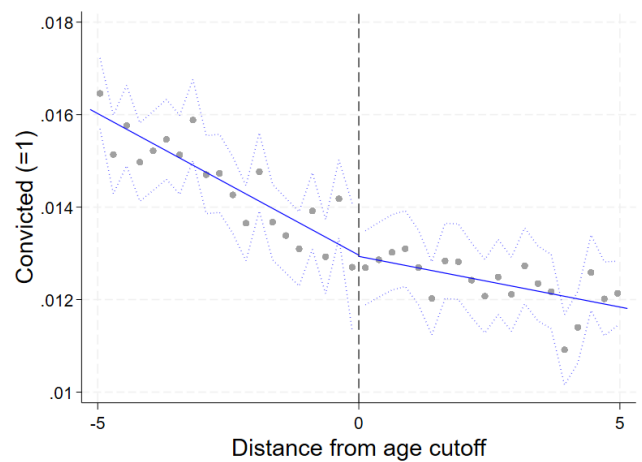
(c) Earnings



(d) WOTC certified job



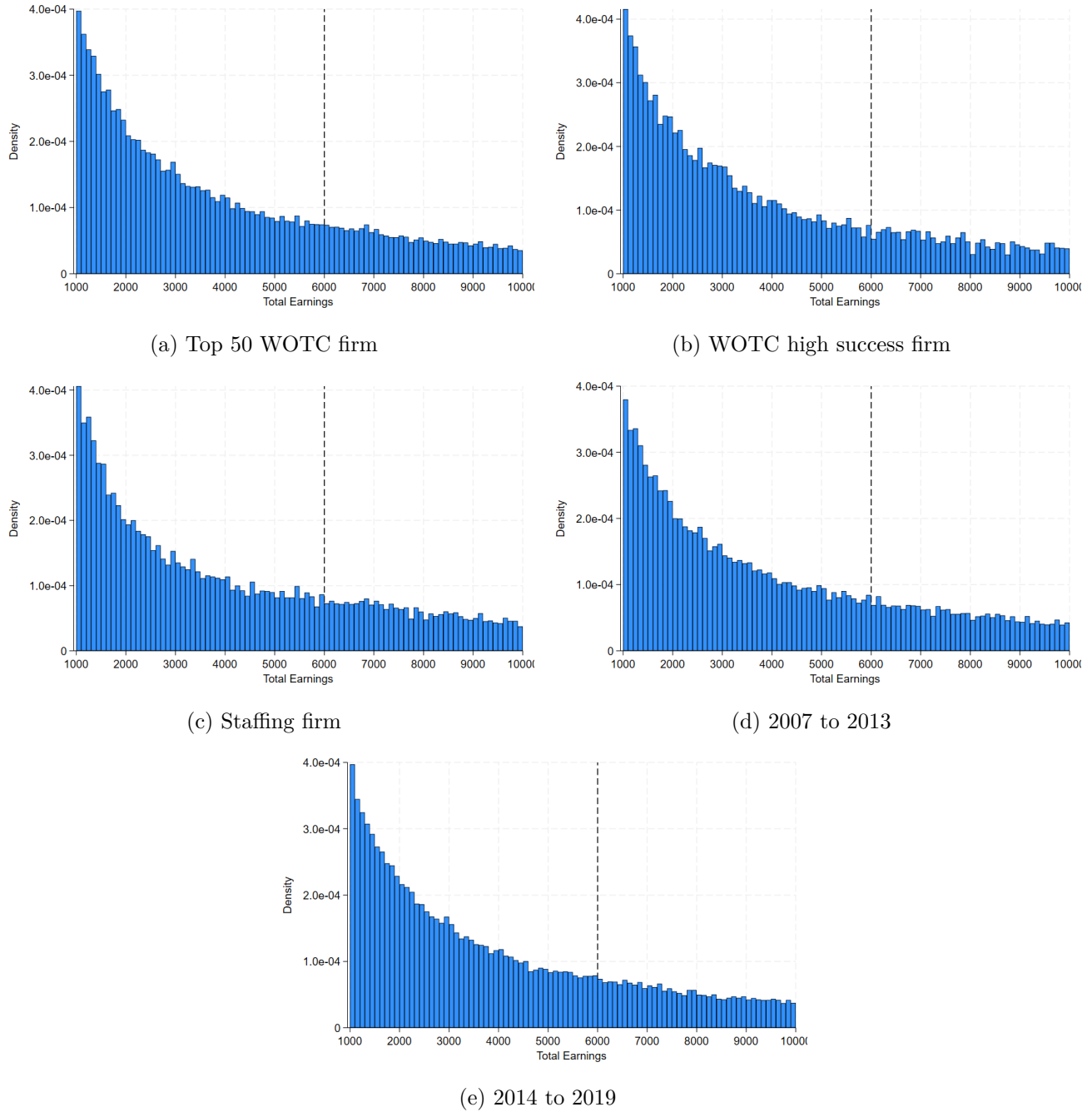
(e) Public benefits



(f) Criminal conviction

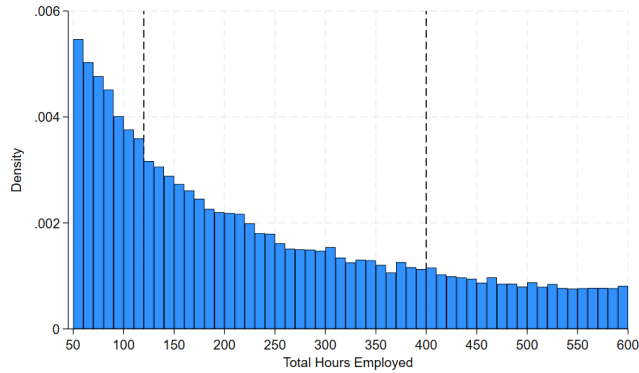
Note: These figures plot the relationship between individual-level outcomes and the difference between the individual's age and the relevant WOTC age eligibility threshold. The data is collected at the quarterly level, and the sample is restricted to individuals who are not employed at the start of the quarter. Individuals whose age is to the left of the threshold are eligible for WOTC, while those to the right of the threshold are not. The bandwidth is based on the optimal bandwidth selection from Cattaneo et al. (2020). Panel (a) examines whether the individual is employed, panel (b) focuses on whether the individual is hired into a new job in that quarter, and panel (c) measures individual earnings in the quarter. Panel (d) plots the first stage relationship between the individual's age and whether they are working in a job with an associated WOTC certification. Panel (e) measures the relationship with the dollar value of three forms of public benefits in a quarter (TANF, Unemployment Insurance, and SNAP), while panel (f) measures if the individual is convicted of a criminal offense in the relevant quarter.

Figure A10: Histograms of total earnings for WOTC-certified workers

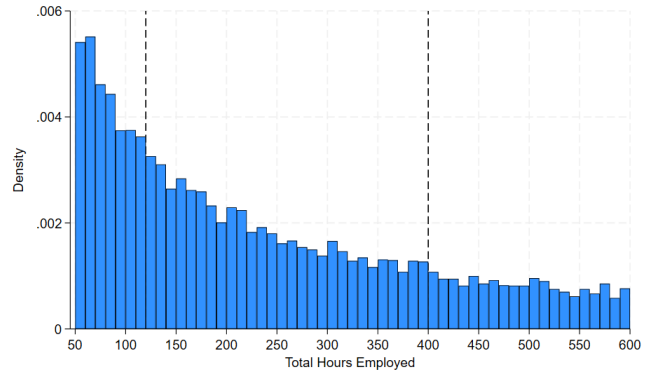


Note: These figures plot the distribution of total earnings prior to separation for workers whose hiring was subsidized by WOTC and who were eligible for WOTC through SNAP receipt. Panel (a) plots this for workers at the 50 firms that most heavily use WOTC. Panel (b) plots this for the WOTC-utilizing firms who are in the top quartile in terms of applying to WOTC for WOTC eligible hires. Panel (c) plots this for workers at employment services firm (i.e. NAICS 5613). Panels (d) and (e) plot this for the years 2007 to 2013 and after 2014 across all firms.

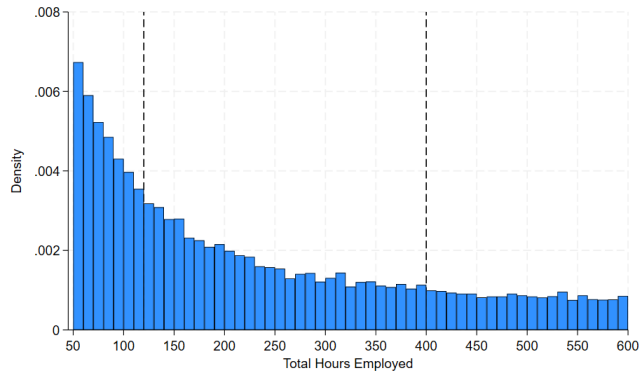
Figure A11: Histograms of total hours worked for WOTC-certified workers



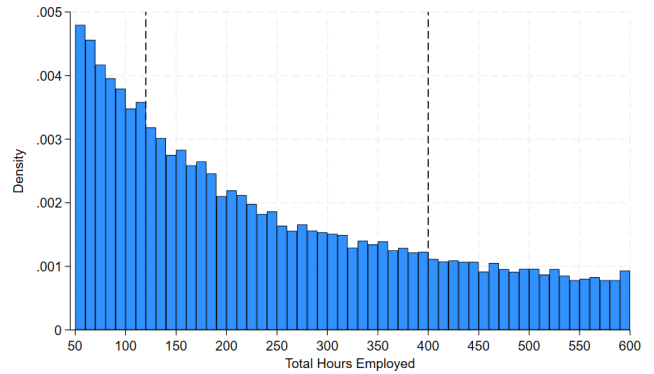
(a) Top 50 WOTC firm



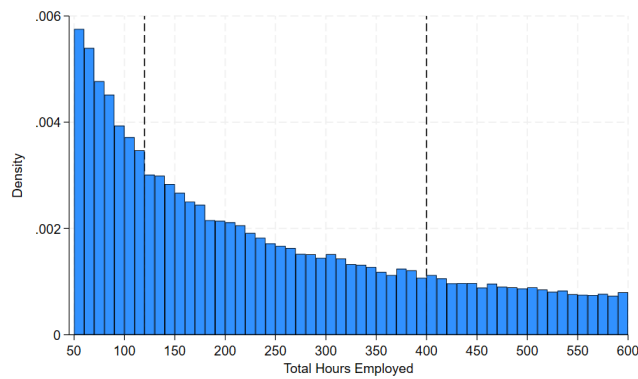
(b) WOTC high success firm



(c) Staffing firm



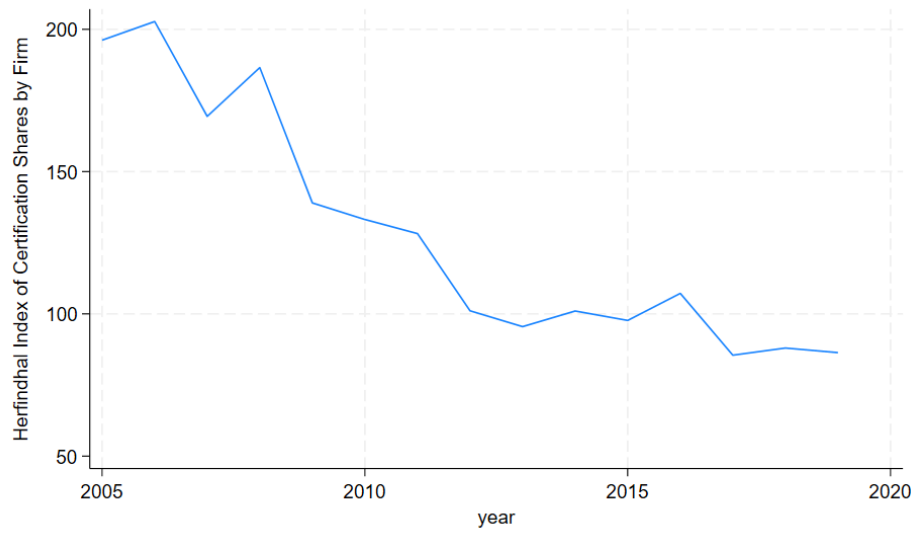
(d) 2007 to 2013



(e) 2014 to 2019

Note: These figures plot the distribution of total hours worked prior to separation for workers whose hiring was subsidized by WOTC and who were eligible for WOTC through SNAP receipt. Panel (a) plots this for workers at the 50 firms that most heavily use WOTC. Panel (b) plots this for the WOTC-utilizing firms who are in the top quartile in terms of applying to WOTC for WOTC eligible hires. Panel (c) plots this for workers at employment services firm (i.e. NAICS 5613). Panels (d) and (e) plot this for the years 2007 to 2013 and after 2014 across all firms.

Figure A12: Herfindahl index of WOTC certifications by year



Note: Panel b calculates a Herfindahl index for WOTC across firms in each year.

Figure A13: Examples of WOTC information collection on job applications

This employer participates in Federal and State tax credit programs such as the Work Opportunity Tax Credit (WOTC). These tax credit programs are offered by the federal government to increase hiring and improve retention of employees.

██████████ is an independent tax consulting firm that has been hired by this employer to administer this and other federal tax credit programs. Your participation in the survey is voluntary, and your decision to participate (or not to participate) will not have any negative effect on the consideration of your application for employment by this employer. All information you provide will be kept confidential by ██████████. Your answers to the survey questions will not be shared with this employer.

Check for more information

The security and protection of your personal information is very important to us. Any personal information you share with us is stored under layers of protection including encryption, firewalls and physical access restrictions. This site also uses 128 bit SSL encryption to protect your data during transmission to this site.

Save and continue

Save and finish later

(a) Example of third-party WOTC screening

WOTC Questionnaire

Please take a few moments to answer the following questions from the Work Opportunity Tax Credit Program (WOTC).

Please note that -

- The questions take less than 3 minutes to complete
- Your responses are voluntary and may assist members of targeted groups in securing employment
- Your answers will be kept strictly confidential and will not adversely affect your employment opportunity

Please read the following disclaimer:

Once you start the WOTC questionnaire the set language cannot be changed until finished.

Let's get started!

(b) Example of direct screening by the company

Note: This figure contains images from job applications that include WOTC screening questions.