Health Insurance and Labor Supply: Evidence from the Affordable Care Act Early Medicaid Expansion in Connecticut*

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Abstract

This paper examines how health insurance affects labor supply by exploiting a quasi-experimental change in health insurance provision under the Affordable Care Act (ACA) early Medicaid expansion in Connecticut implemented in 2010. Applying an instrumental variables approach to a difference-in-differences-in-differences strategy, I find remarkable labor supply impacts of the ACA early Medicaid expansion in Connecticut. I show evidence that Connecticut's Medicaid expansion *increased* Medicaid coverage for low–income childless adults by 5.9 percentage points, and as a result *reduced* the employment rate by 3.8 to 4.5 percentage points among those low–income childless adults. (JEL Codes: I13, I18, J22)

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1 Introduction

Health insurance coverage in the U.S. is tightly linked to employment status in that most private health insurance coverage is obtained through employer-sponsored insurance (ESI).[1] This suggests that some workers remain in jobs that provide ESI due to the fear of being unable to obtain ESI at a new job that better matches their skills or preferences; or stay being employed in order to maintain their health insurance (i.e., ESI) even if they would otherwise prefer not to work at all.[2] Therefore, the provision of health insurance untied to employment status (e.g., Medicaid) is likely to affect labor supply, especially for those who maintain their employment in order to secure their health insurance.

The literature on the effect of health insurance untied to employment status, especially Medicaid, on labor supply is unsettled. Some studies find that the Medicaid expansion decreases the labor supply of female household heads (Moffitt and Wolfe, 1992), pregnant women (Dave et al., 2015), and childless adults (Dague, DeLeire, and Leininger, 2014); the Medicaid contraction increases the labor supply of ever-married women (Yelowitz, 1995) and childless adults (Garthwaite, Gross, and Notowidigdo, 2014). In contrast, other studies show little to no impact on labor supply (Blank, 1989; Winkler, 1991; Montgomery and Navin, 2000; Ham and Shore-Sheppard, 2005; Strumpf, 2011; Baicker et al., 2014).

This paper examines the labor supply impact of Medicaid expansion by exploiting a quasi-experimental change in Medicaid provision – i.e., the Affordable Care Act (ACA) early Medicaid expansion in Connecticut implemented in 2010. The ACA early Medicaid expansion in Connecticut (HUSKY D program) allows low–income childless adults[3] aged 19 to 64 who were previously ineligible for Medicaid to be newly covered by Medicaid if their annual family income is at or below 56% of the Federal Poverty Level (FPL). The ACA early Medicaid expansion in Connecticut became effective on April 1, 2010. Prior to the Medicaid expansion in Connecticut, low–income childless

[1] For example, in 2007, about 92% of the non-elderly (under age 65) with private insurance coverage obtained their health insurance through ESI (Cohen, Makuc, and Bilheimer, 2009).

[2] These phenomena have been described as i) "job-lock" focusing on job mobility (Gruber and Madrian (1993); Madrian (1994)), and ii) "employment-lock" focusing on the decision to work at all (Garthwaite, Gross, and Notowidigdo (2014) among others)

[3] Childless adults are those who do not have a child under age 19.

adults were not covered by Medicaid unless they were disabled or pregnant and thus most of them had to work in order to obtain their ESI coverage as employees if they wanted to have any health insurance at all. Therefore, Connecticut's Medicaid expansion is likely to affect the labor supply of low–income childless adults as it provides them with Medicaid untied to their employment status.

To estimate the labor supply impact of Connecticut's Medicaid expansion, I use the difference-in-differences (DD) approach by comparing low–income childless adults in Connecticut to those in other states in the Census Northeast region[4] after Connecticut's Medicaid expansion (2011-2013) relative to before (2008-2010). I then apply the difference-in-differences-in-differences (DDD) strategy utilizing the income eligibility of the Medicaid expansion in Connecticut – i.e., only those childless adults with income up to 56% of the FPL are eligible for the expansion. More importantly, in order to address possible endogeneity issues (i.e., the income eligibility of the Medicaid expansion would be endogenous to the labor supply decisions of beneficiaries), I apply an instrumental variables approach to the DDD framework. The *predicted* eligibility (i.e., income up to 56% FPL) based on income determinants is used as a *generated instrument* for the eligibility status for Connecticut's Medicaid expansion.

Using the aforementioned approaches, I find remarkable labor supply impacts of the Medicaid expansion among low–income childless adults in Connecticut. I provide evidence that the Medicaid expansion in Connecticut increased Medicaid coverage for low–income childless adults by 5.9 percentage points (or 30% of the pre-expansion level of 19.7), and as a result reduced the labor supply – i.e., reductions in: i) percent employed by 3.8 to 4.5 percentage points (or 12 to 14% of the pre-expansion level of 32.5);[5] and ii) hours of work (per week) by 1.7 hours (or 22% of the pre-expansion level of 7.6).

These findings are similar to those of recent studies on the labor supply impacts of Medicaid in Tennessee (Garthwaite, Gross, and Notowidigdo, 2014) and in Wisconsin (Dague, DeLeire, and Leininger, 2014). Garthwaite, Gross, and Notowidigdo (2014) find the *contraction* of Medicaid in

[4]Other Northeastern states are Maine (ME), Massachusetts(MA), New Hampshire (NH), Jew Jersey (NJ), New York (NY), Pennsylvania (PA), Rhode Island (RI), and Vermont (VT).

[5]The overall reduction of 4.5 percentage points consists of a 3.8 percentage–point decrease in percent employed with ESI and a 0.7 percentage–point decrease in percent employed without ESI.

Tennessee *increased* the labor supply of childless adults (implied labor supply elasticity of 0.63), and Dague, DeLeire, and Leininger (2014) find the *expansion* of Medicaid in Wisconsin *reduced* the labor supply of childless adults by 2 to 24%. In the study of the Oregon Health Insurance Experiment, however, Baicker et al. (2014) find little impact of the Medicaid expansion on labor market outcomes mainly due to lack of the penetration of new Medicaid coverage to those who had private insurance (i.e., no crowd-out effect of Medicaid expansion) in the Oregon experiment setting (Finkelstein et al., 2012).[6]

In addition, I show that the reduced labor supply due to the Medicaid expansion in Connecticut was concentrated in three occupations (cashiers, retail salespersons, and waiters & waitresses) that more likely provided ESI to low-income childless adults before the expansion. This is consistent with an "employment-lock" phenomenon: those low-income childless adults with high valuation of health insurance had worked in occupations that provided ESI before the Medicaid expansion as they were less likely to have alternative sources of insurance; after the expansion, however, they did not have to maintain their employment solely to secure their health insurance (i.e., ESI) because they could obtain alternative health insurance untied to their employment status (i.e., Medicaid).

The paper is organized as follows. Section 2 provides a brief background on the ACA early Medicaid expansion in Connecticut. Section 3 describes the data. Section 4 outlines empirical strategies. Section 5 presents the empirical results, and Section 6 concludes.

2 Background on the ACA Early Medicaid Expansion in Connecticut

Under provisions of the ACA, each state has the option to expand Medicaid eligibility to those adults with incomes up to 138% of the Federal Poverty Level (FPL). There is no deadline for each state to implement the Medicaid expansion. As of April 1, 2014, 27 states including the District of Columbia decided to implement the ACA Medicaid expansion starting from January 1, 2014 (Kaiser

[6]One of the eligibility criteria requires the lottery–selected individuals to have been uninsured for six months, suggesting that *workers with ESI* who would have most likely responded to the Medicaid expansion in their labor supply were not eligible for the Oregon Medicaid expansion program.

Family Foundation, 2014). It is noteworthy that some states had expanded Medicaid before 2014. For example, six states have implemented the Medicaid expansion since the enactment of the ACA – i.e., Connecticut and the District of Columbia in 2010; California, Minnesota, New Jersey, and Washington in 2011 (Sommers et al., 2013; Sommers, Kenney, and Epstein, 2014).[7]

Connecticut is the first state in the nation to expand Medicaid coverage to low–income childless adults under the ACA of 2010. The Medicaid expansion in Connecticut under the ACA was approved on June 21, 2010 and effective retroactively from April 1, 2010 (State of Connecticut Department of Social Services, 2012).[8] In order to qualify for the Medicaid expansion in Connecticut (HUSKY D program)[9], an individual aged 19 through 64 must i) be a resident of Connecticut; ii) be a U.S. citizen or qualified immigrant[10]; iii) not receive federal Supplemental Security Income (SSI) or Medicare; iv) not have a child under age 19; and v) meet the income limit – i.e., annual income at or below 56% of the FPL.[11] For example, 56% of the FPL for a single person in 2010 was $6,064. Medicaid enrollees under this expansion receive the standard Medicaid benefit package for adults.[12]

Prior to the ACA Medicaid expansion in Connecticut, low–income childless adults were not covered by Medicaid unless they were disabled or pregnant and thus most of them had to work to obtain their ESI as a source of health insurance if they wanted to have any insurance at all. Therefore, Connecticut's Medicaid expansion would likely affect the labor supply of low–income childless adults, as it provides them with Medicaid coverage untied to their employment status.

It is noticeable that prior to 2010, Connecticut had a state-funded program, State Adminis-

[7]Note that Wisconsin also expanded Medicaid in 2009 (prior to the enactment of the ACA) to childless adults with incomes up to 200% of the FPL (Dague, DeLeire, and Leininger, 2014).

[8]Accordingly, in the empirical analysis, I consider years up to 2010 as the pre–expansion period.

[9]See State of Connecticut Department of Social Services (2013) and Connecticut Voices for Children (2014b) for detailed information.

[10]Ineligible immigrant groups include, but are not limited to: certain legal immigrant adults in the US for fewer than five years, undocumented immigrants, and immigrants with temporary status, such as students, temporary workers, and tourists.

[11]An additional 12% income disregard is allowed for shelter costs in Region A (Fairfield County) of Connecticut. In this paper, I focus on the income limit of 56% of the FPL (i.e., those not in Region A). Indeed, the American Community Survey (ACS) – the main data set used in this paper to examine the impact of Connecticut's Medicaid expansion – does not include Region A of Connecticut.

[12]This includes inpatient and outpatient hospital services; physician services; laboratory services; prescription drugs; mental health services; immunizations; and emergency services.

tered General Assistance (SAGA) that had almost the same eligibility rules as the 2010 Medicaid expansion except for a couple of conditions (e.g., the 2010 Medicaid expansion did not require an asset limit of $1,000). Indeed, 45,000 SAGA enrollees were transferred into Medicaid in 2010, and more importantly, an additional 36,000 were newly enrolled in Medicaid as of July 2012 (Connecticut Voices for Children, 2014a). Quite consistently, as will be shown in the Empirical Results section, I find an increase in the number of new Medicaid enrollees by 23,000 from 33,000 in 2009 to 56,000 in 2013. This suggests that the findings in this paper come from these newly enrolled beneficiaries.

3 Data

To estimate the labor market impact of the Medicaid expansion in Connecticut among low–income childless adults, I use the American Community Survey (ACS), which provides enough data for studying nine states – i.e., Connecticut (treatment group) and another eight states in the Census Northeast region (control group).[13] Specifically, I use an augmented version of the ACS, IPUMS (Integrated Public Use Microdata Series), prepared by the Minnesota Population Center. (Ruggles et al., 2015)

The ACS-IPUMS provides, among others, information on family interrelationships within a household and an individual's annual income as well. Based on this information, I calculate family income as a percentage of the Federal Poverty Level (FPL), a key variable for identifying the eligible population for the Medicaid expansion in Connecticut – i.e., childless adults with incomes up to 56% of the FPL. Furthermore, in order to define the "family unit" in determining the income eligibility for the Medicaid expansion, I use a general definition of the "health insurance unit" (HIU) proposed by the State Health Access Data Assistance Center (SAHDAC). The HIU is different from the Census definition of a family or a household in a specific way that it aims to construct family interrelationship measures in the ACS data so as to include all those individuals who would likely be considered a "family unit" in determining eligibility for public insurance, especially Medicaid

[13]Other states in the Census Northeast region are Maine (ME), Massachusetts (MA), New Hampshire (NH), New Jersey (NJ), New York (NY), Pennsylvania (PA), Rhode Island (RI), and Vermont (VT).

(State Health Access Data Assistance Center, 2012).

Using detailed information in the ACS-IPUMS data, I identify individuals as eligible for the Medicaid expansion in Connecticut if they i) are aged 19-64; ii) do not have a child under age 19; iii) do not receive federal Supplemental Security Income (SSI) or Medicare; iv) are U.S. citizens or non-citizens who have been living in the U.S. for 5 or more years[14]; and v) have annual family incomes at or below 56% of the Federal Poverty Level (FPL).

4 Empirical Strategy

4.1 Difference-in-Differences

To identify the effect of the ACA early Medicaid expansion in Connecticut, I estimate the following difference-in-difference (DD) regression:

$$Y_{ist} = \lambda_s + \delta_t + \theta \cdot CT_s \times Post_t + U_{ist} \tag{1}$$

where Y_{ist} is the outcome variable for individual i in state s in year t; λ_s are state fixed effects; δ_t are year fixed effects; CT_s is an indicator variable for Connecticut; and $Post_t$ is an indicator for the time period after the Medicaid expansion in Connecticut (i.e., 2011-2013). The parameter of interest is θ which captures the difference in outcome variables (e.g., employment status) between low–income childless adults in Connecticut (treatment group) and those in other Northeastern states (control group) after Connecticut's Medicaid expansion (i.e., 2011-2013) relative to before the expansion (i.e., 2008-2010).

In order to indirectly test the common trends in outcome variables between the treatment and control groups, a key identification assumption of the DD approach (i.e., common trends assumption), I include a time trend interacted with an indicator variable for Connecticut ($CT_s \times Trend_t$). If the two estimates of θ with and without this interaction term in equation (1) are similar

[14] I include those non-citizens as a proxy measure for the qualified immigrants under the Medicaid expansion in Connecticut. Indeed, the empirical results do not change even without using this measure.

to each other, it suggests that the common trends assumption likely holds.

I then modify the DD framework to better examine the timing of the effects, applying an "event-study" approach. I include separate dummy variables for each year before and after the Medicaid expansion as follows:

$$Y_{ist} = \lambda_s + \delta_t + \sum_{\kappa=2009}^{2013} \theta_\kappa \cdot \mathbf{1}\{t = \kappa\} \times CT_s + U_{ist} \tag{2}$$

where θ_κ measures the impact of Medicaid expansion relative to 2008 for the insurance coverage outcomes; and relative to 2006 for the labor supply outcomes.[15]

Furthermore, I apply the difference-in-differences-in-differences (DDD: triple differences) approach by utilizing the fact that only those childless adults with incomes at or below 56% of the FPL (as opposed to those with incomes higher than 56% up to 200 % of the FPL) are eligible for the Medicaid expansion in Connecticut. Then, the DDD regression takes the following form:

$$Y_{igst} = \eta_g + \lambda_s + \delta_t + \mu_{gs} + \nu_{gt} + \phi_{st} + \theta \cdot Eligible_i \times CT_s \times Post_t + U_{igst} \tag{3}$$

where η_g are income group (up to or higher than 56% of the FPL) fixed effects; μ_{gs}, ν_{gt}, and ξ_{st} are income group–by–state, income group–by–year, and state–by–year fixed effects, respectively; $Eligible_i$ is an indicator variable for childless adults with incomes at or below 56% of the FPL; and other variables are the same as in equation (1). The parameter of interest is θ.

For statistical inference of θ, I use cluster-robust standard errors – i.e., clustering standard errors at the state–level over time to allow for unrestricted serial correlation within a state over time. Notwithstanding, another concern may arise due to the small number of clusters (i.e., nine states in this paper) with which asymptotic properties of cluster–robust standard errors may not work well. Therefore, I use a wild cluster bootstrap–t procedure which may lead to improved inference when using a small number of clusters (Cameron, Gelbach, and Miller, 2008). Additionally, I use a type of exact inferential methods – i.e., a "permutation test" (Rosenbaum, 2002a,b). The distribution of

[15]Since the ACS data provide information on insurance only from 2008.

a test statistic is derived from applying the aforementioned DDD estimation iteratively by treating each one of the control states (other than Connecticut) as a treated state in each time – i.e., random permutations of the treatment assignment to control states.[16]

4.2 Instrumental Variables Approach

If there was an endogenous change in the labor supply of low-income childless adults in order to be eligible for the Medicaid expansion in Connecticut, the DD and DDD estimators explained above would be biased. In order to address this potential endogeneity issue, I apply an instrumental variables (IV) approach to the DDD strategy.

I use the *predicted* eligibility (i.e., income up to 56% FPL) as a *generated instrument* for the eligibility status for Connecticut's Medicaid expansion.[17] In order to estimate (generate) the instrument, Z_{ist}, I first estimate the following conditional probability model:

$$Z_{ist} = \Pr(Eligible_{ist} = 1|\mathbf{W}_{ist}) = G(\mathbf{W}'_{ist}\Pi) \equiv p(\mathbf{W}'_{ist}\Pi) \tag{4}$$

where $Eligible_{ist}$ is an indicator for the eligibility status (i.e., having family income up to 56% FPL); $\mathbf{W}_{ist}$ is a vector of pre-determined characteristics that are correlated with the income level – i.e., age, education, gender, race, ethnicity, and marital status; and $G(\cdot)$ is the logistic cumulative distribution function.

It is important to note that I do not use post-expansion data in estimating equation (4), because by doing so, $\widehat{\Pi}$ would be inconsistent if the income determinants are correlated with unobserved factors that affect eligibility status *after* the Medicaid expansion. For example, after the Medicaid expansion, a relatively less-educated and unmarried individual whose income is slightly above 56% FPL could have an incentive to reduce his income (especially by reducing labor supply) in order to become eligible for the Medicaid expansion.[18] If this is the case, the predicted eligibility,

[16] This type of test is also referred to as a "placebo test" or "falsification test" in the literature.

[17] Note that the predicted eligibility is used as an instrumental variable, rather than a plugged-in-fitted-variable in the outcome equation as in a typical two-stage least squares (2SLS) estimation.

[18] This is indeed a source of potential bias when using a typical difference-in-differences-in-differences strategy in the context of Connecticut's Medicaid expansion.

$\widehat{Z}_{ist}$, is not a valid instrumental variable – i.e., it is not exogenous to the Medicaid expansion.

Therefore, I use pre-expansion data (i.e., 2008-2009) to consistently estimate Π in equation (4) as follows:

$$Z_{is,pre} = \Pr(Eligible_{is,pre} = 1|\mathbf{W}_{is,pre}) = p(\mathbf{W}'_{is,pre}\Pi_{pre}) \tag{5}$$

where $\widehat{\Pi}_{pre}$ is a consistent estimator of Π to the extent that individuals did not have any incentives to reduce their income beneath 56% FPL *before* the Medicaid expansion. Hence, the predicted eligibility (generated instrument) from estimating equation (5) is a valid instrumental variable during the pre-expansion period:

$$\widehat{Z}_{is,pre} = \widehat{\Pr}(Eligible_{is,pre} = 1|\mathbf{W}_{is,pre}) = \widehat{p}(\mathbf{W}'_{is,pre}\widehat{\Pi}_{pre}) \tag{6}$$

I then calculate the predicted eligibility after the Medicaid expansion by applying the estimated coefficients, $\widehat{\Pi}_{pre}$, to the income determinants, $\mathbf{W}_{is,post}$:

$$\widehat{Z}_{is,post} = \widehat{\Pr}(Eligible_{is,post} = 1|\mathbf{W}_{is,post}) \equiv \widehat{p}(\mathbf{W}'_{is,post}\widehat{\Pi}_{pre}) \tag{7}$$

As long as the association between the observed income determinants and the income level (income up to 56% FPL) is constant over time in the absence of the Medicaid expansion – i.e., $\widehat{\Pi}_{pre} = \widehat{\Pi}_{post} = \widehat{\Pi}$, the predicted eligibility in (7) is a valid instrumental variable during the post-expansion period.

Finally, I apply an instrumental variables estimation (two-stage least squares (2SLS) estimation) to the DDD framework by estimating the following two equations:

$$Eligible_{ist} = \psi_s + \mu_t + \zeta_{st} + \phi \cdot \widehat{Z}_{ist} + V_{ist} \tag{8}$$

$$\begin{aligned} Y_{ist} &= \lambda_s + \delta_t + \phi_{st} + \gamma \cdot \widehat{Eligible}_{ist} + \widehat{Eligible}_{ist} \cdot \lambda_s + \widehat{Eligible}_{ist} \cdot \delta_t \\ &+ \theta \cdot \widehat{Eligible}_{ist} \times CT_s \times Post_t + U_{ist} \end{aligned} \tag{9}$$

where $\widehat{Z}_{ist}$ in equation (8) (the first-stage regression) is the generated instrument estimated from equations (6) and (7); and $\widehat{Eligible}_{ist}$ in equation (9) (the second-stage regression) is the fitted-value of the eligibility indicator from the first-stage regression.[19] The parameter of interest is θ. As long as the predicted eligibility (instrumental variable) is uncorrelated with the *change* in unobserved factors that might affect the labor supply, this IV-DDD estimator would be consistent. This identification assumption is likely to hold given that the predicted eligibility is estimated based on the *pre*-determined characteristics. For the statistical inference of θ, I apply the usual 2SLS standard errors because the fact that the instrument was estimated can be ignored (i.e., the standard error of $\widehat{\theta}$ does not need to be additionally adjusted) as long as $\widehat{\Pi}$ is consistent for Π and $\mathbf{W}_{ist}$ is mean-independent of U_{ist}.[20] I also report the p-values from the wild cluster bootstrap-t procedure given the small number of clusters.

5 Empirical Results

5.1 Summary Statistics

Table 1 presents summary statistics for low–income childless adults in Connecticut (treatment group) and other Northeastern states (control group) before and after Connecticut's Medicaid expansion. The treatment and control groups are quite similar based on baseline characteristics other than race. Prior to the Medicaid expansion in Connecticut, the treatment group was covered by Medicaid less than the control group, while they worked more than the control group. After the expansion, however, the Medicaid coverage of the treatment group *increased* by 7.7 percentage points (from 19.7 to 27.4) and their employment rate *decreased* by 6.2 percentage points (from 32.5 to 26.3). As a result, the pre-expansion differences in Medicaid coverage and the employment rate (hours of work as well) between Connecticut and other Northeastern states virtually disappeared after the expansion. Indeed, the treatment group's Medicaid coverage (employment rate) is slightly higher (lower) than the control group's after the Medicaid expansion.

[19] Indeed, I run 17 first-stage regressions to estimate the fitted values of the interaction terms ($\widehat{Eligible}_{ist} \cdot \lambda_s$, $\widehat{Eligible}_{ist} \cdot \delta_t$, and $\widehat{Eligible}_{ist} \times CT_s \times Post_t$) in addition to $\widehat{Eligible}_{ist}$.

[20] These are indeed sufficient conditions (see Wooldridge (2010)).

It is noteworthy that the 7.7-percentage-point increase in Medicaid enrollees in Connecticut corresponds to the increase of 23,000 enrollees (from 33,000 in 2009 to 56,000 in 2013). This increased number of enrollees is quite comparable to the number of *new* enrollees under Connecticut's Medicaid expansion, which is 36,000 as of July 2012 (Connecticut Voices for Children, 2014a). This strongly suggests that the empirical findings of this paper on the labor supply impact of Connecticut's Medicaid expansion shown below come from these newly enrolled Medicaid beneficiaries.

5.2 Effects on Medicaid Coverage

Panel A of Figure 1 shows Medicaid coverage of low–income childless adults with family incomes at or below 56% of the Federal Poverty Level (FPL) in Connecticut (solid line) and another eight states in the Census Northeast region (dotted line) from 2008 to 2013. The trends in Medicaid coverage between the treatment and control groups are very much parallel up to 2010 – i.e., prior to the ACA Medicaid expansion in Connecticut. In terms of *levels*, Medicaid coverage in Connecticut was lower than other Northeastern states by about 4 percentage points. After 2010, however, Medicaid coverage in Connecticut increased by 5 to 6 percentage points while other Northeastern states remained stable following their trend-level. As a result, Medicaid coverage of low–income childless adults in Connecticut became similar to (or little higher than) that of other Northeastern states.

Table 2 presents the DD estimates of the effect of the Medicaid expansion on insurance coverage. The DD estimates without covariates (Panel A) and with covariates (Panel B) are very similar as the covariates barely change over time. In terms of magnitudes, Panel B shows an increase in Medicaid coverage by 5.9 percentage points (or 30% of the pre–expansion rate of 19.7%) and in turn an increase in percent with public insurance by 5.6 percentage points. Noticeably, Column (3) shows a decrease in percent with ESI by 3.8 percentage points and a resulting decrease in percent with private insurance by 3.7 percentage points. This implies that the "crowd-out" rate (i.e., the ratio of the decrease in private insurance to the increase in public insurance) is about 66% in the context of Connecticut's Medicaid expansion. The magnitude of this crowd-out effect

of Medicaid on private insurance is very similar to those in the recent study of Garthwaite, Gross, and Notowidigdo (2014) and earlier studies (Cutler and Gruber, 1996; Gruber and Simon, 2008). Despite the fact that Garthwaite, Gross, and Notowidigdo (2014) study the *contraction* of Medicaid in Tennessee and I examine the *expansion* of Medicaid in Connecticut, the crowd-out magnitudes are very similar. This implies similar magnitudes of labor supply impacts with opposite directions, which will be shown to be the case in the next section.

5.3 Effects on Labor Supply

Panel B of Figure 1 shows employment rates of low–income childless adults in Connecticut and in other Northeastern states over time. Prior to Connecticut's Medicaid expansion (from 2008 to 2010), employment rates of low–income childless adults in both Connecticut and the other Northeastern states showed very similar trends with a higher employment rate in Connecticut by about 5 percentage points. After the Medicaid expansion (from 2011), the employment rate in Connecticut decreased by about 5 percentage points whereas there was no discernible change in the other Northeastern states, leading to virtually the same employment rates between Connecticut and the other Northeastern states. Taken together, Figure 1 shows that low–income childless adults in Connecticut had a lower level of Medicaid coverage but a higher employment rate than those in the other Northeastern states prior to the Medicaid expansion; and then became almost the same as those in the other Northeastern states after the Medicaid expansion.

In order to assure the common trends assumption, I extend the labor market outcomes back to 2006.[21] Figure 2 shows extremely parallel trends of labor market outcomes between low–income childless adults in Connecticut and those in the other Northeastern states prior to Connecticut's Medicaid expansion, providing strong graphical evidence of the common trends in labor market outcomes. Table 3 confirms this.

[21]The ACS provides information on labor market activities even before 2008 unlike information on insurance coverage available only from 2008 onwards. I extended the labor market outcomes no earlier than 2006 because Group Quarters (both institutionalized and non-institutionalized) were included in the ACS for the first time from 2006 and this change makes the earnings of people and the poverty estimates from the 2006 ACS not comparable with those estimates from earlier years (Webster and Bishaw, 2007).

Table 3 shows that the DD estimates without and with differential time trends between Connecticut and the other Northeastern states (Panel A.1 and B.1 corresponding to Panel A.2 and B.2) are very similar, which strongly supports the common trends assumption. In terms of the magnitudes of the labor supply impacts, Column (1) of Panel B.2 (estimates adjusted for covariates and differential time trends) shows a decrease in the employment rate by 5.8 percentage points (or 18% of the pre–expansion rate of 32.5%). Columns (2) and (3) show that most of the decreased employment comes from those working less than 30 hours per week. In addition, Column (4) shows a decrease in hours of work (per week) by 1.2 hours (or 16% of the pre–expansion level of 7.6 hours).[22]

More importantly, in Column (5) of Table 3, I estimate a change in percent employed *with* ESI in order to measure how much of the overall labor supply responses resulted from the availability of Medicaid coverage as an alternative insurance to ESI (the substitution effect). The DD estimate shows a 3.5 percentage–point decrease in employment with ESI. This estimate suggests that a 2.3 percentage–point decrease in the employment rate (out of the overall 5.8 percentage–point decrease in Column (1)) might be driven by the income effect. For example, low–income childless adults who worked *without* ESI before the expansion effectively become wealthier by obtaining Medicaid coverage after the expansion, and thus likely to reduce their labor supply. Therefore, a 3.5 percentage–point decrease would be a lower bound estimate of the labor supply impact of Connecticut's Medicaid expansion. This, along with the increase in Medicaid coverage by 5.9 percentage points (as shown in Column (1) in Panel B of Table 2), implies that 59 % of low–income childless adults enrolled in the expanded Medicaid in Connecticut reduced their labor supply after obtaining Medicaid coverage.

The estimates of the labor supply impacts of the Medicaid expansion are similar in magnitude to those of recent studies on Medicaid in Tennessee (Garthwaite, Gross, and Notowidigdo, 2014)

[22]I show that the decrease in hours of work occurred along the extensive margin. Appendix Figure A1 shows the distribution of hours of work (per week) among low–income childless workers with incomes up to 56% of the FPL before and after Connecticut's Medicaid expansion. As shown in Panel A, hours of work (per week) among those workers in Connecticut decreased between before and after the Medicaid expansion across all hours–of–work bins. Indeed, the DD estimate for hours of work (per week) conditional on working is statistically zero (coefficient: 0.09; t–ratio: 0.64). By contrast, Panel B shows an increase in hours of work (per week) among those workers in the other Northeastern states across hours–of–work bins.

and in Wisconsin (Dague, DeLeire, and Leininger, 2014). Garthwaite, Gross, and Notowidigdo (2014)'s study on the Medicaid *contraction* in Tennessee find that about 54 to 63% of people who lost their Medicaid coverage increased labor supply. Dague, DeLeire, and Leininger (2014) also show that the Medicaid *expansion* in Wisconsin reduced the labor supply of childless adults by 2 to 24%. By contrast, in the study of the Oregon Health Insurance Experiment, Baicker et al. (2014) find little impact on labor market outcomes of the Medicaid expansion. This is likely the result of the lack of a crowd-out effect – i.e., the Medicaid expansion did not affect (reduce) private insurance coverage (Finkelstein et al., 2012). Indeed, one of the eligibility criteria requires lottery-selected individuals to have been uninsured for six months, and thus workers *with* ESI who would have most likely responded to the Medicaid expansion in their labor supply were not even eligible for the Oregon Medicaid program.

The findings above show that the effects of Connecticut's Medicaid expansion on insurance coverage and labor supply are remarkably large. In order to verify that the estimated effects are not driven by random chance, I conduct a permutation test. Figure 3 provides a simplified version of permutation tests. Panel A plots the distribution of annual changes in Medicaid coverage in each state in the Northeast region during the 2008–2012 period. The vertical line indicates the annual change in Connecticut from 2010 to 2011 (i.e., the change right after its Medicaid expansion relative to before). As shown, the increase in Medicaid coverage in Connecticut is extremely large relative to the distribution of the annual changes estimated from the control states that did not expand the Medicaid. Indeed, the annual increase in Medicaid coverage in Connecticut from 2010 to 2011 is largest among all annual changes in other states during the 2008–2012 period.

Similarly, Panel B of Figure 3 shows the distribution of annual changes in the employment rate in each state during the 2008–2012 period. The decrease in the employment rate in Connecticut after the expansion (2011) relative to before (2010) is unusually large. Indeed, the probability of estimating the annual decrease in the employment rate in Connecticut from 2010 to 2011, under random permutations of the Medicaid expansion status to other control states, is 0.056.[23]

[23]Appendix Figure A2 shows the result of permutation tests using all states (other than Connecticut) in permutations. Both the increase in Medicaid coverage and the decrease in employment rate in Connecticut from 2010 to 2011 are exceptionally large relative to the distribution of the annual changes of all other states during the 2008-2012

I next assess whether the timing of the estimated effects lines up with the implementation of Connecticut's Medicaid expansion in 2011 (the first full-year of the expansion). I apply an "event-study" analysis by estimating equation (2). Figure 4 plots $\widehat{\theta}_{\kappa}$ (along with its 95% confidence interval) in equation (2) for Medicaid coverage (Panel A) and the employment rate (Panel B). Since the ACS data provides information on insurance only from 2008, I estimate $\widehat{\theta}_{2009}$ to $\widehat{\theta}_{2013}$ (relative to 2008) for Medicaid coverage, while $\widehat{\theta}_{2007}$ to $\widehat{\theta}_{2013}$ (relative to 2006) are estimated for employment rate. As evidently shown together, the timings of both the increase in Medicaid coverage and the decrease in employment rate match exactly with the timing of Connecticut's Medicaid expansion in 2011. In addition, the changes are immediate and upholding over time after the expansion (at least over the course of three years). For example, the Medicaid coverage for low-income childless adults started increasing from 2011, and the increase remains similar in the following years. Also, the employment rates started decreasing from 2011, and stays at the same level of decrease over the years. The corresponding estimates are shown in Appendix Table A1.

5.4 Difference-in-Differences-in-Differences (DDD) Estimation

In this section, I apply the difference-in-differences-in-differences (DDD) strategy. First, as a falsification check of the DD estimates presented above, I examine the Medicaid coverage and the labor supply of those childless adults with family incomes *higher* than 56% of the FPL (up to 200% of the FPL). If the reduced labor supply of eligible childless adults with incomes up to 56% of the FPL was driven by Connecticut-specific factors other than the Medicaid expansion, one would see a similar pattern of (a decrease in) labor supply among childless adults with incomes *higher* than 56% of the FPL as well. However, this is not the case as will be shown below.

Panel A of Figure 5 shows Medicaid coverage of childless adults with incomes higher than 56% up to 200% of the FPL in Connecticut (solid line) and the other Northeastern states (dotted line) from 2008 to 2013. As would be expected given the ineligibility of these populations for the Medicaid expansion, there was no change in Medicaid coverage between pre– and post–expansion periods in either Connecticut or the other Northeastern states. Panels B through D of Figure 5 show the

period.

labor market outcomes of those ineligible populations in Connecticut and the other Northeastern states from 2006 to 2013. The trends of labor market outcomes for those in Connecticut and in the other Northeastern states are very similar, and more importantly there seems to be no differential changes in the labor market outcomes before and after the expansion between Connecticut and other Northeastern states. The DD estimates reported in Table 4 are consistent with these graphical results: no impact of Medicaid expansion on Medicaid coverage and the labor supply of those ineligible population.[24]

Now, I turn to the the difference-in-differences-in-differences (DDD) estimation based on the fact that only those childless adults with income up to 56% of the FPL are eligible for Connecticut's Medicaid expansion. Table 5 presents the DDD estimates. The estimates after adjusting for covariates (Panel B) show that Connecticut's Medicaid expansion increased Medicaid coverage for low–income childless adults by 6.1 percentage points; and as a result reduced the labor supply of those low–income childless adults by 5.6 percentage points. Indeed, the magnitudes the estimates are very similar to those of DD estimates shown in Tables 2 and 3.

5.5 Instrumental Variables Estimation in the DDD Framework

In this section, I apply an instrumental variables approach to the difference-in-differences-in-differences (DDD) framework in order to address possible endogeneity issues – i.e., the income eligibility of the Medicaid expansion could be endogenous to the labor supply decisions of beneficiaries.

Figure 6 plots the actual fraction of the eligible individuals (i.e., the treatment status) against the predicted probability of being eligible for the Medicaid expansion (i.e., the instrumental variable).[25] This is a graphical version of the first-stage regression. If the predicted eligibility is strongly correlated with the actual fraction of the eligible population, the dots in the figure would

[24] As an alternative falsification check, I apply the DD estimation strategy to another ineligible population – i.e., low-income *parents*. Appendix Table A2 confirms no impact of Medicaid expansion on the labor supply of this ineligible population.

[25] I divide the data into 100 equal-sized cells based on the predicted probability of being eligible – i.e., percentile of the predicted probability $\widehat{p}(\mathbf{W}'_{ist}\widehat{\Pi})$

be along the 45-degree line. In fact, the figure shows a strong first-stage relationship between the instrumental variable and the treatment variable. The F-statistic of the first-stage regression of the eligible status on the predicted eligibility is 2,016.91.

Figure 7 shows the reduced-form relationship between the outcome variables (changes in Medicaid coverage and the employment rate) and the instrumental variable (the predicted probability of being eligible for the Medicaid expansion).[26] Panel A plots the change in Medicaid coverage after the expansion (2013) relative to before (2010) in Connecticut (left Panel) and in the other Northeastern states (right Panel). It shows the increase in Medicaid coverage only in Connecticut, but not in the control states, which is consistent with the fact that the Medicaid expansion was implemented only in Connecticut. Similarly, Panel B shows a decrease in the employment rate from 2010 to 2013 only in Connecticut (left Panel), while no change in the other Northeastern states (right Panel).

Table 6 presents the IV-DDD estimates. It shows that the Medicaid expansion in Connecticut increased Medicaid coverage by 5.9 percentage points (or 30% of the pre-expansion level of 19.7), and as a result it reduced: i) the employment rate by 3.8 to 4.5 percentage points[27] (or 12 to 14% of the pre-expansion level of 32.5); and ii) hours of work (per week) by 1.7 hours (or 22% of the pre-expansion level of 7.6) among low-income childless adults. Noticeable is that the magnitudes of the estimates are very similar to those of the DDD estimates reported in Table 5. This suggests that endogenous labor supply in order to become eligible for the Medicaid expansion is less of a concern.

In order to assess that the estimated effects above are not driven by unobserved Connecticut-specific factors (other than the Medicaid expansion), I perform a placebo test by estimating changes in Medicaid coverage and labor supply *before* Connecticut's Medicaid expansion – i.e., changes from 2008 to 2010 – applying the same IV-DDD approach used above. If the estimated effects above were

[26] Note that comparing the change in the outcome variables in (almost) zero-percentile to that in 100-percentile of the estimated probability is equivalent to the change in the outcome variables by an indicator variable of actual eligibility.

[27] The reductions in i) percent employed with ESI (Column (5)) by 3.8 percentage points; and ii) percent employed (Column(2)) by 4.5 percentage points. This implies that the overall reduction of 4.5 percentage points consists of a 3.8 percentage–point decrease in percent employed with ESI and a 0.7 percentage–point decrease in percent employed without ESI.

indeed driven by Connecticut-specific factors, not by its Medicaid expansion, then similar effects should be found even before the Medicaid expansion. Appendix Figure A3 plots the association between changes in the outcome variables before the Medicaid expansion and the instrumental variable. As shown, there is no discernible association. The corresponding IV-DDD estimates in Appendix Table A3 confirms this: no change in Medicaid coverage, and an increase, if any, in labor supply.

Overall, the IV-DDD estimates show that the Medicaid expansion in Connecticut increased Medicaid coverage substantially; and as a result it remarkably reduced the labor supply of low-income childless adults.

5.6 Analysis by Occupation

The findings so far show that the Medicaid expansion in Connecticut reduced the labor supply of low–income childless adults. I argue that this labor supply impact of the Medicaid expansion is driven by enrollees' relatively high valuation of insurance. To test this, I examine the labor supply of low–income childless adults by occupation. I hypothesize that low–income childless adults working in occupations that more likely provide ESI (measured by the number of workers with ESI within an occupation) would reduce their labor supply more than those working in other occupations, assuming that workers in occupations that provide ESI have a relatively high valuation of insurance.

Panel A of Figure 8 plots percent changes in the number of low–income childless workers (with incomes at or below 56% of the FPL) in Connecticut from 2008-2010 to 2011-2013 by the number of workers with ESI prior to the Medicaid expansion (2008-2010) in each occupation. It shows that the post-expansion reduction in employment is intensified in occupations that more likely provided ESI before the expansion. Noticeably, the reduced labor supply was concentrated in three occupations (i.e., cashiers, retail salespersons, and waiters & waitresses.) that most likely provided ESI to low-income childless workers before the Medicaid expansion. By contrast, Panel B of Figure 8 shows that the number of low–income childless adults who worked in these three occupations in the other Northeastern states increased as they would prefer working in those occupations that

provide ESI.

As a falsification check, Appendix Figure A4 plots percent changes in the number of childless workers ineligible for the Medicaid expansion (with incomes *higher* than 56% of the FPL). Panel A shows that even in Connecticut, the number of those workers ineligible for the expansion indeed increased in occupations that more likely provided ESI as they would seek to obtain health insurance through their jobs given their ineligibility for Medicaid. Panel B also shows the same pattern in the other Northeastern states.

The result from the occupation-level analysis is consistent with an "employment-lock" phenomenon: those low-income childless adults with high valuation of health insurance had worked in occupations that provided ESI before the Medicaid expansion as they were less likely to have alternative sources of insurance; after the expansion, however, they did not have to remain employed solely to secure their health insurance (i.e., ESI) because they could obtain health insurance untied to their employment status (i.e., Medicaid).

6 Conclusion

In this paper, I examine the labor supply impacts of the ACA early Medicaid expansion in Connecticut. I find remarkable labor supply impacts of Connecticut's Medicaid expansion – i.e., reduction in the labor supply of low–income childless adults on the extensive margin. The implied labor supply elasticity of Connecticut's Medicaid expansion is -0.64 to -0.76. This finding suggests that some workers maintain their employment to secure their health insurance coverage, which is consistent with an "employment-lock" phenomenon.

It is important to note that the reduced labor supply of low–income childless adults resulting from the Medicaid expansion does not necessarily imply a decrease in social welfare. For example, if a job at which a low–income childless adult chooses not to work is taken by someone else who has more productive skills for that job, social welfare will be increased. The welfare implications of the labor market effects of health insurance untied to employment status, although beyond the scope of this paper, would be an important venue for future research.

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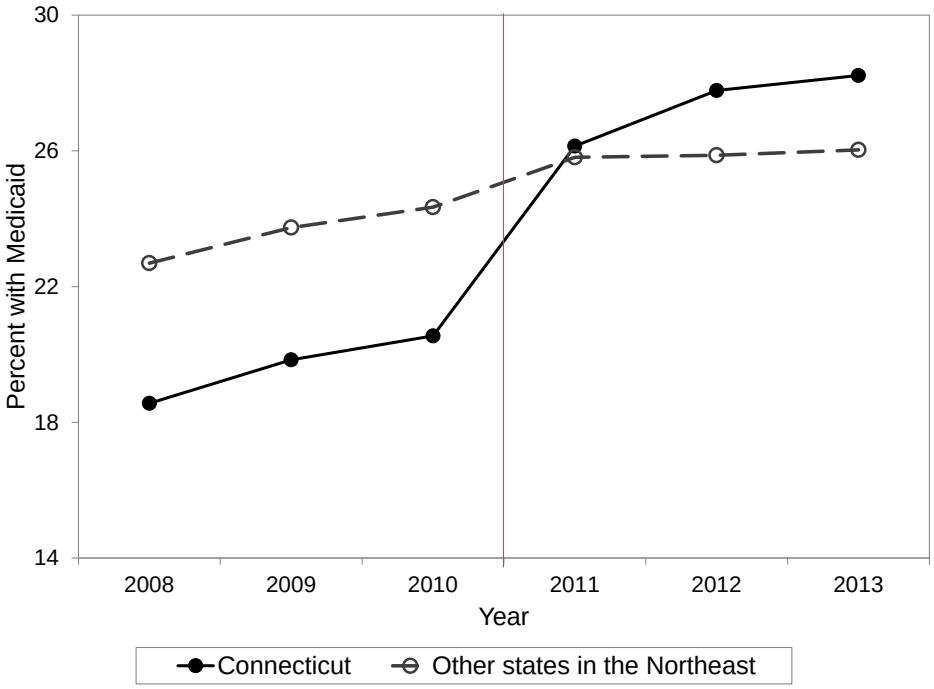
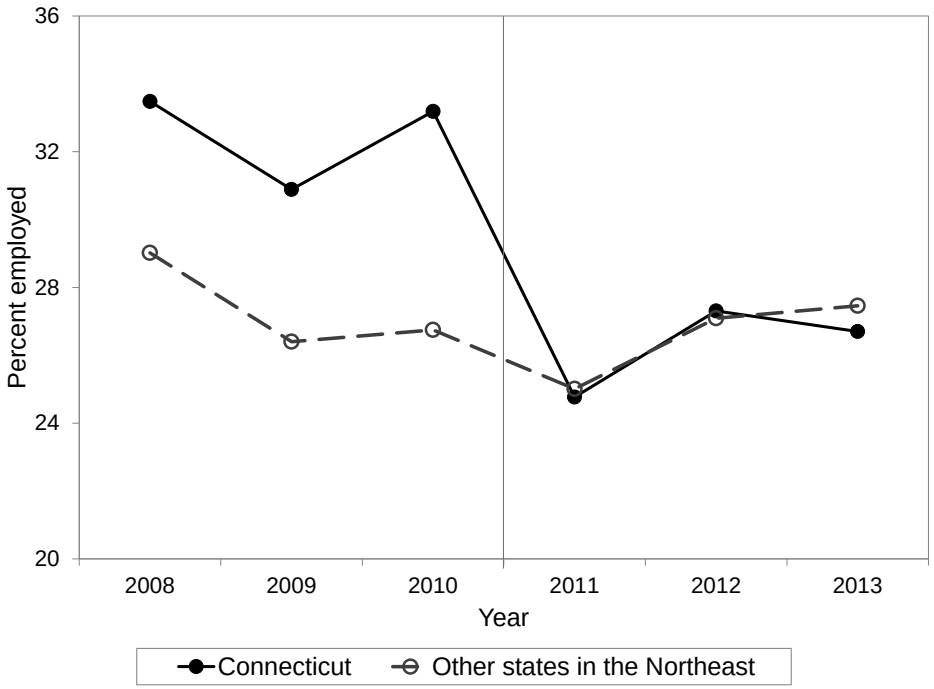
Figure 1: Medicaid and employment, childless adults with incomes at or below 56% FPL

Panel A. Percent with Medicaid



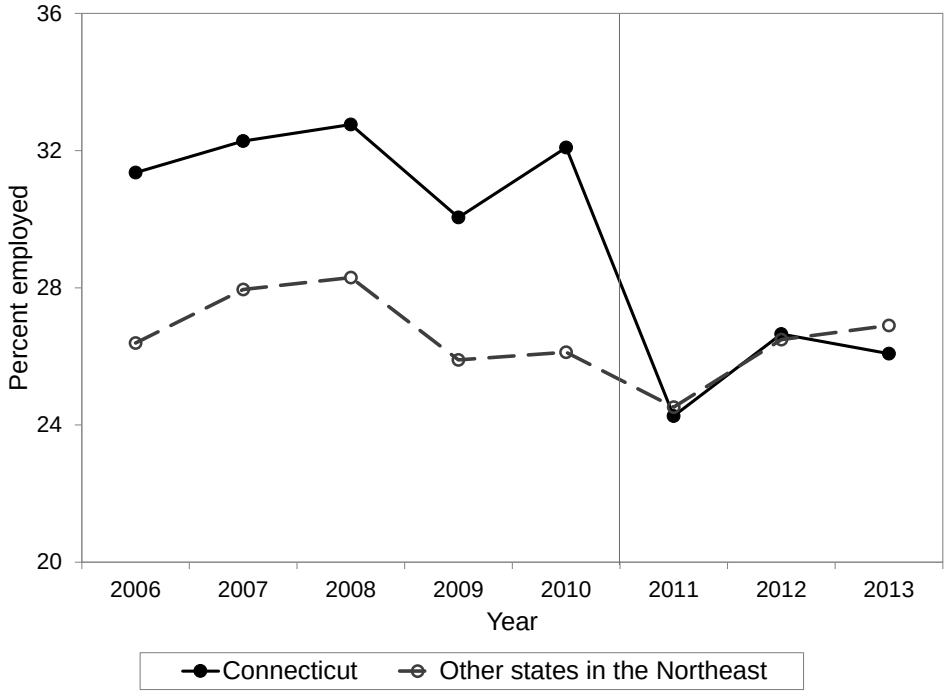
Panel B. Percent employed



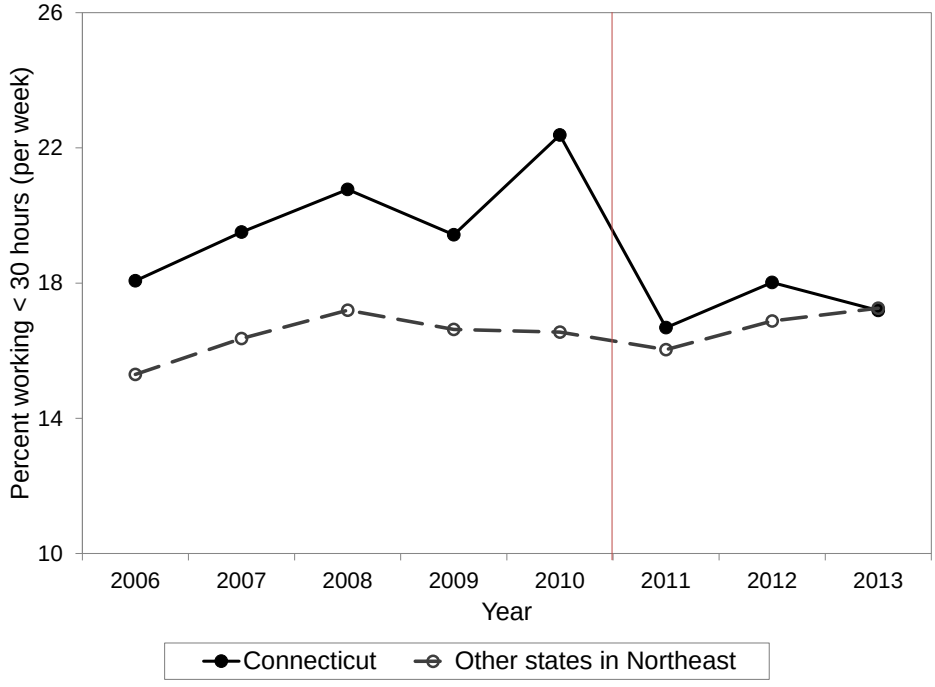
Notes: Figures include individuals aged 19 to 64 without a child (childless adults) and whose family incomes are at or below 56% of the Federal Poverty Level (FPL). The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

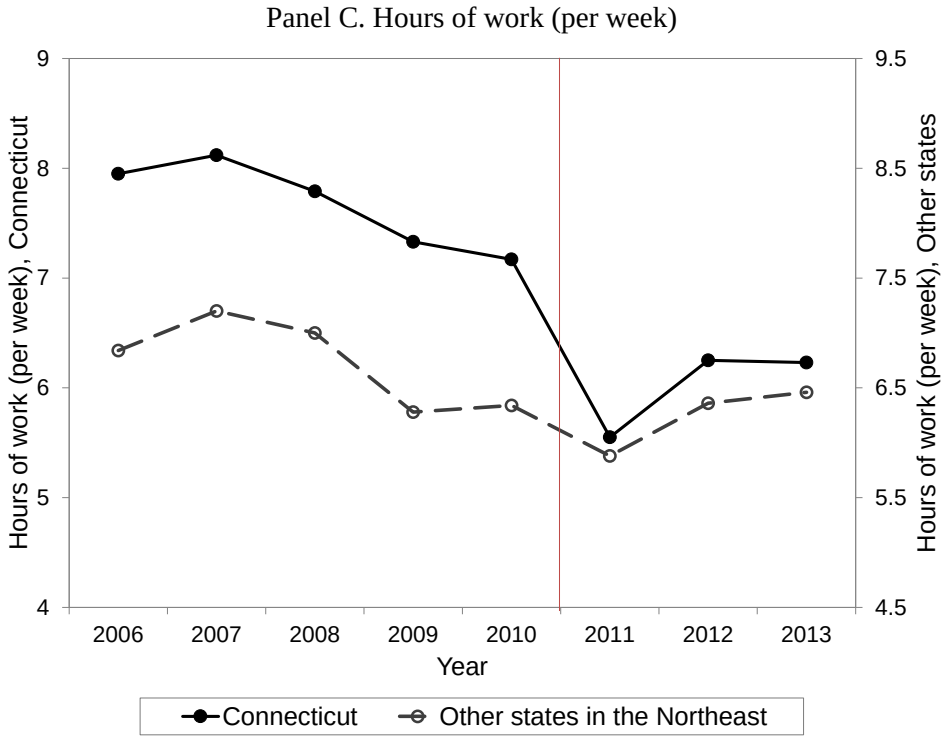
Figure 2: Labor market outcomes of childless adults with incomes at or below 56% FPL

Panel A. Percent employed



Panel B. percent working less than 30 hours (per week)

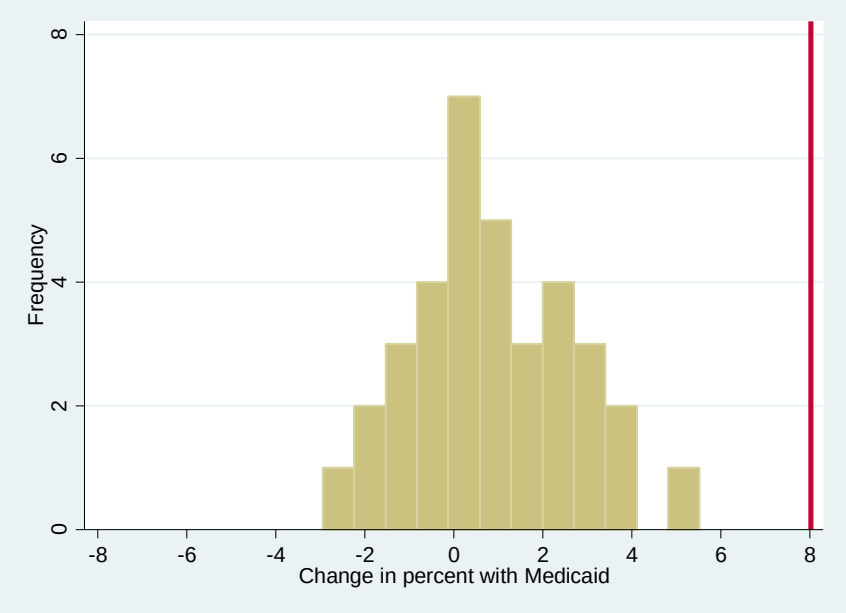




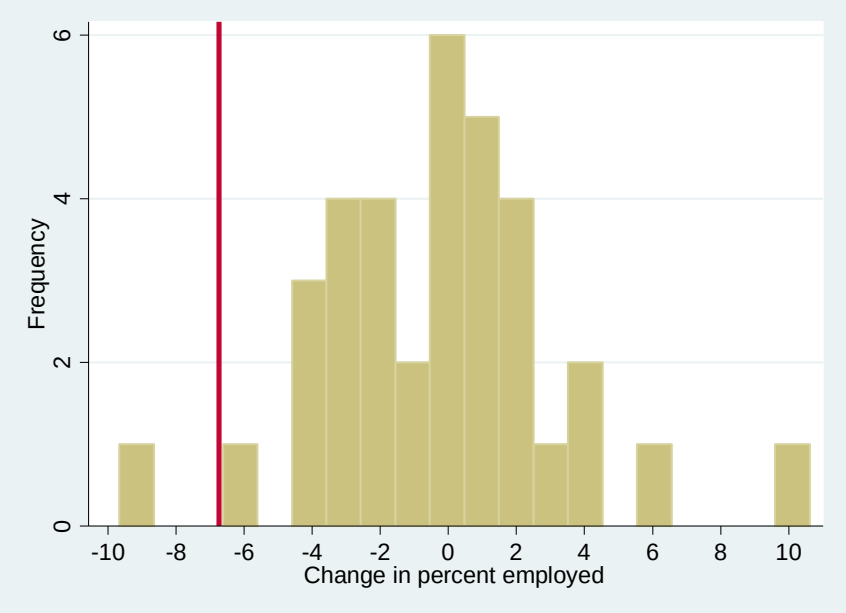
Notes: Figures include individuals aged 19 to 64 without a child (childless adults) and whose family incomes are at or below 56% of the Federal Poverty Level (FPL). The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

Figure 3: The distribution of annual changes, Northeastern states

Panel A. Percent with Medicaid



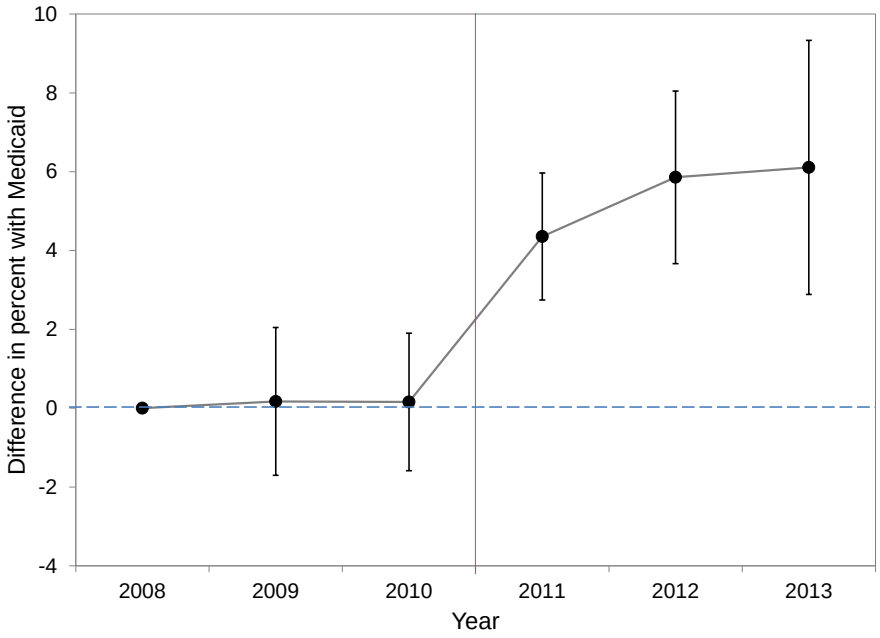
Panel B. Percent employed



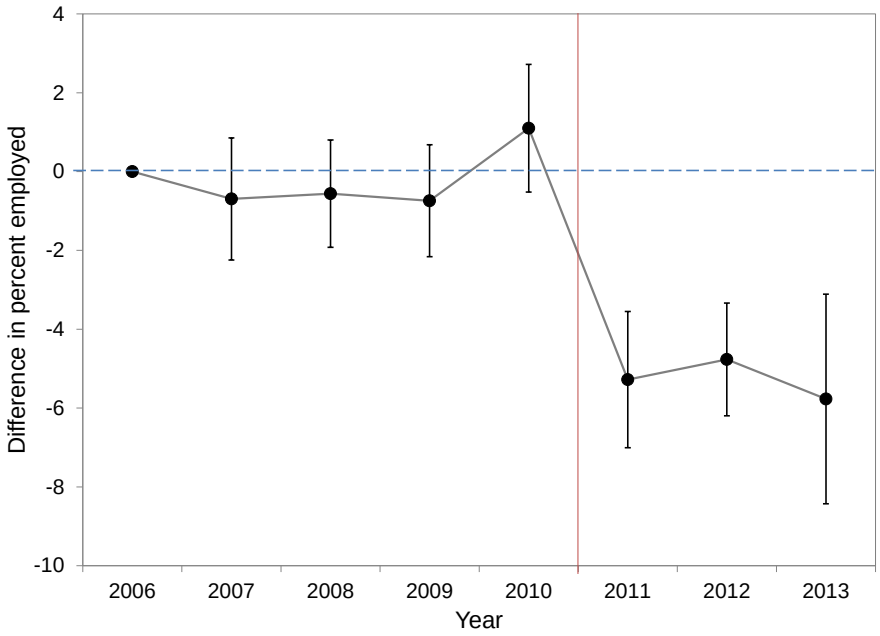
Notes: Figures plot the distribution of the annual changes in Medicaid coverage rate (Panel A) and employment rate (Panel B) within each state in the Northeast from 2008 to 2012 for those childless adults aged 19 to 64 whose family incomes are at or below 56% of the Federal Poverty Level (FPL). The vertical line indicates the 2010-2011 annual change of Connecticut. The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

Figure 4: Event study for Medicaid coverage and employment rate

Panel A. Difference in Medicaid coverage between Connecticut and other states, relative to 2008



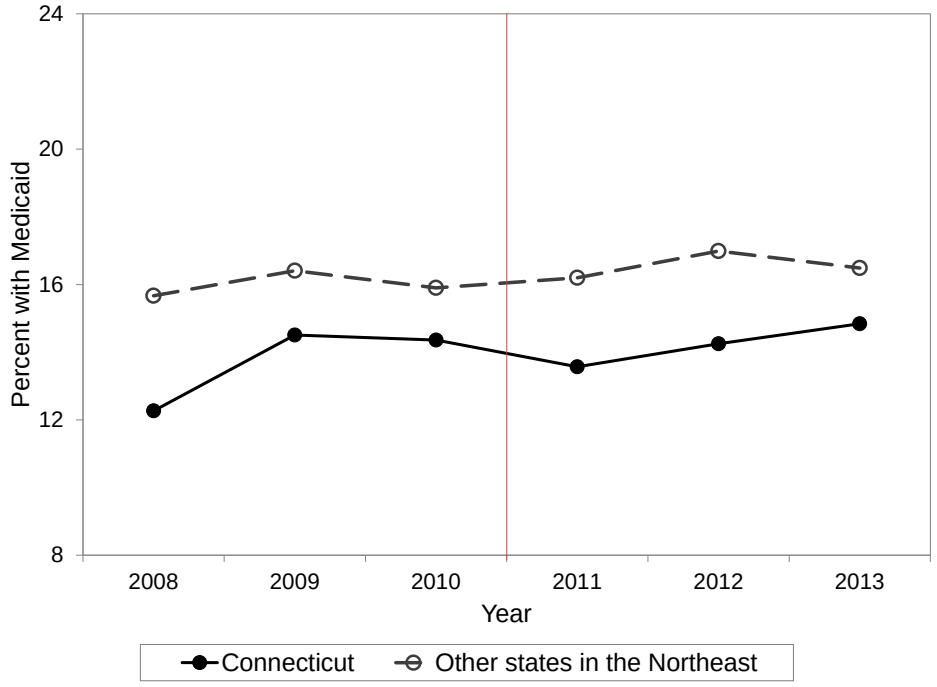
Panel B. Difference in percent employed between Connecticut and other states, relative to 2006



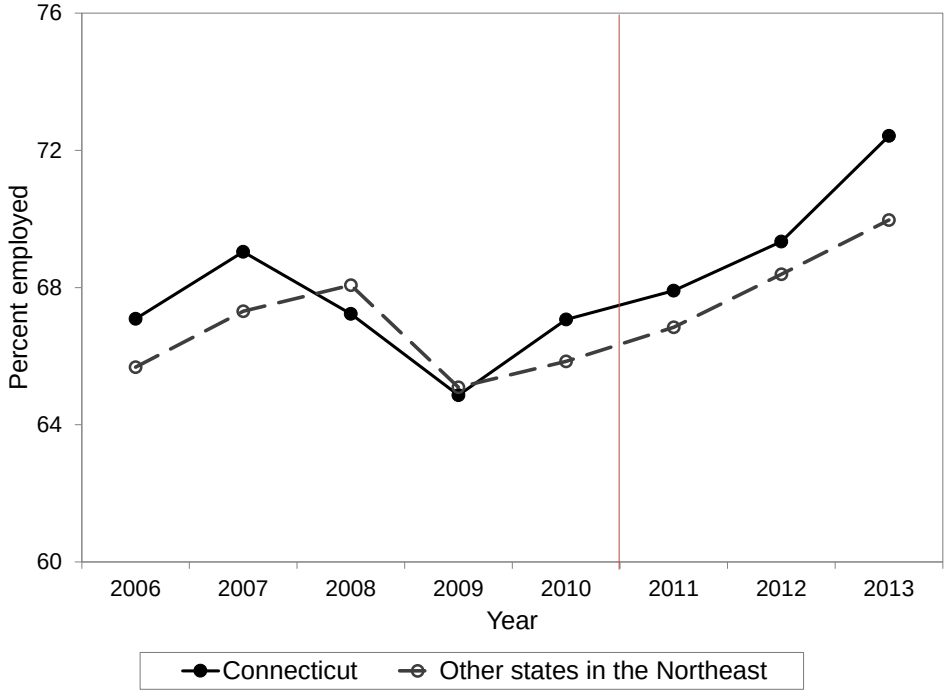
Notes: Figures plot the coefficient θ_κ along with 95% confidence intervals (vertical lines with bars) in equation (2). Standard errors are adjusted for heteroscedasticity and clustered at the state level. Samples include individuals aged 19 to 64 without a child (childless adults) and whose family incomes are at or below 56% of the Federal Poverty Level (FPL). The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

Figure 5: Medicaid and labor market outcomes of childless adults with incomes of 56~200% FPL (falsification check)

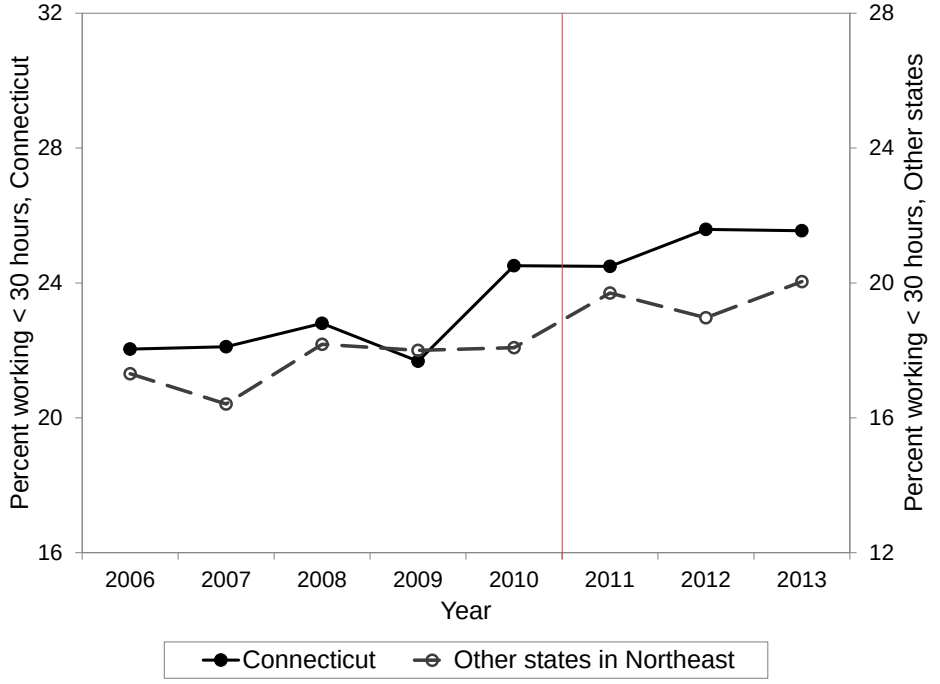
Panel A. Percent with Medicaid



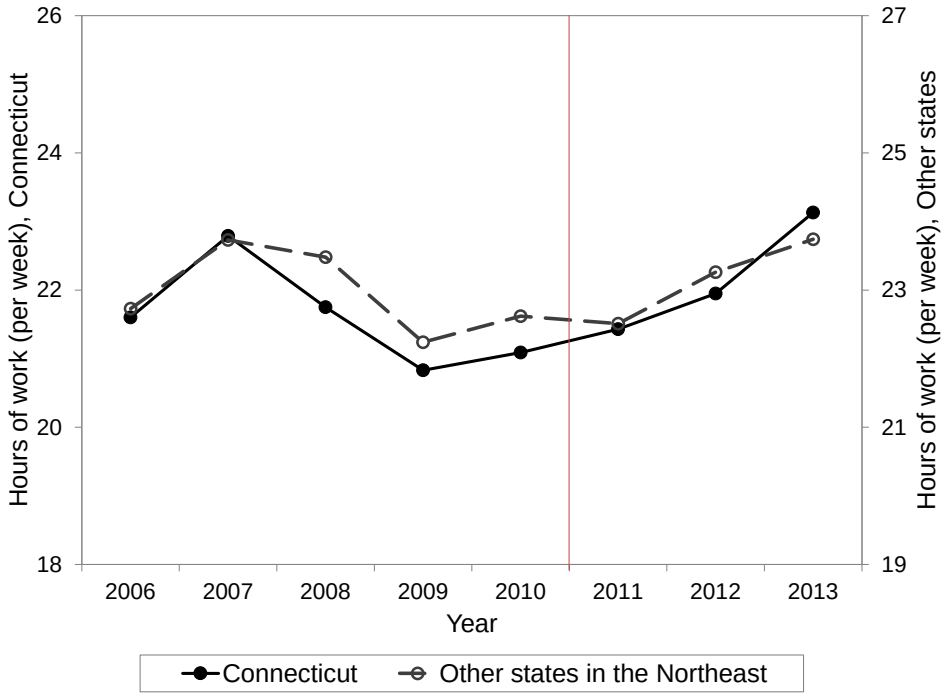
Panel B. Percent employed



Panel C. Percent working less than 30 hours (per week)

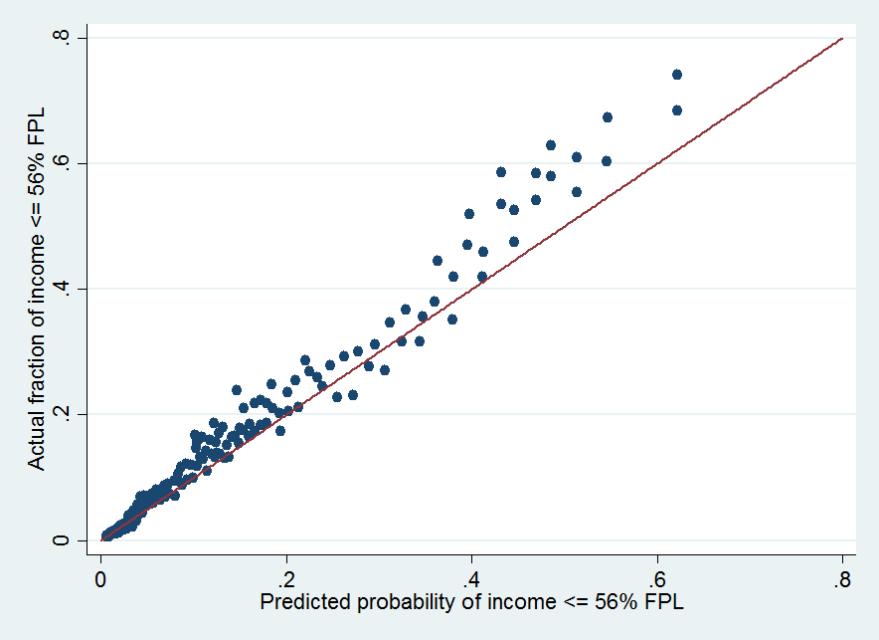


Panel D. Hours of work (per week)



Notes: Figures include individuals aged 19 to 64 without a child (childless adults) and whose family incomes are between 56% and 200% of the Federal Poverty Level (FPL). The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

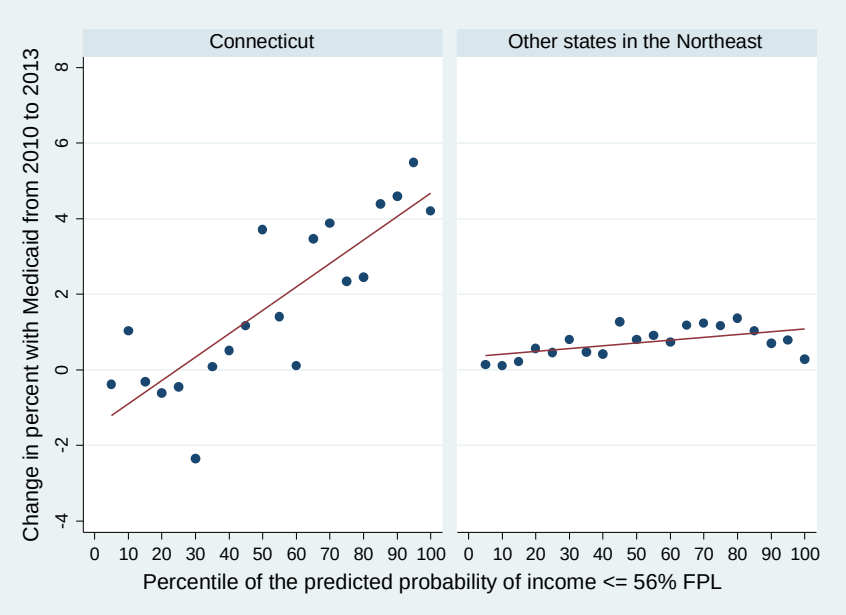
Figure 6: Actual eligibility by predicted eligibility



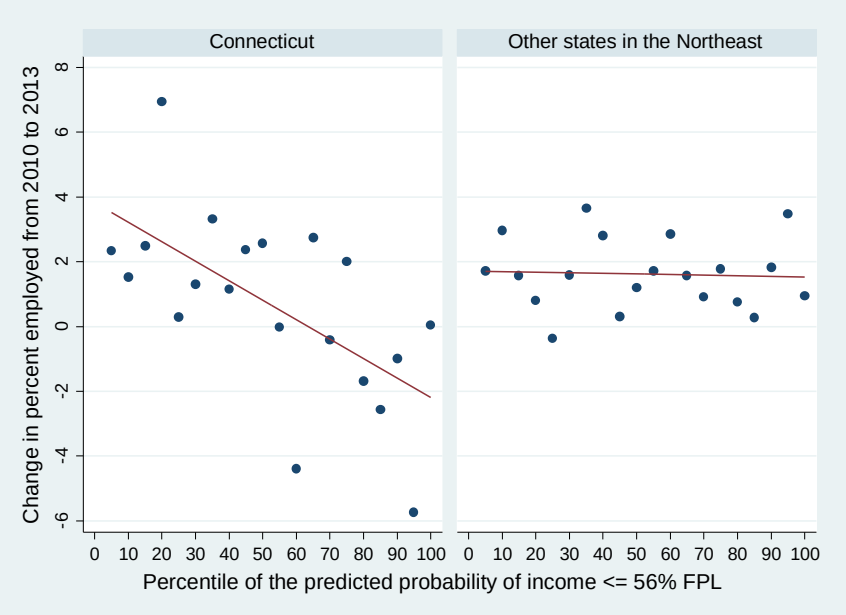
Notes: The predicted probability of having income up to 56% FPL (i.e., eligible for the Medicaid expansion) is estimated by a logit model as specified in equation (4). The dots represent 100 equal-sized cells based on the predicted probability (i.e., percentile of the predicted probability). Samples include individuals aged 19 to 64 without a child (childless adults).
Source: American Community Survey (ACS).

Figure 7: Changes in Medicaid coverage and employment rate by predicted eligibility

Panel A. Change in percent with Medicaid



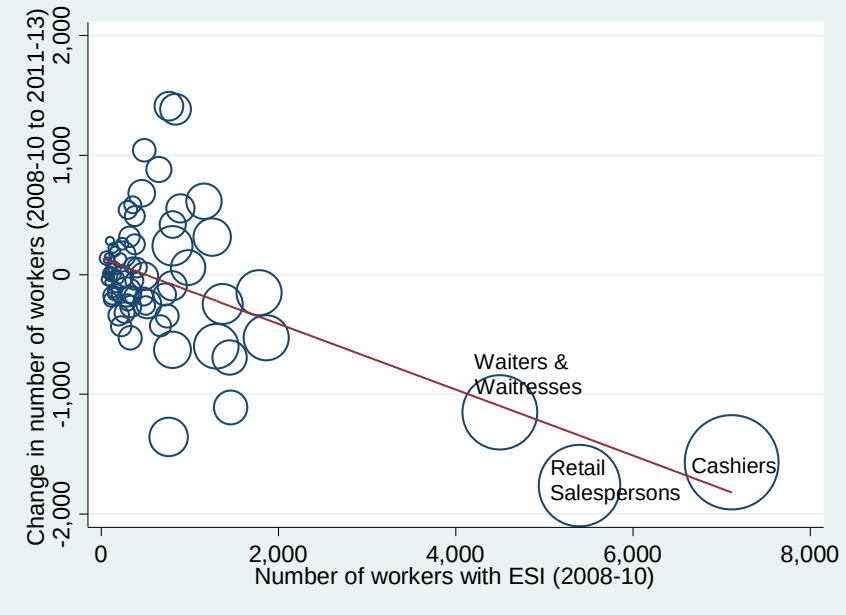
Panel B. Change in percent employed



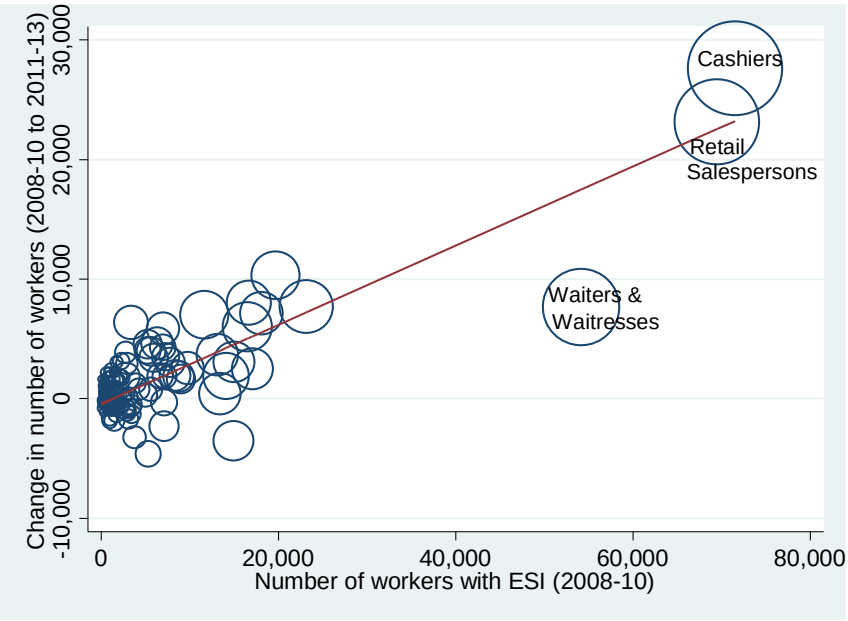
Notes: The predicted probability of having income up to 56% FPL (i.e., eligible for the Medicaid expansion) is estimated by a logit model as specified in equation (4). The dots represent 20 equal-sized cells based on the predicted probability. Samples include individuals aged 19 to 64 without a child (childless adults).
Source: American Community Survey (ACS).

Figure 8: Change in number of workers by occupation,
childless adults with incomes up to 56% FPL

Panel A. Connecticut



Panel B. Other states in the Northeast



Notes: Figures include individuals employed and working less than 30 hours per week. Each circle represents an occupation. The size of a circle shows the number of workers in 2008-2010. The lines are fitted values from an occupation-level linear regression of changes in the number of workers (from 2008-2010 to 2011-2013) on the number of workers with ESI (in 2008-2010) weighed by the number of workers in 2008-2010. The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

Table 1: Summary Statistics

	Connecticut (1)	Other states (2)	Difference (3)	P-value (4)
A. Characteristics (2008-2010: pre-expansion)				
Age	30.60	30.45	0.16	0.536
Female (%)	46.20	47.55	-1.35	0.160
Whites (%)	71.14	64.26	6.88***	0.000
Hispanic (%)	15.95	15.70	0.24	0.740
High school dropout (%)	17.46	16.61	0.85	0.263
High school graduate (%)	29.66	29.84	-0.18	0.839
Some college or more (%)	52.88	53.55	-0.67	0.487
B. Insurance and employment (2008-2010: pre-expansion)				
Percent with Medicaid	19.74	23.64	-3.90***	0.000
Percent with public insurance	21.13	24.67	-3.54***	0.000
Percent with private insurance	48.47	44.93	3.54***	0.000
Percent employed	32.46	27.32	5.14***	0.000
Hour of work (per week)	7.61	6.68	0.93***	0.000
C. Insurance and employment (2011-2013: post-expansion)				
Percent with Medicaid	27.41	25.91	1.51*	0.075
Percent with public insurance	28.55	27.01	1.54*	0.072
Percent with private insurance	46.27	45.87	0.40	0.667
Percent employed	26.28	26.55	-0.27	0.737
Hour of work (per week)	6.19	6.38	-0.19	0.412

Notes: Samples include 156,894 individuals aged nineteen to sixty four year-old low-income childless adults with incomes at or below 58% of Federal Poverty Level (FPL) who do not receive Medicare or Supplemental Security Income (SSI) in the 2008-2013 American Community Survey (ACS). The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 2: The effect of the Medicaid expansion on insurance coverage

	Percent with Medicaid	Percent with public insurance	Percent with ESI	Percent with private insurance	Percent with any insurance
	(1)	(2)	(3)	(4)	(5)
A. Without covariates					
CT × Post (2011-13)	5.35***	5.01***	-3.33***	-3.20***	2.06
{Wild-cluster bootstrap-t procedure}	{0.000}	{0.000}	{0.002}	{0.002}	{0.154}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.000}	{0.000}	{0.028}
[absolute value of t-ratio]	[8.75]	[8.46]	[10.16]	[11.00]	[2.75]
B. With covariates					
CT × Post (2011-13)	5.90***	5.57**	-3.80***	-3.74***	2.04
{Wild-cluster bootstrap-t procedure}	{0.000}	{0.012}	{0.002}	{0.002}	{0.122}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.000}	{0.000}	{0.025}
[absolute value of t-ratio]	[8.55]	[8.29]	[11.70]	[13.08]	[2.83]

Notes: Samples consist of 156,894 individuals aged nineteen to sixty four year-old low-income childless adults with incomes at or below 58% of Federal Poverty Level (FPL) in the Census Northeast region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2008-2013 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for state and year fixed effects. Covariates include gender, race, ethnicity, marital status, and disability status. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time. *P*-values are in curly brackets. The *p*-values of a wild-cluster bootstrap-t procedure are calculated from 1,000 repetitions.
*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 3: The effect of the Medicaid expansion on labor supply

	Percent employed (1)	Percent working < 30 hours (per week) (2)	Percent working ≥ 30 hours (per week) (3)	Hours of work (per week) (4)	Percent employed with ESI (5)
A. Without covariates					
A.1. Without differential time trends					
CT × Post (2011-13)	-5.16***	-3.17***	-1.99***	-1.16***	-3.10***
{Wild-cluster bootstrap-t procedure}	{0.002}	{0.002}	{0.002}	{0.002}	{0.002}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}
[absolute value of t-ratio]	[9.82]	[10.65]	[7.67]	[7.45]	[10.87]
A.2. With differential time trends					
CT × Post (2011-13)	-5.70***	-4.83***	-0.87	-1.11***	-3.42***
{Wild-cluster bootstrap-t procedure}	{0.002}	{0.002}	{0.108}	{0.002}	{0.002}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.009}	{0.000}	{0.000}
[absolute value of t-ratio]	[16.83]	[18.84]	[3.61]	[10.46]	[23.40]
B. With covariates					
B.1. Without differential time trends					
CT × Post (2011-13)	-5.34***	-3.30***	-2.04***	-1.20***	-3.20***
{Wild-cluster bootstrap-t procedure}	{0.002}	{0.002}	{0.002}	{0.002}	{0.002}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}
[absolute value of t-ratio]	[11.34]	[12.01]	[8.75]	[8.59]	[11.49]
B.2. With differential time trends					
CT × Post (2011-13)	-5.83***	-4.81***	-1.02	-1.17***	-3.46***
{Wild-cluster bootstrap-t procedure}	{0.002}	{0.002}	{0.112}	{0.002}	{0.002}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.007}	{0.000}	{0.000}
[absolute value of t-ratio]	[16.72]	[19.26]	[3.80]	[9.89]	[17.44]

Notes: Samples consist of 206,250 individuals aged nineteen to sixty four year-old low-income childless adults with incomes at or below 58% of Federal Poverty Level (FPL) in the Census Northeast region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2006-2013 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for state and year fixed effects, and differential time trends between Connecticut and other Northeastern states. Covariates include gender, race, ethnicity, marital status, and disability status. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time. *P*-values are in curly brackets. The *p*-values of a wild-cluster bootstrap-t procedure are calculated from 1,000 repetitions.
*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 4: The effect of the Medicaid expansion, incomes between 56% and 200% FPL (falsification check)

	Percent with Medicaid	Labor supply			
		Percent employed	Percent working < 30 hours (per week)	Hours of work (per week)	Percent employed with ESI
	(1)	(2)	(3)	(4)	(5)
A. Without covariates					
CT × Post (2011-13)	-0.21	1.00***	-0.19	0.59***	-0.77
{Wild-cluster bootstrap-t procedure}	{0.670}	{0.008}	{0.140}	{0.000}	{0.166}
{Cluster-adjusted t-dist.}	{0.750}	{0.038}	{0.257}	{0.009}	{0.107}
[absolute value of t-ratio]	[0.33]	[2.56]	[1.23]	[3.59]	[1.85]
Sample size	197,206	284,022	284,022	284,022	197,206
B. With covariates					
CT × Post (2011-13)	-0.11	-0.06	-0.43***	0.22*	-0.67
{Wild-cluster bootstrap-t procedure}	{0.880}	{0.862}	{0.002}	{0.090}	{0.188}
{Cluster-adjusted t-dist.}	{0.861}	{0.862}	{0.035}	{0.158}	{0.109}
[absolute value of t-ratio]	[0.18]	[0.18]	[2.61]	[1.58]	[1.84]
Sample size	197,206	284,022	284,022	284,022	197,206

Notes: Samples consist of individuals aged nineteen to sixty four years old in the Census Northeast region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2006-2013 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for gender, race, ethnicity, marital status, disability status; and state and year fixed effects. Columns (2) though (4) additionally adjusted for differential time trends between Connecticut and other states in the Northeast. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time. *P*-values are in curly brackets. The *p*-values of a wild-cluster bootstrap-t procedure are calculated from 1,000 repetitions.
*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 5: The effect of the Medicaid expansion, DDD estimates

	Percent with Medicaid	Labor supply			
		Percent employed	Percent working < 30 hours (per week)	Hours of work (per week)	Percent employed with ESI
	(1)	(2)	(3)	(4)	(5)
A. Without covariates					
56% FPL × CT × Post (2011-13)	5.67***	-5.99***	-3.73***	-1.52***	-2.37***
{Wild-cluster bootstrap-t procedure}	{0.000}	{0.002}	{0.002}	{0.002}	{0.002}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}
{Permutation test}	{0.019}	{0.056}	{0.078}	{0.099}	{0.111}
[absolute value of t-ratio]	[26.85]	[12.13]	[13.80]	[9.96]	[6.75]
Sample size	354,100	490,272	490,272	490,272	354,100
B. With covariates					
56% FPL × CT × Post (2011-13)	6.08***	-5.58***	-3.76***	-1.35***	-2.74***
{Wild-cluster bootstrap-t procedure}	{0.000}	{0.002}	{0.002}	{0.002}	{0.002}
{Cluster-adjusted t-dist.}	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}
{Permutation test}	{0.019}	{0.089}	{0.078}	{0.099}	{0.111}
[absolute value of t-ratio]	[34.62]	[13.22]	[14.81]	[10.56]	[7.65]
Sample size	354,100	490,272	490,272	490,272	354,100

Notes: Samples consist of individuals aged nineteen to sixty four year-old childless adults whose family income up to 200% FPL in the Census Northeast Region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2006-2013 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for year, state, 56% FPL-by-year, 56% FPL-by-state, and year-by-state fixed effects. Covariates include gender, race, ethnicity, marital status, and disability status. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time. *P*-values are in curly brackets. The *p*-values of a wild-cluster bootstrap-t procedure are calculated from 1,000 repetitions.

*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

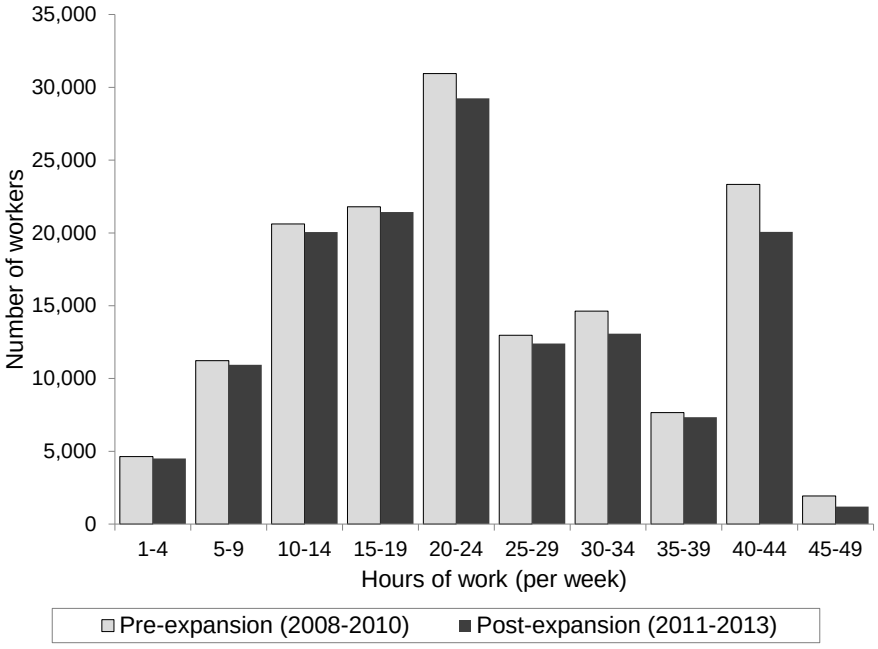
Table 6: The effect of the Medicaid expansion, Instrumental Variables (IV) estimates
[absolute value of t-ratio]

		Labor supply			
	Percent with Medicaid	Percent employed	Percent working < 30 hours (per week)	Hours of work (per week)	Percent employed with ESI
	(1)	(2)	(3)	(4)	(5)
Predicted eligibility × CT × Post (2011-13)	5.88***	-4.47***	-1.38**	-1.70***	-3.80***
	[3.34]	[3.20]	[0.47]	[2.28]	[0.54]
{Wild-cluster bootstrap-t procedure}	{0.000}	{0.002}	{0.044}	{0.002}	{0.002}

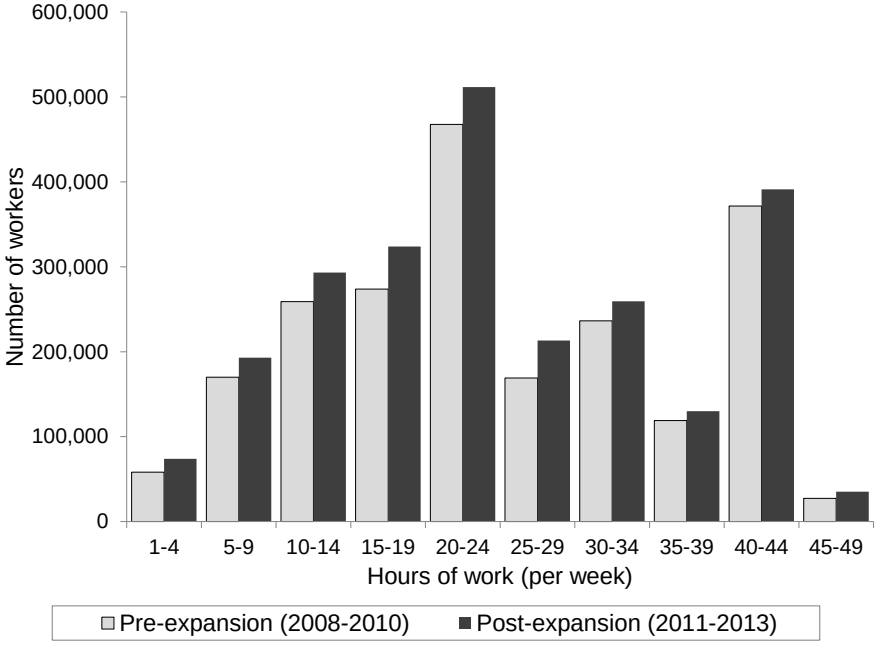
Notes: Samples consist of 1,164,170 individuals aged nineteen to sixty four years old in the Census Northeast region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2008-2013 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for year, state, predicted eligibility-by-year, predicted eligibility-by-state, and year-by-state fixed effects. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time. *P*-values are in curly brackets. The *p*-values of a wild-cluster bootstrap-t procedure are calculated from 1,000 repetitions.
*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Appendix Figure A1: Distribution of hours of work (per week), low-income childless workers with incomes up to 56% FPL

Panel A. Connecticut



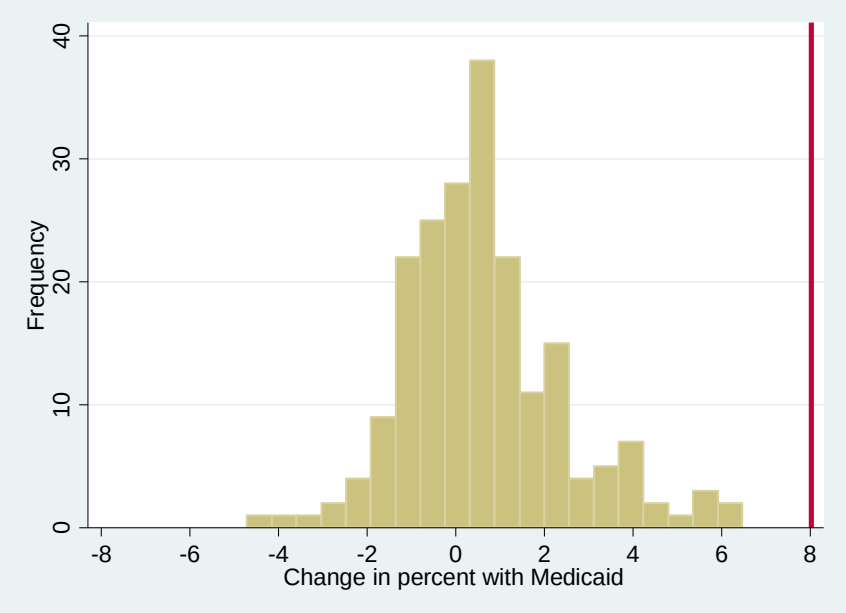
Panel B. Other Northeastern states



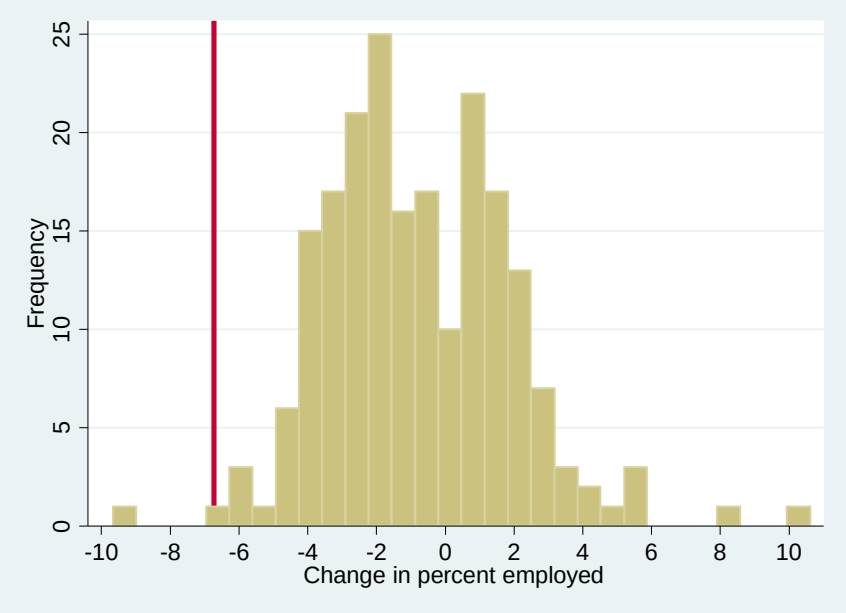
Notes: Figures include individuals aged 19 to 64 without a child (childless adults) and whose family incomes are at or below 56% of the FPL. The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

Appendix Figure A2: The distribution of annual changes, all states

Panel A. Percent with Medicaid



Panel B. Percent employed

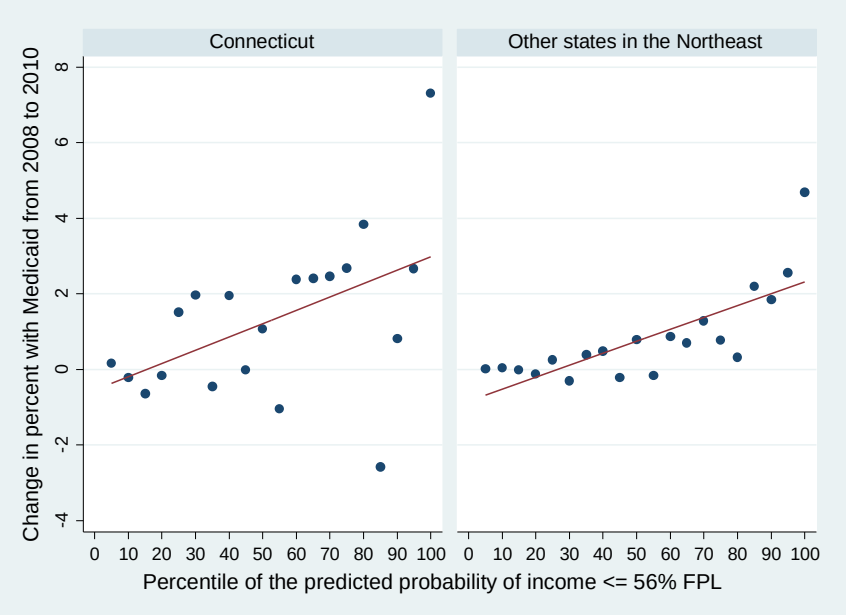


Notes: Figures plot the distribution of the annual changes in Medicaid coverage rate (Panel A) and employment rate (Panel B) within each state in from 2008 to 2013 for those childless adults aged 19 to 64 whose family incomes are at or below 56% of the Federal Poverty Level (FPL). The vertical line indicates the 2010-2011 annual change of Connecticut.

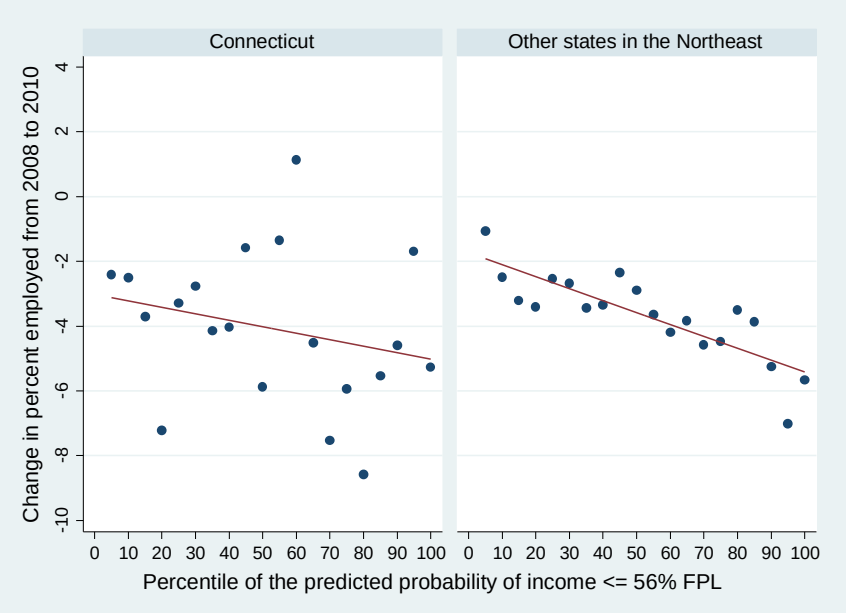
Source: American Community Survey (ACS).

Appendix Figure A3: Changes in Medicaid coverage and employment rate by predicted eligibility, before the Medicaid expansion (falsification check)

Panel A. Change in percent with Medicaid



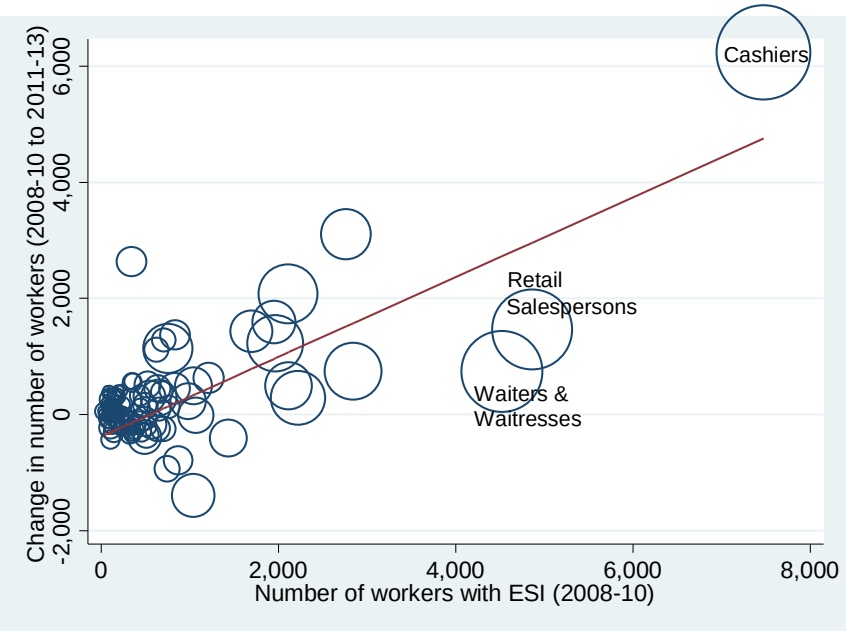
Panel B. Change in percent employed



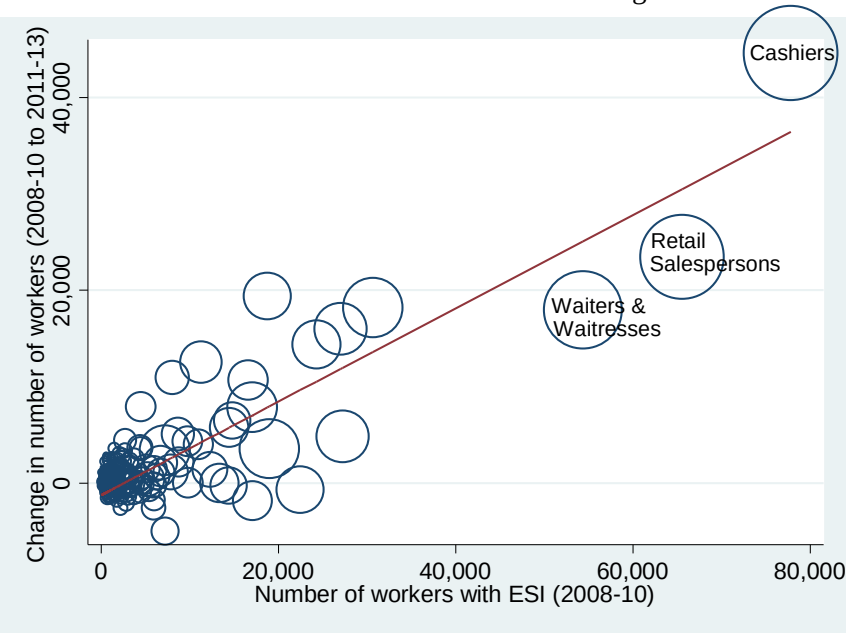
Notes: The predicted probability of having income up to 56% FPL (i.e., eligible for the Medicaid expansion) is estimated by a logit model as specified in equation (4). The dots represent 20 equal-sized cells based on the predicted probability. Samples include individuals aged 19 to 64 without a child (childless adults).
Source: American Community Survey (ACS).

Appendix Figure A4: Change in number of workers by occupation, childless adults with incomes of 56~200% FPL (falsification check)

Panel A. Connecticut



Panel B. Other states in the Northeast region



Notes: Figures include individuals employed and working less than 30 hours per week. Each circle represents an occupation. The size of a circle shows the number of workers in 2008-2010. The lines are fitted values from an occupation-level linear regression of changes in the number of workers (from 2008-2010 to 2011-2013) on the number of workers with ESI (in 2008-2010) weighed by the number of workers in 2008-2010. The other states in the Northeast include Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: American Community Survey (ACS).

Appendix Table A1: Even-study of the effect of the Medicaid expansion

	Percent with Medicaid	Labor supply		
		Percent employed	Percent working < 30 hours (per week)	Hours of work (per week)
	(1)	(2)	(3)	(5)
A. Without covariates				
CT × 2007	---	-0.69	0.35	-0.21
CT × 2008	---	-0.56	0.77*	-0.33
CT × 2009	0.17	-0.74	0.09	-0.03
CT × 2010	0.16	1.10	3.14***	-0.26
CT × 2011 (after expansion)	4.35***	-5.28***	-2.14***	-1.45***
CT × 2012 (after expansion)	5.86***	-4.77***	-1.59***	-1.21***
CT × 2013 (after expansion)	6.11***	-5.77***	-2.82***	-1.33***
B. With covariates				
CT × 2007	---	-0.86	0.36	-0.28
CT × 2008	---	-0.75	0.61	-0.37
CT × 2009	0.02	-0.68	0.18	-0.03
CT × 2010	-0.62	1.25	3.16***	-0.2
CT × 2011 (after expansion)	4.35***	-5.12***	-1.95***	-1.44***
CT × 2012 (after expansion)	5.98***	-5.04***	-1.82***	-1.26***
CT × 2013 (after expansion)	6.60***	-6.20***	-3.14***	-1.42***

Notes: Samples consist of 156,894 individuals for Column (1) and 206,250 individuals for Columns (2) through (5), aged nineteen to sixty four year-old low-income childless adults with incomes at or below 58% of Federal Poverty Level (FPL) in the Census Northeast region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2008-2013 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for state and year fixed effects. Covariates include gender, race, ethnicity, marital status, and disability status. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time.
*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Appendix Table A2: The effect of the Medicaid expansion, low-income parents (ineligible population)

	Percent with Medicaid	Labor supply		
		Percent employed	Percent working < 30 hours (per week)	Hours of work (per week)
	(1)	(2)	(3)	(4)
CT × Post (2011-13)	1.98	-0.41	-2.26**	-0.11
{Wild-cluster bootstrap-t procedure}	{0.354}	{0.653}	{0.013}	{0.593}
{Cluster-adjusted t-dist.}	{0.118}	{0.660}	{0.002}	{0.656}
[absolute value of t-ratio]	[1.78]	[0.47]	[3.29]	[0.56]
Sample size	33,643	44,252	44,252	44,252

Notes: Sample for Panel A consists of individuals aged nineteen to sixty four year-old low-income parents with incomes at or below 58% of Federal Poverty Level (FPL) in the Census Northeast region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2006-2013 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for gender, race, ethnicity, marital status, and disability status ; year, state, 56% FPL-by-year, 56% FPL-by-state, and year-by-state fixed effects. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time. *P*-values are in curly brackets. The *p*-values of a wild-cluster bootstrap-t procedure are calculated from 1,000 repetitions.
*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Appendix Table A3: Placebo test for the effect of the Medicaid expansion, IV estimates
[absolute value of t-ratio]

	Percent with Medicaid	Labor supply			
		Percent employed	Percent working < 30 hours (per week)	Hours of work (per week)	Percent employed with ESI
	(1)	(2)	(3)	(4)	(5)
Predicted eligibility × CT × Pre (2010)	0.32	4.58	3.93*	1.70***	2.56
	[0.09]	[1.11]	[3.27]	[0.82]	[1.08]
{Wild-cluster bootstrap-t procedure}	{0.752}	{0.104}	{0.066}	{0.000}	{0.140}

Notes: Samples consist of 382,139 individuals aged nineteen to sixty four years old in the Census Northeast region (i.e., Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) from the 2008 and 2010 American Community Survey (ACS). All analyses are weighted by the ACS annual sampling weights and adjusted for year, state, predicted eligibility-by-year, predicted eligibility-by-state, and year-by-state fixed effects. Estimated standard errors are corrected for heteroskedasticity and clustered at the state-level over time. *P*-values are in curly brackets. The *p*-values of a wild-cluster bootstrap-t procedure are calculated from 1,000 repetitions.
*** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.