The Effect of Unemployment Insurance Eligibility in Equilibrium *

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Abstract

In the U.S., workers whose past earnings were below a threshold are ineligible to receive unemployment insurance (UI), creating a discontinuous jump in their value of being unemployed. Exploiting this in a regression discontinuity design using administrative panel data, we estimate a sizable local effect from UI eligibility on earnings in the next employer, around \$300 or roughly 10% of quarterly earnings. This provides robust evidence of a non-zero treatment effect of UI on unemployment outcomes, however, it understates UI's causal effect and does not distinguish between a higher share of production or more productive matches as the underlying reason. Using a tractable equilibrium directed search model with endogenous match quality take-up, we interpret additional evidence–nearly all of the earnings gains are wages not employment duration–to mean that workers' bargaining power is near zero. A quantitative model also lets us adjust the observed effect for endogenous non-compliance, bounding the underlying treatment between \$536-\$946.

Keywords: Unemployment Insurance, Directed Search, Earnings
JEL: E24, E30, J62, J63, J64.

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1 Introduction

There are few events that have as significant and long-lasting an effect as unemployment. Earnings are scarred, often permanently, human capital is lost, and workers may only regain employment at a less desirable occupation. Unemployment insurance (UI) is intended to mitigate these effects. For many workers, UI offers vital income replacement, acting as a buffer against consumption risk. However, a significant fraction of the unemployment are determined to be ineligible and face the spectre unemployment without income support. Those ineligible workers are often among the most vulnerable to consumption risk: one in five workers in covered employment are ineligible because their annual earnings fall below a minimum threshold. With a limited ability to self-insure by drawing on savings, these low-income workers are exposed to significant consumption risk because of they are ineligible for UI.

In this paper, we address a crucial question: does UI improve earnings and employment outcomes? To answer this question, we exploit eligibility thresholds by income in a large administrative dataset to estimate the local, causal effect of UI eligibility. Then we construct an equilibrium directed search model with a detailed UI system to account for workers who are eligible, but never claim UI. In tandem, we show that eligibility has a sizable effect on earnings, particularly for workers at the margin.

Our empirical approach uses administrative data from the Longitudinal Employer-Household Dynamics (LEHD) dataset and a regression discontinuity design (RDD) to provide quasi-experimental evidence on the lost future earnings due to ineligibility. This dataset offers highly detailed earnings and employment data across 17 states from 1997-2014. Using the exact earnings criteria for eligibility, we look at re-employment earnings just below and just above state-level cut-offs. This identification strategy contrasts with other RDD-based estimates such as Nekoei and Weber (2017) or Schmieder et al. (2016) in that the treatment is on the extensive margin and the local effect is among workers with a higher marginal utility who are likely to exhibit a large response from UI receipt.

Our findings show a remarkable endorsement of the effectiveness of UI: we find a discontinuous jump of about $300 in income during the next full quarter of employment. This $300 is an increase of nearly 10% of quarterly re-employment earnings at the eligibility threshold. Our estimate is conservative: we do not directly observe UI receipt and those with no intent to claim likely do not vary across the threshold. This means that we likely understate the full effect of UI eligibility.

We construct a frictional model of the labor market to address this attenuation. We build on a canonical Acemoglu and Shimer (1999) or Menzio and Shi (2010) framework, incorporating a highly detailed UI system into an equilibrium directed search model of infinitely-lived agents. In the model, workers search for jobs posted by firms. These jobs offer a fixed hourly wage, but subsequently hours vary due to idiosyncratic shocks. As a result, workers with identical wages may receive different earnings. These difference in earnings may affect the workers eligibility for UI. Production in this economy is subject to idiosyncratic shocks, and firms must pay a fixed operating cost which is distinct from the wage each period. This causes firms to occasionally fire workers when productivity drops too low. Workers may also quit when employment is less valuable than returning to unemployment and searching for a new job. These features allow us to account for both key dimensions of UI eligibility: income and separation without cause.

2 Related Literature

This paper relates to the ample of empirical papers that document the treatment effect of unemployment insurance on workers' labor market outcomes and especially recent work on how the system can affect people differently, e.g. Skandalis et al. (2022). To get clean identification of the effect of UI policy, several exploit these differences in the form of natural experiments using regression discontinuity design. In the 1990s, Card and Levine (2000) utilized a discontinuity in the UI policy in New Jersey, USA. of a six-month extended benefit in 1996 and found that the program has a very modest effect on the UI claimants. Lalive and Zweimüller (2004) found a negative effect on transition rate (17%) after accounting for endogeneity of a unique policy change in Austria that prolonged UI duration from 30 weeks to 209 weeks. Similarly using policy design in Austria, Card et al. (2007) studied sharp discontinuity in eligibility for severance pay and extended unemployment insurance and found a negative effect on the job-finding rate (5-9%) of UI extension.

However, only a small fraction of the literature considers the effect of UI on other labor market outcomes such as match quality and post unemployment wage. Furthermore, the findings of these papers are mixed. Centeno (2004) showed that the more generous UI is, the longer job tenure is (i.e., the higher match quality is). Ehrenberg and Oaxaca (1976) uses National Longitudinal Survey (NLS) and found a positive effect of UI benefit level on average wage using cross-sectional variation in replacement rate. However, their result cannot be generalized due to the limitation of the data. Griffy (2021) reaches a similar conclusion using more recent data from the Survey of Income and Program Participation (SIPP) and between-state variation in replacement rates over time. He finds a positive effect on re-employment earnings and a negative effect on hazard rates, but lacks a natural experiment and faces the same endogeneity concerns addressed in this paper. Addison and Blackburn (2000) acknowledged the lack of research on the effect of UI on post unemployment wage outcomes and aimed to provide new estimates using Displaced Worker Survey in the period of 1983-1990. They found little evidence of a positive effect of UI on wage. However the data only includes UI claimants and so it is not a causal estimate.

Recently, Schmieder et al. (2013) uses quasi-experiment of UI policy changes in Germany to estimate the causal effect of extended UI duration on wage offers. Their estimate suggests a small and negative effect of UI extension on post unemployment wage. Nevertheless, by the nature of the design, the sample is limited to those who are at the longer end of the UI duration.

3 Data

We begin by describing our data sources and their unique features that enable our empirical approach. We construct a panel of state-level UI laws, which includes eligibility requirements. We combine this panel with administrative data from the LEHD.

3.0.1 Unemployment Insurance eligibility requirements

Unemployment insurance is a progressive, conditional transfer program intended to provide consumption insurance for workers who lose their job. For recipients, UI replaces a fraction of previous income (typically around 50%) up to a maximum weekly amount. Not all workers who separate are eligible, however. In order to be eligible, a prospective applicant must have experienced a no fault job loss and have earned a minimum amount in qualified employment during the "base period," which typically constitutes the 4 quarters prior to job loss. This final stipulation may appear innocuous, but is crucial for our exploration.

Despite relatively low requirements, income eligibility is a relevant consideration for a large number of potential claimants. While the level of this threshold is varies between is small in the overall distribution of earnings, it considerably higher in the job losers' distribution of earnings: on average, about $\frac{1}{5}$ of workers who lose their job earned less than this amount in qualified employment during the base period. Yet, many workers deemed "monetarily ineligible," having earned less than the minimum, still claim: monetary eligibility requirements account for about half of the rejections of initial claims, while the majority of the remaining fail to meet the no fault requirement. And among those who are ineligible and claim, many are still successful and receive UI. The reasons include a lack of enforcement and variability in laws over time and between states.

While UI is federally mandated, states are allowed to set their own rules for eligibility and provisions for generosity. Replacement rates and maximum benefits vary, and many states include additional eligibility requirements, like a minimum for the highest earning quarter during base period. Crucially, while some states do create additional eligibility requirements, all create a threshold for minimum earnings over the "base-period." [1]

There is still variation between states in minimum levels of income for eligibility. We plot the distribution of these in Figure 1. While these differences reflect local wage levels to some extent, their dispersion is far larger than that of the state-level wages.

We use these eligibility cut-offs to determine the effect of UI eligibility on re-employment outcomes. (cut?)These multiple thresholds are both a help and

[1] In almost all states, this is defined as the first four of the past five quarters so that it doesn't include the quarter of the separation.

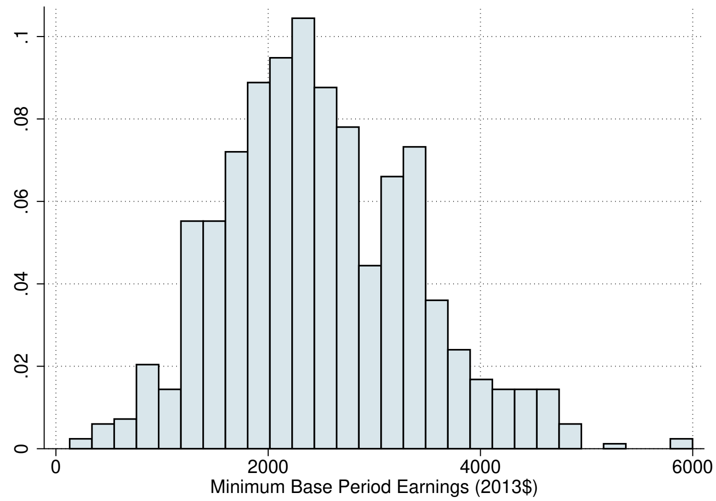

Figure 1: Distribution of state-year base period thresholds.

hindrance. In our baseline analysis, we will normalize our running variable to be percent deviations from the income eligibility threshold in a separator's state. We then also present evidence that the threshold is significant even after conditioning on prior earnings, which now may differ across treatment categories. In further analysis we adjust for different local price-levels and then use multiple-cutoff methods to generalize slightly from our local effects. This is made possible by using these cut-offs in concert with highly accurate administrative earnings data.

3.0.2 Data on workers' earnings history

To track each worker's earning history prior to separation and after re-employment, we use data from the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program. The LEHD is administrative data on covered earnings collected by the states and used in their unemployment insurance systems to determine eligibility. This is crucial for our application: because it is administrative data, it abrogates many of the measurement error concerns to which we would be subject in survey data. And because it includes *all* covered employment, we are able to very precisely determine whether an individual in monetarily eligible when they separate. In addition to earnings it includes important job and individual characteristics, like state of employment, industry, occupation, tenure, sex, age and imputed education, and race. These features make it a nearly ideal dataset to study the impact of UI eligibility.

Despite its advantages, the LEHD does have some short-comings. Ironically, although it is the data used in state UI systems, it does not include data on UI receipt or application. In addition, it is constructed from quarterly data, which limits our ability to track employment transitions at the same frequency as some available surveys. While these are both noteworthy limitations, our highly accurate earnings data along with the quarterly structure of state UI systems lend credence to the validity of our results. And as we discuss, any mis-classification of treated and un-treated groups is likely to bias our findings downward, meaning we are likely to understate the size of any effect.

We follow standard restrictions when constructing out LEHD sample. We create a panel following individuals in 17 states over the period of 1997-2014. [2] From this super-sample that represents approximately 40% of the U.S. labor force over this period, we draw a random 2% sample of individuals, maintaining the panel dimension for these individuals. The panel dimension allows us to identify separations and the resulting unemployment spells, using the approach from Gregory et al. (2021). This approach identifies a separation any time we observe one of three joint earnings and employment outcomes: first, if there is a full quarter of non-employment; second, if two employers abut but without a quarter in which both pay simultaneously; and third, if two employers abut with a quarter of overlapping pay, but which is lower than the minimum of the two adjacent quarters. The first case is unambiguously a separation into unemployment whereas the latter two attempt to separate job-to-job transitions from transitions through unemployment.

We use the state laws collected in section to calculate base-period earnings exactly as they would be calculated by state UI systems. Although the quarterly frequency of the LEHD seems like it could potentially inhibit our ability to accurately calculate earnings over the year prior to separation, a consistent idiosyncrasy of state UI laws proves highly beneficial: all states determine UI monetary eligibility by calculating income over *completed* quarters prior to separation, which solves this problem to the extent that we accurately classify separations. State UI systems calculate base-period earnings by adding up the earnings in all covered employment over the year prior to the last complete quarter of employment. Though the LEHD does not include some earnings from employment that is not covered by UI, e.g. at the Federal government, the structure of state UI systems again assists our approach: any earnings in non-covered employment also should not included in base-period earnings calculations. We plot our calculated base-period earnings in the from zero to the highest state eligibility thresholds in Figure 2. Although there is a spike near zero, there is no apparent bunching at any state eligibility threshold. We test this with a test akin to McCrary's manipulation test. For this the test statistic is -1.4 and P-value 0.162. This means we cannot reject that the distribution is smooth in the location of the cutoff. Put another way, we cannot conclude there is manipulation, that workers cluster just over the threshold.

[2]The 17 states are California, Colorado, Hawaii, Idaho, Illinois, Indiana, Kansas, Maine, Maryland, Missouri, Montana, Nevada, North Dakota, Tennessee, Texas, Virginia and Washington.

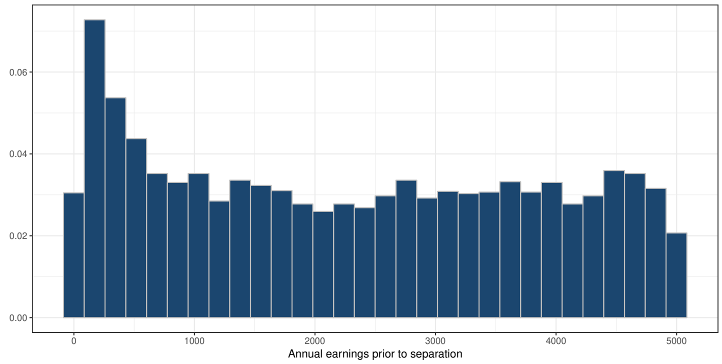

Figure 2: Base-period earnings prior to separation.

3.1 Benefit Accuracy Measurement Data

The Unemployment Insurance Benefit Accuracy Measurement ([3]BAM) is a survey conducted by the department of labor to provide a comprehensive assessment of the accuracy of the unemployment insurance, assess improvements in program accuracy and integrity, and encourage more efficient administration of the program. Based on the survey designed of BAM, the finding of BAM should be consistent with official rules and written policies of the Federal and State Workforce Agency (SWA). Each week, each state is required to provide a weekly representative sample of paid claims (PCA), incorrect payments (Error), and disqualifying determination (DCA). Then, each provided individual is surveyed. As a result, with BAM, we will be able to observe invaluable information on surveyed individuals regarding their past earnings at base-period before and after the investigation (thus, improper payments), demographic characteristics (gender, age, occupation, education), employment history (job before application, employer before applications), job search behavior, and rejection reasons (Monetary, separation, and non-separation reasons).

4 Empirical evidence on the effect of UI elgibility

In this section we provide quasi-experimental evidence on the impact of unemployment insurance eligibility on workers' search behavior. We exploit a discrete cut-off in UI eligibility created by minimum previous income requirements as a source of variation for a regression discontinuity design (RDD). We use this RDD to document three key facts: First, UI eligible workers experience a 10% increase in earnings upon re-employment. Second, there is little or no difference in subsequent employment duration among eligible and ineligible workers. Third, for nearly and barely eligible workers, exposure to UI eligibility appears to be

[3]The authors thank David Fuller for his generosity of sharing BAM data

random. We start by describing our data, the longitudinal employer-household dynamics (LEHD) dataset from the Census Bureau. Then, we discuss our research design and our findings. Last, we describe the implications of our findings for models of labor market search.

4.1 Discontinuity-based evidence on the earnings effect of UI eligibility

With the earnings data from the LEHD, we create a running variable in the RDD estimate. To normalize across states and years, we convert base-period earnings into a percent deviation from the state- and year-specific threshold. Let base-period earnings be $B_{i,t}$ for individual i in quarter t, which is the quarter or the separation. The threshold is given by $\underline{B}_{s(i,t),y(i,t)}$, indexed by the state s in which i resides during quarter t and year y, which corresponds to quarter t. Then we define the percent of the threshold as $\frac{B_{i,t}-\underline{B}_{s(i,t),y(i,t)}}{\underline{B}_{s(i,t),y(i,t)}}$. Most of our analysis will focus on 25% deviation, $-0.25 \leq \frac{B_{i,t}-\underline{B}_{s(i,t),y(i,t)}}{\underline{B}_{s(i,t),y(i,t)}} \leq 0.25$. On the left side of the cutoff that domain includes about 132,000 observations and the right side includes 101,000 observations.

As the dependent variable, define $y_{i,t}$ as the earnings in the first full quarter of re-employment. Note, t again refers to the quarter of the separation although these earnings occur at some date in the future. Figure 3 provides graphical evidence of the threshold effect. We include estimates of a 4-th order polynomial on either side of the threshold estimated over a domain of 25% above and below. The open circles are the binned scatter, average re-employment earnings in a bit optimally chosen by the methods of Calonico et al. (2019).

In our main specification, Equation 1, the coefficient of interest is that of the dummy for base-period earnings above the threshold. On either side, the regression has separate local polynomial regressions on $\frac{B_{i,t}-\underline{B}_{s(i,t),y(i,t)}}{\underline{B}_{s(i,t),y(i,t)}}$ characterized by vectors of parameters ψ_L, ψ_R for negative and positive values. We also include dummies for the state of separation and the period t. Because the threshold actually represents different values of the base period earnings, we also include $B_{i,t}$ as a separate covariate.

$$\begin{aligned} y_{i,t} =& \mathbb{I}(B_t \geq \underline{B}_{s,y}) f\left(\frac{B_t-\underline{B}_{s,y}}{\underline{B}_{s,y}}, \gamma_R\right) + \mathbb{I}(B_t \leq \underline{B}_{s,y}) f\left(\frac{B_t-\underline{B}_{s,y}}{\underline{B}_{s,y}}, \gamma_L\right) \\ &+ \beta B_{i,t} + D_y + D_s + \epsilon_{i,t} \end{aligned} \tag{1}$$

The jump we observe is our coefficient of interest γ given by

$$\gamma = \lim_{B_t \to^+ \underline{B}_{s,y}} E\left[f\left(\frac{B_t-\underline{B}_{s,y}}{\underline{B}_{s,y}}, \gamma_R\right)|\cdot\right] - \lim_{B_t \to^- \underline{B}_{s,y}} E\left[f\left(\frac{B_t-\underline{B}_{s,y}}{\underline{B}_{s,y}}, \gamma_L\right)|\cdot\right]$$

Table 1 shows the estimates for our treatment effect γ, which is just over \$300 in 2013 US dollars. The bandwidths of the local polynomials are chosen

Figure 3: Annual earnings prior to separation as a percent deviation from the state eligibility cutoff against earnings in the next job. Binned scatter and 4th-order polynomial fit.

independently on the left-hand and right-hand side following the data-driven procedures of Imbens and Kalyanaraman (2012) We use the bias-correction methods presented in Calonico et al. (2014). The row uses the non-parametric bias-corrected estimator for the treatment effect, with the second estimator combines the bias-correction with robust standard errors. In the first and third column we are estimating without controls for the income level. In the second and fourth we include income controls, which is feasible because the eligibility cutoff differs across states.

4.2 Discontinuity-based Evidence on the employment effect of UI eligibility

The earnings discontinuity could be caused either by differences in employment rates after re-employment or by differences in wages, and the two have potentially different economic interpretations. Relatedly, the very low earnings of workers near the eligibility threshold could be because of low base-period em-

Dependent	$y_{i,t}$		$\frac{y_{i,t}}{\underline{B}_{s,y}}$	
	(1)	(2)	(3)	(4)
Bias-Corrected	318.92	276.913	0.102	0.0970
	(67.47)	(69.22)	(0.0351)	(0.0328)
Robust	318.92	276.913	0.102	0.0970
	(80.81)	(82.71)	(0.0415)	(0.0393
With B_t control		X		X

Table 1: Causal effect of UI receipt in 2013$ or as a fraction of cutoff. Standard errors in parenthesis

ployment rates or low base-period wages. In this subsection, we disentangle this using evidence from the LEHD and from the BAM.

The quarterly frequency of the LEHD, while better than much administrative earnings data and ideally suited to measure base-period earnings, is somewhat of a challenge to observe potential high-frequency moves into and out of non-employment. The BAM gives us direct measures of weeks employed during the base-period, but does not observe re-employment outcomes as we do in the LEHD. Hence, this section uses data from both, augmenting low-frequency employment rates before and after the spell with high frequency employment before.

Figure 4 shows the LEHD-derived employment rates prior to and after the unemployment spell as a function of base-period earnings. For example, those whose base-period earnings were two-times the state elgibility threshold were employed for about three of four quarters in the base-period and employed for nearly 90% of quarters in the year after re-employment. To interpret this figure, note it orders people by base-period earnings, which will be closely related to employment, and hence the red line almost has to be increasing sharply. That the re-employment line is far flatter partly because of mean reversion and partly because it only begins counting employment after the new job is found. The figure allows a break in re-employment earnings at the eligibility cutoff, fitting local linear fits independently on either side of the threshold. The jump after re-employment is only about 0.4pp: a minimal increase in employment at the threshold that is statistically indistinguishable from zero.

4.3 Observable characteristics and continuity at the cutoff

Of course, these estimators all rely upon continuity across the the cutoff and, that workers are not endogenously choosing to be above or below. This amounts to testing for manipulation and bunching of the distribution of the running variable.

To begin addressing these concerns, Table 2 shows several characteristics and their standard errors for a window of 2% in the running variable above and below the cutoff. Along most of the demographic dimensions that we can observe in the LEHD, there is little economically meaningful difference between those

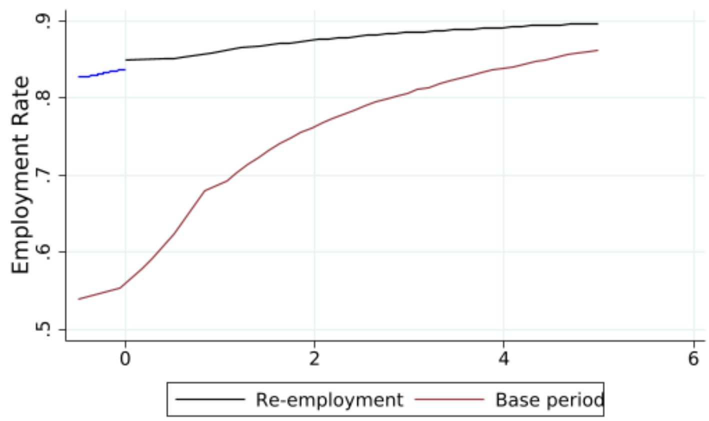

Figure 4: employment rates prior to and after the unemployment spell as a function of base-period earnings relative to state eligibility cutoffs.

above and below the threshold. Of particular interest is the tenure variable, which is calculated as the number of quarters their prior job lasted. Somewhat surprisingly, those under the threshold actually have slightly longer tenures. If the threshold were selecting "worse" workers below it, we would expect the opposite relationship.

	Born	Tenure	College	Female	Non-white	Employment
$B_t < \underline{B}_{s,y}$	1973.63	12.85	0.49	0.54	0.37	0.54
	(0.058)	(0.099)	(0.002)	(0.002)	(0.002)	(0.0015)
$B_t > \underline{B}_{s,y}$	1973.06	12.48	0.49	0.53	0.36	0.51
	(0.065)	(0.112)	(0.002)	(0.002)	(0.002)	(0.0017)

Table 2: Characteristics within 2% of $B_{i,t} = \underline{B}_{s,y}$. Standard errors in parentheses.

The goal of this regression discontinuity design is to estimate the treatment effect of UI on the employment outcomes of unemployed workers. The regression discontinuity design has several advantages over looking at more aggregated data, like differences in outcomes for UI recipients and non-recipients, because at the threshold we can see exogenous variation in access to the program rather than the endogenous decision to take up the payments or not. However, the estimators can not be interpreted directly as the pure treatment effect of the UI program for several reasons. In this section, we discuss them and foreshadow how the model in Section 5 can be used to address them.

4.4 Interpreting the estimated treatment effects

While our empirical findings credibly establish that UI affects employment outcomes, it is a “fuzzy” regression discontinuity and so further interpretation is needed. First, our estimates cannot be interpreted as the ”pure” treatment effect of UI on workers because many that are eligible do not comply and many that are above the earnings eligibility are ineligible for other reasons. Neither of these can be seen directly at the individual-level in the LEHD. Further, we cannot determine the sources through which UI affects earnings: we require a model to understand the degree to which these earnings gains reflect improvements in match quality or higher worker selectivity. In this section, we relate our findings to the underlying worker decisions and describe how these effects guide our subsequent construction of our model.

We start by describing how the decisions made by workers affect our estimates. The most obvious channel is through endogenous non-compliance in take-up by workers. Workers above the income threshold may choose not to take-up UI, while workers below the income threshold may claim and take-up UI if they are mistakenly deemed eligible. The cumulative effect of non-compliance is composed of three factors: the cause of separation, whether an individual claimed UI, and whether the UI agency accepted their claim. Prior to their unemployment spell in which they are observed, our workers face a decision to quit or not. This decision depends on their base period income as well as the impact that this decision will have on their likelihood of UI receipt. If they quit or they are fired, our workers must choose whether or not to apply for UI benefits. This is a costly process: applying involves spending time contacting the agency and collecting the required documents. Both of these decisions are affected by the probability that the state department of labor will accept their application, given their base period income and quit eligibility.

	Ineligibility	Non-claiming
Non-Compliance	0.405	0.434
Implied effect	536.55	946.20

Table 3: The underlying treatment can be ∼3X

5 A tractable model of unemployment insurance take-up and match quality

This section describes an economy with UI eligibility, endogenous take-up, and heterogenous match quality. We begin with a simple, analytically tractable model to illustrate concepts and then present the full quantitative model.

Consider a one-period economy in which workers begin unemployed, and firms post vacancies to hire them. Before making decisions regarding the search, the workers will choose to apply for unemployment insurance or not. An application costs ϕ and will be successful with probability ξ. They receive flow utility b if the application is successful and η if it is unsuccessful or they do not claim.

If a match forms, it produces $z \in (0,1]$, distributed according to $F(z)$, and pays the worker wz. Matches are formed in a frictional labor market with tightness θ and posting cost $z\kappa$ workers and firms face finding rates $p(\theta) = \theta^{1-\alpha}, q(\theta) = \theta^{-\alpha}$, respectively. Search is directed. Workers choose a submarket indexed by w, θ. After a vacancy and a worker match, z is revealed to workers, so they also must choose a lower threshold for acceptable match qualities, $\check{z}$.

We will explore two scenarios, one in which ϕ differs across workers and the other in which η does. These two distributions will be G_ϕ, G_b. The workers' problem can be described in

$$U(\phi,\eta) = \max_{\ell\in\{0,1\}} \ell \left\{ \xi(\max_{w,\check{z}} pw \int_{\check{z}}^{1} zdF(z) + (1-p(1-F(\check{z})))b) \right. \quad (2)$$

$$\left. (1-\xi)(\max_{w,\check{z}} pw \int_{\check{z}}^{1} zdF(z) + (1-p(1-F(\check{z})))\eta) - \phi \right\} \quad (3)$$

$$+(1-\ell)\left\{ \max_{w,\check{z}} pw \int_{\check{z}}^{1} zdF(z) + (1-p(1-F(\check{z})))\eta \right\}. \quad (4)$$

Firms post vacancies in submarkets that are specific to receipt or non-receipt and are z-, $\phi-$, and η-specific. Denote this whole vector of characteristics as s. Because of free-entry, the value of any of these vacancies is 0. The value of such a vacancy is

$$V(s) = z(-\kappa + q(\theta(s))(1-w(s)) \quad (5)$$

,which implies a functional relationship between p and w that workers face for any ϕ, η and receipt or non-receipt, as in

$$1 - p^{\frac{\alpha}{1-\alpha}}\kappa = w. \quad (6)$$

Turning back to the solution to the workers' problem, then we denote the wage, finding rate and $z-$threshold choices of a worker who receives UI as $w_R(\phi,\eta), p_R(\phi,\eta), \check{z}_R(\phi,\eta)$ and the wage and $z-$threshold choices of a non-receiver as $w_N(\phi,\eta), p_N(\phi,\eta), \check{z}_N(\phi,\eta)$. The optimal decisions can be expressed as $\tilde{z}_x(\phi,\eta) = \int_{\check{z}_x(\phi,\eta)}^{1} tdF(t)/(1-F(\check{z}_x(\phi,\eta)))$.

From solving the above problem, a worker claims UI ($\ell = 1$) if the value of receiving UI is greater or equal to the value of not receiving UI, as in

$$U_R(\phi,b) \geq U_N(\phi,\eta) \Leftrightarrow \max_{p,\check{z}} pw \int_{\check{z}}^{1} zdF(z) + (1-p(1-F(\check{z})))b - \frac{\phi}{\xi} \quad (7)$$

$$\geq \max_{p,\check{z}} pw \int_{\check{z}}^{1} zdF(z) + (1-p(1-F(\check{z})))\eta. \quad (8)$$

From (7), we show that the heterogeneity can drive the difference between the true and observed treatment effect in ϕ or η. Moreover, the true treatment will only be inflated by non-compliance through G_ϕ and not G_η. In the first of the two scenarios where $\phi \sim G_\phi$, the observed treatment can be expressed as

$$\widehat{\Delta w} = \int_\phi (w_R(\phi) - w_N)\mathbb{I}_{U_R(\phi) \geq U_N} dG_\phi(\phi) \ , \tag{9}$$

and the true treatment can be expressed as equation

$$\Delta w = \frac{\int_\phi (w_R(\phi) - w_N)\mathbb{I}_{U_R(\phi) \geq U_N} dG_\phi(\phi)}{\int_\phi \mathbb{I}_{U_R(\phi) \geq U_N} dG_\phi(\phi)}. \tag{10}$$

In the second scenario where $\eta \sim G_\eta$, the observed and the true treatment can be expressed as

$$\widehat{\Delta w} = \int_\phi (w_R - w_N(b_N))\mathbb{I}_{U_R \geq U_N(b_N)} dG_b(b_N). \tag{11}$$

Observing higher post-unemployment wage in the data can be translated into two things: the match quality and the surplus of the match is higher, thus a higher payoff. Or, workers have higher outside options (having access to UI) to extract more of the surplus. One of the key advantages of having a model is to further decompose the causal effect of UI take-up on post-unemployment wage into better match quality and higher rents. In

$$w_x(\phi,\eta)\tilde{z}_x(\phi,\eta) = \alpha \tilde{z}_x(\phi,\eta) + (1-\alpha)b_x \qquad , x = \{R, N\}, \tag{12}$$

, the wage received by matched workers $w_x \tilde{z}_x$ can be expressed as a fraction of $\tilde{z}_x$, and worker's outside options b or η, with the fraction as α. One can think of α as the competitive search analog of Nash bargaining weight in random search. As bargaining weight α goes to zero, the change in wage is almost all caused by the change in outside option. (i.e. As $\alpha \to 0$, $\frac{\partial w}{\partial b}\frac{b}{w} \to 1$)

6 Quantitative model

6.1 Environment

Our economy is populated with a continuum of infinitely-lived workers of measure one, and firms with positive measure. Time in our economy is discrete and continues forever, and both firms and workers discount future value at an identical rate, β. Workers and firms are ex-ante homogeneous, but workers become ex-post heterogeneous as a result of their income history, μ. Workers may be employed or unemployed and receiving UI, or unable to receive UI. Upon separating, workers choose whether or not to claim UI, which is a stochastic process that depends on their income history (μ) and whether they separated to unemployment by quitting, $q = 1$, or being fired, $q = 0$. Unemployed workers of either UI status are able to direct their search to vacancies posted by firms in different submarkets, which are indexed by $(\mu, w) \in R_+ \times R_+$, the income history and piece-rate.

Matched firms produce using a linear technology, z, where z is a stochastic productivity process composed of an idiosyncratic and persistent component. At the beginning of the period, an idiosyncratic shock realizes, with probability $p_0(z)$, and the match produces a trivial amount $\underline{z}$, reflecting a period where the firm does not require output. With complementary probability, the match is productive and z follows an AR(1) process: $z' = \rho_z z + \epsilon_z$, where $\epsilon_z \sim N(0, \sigma_\epsilon)$. $p_0(z)$ is a decreasing function of productivity: $p_0(z) = \bar{p_0} - \nu_{p_0} z$. Firms pay piece-rate wages w, which yields a wage bill of wz, and are subject to a fixed cost of operating, τ. After observing the productivity and hours shocks, the firm decides whether to fire their worker, which we denote with the indicator $d_f(w, z)$. Matches may also dissolve because workers quit, which depends on a "leisure" shock, δ, realized by workers each period. For some values of δ, workers prefer to quit and enter unemployment. This yields an indicator function $D(w, z, \mu, h) = \max\{d_f(w, z), d_q(w, z, \delta)\}$, the expectation of which is the probability a match dissolves between periods. We assume that a firm's decision to fire a worker occurs before the worker's decision to quit, should both realize.

Workers are risk-averse with utility $u'(c) \geq 0$, $u'(0) = \infty$ and do not have access to savings technology. While they are employed, their income history updates according to $\mu' = (1 - \frac{1}{T})\mu + \frac{1}{T}w$, where T is the "look-back" period, over which previous income is calculated for eligibility and level of benefits (52 weeks in our calibration). After producing, the quit shock realizes. If a worker separates, they choose whether or not to claim UI.

The likelihood of UI recipiency depends on two factors: whether the worker was fired and whether or not their income history falls above or below a monetary eligibility threshold, $\bar{\mu}$. While neither factor unilaterally precludes a worker from receiving UI, quitting or having income below the threshold hamper their likelihood of receipt. If a worker fails to meet either the separation or monetary eligibility requirement, they face a likelihood ξ_l of being deemed eligible if they claim. If they meet both criteria, they have a probability $\xi_h > \xi_l$ of receipt should they claim. Claiming UI entails a cost, $\epsilon \sim$ *Gumbel* as well as a fixed cost η, both of which linearly decrease utility. If they are successful, they receive $\max\{b_r(\max[\mu, \bar{\omega}])\}$ in UI benefits. They face a probability λ_0 of exogenously losing benefits, and may only receive benefits for at most T_b consecutive periods. If they are not receiving UI or have exhausted their benefits, they receive $b_n < b_r(\bar{\omega})$.

Firms post vacancies at a cost κ. Vacancies are one-firm one-worker contracts that specify a piece-rate to which the firm can commit for the duration of the contract. In each submarket, there exists a constant return to scale (CRTS) matching technology, $M(u, v)$, where u is the number of unemployed in the submarket, and v is the vacancies. We define the market tightness θ as $\frac{u}{v}$. We define the job-finding rate as $\frac{M(u,v)}{u} = p(\theta)$ and the job-filling rate $\frac{M(u,v)}{v} = q(\theta) = \frac{p(\theta)}{\theta}$. p is a strictly increasing and concave function such that $p(0) = 0$, and $p'(0) > 0$, and q is a strictly decreasing and convex function such that $q(0) = 1$, $q'(0) < 0$, and further the composite function $p(q^{-1})$ is concave. We assume that the free entry condition holds in any open submarket.

The aggregate state of this economy is given by a tuple (y, e, u), the aggregate productivity, and measures of employed and unemployed, respectively. The equilibrium is stationary and block recursive, so we suppress this notation for ease of exposition.

6.2 Worker's Problem

We first describe the problems solved by employed and unemployed agents. Unemployed agents may be in one of four discrete states: they may be receiving, eligible to receive, ineligible but not rejected, or rejected and ineligible to receive UI. We first describe the production phase and subsequent quit decision for the employed worker.

6.2.1 Production and Quit Decision

A employed worker faces the following problem during the production phase, and his value function is

$$\begin{aligned} U_E(w, z, \mu) = u(c) + &\\ \max_{d_q} \beta E[(1 - D(w, z', \delta))U_E(w, z', \mu') + &\\ d_f(w, z')U_C(\mu', 0) + d_q(w, z', \mu')U_C(\mu, 1)] & \qquad (13) \end{aligned}$$

$$\text{s.t. } c = \left\{ \begin{array}{ll} wz & \Pr = 1 - p_0(z) \\ b_n & \Pr = p_0(z) \end{array} \right\} \qquad (14)$$

$$\mu' = \left(1 - \frac{1}{T}\right)\mu + \frac{1}{T}wz \qquad (15)$$

$$z' = \left\{ \begin{array}{ll} \underline{z} & , p_0(z) \\ z' = \rho z + \epsilon_z & , 1 - p_0(z) \end{array} \right. \qquad (16)$$

$$D(w, z', \delta) = \max\{d_f(w, z'), d_q(w, z', \mu)\}. \qquad (17)$$

They receive income wz, where z is realized before the period. They consume their income, $c = wz$.[4] After age advances and shocks realize, the worker may choose to quit exogenously with probability δ, or be fired if $d_f(w, z') = 1$, which is determined by the firm's problem.

6.2.2 UI Take-Up and Receipt

Each period, an unemployed worker who is still eligible chooses whether to apply for UI benefits. He makes this decision based on the probability of acceptance,

[4] Because our focus is on workers barely eligible or ineligible for UI, they are unlikely to have sizable differences in savings. In addition, this group is very poor, meaning that they are unlikely to have precautionary savings. For this reason, we abstract from a savings decision.

$\xi(\mu, \mathcal{Q})$, which depends on income eligibility and quit status ($\mathcal{Q}$). Should he chooses to apply for UI benefits, he pays a fixed cost η and a stochastic utility cost $\epsilon \sim$ *Gumbel*. If he is rejected for UI, he becomes ineligible. If he is successful, he receives $b_{UI} = \max\{b_{RR}\mu', b_{RR}\bar{\omega}\}$ and has $\bar{\tau}$ periods remaining of receipt. His value function is

$$
\begin{aligned}
U_C(\mu, \mathcal{Q}) = \max_{\ell \in \{0,1\}} u(b_n) + \beta E[\mathbb{I}_{\{\ell=1\}}\{\xi(\mu, \mathcal{Q}) R_R(\mu', b_{UI}, \bar{\tau}) \quad (18)\\
+ (1 - \xi(\mu, \mathcal{Q})) R_X(\mu') - \eta - \epsilon\} + \mathbb{I}_{\{\ell=0\}} R_C(\mu')\}] \quad (19)\\
\quad (20)\\
s.t.\;\; \mu' = \left(1 - \frac{1}{T}\right)\mu \quad (21)\\
b_{UI} = \max\{b_{RR}\mu', b_{RR}\bar{\omega}\} \quad (22)\\
\xi(\mu, \mathcal{Q}) = \begin{cases} \xi_h e^{\varphi \mathcal{Q}} & \text{if } \mu \geq \bar{\omega} \\ \xi_l e^{\varphi \mathcal{Q}} & \text{if } \mu < \bar{\omega} \end{cases} \quad (23)\\
\epsilon \sim \text{Gumbel} \quad (24)
\end{aligned}
$$

, where R_R, R_X, and R_C are the values of searching for receivers, ineligible, and potential claimants, respectively, during the search subperiod. Because ϵ is realized prior to applying, potential claimants have apply with probability

$$
Pr(\{\xi R_R + (1-\xi) R_X - \epsilon - \eta\} > [R_C]) = \frac{\exp\{(\xi R_R + (1-\xi) R_X - \eta - R_C) / \sigma_\epsilon\}}{1 + \exp\{(\xi R_R + (1-\xi) R_X - \eta - R_C) / \sigma_\epsilon\}} \quad (25)
$$

,which is increasing in the likelihood of acceptance (ξ) and decreasing in costs ϵ and η. Notably, ϵ can take values less than zero, which can cause workers who are ineligible and unlikely to receive UI to claim.

An unemployed worker who is receiving UI has the value function

$$
U_R(\mu, b_{UI}, \tau) = u(b_{UI}) + \beta E[(1 - \lambda(\tau)) R_R(\mu', b_{UI}, \tau') + \lambda(\tau) R_X(\mu')].
$$

$$
\begin{aligned}
s.t.\;\; \mu' = \left(1 - \frac{1}{T}\right)\mu\\
\lambda(\tau) = \begin{cases} \lambda_0 & \tau > 0 \\ 1 & \tau = 0 \end{cases}
\end{aligned}
$$

, where λ determines whether he becomes ineligible for UI after the search subperiod. While he still has periods of eligibility ($\tau > 0$), he faces a probability λ_0 of losing UI, reflecting the probability that his receipt is discontinued.[5] Once he has exhausted his UI, he no longer receives UI after the search subperiod ($\lambda = 1$).

[5]Claims may be discontinued for violations of the receipt agreement, like not actively searching for a job.

An ineligible worker faces a similar problem, with zero probability of regaining UI without first finding employment. His value function is

$$U_X(\mu,) = u(b_n) + \beta E[R_X(\mu')].$$

$$s.t.\ \ \mu' = \left(1 - \frac{1}{T}\right)\mu$$

6.2.3 Job Search

After producing, separating, and resolving the claims decision, an unemployed worker searches for a job. We generically define a search value function R_Y, where Y is one of R, X, C, for receivers, ineligible, and potential claimants, respectively. The value function is

$$R_Y(\mu, b_{UI}, \tau) = max_w E[p(\theta)\max\{U_E(w,z,\mu), U_Y(\mu, b_{UI}, \tau)\} + [1-p(\theta)]U_Y(\mu, b_{UI}, \tau)]$$

, where b_{UI} and τ can be suppressed for ineligible or potential claimants.

6.3 Firms's Problem

In our model, firms may be matched with a single worker, or unmatched. Matched firms produce and choose whether or not to continue the match. Unmatched firms choose whether or not to post a vacancy.

6.3.1 Production and Firing

A matched firm produces Az units of output each period and pays wz in income. It also pays a fixed cost ψ associated with operating the firm. Productivity, z, is stochastic and realizes prior to the separation decision (D). The firm's problem is

$$\begin{aligned}
J(w,z,\mu) = E_{z',\psi}&(A-w)z\zeta - \psi \\
&+ \max_{d_f} \beta\{D(w,z',\mu')V(w,z') + [1 - D(w,z,\mu'')]J(w,z',\mu)\} \\
&D(w,z',\mu') = \max\{d_f(w,z',\mu'), d_q(w,z',\mu')\} \\
&d_f(w,z',\mu') = 1_{\{J'<V'\}} \\
\mu' &= \left(1 - \frac{1}{T}\right)\mu + \frac{1}{T}(wz(1-\zeta) + \zeta b_n) \\
z' &= \rho z + \epsilon_z \\
\zeta &= \begin{cases} 0 & p_0(z) \\ 1 & 1 - p_0(z). \end{cases}
\end{aligned}$$

A Firm fires workers, $D(w, z') = 1$, if the value of continued employment falls below the value of searching for a new worker, $J(w, z') < E[V(w, z')]$, a rate governed by ψ. In equilibrium, $E[V(w, z')] = 0$, satisfying the free entry condition. If the firm chooses not to fire the worker, the worker may quit with probability $d_q(w, z', \mu') \geq \delta$.

6.3.2 Vacancy Creation and Free Entry

An unmatched firm can post a vacancy at cost κ that specifies a wage w. With probability $q(\theta)$ it contacts a worker during the following week and draw an idiosyncratic productivity, z. An unmatched firm has the value function

$$V(w) = -\kappa + \beta q(\theta(\theta)))E_{z'}[(1 - D(w, z'))J(w, z')]. \tag{26}$$

We assume that the free entry condition holds in equilibrium, which yields the following worker contact rates

$$q(\theta(w)) = \frac{\kappa}{\beta E_{z'}[(1 - D(w, z'))J(w, z')]} \tag{27}$$

in a submarket.

6.4 Equilibrium

A *Block Recursive Equilibrium* (Shi (2009) and Menzio and Shi (2010)) in this model economy is a set of policy functions for workers, $\{\ell, w\}$, value functions for workers U, R, value functions for firms with filled jobs, J, and unfilled jobs, V, as well as a market tightness function $\theta(w)$. These functions satisfy the following:

1. The policy functions $\{\ell, w\}$ solve the workers problems, $U,\ R$.
2. $\theta(w)$ satisfies the free entry condition for all submarkets (w).
3. The aggregate law of motion is consistent with all policy functions.

As in the prior literature, the equilibrium is "Block" Recursive in that the first two blocks of the equilibrium, i.e. the individual decision rules, can be solved without conditioning upon the aggregate distribution of agents across states, i.e. the third block of the equilibrium. In our context, this has implications for how we interpret the RDD because firms know they are getting either treated or untreated workers and the equilibrium finding rate reflects the firms' internalization of the workers' outside option.

7 Calibration

To draw quantitative conclusions from the model, we calibrate it to match standard search and matching model targets, features specific to UI and the jump in earnings observed in Table 1. We target earnings and employment dynamics as well as the estimated treatment effect to capture the incomplete exposure to UI as in the data so that we can assess the underlying treatment effect that generates our observed, quasi-experimental treatment. In matching the RDD estimated treatment, we will also be able to infer frequently difficult to observe parameters governing the workers' share of the surplus.

7.1 Preset Parameters and Functional Forms

We make standard functional form assumptions from the related labor search literature. We assume that workers have CRRA utility, $u(c) = \frac{c^{1-\gamma_0}}{1-\gamma_0}$, and that matching technology takes the form from den Haan et al. (2000), $M(u,v) = n_0 \frac{uv}{(u^{n_1}+v^{n_1})^{\frac{1}{n_1}}}$. This matching function implies a job finding rate of $p(\theta) = n_0 \frac{\theta}{(1+\theta^{n_1})^{1/n_1}}$ and $q(\theta) = n_0 \frac{1}{(1+\theta^{n_1})^{1/n_1}}$ for vacancy filling. Our productivity process for z is set to an AR(1), $ln(z') = \rho ln(z) + \epsilon_z$, where $\epsilon_z \sim N(0, \sigma_z)$, with temporary separation probability Π_z during each period.

7.2 Targeted Moments

The model is calibrated by matching simulated moments. The frequency of the model is weekly, and the parameters calibrated to the model are shown in Table 4. The first panel shows the fixed parameters calibrated outside of the model. For the parameters regarding UI policies such as $b_{rr}, \bar{br}, \bar{\omega}$, and λ, the values are fixed according to the U.S Department of Labor. Then, the parameters regarding worker's productivity process is directly estimated from SIPP, with auto-correlation 0.8 and standard deviation 0.2. Vacancy cost 0.2 is commonly used in literature, as in Petrongolo and Pissarides (2001). TFP is normalized to one.

The free parameters in the second panel of Table 4 is calibrated by matching simulated moments. There are three sets of moments are important to the success of this paper: the UI status distribution, the labor market transitions, and the jump in earnings observed in the data. **??** shows the comparison between the moments estimated from the data, and the ones generated from the model. The data moments of the UI status are estimated from the Non-monetary Determinations Activity reports and the Benefit Rights and Experience reports from the Employment and Training Administration (ETA).[6] The data moments on labor market transitions and the jump in earnings are estimated from SIPP and LEHD. One interesting result is the value of the matching elasticity n_1. The matching elasticity, as we derived in Section 5, plays a key role in determining how much earnings is coming from the productivity of a worker and how much

[6] ETA reports are from the National Office database that is populated by collecting data from the 50 States, Washington DC, Puerto Rico, and the Virgin Islands. The data in the Non-monetary Determinations Activity reports are used by the U.S Department of Labor to project budgets and to assess the disqualification processes. The Benefit Rights and Experience reports are used to evaluate state benefit formulas

of that is from workers' outside options. Another sets of results worth mentioning is the probability of receiving UI conditional on the earnings eligibility status ξ_h, ξ_l. Having sufficient earnings to qualify for the monetary eligibility requirement gives the applicant a three times higher probability of receiving UI.

Parameter	Value	Comment
δ	0.0110	Exogenous separation probability
ν_δ	0.0000	Slope of separation probability
ξ_h	0.9150	Monetarily eligible UI receipt probability
ξ_l	0.1750	Monetarily ineligible UI receipt probability
n_1	0.3930	Matching elasticity
p_0	0.5000	Probability of no hours
b_n	0.0043	Outside subsistence income
η	0.0320	Fixed application cost
ν_{p_0}	0.0001	Slope of no hours probability
σ_ϵ	2.94	Gumbel parameter for worker cost shock
σ_τ	1.25	Gumbel parameter for firm cost shock
φ	-0.3660	Quitting UI receipt probability penalty
β	0.998	Discount rate
n_0	0.5	Matching efficiency
$\bar{\omega}$	0.0540	Monetary elibility threshold
ρ_z	0.8	Auto-corr. of z shock
σ_z	0.2	SD of z shock
γ	0.0010	Exogenous probability of losing UI
λ	1.00	Normalization
y	0.555	UI replacement rate
b_{RR}	0.25	Vacancy creation cost
κ	2	Risk aversion
$_0$	52	Base period lookback

Table 4: Parameter values.

Moment	Data	Model
Re-Employment gains from UI receipt	0.0315	0.0983
Claiming rate	-0.0238	0.7472
Monetarily ineligible rejectino rate	0.1000	0.1186
Separation rejection rate	0.1000	0.1521
Ineligible receipt rate	0.1000	0.1377
E-to-U rate	0.3070	0.0775
E-to-U slope in earnings	0.5600	-0.0191
U-to-E rate	0.1050	0.2564
Employment rate	0.1000	0.6733
Employment rate slope in base period earnings	0.7340	0.1465
No-work rate	0.2620	0.1615

Table 5: Estimated Moments.

8 Findings

In this section, we use our calibrated model to interpret our empirical findings in subsection 4.1. First, in subsection 8.1, we decompose the total treatment effect and quantify the underlying true treatment effect by comparing the baseline model with four other alternatives that groups workers by their UI receiving status. Then, in subsection 8.2, we quantify the impact of both monetary eligibility requirement and no-quit requirement by performing counterfactual policy exercises.

8.1 The True Effect of UI on Re-Employment Wages

In this section, we explore the true effect of UI receipt on re-employment earnings. While our baseline result strongly suggests that UI receipt leads to higher re-employment earnings, we are unable to observe claim and receipt status in the data, which could affect the magnitudes of the underlying true effect. Here we consider 4 comparison groups: receivers only, non-receivers only, non-receivers who do not claim UI, and receivers above the earnings requirement and all claimants below the earnings requirement. The earnings differences are reported in Table 10.

Subset	Above	Below	Difference
Base	0.6710	0.6100	0.1010
Receivers	0.7000	0.6050	0.1580
Non-Receivers	0.6660	0.6390	0.0410
Non-Receivers, Non-Claimants	0.6990	0.6590	0.0600
Above Receivers, Below Claimants	0.7020	0.6250	0.1230

Table 6: Comparison of re-employment earnings for different claimant and receipt statuses.

From Table 10, we find that for workers uninterested in acquiring UI, either because they regain employment quickly, or the costs associated are too high, exhibit little difference between the groups. The largest differences in outcomes occur for claimants, indicating that UI has an important effect on their re-employment prospects. We find that the effect of UI is 2.2 to 5.7 percentage points higher than in our empirical study.

Now we determine whether this difference comes primarily from improvements in match quality, i.e., higher average z for the duration of the match, or higher rents accrued by the worker (equivalently, in a random search model, a higher bargaining power). We repeat our comparisons for both z and μ for the groups above. We start with match quality and present our results in Table 7.

Table 7 shows the average productivity z below, above the threshold and the differences. A sizable share of the overall effect comes from improvements in match quality. Moreover, for every group, match quality are always increasing from below to above the thresholds. It increases by 4.5% to 7.6%. More interesting, the difference from the Baseline model in Table 7 is more than half of the difference in Table 10. To be more specific, 56% of the differences in the the observed post unemployment earnings can be explained by the increase in match quality.

Subset	Above	Below	Difference
Base	1.54	1.46	0.0560
Receivers	1.52	1.46	0.0370
Non-Receivers	1.55	1.44	0.0740
Non-Receivers, Non-Claimants	1.50	1.43	0.0450
Above Receivers, Below Claimants	1.55	1.44	0.0760

Table 7: Comparison of match quality for different claimant and receipt statuses.

Next we turn to rents, μ and present our findings in Table 8. Table 8 shows the average rents μ below, above and the differences. Here, we find a surprising result: there is very little difference for most groups in their piece-rate once they regain employment. Moreover, unlike match qualify, the rents from below to above the threshold is not always increasing. The differences are only positive for receivers group, which are unemployed workers who are the most desperate. On the other hand, non-receivers despite having a past earning above the thresholds are mostly likely quitters. This type of workers have lower rent above the thresholds than below because they already have a high value of being unemployed at the first place that allows them to quit. Despite our previous finding of negligible differences in tenure, rents appear to play less of a role in the improvement in earnings than match quality.

Subset	Above	Below	Difference
Base	0.0330	0.0320	0.0290
Receivers	0.0370	0.0320	0.1530
Non-Receivers	0.0330	0.0360	-0.0865
Non-Receivers, Non-Claimants	0.0370	0.0370	-0.0061
Above Receivers, Below Claimants	0.0350	0.0340	0.0200

Table 8: Comparison of worker rents for different claimant and receipt statuses.

8.2 The Impact of Eligibility Requirements

In this section, we consider the elimination of each of the eligibility requirements. First, we remove the base period earnings requirement. Then, we move the no-quit requirement. Finally, we consider the impact of both being removed simultaneously. In reality, elimination of the first requirement was actually implemented during the pandemic within the CARES Act. Few papers have discuss the effect of removing such requirement during the pandemic, this exercise allow us to move away from that special event and only focus on normal time. Also, even though no-quit requirement has not been removed in the United States, there are countries that do not have no-quit requirement as eligibility requirement at the first place. For example, in Argentina, workers are allow to apply for UI even if they quit in their previous job. Therefore, understanding those effects are non-trivial. We start by considering the role of the base period earnings requirement. The eliminate this barrier, we set $\bar{\omega} = 0$, meaning that all agents in the economy are monetarily eligible for UI should they experience a separation. They may still suffer a reduction in receipt likelihood, however, should they quit. We present these results in Table 9.

Variable	Baseline	$\bar{\omega} = 0$
Employment Rate	0.7680	0.5200
Quit	0.0160	0.0380
Wage	0.0470	0.0520
Piece-Rate	0.0320	0.0290
Match-Specific Prod.	1.46	1.48
Base Period Earnings	0.0460	0.0510
Unemployment Benefits ($)	0.0036	0.0120
Receiving UI	0.5920	0.8740
Inelibible for UI	0.0930	0.0670
Applied for Benefits	0.0940	0.0660
Approved for Benefits	0.0360	0.0560
Quit	0.0001	0.0180
Fired	0.0530	0.0450
Approval Probability	0.5110	0.9040

Table 9: Comparison of outcomes when BPE requirements are lifted.

As expected, removal of the monetary eligibility requirement considerably alters the labor market for these workers. First, the average wage increases from 0.0470 to 0.0520. This is because, after the requirement is removed, even low earners can receive UI. With UI supporting their unemployment, they have the incentive to search for a higher paying job. Since higher paying job associated with a lower job finding rate, workers are more likely to stay longer in their unemployment spell. Their employment rates fall by roughly 25 percentage points. Also, the quit rates increase. Moreover, they are less likely to be fired, and have higher match-specific productivity.

Next, we turn to the no-quit requirement. To emulate this policy, we set the φ parameter to 0, which means that a worker who quits will not be subject to a penalty be rejected as a result. We present our findings in Table 10.

The economy is minimally different, due to the fact that the baseline economy features few quits. Workers are slightly more likely to receive benefits, and when they do, they tend to be slightly higher.

Last, we consider the removal of both requirements at once. We implement the same restrictions as in the previous two experiments simultaneously and present our results in Table 11.

These results show the importance of the monetary requirement for these low pay workers. Lifting both requirements closely mirrors the impact of lifting the monetary requirement exclusively, because this group of workers is most vulnerable to extended spells of unemployment.

Variable	Baseline	$\varphi = 0$
Employment Rate	0.7680	0.7670
Quit	0.0160	0.0160
Wage	0.0470	0.0470
Piece-Rate	0.0320	0.0330
Match-Specific Prod.	1.46	1.46
Base Period Earnings	0.0460	0.0460
Unemployment Benefits ($)	0.0036	0.0037
Receiving UI	0.5920	0.6070
Inelibible for UI	0.0930	0.0900
Applied for Benefits	0.0940	0.0910
Approved for Benefits	0.0360	0.0370
Quit	0.0001	0.0003
Fired	0.0530	0.0530
Approval Probability	0.5110	0.5260

Table 10: Comparison of outcomes when quit penalties are lifted.

Variable	Baseline	$\bar{\omega} = 0$
Employment Rate	0.7680	0.5200
Quit	0.0160	0.0380
Wage	0.0470	0.0520
Piece-Rate	0.0320	0.0290
Match-Specific Prod.	1.46	1.48
Base Period Earnings	0.0460	0.0510
Unemployment Benefits ($)	0.0036	0.0120
Receiving UI	0.5920	0.8740
Inelibible for UI	0.0930	0.0670
Applied for Benefits	0.0940	0.0660
Approved for Benefits	0.0360	0.0560
Quit	0.0001	0.0180
Fired	0.0530	0.0450
Approval Probability	0.5110	0.9040

Table 11: Comparison of outcomes when both the BPE requirement and the quit penalty are lifted.

9 Conclusion

In this paper, we first present a robust empirical evidence using regression discontinuity design to identify the local effect of UI. We show that an unemployed worker, who is UI eligible, receives a $300 or roughly 10% increase in their post unemployment quarterly earnings. This provides robust evidence of a non-zero treatment effect of UI on unemployment outcomes, however, it understates UI's causal effect and does not distinguish between a higher share of production or more productive matches as the underlying reason.

Then in order to pick up the true treatment effect of UI, we decompose the total effect by using a tractable equilibrium directed search model with endogenous match quality and take-up. With the model, we are able to show that almost half of the increase in the post unemployment earnings is due to the increase in match quality. Last, we perform counterfactual exercises to quantify the impact of removing both the monetary eligibility requirement and the no-quit requirement. We find that removing the no-quit requirement do not have significant impact on the workers because quitters are not a big portion of the workers who are around the earning threshold. On the other hand, removing monetary eligibility requirement has a more sizeable impact, especially on workers' average earnings and employment rate.

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A Appendix: Policy functions

In this section, we show some relevant policy functions. In the following figures, we plot the wage policy and the corresponding market tightness over past earnings (or past earnings at take-up for receiver) conditional on UI status. Figure 5 shows the wage policy and the corresponding market tightness of UI non-receivers. And Figure 6 shows that of UI receivers.

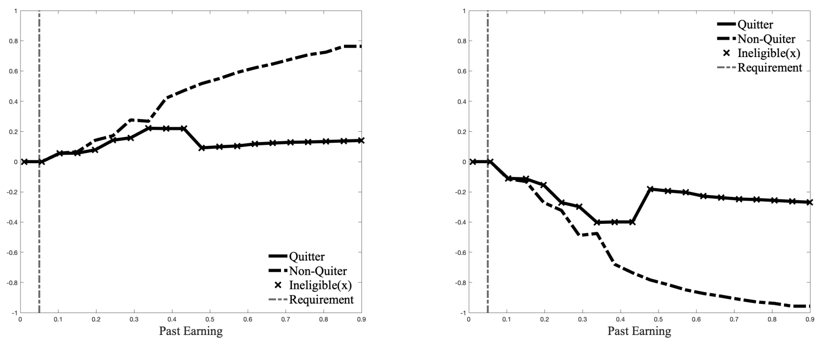

Figure 5: Wage policy (left) and market tightness (right) of non-receivers

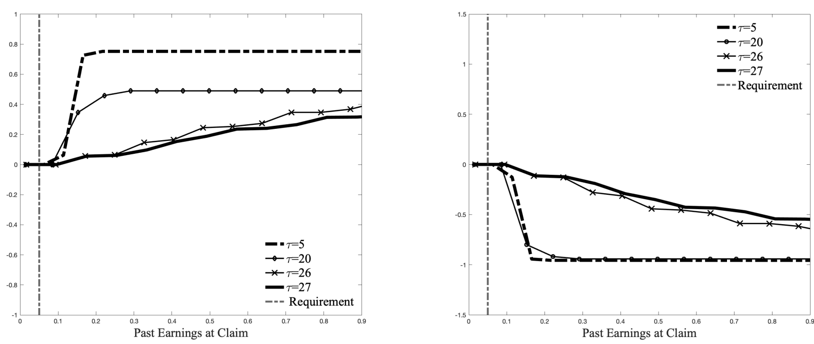

Figure 6: Wage policy (left) and market tightness (right) of receivers

Each figure is plotted as the percentage change from the monetary eligibility threshold. We can see that once a worker has past earning past the monetary eligibility threshold, the value of applying for UI increases as past earning increases. As a result, worker search for a higher wage since their outside options increase. Moreover, since non-quitters have a higher probability of getting accepted with UI, their targeted wage is even higher than quitters.

For a worker who is already receiving UI, his UI benefit is a function of the past earnings at the time when they decide to apply. Therefore, the wage they search for is a function of that past earnings. Moreover, since receiver can only receive UI for at most 26 weeks under regular state program, given a same past earnings, optimal wage decreases as τ increases.This is due to the fact that for workers who almost reach the end of the maximum UI duration, they value the expected value of getting back to employment much more than staying unemployed since being employed again means another opportunity to renew UI.

Next we show the distribution of the workers from the simulation. Here, we only look at workers who found a job. Figure 7 shows the distribution of those workers' base period earnings, and the distribution of post unemployment quarterly earnings, which $\sum_{t=1}^{13} w_t z_t$ since reemployment. Then we show the discontinuity at the monetary eligibility cut-off (past earning at 2.6) in post unemployment earnings generated by the model Figure 8.

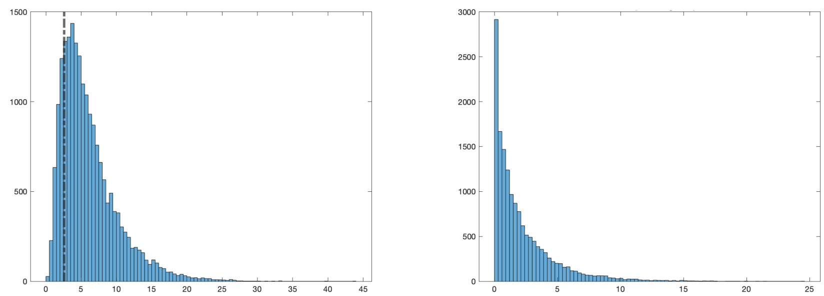

Figure 7: Annual Base Period Past Earning (left) and Quarterly Post unemployment Earning (right))

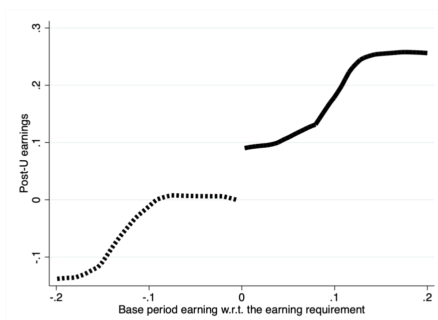

Figure 8: Post unemployment earnings conditional on base period earnings