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The Implications of Labor Market Heterogeneity for Unemployment Insurance Design*

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August 2026

Abstract

We estimate unemployment insurance (UI) eligibility, take-up, and replacement rates at the individual level and document how they vary with earnings, wealth, and unemployment duration. We extend a widely used framework that combines an incomplete-markets model with a frictional labor market to match our findings. We show that the optimal UI policy becomes substantially more generous once the model captures our findings. The gap between optimal policies in the two models is largely driven by endogenous UI take-up, which entails a utility cost: only those who value UI the most choose to claim it. The welfare gains from insuring these workers outweigh the losses from increased take-up.

Keywords: Unemployment Insurance, Fiscal Policy and Household Behavior, Job Search
JEL Classification: E24, H31, J64, J65

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1 Introduction

Unemployment insurance (UI) benefits in the U.S. are the key source of transfers to jobless workers. A critical aspect of UI is that job loss is not entirely random, UI eligibility is shaped by employment histories prior to job loss, and UI take-up is a choice. Consequently, the composition of recipients reflects a distinct subset of individuals who have passed through these filters. This paper accounts for the fact that UI recipiency is endogenous—giving rise to a non-representative distribution of recipients—and revisits optimal UI design using a model that links microdata on unemployment and UI outcomes to income and wealth dynamics during unemployment spells.

We make two contributions. First, we construct a dataset that combines state-level and time-varying UI laws on UI eligibility, benefit amount, and benefit duration with microdata on individuals' labor market histories. This dataset allows us to document how income and wealth influence the UI eligibility rate (the share of unemployed who qualify), the take-up rate (the share of the eligible receiving UI), and the replacement rate (the share of past earnings replaced by UI), leading to a non-representative distribution of recipients. Second, we show that when a model reproduces the endogenous selection of UI recipients, the optimal UI policy is substantially more generous, and the welfare gains from the optimal policy are an order of magnitude larger.

A prerequisite for our quantitative analysis is a database, which we construct, that allows us to discipline our model with the characteristics of UI recipients. While past research shows that unemployment risk is higher for low-income workers (Krusell et al., 2017; Mueller, 2017; Guvenen et al., 2021), it remains unclear how income and wealth influence UI eligibility, take-up, and replacement rates. This link is difficult to establish due to the lack of microdata that contain eligibility and replacement rate information.[1] To fill this gap in the literature, we digitize state-level, time-varying UI laws over three decades, detailing eligibility rules for initial applications, payment amounts, and payment durations. We then merge them with microdata from the Survey of Income and Program Participation (SIPP), which provides monthly data on employment, earnings, state of residence, reason for job loss, and UI receipt, and annual data on asset holdings. Using the SIPP, we compare each individual's outcomes against these laws to predict their eligibility and replacement rates. This step allows us to distinguish between the unemployed who are UI-ineligible and those who are eligible but do not collect UI.

Our data reveal substantial heterogeneity in eligibility and take-up rates across income and wealth and over the duration of unemployment. The eligibility rate is higher for those with higher earnings prior to job loss but is lower for those who remain unemployed longer. The former reflects monetary eligibility rules that exclude low-income workers, while the latter is driven by benefit expiration. On the other hand, the take-up rate is lower for those with greater wealth upon job loss but is higher for the long-term unemployed. Wealthier individuals value

[1] In Section 2.1, we discuss how our analysis differs from earlier work estimating UI eligibility and take-up rates (e.g., Blank and Card, 1991; Chetty, 2008).

UI less, whereas those unable to find jobs quickly are more likely to take it up over time.

The main purpose of our quantitative exercise is to answer the following question: If one takes the standard model in the literature and introduces parsimonious deviations that allow the model to capture our empirical findings, how does the optimal UI prescription change? The standard framework used to analyze the positive and normative implications of UI policy is the incomplete-markets model with a frictional labor market in general equilibrium (Hansen and Imrohoroğlu, 1992; Shimer and Werning, 2008; Krusell, Mukoyama, and Şahin, 2010; Nakajima, 2012b; Mitman and Rabinovich, 2015; McKay and Reis, 2016; Kekre, 2023; Braxton, Herkenhoff, and Phillips, 2024). We intentionally introduce parsimonious deviations from this framework for two reasons. First, our baseline model is designed to nest the standard model, allowing us to benchmark our results against a framework that abstracts from the characteristics of UI recipients. Second, the parsimonious nature of our extensions allows us to isolate the mechanisms driving the differences in optimal UI policies across the two frameworks.

Our model extends the standard model along four dimensions. First, rather than assuming full UI take-up, we model take-up as an endogenous decision that entails a utility cost. Second, instead of assuming full UI eligibility and identical replacement rates across recipients, we allow eligibility and replacement rates to depend on past wages. Third, while the literature often models UI expiration as stochastic, we track the duration of UI receipt as benefits are guaranteed for a fixed period. Finally, we introduce heterogeneity in unemployment risk based on worker productivity. As a result, unemployment, eligibility, and take-up dynamics are *not* entirely random but depend on income, wealth, and unemployment duration.

We calibrate the model to match, among other moments, average labor market flow rates, the elasticity of unemployment duration with respect to UI duration, and average eligibility, take-up, and replacement rates across U.S. states. The model reproduces key empirical patterns that are untargeted: the decline in eligibility and the rise in take-up over the unemployment duration, the persistent gaps in eligibility by past earnings, and the wealth differences between unemployed and employed individuals, as well as between UI recipients and non-recipients.

We find that, relative to current U.S. policy, the optimal UI policy features more generous replacement and eligibility rates, particularly for low-wage workers, and a much longer payment duration. In particular, while the average eligibility rate upon job loss is 61 percent and the average replacement rate is 55 percent under the current policy, the optimal policy features full eligibility upon job loss with an average replacement rate of 74 percent. Relative to the current policy, the optimal policy yields a 2.1 percent average consumption-equivalent welfare gain, with around 40 percent of the population experiencing welfare gains. The unemployed with low wealth gain substantially, while most employed with high productivity incur losses from higher taxes.

Our key message is that capturing the characteristics of UI recipients is fundamental for normative prescriptions for UI policy. To show this, we shut down the novel elements of our model and reduce it to the standard model that assumes full take-up and homogeneous job-finding, job-separation, eligibility, and replacement rates. Consequently, the standard model cannot capture the characteristics of UI recipients because it severs the link between heterogeneity in income and wealth and heterogeneity in unemployment risk and UI outcomes. In the standard model, the optimal policy features an 82 percent eligibility rate upon job loss but only an 11 percent replacement rate. Relative to the current policy, the optimal policy in this model yields only a 0.4 percent average welfare gain, with almost all individuals experiencing similar welfare gains.

Why does accounting for the characteristics of UI recipients call for a more generous optimal UI? The reason lies in the heterogeneity in the insurance–incentive tradeoff of UI. First, the consumption-smoothing motive is strong when recipients are mainly wealth-poor and low-income, as in the data. Insurance benefits are therefore more potent than in models that abstract from this feature. Second, the adverse effects of UI on job finding are relatively weaker for the wealth-poor unemployed in our model—consistent with both our data and the specifications in Chetty (2008) closest to our measurement, as we discuss later. In the model, wealth-poor individuals have a larger surplus from employment relative to unemployment. Thus, holding limited wealth during unemployment acts as a disciplining device that dampens the negative impact of UI on job search. In the standard model that does not capture our findings, individuals with high income and wealth are as likely to be unemployed and receive UI as those with low income and wealth, contrary to the data. Hence, the insurance value of UI is understated, since wealthy agents have sufficient self-insurance, while the incentive costs are overstated, as wealth-rich recipients reduce search effort and seek high-wage jobs that are harder to find when UI generosity increases.

We find that the main channel leading to the large gap between the optimal policies in the two models is endogenous take-up. One might expect that when the take-up decision is endogenous and entails a utility cost, higher take-up rates mechanically reduce average welfare, discouraging the planner from providing more generous UI. While this intuition is correct, a separate mechanism dominates. When claiming benefits is costly, only those who value UI the most choose to take it. This self-selection incentivizes the planner to set more generous UI. If take-up is random or full, this mechanism disappears, and optimal UI is less generous.

We acknowledge and, in fact, show that the exact optimal policy depends on modeling choices. However, the *gap* between the optimal policies in our model and the standard model is robust across a range of plausible specifications: The optimal policy is *always more generous* in a model that captures the characteristics of recipients than in one that does not. This holds even when the redistributive role of UI is muted or when the disincentive effect of UI is larger. Ultimately, ignoring the characteristics of recipients biases optimal policy toward being too restrictive.

Recent work has digitized selected dimensions of the UI system, such as benefit amount formulas across states (Doniger and Toohey, 2022) or the eligibility rules of a single state (Chao, Griffy, and Wiczer, 2025). We build a comprehensive database that digitizes the full UI system, covering granular eligibility, payment, and duration rules across all U.S. states over three decades. Importantly, we have prepared our database in a format that can be merged with microdata, in the spirit of the NBER TAXSIM. The eventual publication of this resource can be useful for future analyses in several ways, which are left out of this paper to keep it focused. First, we document large differences in eligibility rules across U.S. states as well as *simultaneous* changes in these rules alongside UI extensions. In particular, the correlation between state-level increases in previous earnings required for eligibility and extensions in UI duration is 0.43. As such, a comparison of unemployment responses based solely on changes in UI duration may be misleading. Second, our data can be useful for studies comparing fiscal policies across U.S. states over time. Finally, on the quantitative side, our data can also be useful for analyzing optimal UI at the state level.

The rest of the paper is organized as follows. Section 2 describes the data and empirical findings, Section 3 presents the model, and Section 4 provides calibration details. Section 5 discusses model validation, and Section 6 presents the results from our model and the standard model. Section 7 provides results under different model specifications, and Section 8 concludes.

2 Empirical Findings

In this section, we link two sources of data: the SIPP and UI policy rules. Because the SIPP provides information on UI receipt but not on eligibility or replacement rates, we use observables to predict eligibility and replacement rates based on UI rules. This allows us to document heterogeneity among the unemployed by previous income, wealth, and UI outcomes. While Birinci and See (2023) established heterogeneity among the unemployed *upon* job loss, our analysis here makes three key contributions. First, we provide novel evidence on how heterogeneity among the unemployed evolves over unemployment duration. This extension is non-trivial: it requires tracking changes in state-level UI rules and labor market outcomes across all spells over time. Second, we provide results to uncover the underlying reasons behind imperfect eligibility and take-up. These findings inform our modeling choices and serve to discipline the model. Finally, we show how our empirical work is useful in analyzing how *all* levers of UI policy—beyond the well-studied effects of UI duration—shape labor market outcomes for heterogeneous workers.

2.1 Data and measurement

We start by providing details on our two data sources and our measurement of UI outcomes.

2.1.1 SIPP

The SIPP provides monthly data on demographics, employment, earnings, state of residence, reason of job separation, and UI receipt. The monthly information on employment and earnings will be important for improving the earlier measures of UI eligibility, as we discuss in detail below. In addition, the SIPP also provides (typically) annual data on wealth holdings. Appendix A.1 and A.2 provide more details on the data and measurement, respectively.

2.1.2 State-level and time-varying UI policies

The UI laws determine (i) the eligibility of a new UI application, (ii) the UI payment amount, and (iii) the duration of UI payment (i.e., how many weeks an eligible unemployed may collect UI). Importantly, all these rules vary *between* states, as well as over time *within* a state.[2]

UI eligibility of a new application. A person's eligibility upon submitting a new application is determined by both monetary and non-monetary rules. The non-monetary criterion assesses the reason for job loss, ensuring that the individual did not leave their job voluntarily or was not terminated due to misconduct. This requirement is invariant across states and over time.[3]

The monetary eligibility rules require that the applicant meets certain earnings and employment thresholds during the base period (BP)—typically the first four of the last five completed calendar quarters preceding the UI claim. While almost all states require a certain number of quarters with positive earnings in the BP, some states impose a minimum amount of earnings during the BP, and others impose a combination of requirements based on quarter-specific earnings and the expected weekly benefit amount (WBA). Importantly, states not only often change their earnings thresholds but also sometimes change their eligibility rules altogether. Thus, we cannot assume the same eligibility rules for all unemployed individuals and must instead keep track of these location- and time-based rules between 1996 and 2023—the period between the start of our SIPP sample and the most recent publication of UI laws across states. The rules used to determine monetary eligibility vary greatly across states, as we describe below.

Employment or hours worked. Most states require two quarters with positive earnings (i.e., employment) in the BP.[4] Some states, such as California and Colorado, did not impose this requirement between 1996 and 2023 except in 2004, while other states opted in or out of it over time. For instance, Minnesota implemented it after 2013, while Vermont removed it after 2001.

BP earnings. Many states use BP earnings thresholds for UI eligibility. However, the formula to calculate the minimum BP earnings varies greatly across states and over time. Specifically, states calculate the minimum BP earnings using any of the following methods: (i) certain (arbitrarily chosen) dollar amount, (ii) multiple of highest quarter earnings (typically at least 1.5 times of the highest quarter earnings), or (iii) multiple of the worker's expected WBA. Moreover, if earnings in the BP do not allow eligibility, some states also check earnings during the alternative base period (ABP)—typically the four most recently completed calendar quarters preceding the UI claim. We implement the same rule for these states in our analysis.

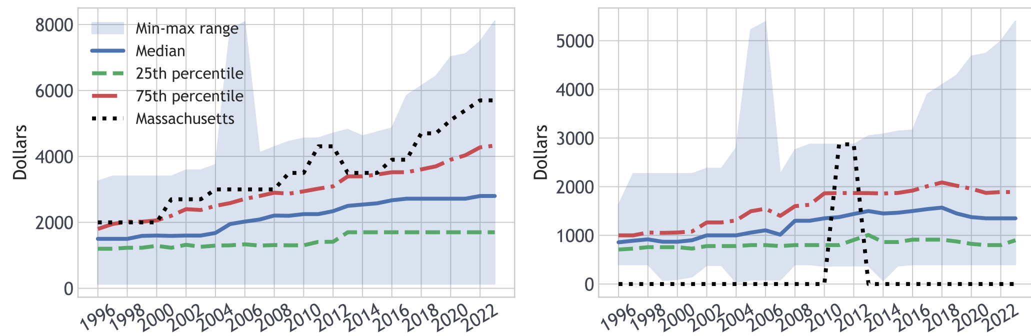
[2] We obtain these rules from the website of the Department of Labor Employment and Training Administration.

[3] However, during the COVID-19 episode—which is outside our period of analysis for main results, due to reasons noted below—those who quit their jobs due to health concerns were considered eligible in many states.

[4] Between 2004 and 2007, Nevada required three quarters of employment in the BP. Other than this case, no other state required more than two quarters of employment in the BP. In addition, instead of quarters of employment, some states impose specific thresholds on total hours worked in the BP. For such rare instances, we approximate these hour thresholds by quarters of employment. For example, in 2016, Washington required a total of 680 hours of employment in the BP, for which we impose a two-quarter employment requirement.

Figure 1: State-level and time-varying UI eligibility requirements

(a) Earnings required in base period (b) Earnings required in highest quarter



Note: Panels (a) and (b) present the minimum amount of earnings required in the base period (BP) and in the highest quarter of the BP across states, respectively. Among states that implement these rules, we show minimum and maximum nominal dollar amounts of these minimum earnings requirements as well as the median, 25th, and 75th percentiles of distributions of these requirements. We also present these requirements for one state—for which we chose Massachusetts—to demonstrate changes over time within a state.

Highest quarter or two highest quarter earnings. Some states require that workers earn a certain amount in the quarter with the highest earnings or in two quarters with the highest earnings of their BP. These highest-quarter or two-highest-quarter earnings requirements are often combined with either a BP earnings requirement or an amount earned outside the highest quarter.

Qualifying for minimum WBA. A few states require that a worker's calculated WBA should be larger than a minimum WBA threshold for eligibility.

To illustrate the extent of differences in these requirements across states and over time, Figure 1 presents the minimum amount of earnings required in the BP (Panel (a)) and in the highest quarter of the BP (Panel (b)). Among states that implement these rules, it shows the minimum and maximum nominal amounts of these requirements as well as the median, 25th, and 75th percentiles of the distributions of these requirements. We also present these requirements in Massachusetts (MA) as an example to show how these rules change over time within a state.

We highlight two important takeaways. First, there are large differences in minimum earnings thresholds for any given year. In 2023, the earnings requirement in the BP (Panel (a)) varied across states between \$130 (HI) and \$8,103 (AZ) with the median value of \$2,800 (NH), and the earnings requirement in the highest quarter (Panel (b)) varied across states between \$400 (NV) and \$5,402 (AZ) with the median value of \$1,350 (WI).[5] Second, there are large and unsystematic changes within a state.[6] For example, relative to the year prior, MA increased the BP earnings threshold by 35 percent in 2001 and by 23 percent in 2011—both of which are beyond inflationary adjustments—but reduced it by 19 percent in 2013. Further, MA did not impose any earnings requirement for the highest quarter in all years except 2011 and 2012. Thus, in 2011, MA made eligibility criteria stricter by increasing the BP earnings threshold and imposing a highest-quarter

[5] These differences are not driven by differences in price levels across states. For example, New York and California—two states with relatively similar price levels—have substantially different eligibility requirements. In 2023, the BP earnings requirement was \$4,650 in New York, compared with \$1,125 in California. By contrast, the requirement was \$8,103 in Arizona, despite its substantially lower price level than New York and California.

[6] Large increases in 2005 and 2006 occurred in Oregon due to additional monetary requirements in state law.

earnings requirement.[7] Then, in 2013, it reduced the BP earnings threshold substantially and removed the highest-quarter earnings requirement, making the eligibility criteria less strict again.

UI payment amount. The WBA replaces a certain fraction of previous earnings. However, states differ in their (i) methods of computing WBA and (ii) maximum WBA levels. We first explain the differences in methods of computing WBA across states.

High-quarter method. Around half of the states determined the WBA by utilizing earnings in the highest quarter in the BP. Under this method, the WBA is calculated by multiplying the average earnings per week in that quarter with the percentage of weekly earnings that the state replaces. For instance, if a state replaces 50 percent of weekly earnings, then the WBA is obtained by multiplying the earnings in the highest quarter by 1/26. While 1/26 is the most common multiple used by states, it varies across states as some use a fraction generating a higher WBA (e.g., 1/23) given that even the highest quarter may include some unemployment.

Multi-quarter method. The WBA is obtained as a percentage of the total or average quarterly earnings in more than one quarter—often two quarters—in the BP.

Annual-earnings method. The WBA is calculated as a percentage of BP annual earnings.

Once the WBA is calculated under either of these methods, the WBA is then checked against the maximum WBA paid by the state. If the calculated WBA is greater than the maximum WBA, then the worker only receives the maximum WBA as UI payment. Although all states maintained a maximum WBA threshold, the levels of this threshold largely varied both across states and over time within a state, as shown by Figure A1 in Appendix A.3.

UI payment duration. Finally, the maximum UI duration also differs across states and over time. Regular benefits are typically paid for 26 weeks in most states, with a range between 13 and 30 weeks. However, longer UI durations are made available during periods of high unemployment through the Extended Benefits (EB) program or discretionary programs such as the Temporary Emergency Unemployment Compensation (TEUC) program and the Emergency Unemployment Compensation (EUC) program.[8] For instance, the maximum UI duration peaked between 81 and 99 weeks in many states during the Great Recession due to these extensions.

2.1.3 Estimation of UI eligibility, take-up, and replacement rates

Because the SIPP does not provide information on eligibility or replacement rates for unemployed individuals, we develop a program that combines SIPP data with digitized, state-level, and time-varying UI laws to predict eligibility and replacement rates.

First, we link the information on employment, earnings, reason for unemployment, and state of residence from the SIPP with monetary and non-monetary eligibility rules across states be-

[7] In fact, MA had the highest earnings required in the highest quarter in 2011 and 2012 together with Michigan.
[8] We incorporate all of these UI extensions into our program based on state-level unemployment rates.

tween 1996 and 2016.[9] Using respondents' labor market histories, this allows us to estimate a person's UI eligibility upon unemployment.[10] This way, we distinguish in the microdata job losers who are UI-ineligible from those who are eligible but choose not to collect benefits.

We define an unemployed individual as *UI eligible* for that spell if her outcomes in the SIPP prior to job loss satisfy all eligibility rules in her state at that time. Otherwise, the person is *UI ineligible* for that spell. Next, we define UI-eligible individuals with non-zero UI income in a given month in the SIPP as eligible unemployed who *take up* UI in that month, and those with no UI income as those who *do not take up* UI or *non-take-up* in that month.[11]

Next, we change an individual's status to UI-ineligible in a spell after her benefit duration reaches the maximum duration. An individual whose benefits expire is defined as an *exhaustee*.[12]

Finally, using rules on UI payment amounts together with information from the SIPP, we estimate an unemployed individual's UI replacement rate by dividing the WBA with the average weekly wages (AWW). The AWW is calculated as the ratio of total BP (or ABP) earnings to the number of weeks with positive earnings in the BP (or ABP).

Given these definitions, we calculate our moments of interest: the fraction of eligible unemployed (FEU), i.e., $\frac{\text{Eligible unemployed}}{\text{Unemployed}}$; the fraction who take up among the UI eligible, i.e., the take-up rate (TUR) $\frac{\text{UI recipients}}{\text{Eligible unemployed}}$; and the average replacement rate among the eligible, i.e., the average of individual-specific replacement rates obtained by $\frac{\text{WBA}}{\text{AWW}}$. We use individual weights in the SIPP to obtain these moments over time and over the duration of unemployment.

Validation of our approach. As our analysis involves many steps, it is necessary to comment on how we validate the correctness of our approach. We provide three results for this purpose. First, to evaluate whether the number of UI recipients in our data aligns with aggregate statistics, we compare the number of recipients in the SIPP with the number of continued claims reported by the Department of Labor. Figure A3 shows that the two series closely track each other over time. Second, our program very rarely classifies an individual who reports receiving UI in the SIPP as ineligible, suggesting that it correctly assigns eligibility status. Finally, we show

[9]While we document UI laws through 2023, we do not extend the estimation of eligibility, take-up, and replacement rates beyond 2016 because of the redesign of the SIPP survey starting with the 2014 panel. Using the SIPP 2014 panel, we show in Figure A2 that this redesign caused a large underestimation of the take-up rate.

[10]Since we do not observe the UI application date in the SIPP, we use the month of job loss rather than the UI claim month to assign the BP. As Panel (c) of Figure 3 shows, more than 95 percent of UI recipients collect their first UI payment within three months of job loss. Therefore, using the month of job loss to assign the BP is an appropriate assumption in the absence of the UI application date.

[11]One concern is the under-reporting of UI income in survey data, including the SIPP (Meyer et al., 2015), which may lead to an underestimation of take-up rates in our analysis. While UI income is under-reported in the SIPP, we show in Figure A3 that the number of people receiving UI in the SIPP closely tracks the official number of continued claims reported by the Department of Labor over time. This result alleviates the concern that take-up rates are underestimated in our program. Moreover, it is not clear whether UI income misreporting varies by income or asset levels. Finally, as Footnote 9 discusses, our main results do not use data after the SIPP 2014 panel, as the survey redesign in 2014 caused a large underestimation of the take-up rate.

[12]To remain eligible for UI during the spell, recipients must keep searching for work and not reject reasonable offers. Because we lack data on these behaviors, our approach cannot capture this aspect of eligibility.

that eligibility and take-up rates over spell duration change in an intuitive way during recessions, lending further credibility to our eligibility estimates. As discussed in Section 2.2, eligibility rates do not decline over the spell during the Great Recession due to UI extensions, while take-up rates rise even more over the spell during this episode due to lower job-finding rates.

Comparison to earlier work. Other efforts to estimate UI eligibility, take-up, and replacement rates exist but have notable limitations. For example, Blank and Card (1991) estimate eligibility and take-up rates using the Current Population Survey (CPS) between 1977 and 1987.[13] Because the CPS contains only annual earnings information, their approach relies on substantially simplified monetary eligibility rules—only the BP earnings requirement—and ignores more complex quarter-specific requirements, such as highest-quarter earnings or the distribution of earnings across quarters during the BP. By 1987, 38 states imposed such additional rules, and failing to account for them would produce inaccurate estimates. Blank and Card (1991) also assume that reported annual earnings represent BP earnings, which is true only if the job loss coincides precisely with the calendar year. In contrast, our analysis uses monthly earnings in the SIPP to determine BP earnings exactly. Chetty (2008) also estimates eligibility and take-up rates using the SIPP and UI rules for 1984–1994 but omits many key provisions. As in Blank and Card (1991), eligibility rules in Chetty (2008) capture only the basic BP earnings requirement, leaving out other rules such as a highest-quarter earnings requirement, which in 1996 alone served as the sole requirement in 14 states and existed in some form in 33 states. Multi-quarter requirements, present in 20 states in 1996, and ABP earnings tests that provide opportunities to qualify are also omitted. In contrast, our approach covers all monetary and non-monetary eligibility rules at a granular, state- and time-specific level, largely improving the accuracy of estimating eligibility, take-up, and replacement rates.

2.1.4 State-level average UI eligibility, take-up, and replacement rates

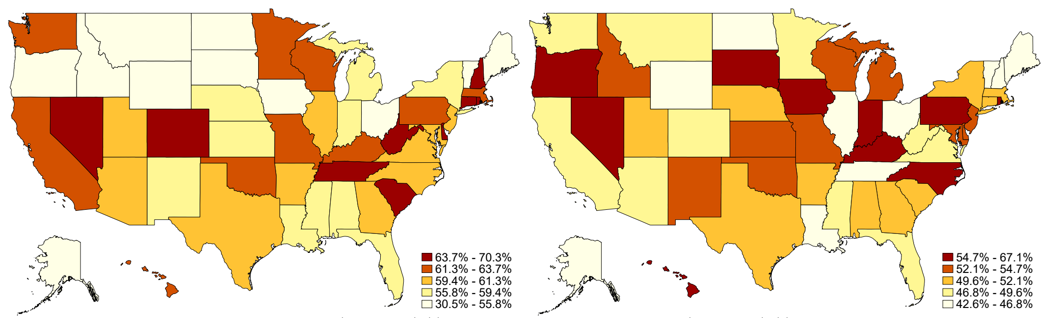
Before proceeding to our results on how the composition of unemployed changes over the unemployment spell, we first illustrate the extent of variations in eligibility, replacement, and take-up rates across states. Figure 2 presents the average eligibility and replacement rates between 1996 and 2016 across states, while Figure A4 in Appendix A.3 shows the average take-up rates.[14]

We find substantial differences in eligibility and replacement rates across states.[15] Specifically, eligibility and replacement rates vary across states between 30.5 percent and 70.3 percent (Panel (a)) and 42.6 percent and 67.1 percent (Panel (b)), respectively. Importantly, these rates differ even among some neighbor states that are expected to have similar economic performances.

[13] Auray et al. (2019) update these estimates until 2012 following the approach in Blank and Card (1991).
[14] For each state, we obtain these averages by taking the mean of monthly rates between 1996 and 2016.
[15] These differences are driven by both differences in UI systems and compositions of unemployed individuals.

Figure 2: State-level average eligibility and replacement rates

(a) Eligibility rate (b) Replacement rate



Note: This figure plots the average eligibility (Panel (a)) and replacement rates (Panel (b)) between 1996 and 2016 across states. We obtain these averages by taking the mean of monthly rates, separately for each state. In each panel, we group states based on the quintiles of unweighted distributions of rates across states. Lighter (darker) colors represent lower (higher) values of these rates.

2.1.5 Relevance of our empirical analysis for estimating disincentive effects of UI

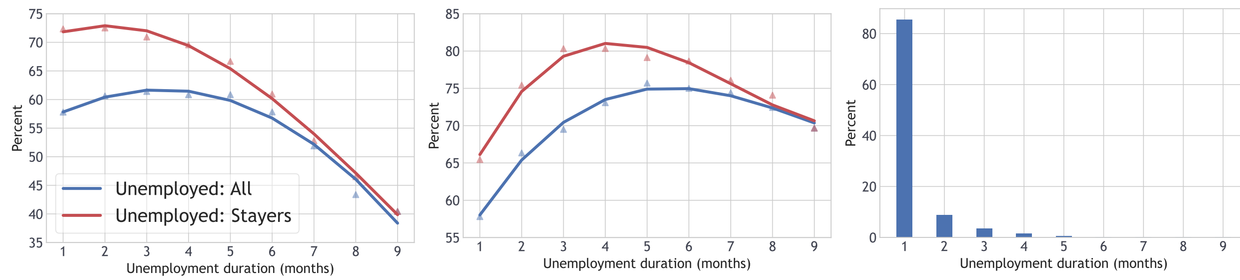
Our results in Figures 1 and 2 speak directly to the large literature on estimating the disincentive effects of UI. These studies rely on differences in the maximum UI duration across states and changes in this rule over time to identify the effect of UI generosity on job-finding and unemployment rates (Rothstein, 2011; Amaral and Ice, 2014; Farber and Valletta, 2015; Johnston and Mas, 2018; Chodorow-Reich et al., 2019; Hagedorn et al., 2019; Dieterle et al., 2020; Boone et al., 2021; Hornstein et al., 2023; Acosta et al., 2024; Karahan et al., 2025). This approach, however, overlooks state- and time-varying differences in UI eligibility rules and payment amounts.

Why do such differences matter for estimating the effects of changes in UI duration? First, there are large differences in eligibility rules across states. These differences can distort estimates of how much changes in UI duration affect job-finding and unemployment rates. For example, if two states extend benefits by the same amount but they differ in terms of eligibility rules, job losers in the state with stricter eligibility may not benefit from the extension. As a result, the measured changes in labor market outcomes in that state may appear smaller—not because the true behavioral elasticity differs, but because the extension reaches fewer workers.

Second, states often make changes in eligibility rules *simultaneously* with changes in UI duration. For example, large changes in UI duration in Massachusetts (MA) occurred during the Great Recession: the regular duration of 30 weeks in 2008 was raised to 99 weeks in 2011 and remained well above 30 weeks in 2012. However, because of budgetary concerns, MA tightened eligibility between 2011 and 2012 by raising the BP earnings threshold and imposing a highest-quarter earnings requirement, as Figure 1 shows. Thus, while UI extensions appeared to make UI more generous, eligibility rules were also tightened during these years. Generalizing from this example, we find that the correlation between state-level increases in the earnings required in the BP and extensions in UI duration is 0.43. As a result, we conjecture that a comparison of unemployment responses based solely on changes in UI duration may be misleading because such responses may be amplified or dampened by simultaneous changes in eligibility rules.

Figure 3: Eligibility and take-up dynamics over unemployment duration

(a) Eligibility rate (b) Take-up rate (c) Timing of initial take-up



Note: Panel (a) shows how the eligibility rate (FEU)—defined as the fraction of unemployed individuals who are eligible for UI—evolves with months of unemployment. To construct FEU dynamics, we restrict the sample to unemployed individuals and regress an eligibility dummy on unemployment-duration dummies (in months), applying individual weights. We then fit a cubic polynomial (solid blue line) through the estimated coefficients (blue triangles). Panel (b) applies the same procedure to the take-up rate (TUR)—defined as the fraction of eligible who take up UI. Here, we restrict the sample to UI-eligible individuals and replace the dependent variable with a UI-receipt dummy. The blue lines compute the FEU and TUR for the full sample of unemployed, while the red lines are for a subset of individuals who remain unemployed for at least 9 months. Panel (c) takes a sample of all recipients at some point during the unemployment spell and shows the distribution of the month of the spell during which UI is taken up for the first time.

2.2 Composition of unemployed over unemployment duration

We now present results on how the composition of unemployed changes over the unemployment spell and discuss underlying reasons behind imperfect eligibility and take-up rates.

Eligibility and take-up dynamics. To obtain the FEU and TUR over the spell, we pool all observations from the 1996, 2001, and 2004 SIPP panels and create an individual-level panel data of the unemployed with detailed information on outcomes before and after the job loss.[16]

Panels (a) and (b) of Figure 3 show the dynamics of average FEU and TUR, respectively. To generate the dynamics of average FEU, we restrict our sample to unemployed individuals and first regress a UI eligibility dummy on monthly unemployment-duration dummies. We then fit a cubic polynomial (solid blue line) to the resulting coefficients (blue triangles). We repeat the same process to obtain the dynamics of TUR where we use the same data but restrict the sample to those who are eligible and change the dependent variable to a dummy of UI receipt. We note that even when we control for the characteristics of individuals in our regressions, dynamics of FEU and TUR remain mostly similar, as shown by Figure A5 in Appendix A.3.

We first focus on the blue lines ("Unemployed: All") which encompasses the full sample (i.e., all unemployment spells). The average FEU declines from 58 percent to 38 percent after nine months of unemployment, while the average TUR rises from 58 percent in the first month of unemployment to 75 percent in the sixth month and remains mostly similar after that month.[17]

The average FEU and TUR can change over the unemployment duration either due to changes in the composition of groups within the unemployed or due to changes in the behavior and

[16]Because our model is calibrated to the episode prior to the Great Recession, we present our main results using these SIPP panels, covering between 1996 and 2007. Figure A2 repeats these results for other SIPP panels.

[17]To show how FEU and TUR evolve during a downturn, Figure A2 replicates Panels (a) and (b) of Figure 3 using the SIPP 2008 panel (covering 2008–2013). Figure A2 also reports the same moments using the SIPP 2014 panel (covering 2014-2016) to show how a survey redesign in the SIPP affected these moments.

outcomes of those who remain unemployed for the entire nine months. Our remaining discussions and results in this section help us differentiate between these potential reasons.

Role of composition. We calculate the average FEU and TUR for a restricted sample of individuals who remain unemployed for at least nine months. These moments are given by the red lines in Panels (a) and (b), which we label "Unemployed: Stayers." Comparison of blue and red lines help us isolate the role of compositional changes on the dynamics of FEU and TUR.

Starting with Panel (a), we highlight three important observations. First, the FEU upon job loss is higher for the long-term unemployed (red line) than for all unemployed (72 vs 58 percent). This result is interesting because one might expect a lower eligibility rate upon job loss among the long-term unemployed (stayers), as they typically earn less while employed and are thus less likely to satisfy monetary eligibility rules. While this insight is true (as discussed below in Figure 4), this effect is outweighed by the fact that the long-term unemployed are much more likely to separate from their jobs for a valid reason (i.e., not due to a voluntary quit).[18] Second, while the FEU slightly increases during the earlier months of the spell for the full sample, the same pattern is not observed for the long-term unemployed. This is because UI-ineligible individuals typically exit unemployment earlier.[19] Finally, the FEU among stayers also declines but more sharply, reflecting UI exhaustion after collecting it for six months (i.e., the typical UI payment duration), though it remains substantial at about 40 percent at nine months. There are two reasons why the FEU is not close to zero at nine months: Some eligible individuals delay or never take up UI (as discussed below) and some states provide UI for longer duration.

Moving to Panel (b), stayers exhibit higher TUR upon job loss as those who are predisposed to remain unemployed longer tend to have lower wealth, leading to greater reliance on UI, as shown below in Figure 4.[20] The TUR also reaches to higher levels over the spell among the stayers since they are more likely to deplete their wealth over time, inducing greater UI participation.

Role of delayed take-up. There are two key features in the TUR dynamics that merit further discussion. First, the TUR rises during the early months of unemployment. To understand this, Panel (c) takes a sample of unemployment spells with UI receipt at some point during the spell and shows the distribution of the month of the spell during which UI is taken up for the first time. It shows that while a majority (86 percent) of all such spells exhibit take up in the first month, a fraction of workers delay claiming even until the fourth or fifth month, though this share becomes progressively smaller. As discussed earlier, delayed take up may reflect the depletion of self-insurance (with low-wealth workers exhibiting higher take-up, as will be shown below) or the realization that a spell will last longer than initially expected. Second, the TUR begins to decline

[18] The fraction of spells with a valid job separation reason is around 20 percentage points higher among the stayers. This difference largely accounts for the gap in FEU upon job loss between the stayers and the full sample.

[19] The average completed spell duration is 2.6 months among the ineligible and 3.2 months among the eligible.

[20] The average net liquid wealth upon job loss among stayers is only 40 percent of that in the full sample.

after the sixth month. Turning to the red lines to eliminate the compositional effects of exits from unemployment, the decline in FEU during the later months indicates that many workers who claimed benefits early eventually exhaust UI. This implies that, over time, the remaining eligible unemployed increasingly consist of individuals who never take up UI, which is why the TUR declines after six months. The fact that around 30 percent of eligible unemployed do not claim UI even after staying unemployed for nine months suggests that they are either unaware of their eligibility or are well-insured from other sources to remain "never takers."

Role of previous labor earnings and self insurance. Finally, imperfect FEU upon job loss is likely driven by job losers whose previous earnings do not satisfy monetary eligibility rules. To document the role of previous earnings in determining eligibility, we provide FEU dynamics separately for individuals with lower and higher previous earnings. Specifically, using previous earnings for each spell, we classify spells into those originating from below or above the median of the earnings distribution of employed individuals in that month.

Panel (a) in Figure 4 shows that the eligibility rate is lower among low-income workers. In particular, at the onset of the spell, the FEU of separations originating from below the median of the earnings distribution is 9 percentage points (pp) lower than that of those originating from above the median.[21] This gap remains largely unchanged over the course of the unemployment spell. Furthermore, as shown in Table 1, when we calculate the FEU upon job loss across quintiles of the previous earnings distribution—rather than comparing below- vs. above-median differences—we find an even larger gap between the top and bottom quintiles: the FEU upon job loss in the bottom quintile is only around half that of the top quintile.

Moving to TUR dynamics, one potential reason behind the imperfect TUR upon job loss is the presence of job losers with high levels of wealth. To document this, we measure the TUR dynamics separately for individuals with lower and higher wealth levels. Our analysis involves the following steps. Using specific waves of the SIPP panels that contain wealth information, we measure net liquid assets—the summation of liquid assets net of revolving debt—of each individual. To evaluate the level of self-insurance, we use the asset-to-income ratio as our metric, which is obtained by dividing net liquid assets by current earnings for the employed or previous earnings for the unemployed. Then, we assign each spell into those that originate from below or above the median of the asset-to-income ratio distribution in that month.[22]

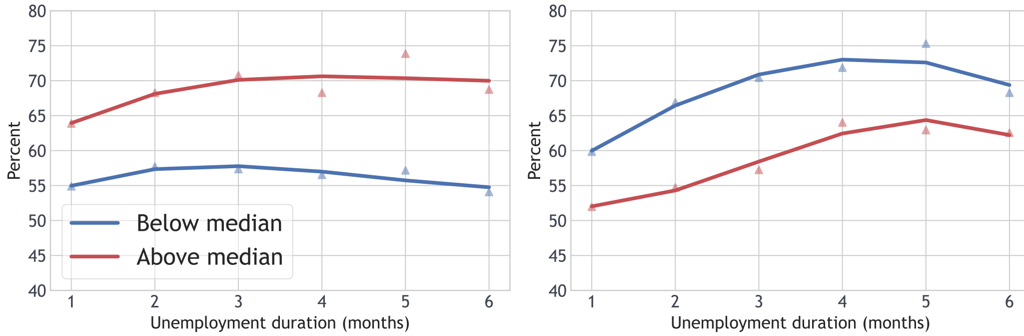
Panel (b) shows that the TUR is higher among wealth-poor workers. Specifically, the TUR in the first month of unemployment is 60 percent for separations below the median, while it is

[21] When the sample is split into groups, the sample size in each group at longer durations becomes small. For this reason, we plot coefficients only until the sixth month in Figure 4. Notice that, as expected, the two lines in Panel (a) of Figure 4 bracket the blue line in Panel (a) of Figure 3. The same is not true when comparing Panel (b) across these figures, as Figure 4 is based on specific waves of the SIPP panels that contain wealth information.

[22] We note that since we typically observe asset holdings annually, we cannot meaningfully analyze how changes in asset holdings over the months of unemployment affect take-up decisions.

Figure 4: Heterogeneity in eligibility and take-up rates over unemployment duration

(a) Eligibility rate by previous earnings (b) Take-up rate by asset-to-income ratio



Note: Panel (a) plots the eligibility rate (FEU)—measured as the fraction of UI eligible within the unemployed—over unemployment duration separately for spells originating from below or above the median of the earnings distribution of the employed. Panel (b) plots the take-up rate (TUR)—measured as the fraction of UI eligible who take up UI within the UI eligible—over unemployment duration separately for spells originating from below or above the median of the economy-wide asset-to-income ratio distribution. We calculate these moments (solid lines and triangles) in both panels following the same procedure described earlier.

52 percent for those above the median. This gap remains similar over the spell. In addition, Table A1 shows that those who take up have lower levels of self insurance than those who do not.[23] Thus, incentives to claim public insurance are linked to the level of private insurance.

As mentioned earlier, another potential reason for imperfect TUR upon job loss is the gap between the expected and realized unemployment durations. As shown by Spinnewijn (2015), the unemployed typically overestimate their job-finding prospects. This optimism may lower their incentives to take up UI early in their spells. However, it is not clear how the gap between expected and realized unemployment durations varies across income and wealth groups in the data. While we are unaware of any previous work or available data that explores this heterogeneity, we conjecture that this gap is larger for low-income workers because of two observations. First, according to the Survey of Consumer Expectations of the New York Fed, while there is limited heterogeneity in the expected probability of an offer arrival among the unemployed by income groups, this probability is slightly higher for low-income workers.[24] Second, the realized average job-finding rate is slightly lower for low-income workers (Krusell et al., 2017). As such, if anything, the gap between expected and realized unemployment durations is potentially larger for low-income workers. However, we find in our data that low-income and low-wealth workers have higher take-up rates early in the spell. Thus, workers who likely underestimate unemployment duration are actually more likely (not less likely) to take up early, suggesting that this gap plays a limited role in the dynamics of the take-up rate over unemployment duration.

2.3 Taking stock and motivations for the model

Our novel contribution is documenting how eligibility and take-up rates evolve as unemployment spells lengthen and uncovering the reasons behind imperfect eligibility and take-up rates.

[23] The mean asset-to-income ratio is 1.55 for the former group, while it is 2.84 for the latter group.

[24] We obtain this result from the website of the New York Fed.

Overall, the insurance value of UI appears to be high upon job loss because, among eligible individuals, the take-up rate is higher among the wealth poor. Importantly, the insurance value of UI potentially grows with the duration of unemployment, as indicated by higher take-up rates over time. In addition, some low-income unemployed individuals—for whom UI's insurance value is potentially large—fail to become UI-eligible upon job loss. These findings motivate a model in which (i) unemployment, eligibility, and take-up dynamics are not entirely random but are tied to income and wealth, and (ii) spell length endogenously affects eligibility and take-up rates.

3 Model

In this section, we adopt a standard framework widely used in the recent UI literature that combines the search-and-matching model of the labor market with an incomplete markets model in general equilibrium (e.g., Krusell et al., 2010; Nakajima, 2012b; Braxton et al., 2024, among others). We extend the standard model along a few dimensions so that it can match our empirical findings. In particular, relative to the standard model, our model incorporates an endogenous UI take-up decision that is subject to a utility cost; a detailed UI system covering imperfect and heterogeneous UI eligibility rates upon job loss, heterogeneous replacement rates, and deterministic UI expiration; and heterogeneous unemployment risk. Importantly, because we deliberately keep our model as close as possible to the standard model, it still nests the standard model, allowing us to evaluate whether matching our empirical findings alters the optimal design of UI.

We note that the model presented here differs from our earlier work (Birinci and See, 2023) in four critical ways. First, given the normative focus of this paper, we adopt a general equilibrium setting in asset markets. This is necessary to capture the impact of UI changes on the interest rate and output through the crowding out of private insurance (i.e., savings) when public insurance (UI) becomes more generous, as highlighted by Young (2004). Second, we explicitly track the number of months of UI receipt and determine benefit exhaustion based on this duration. We discuss later that this structure is critical for the model to generate the observed average FEU and TUR over the course of a spell. Third, we generalize the taxation system, allowing for both linear and progressive taxation, enabling us study optimal UI policy under different tax regimes. Finally, we introduce an exogenous level of government spending to ensure a realistic ratio of spending to output. Without such spending, the tax rate required to finance only UI benefits would be very low, and changes to this low rate would generate unrealistically small welfare effects. This adjustment is important because the welfare consequences of UI reforms depend critically on how policy changes shift the tax rate from empirically relevant levels.

Environment. The preferences of ex-ante identical individuals are given by

$$U(c,s,d) = u(c) - \nu_s(s) - \nu_d(d),$$

where $u(\cdot)$ is a utility function over consumption c, and $\nu_s(\cdot)$ and $\nu_d(\cdot)$ represent the disutility associated with job-search effort $s \in [0,1]$ and UI take-up effort $d \in [0,1]$, respectively. Individuals discount the future at rate β and die with probability ω.

Individuals are risk-averse and are ex-post heterogeneous in terms of their employment status $l \in \{W, B, NB\}$, assets $a \in \mathcal{A} \equiv [a_l, a_h] \subseteq \mathbb{R}$, labor productivity $y \in \mathcal{Y} \equiv [y_l, y_h] \subseteq \mathbb{R}_+$, current (previous) wages for employed (UI eligible unemployed) $w \in \mathcal{W} \equiv [w_l, w_h] \subseteq \mathbb{R}_+$, and completed duration of UI receipt within a spell for UI eligible unemployed $x \in \mathcal{X} \subseteq \mathbb{Z}_{\geq 0}$. An individual can be a worker W, unemployed and eligible for UI B, and unemployed and not eligible for UI NB.[25] Idiosyncratic productivity y evolves according to a persistent process given by $y' \sim Q(y' \mid y)$.[26] Individuals have access to a risk-free asset a used to insure against employment shocks. We allow for borrowing, i.e., $a_l < 0$, following Braxton et al. (2024) who document that workers maintain access to borrowing upon job loss. To generate an empirically-plausible fraction of net borrowers, we assume that there exists a fixed asset supply A from foreigners.[27] Further, individuals rent capital to firms, which depreciates at rate δ and earns an endogenously determined return r.

Job search in the labor market is directed. Unemployed individuals direct their search toward submarkets indexed by productivity y and wage w. On the other side of the labor market, firms owned by foreign entrepreneurs post vacancies across these submarkets to hire workers and rent capital from individuals to produce. The labor market tightness θ of submarket (w, y) is the ratio of vacancies v posted in the submarket to the aggregate search effort S exerted by all unemployed individuals searching for a job within that submarket. That is, $\theta(w, y) = \frac{v(w,y)}{S(w,y)}$. Given a constant-returns-to-scale matching function $M(v, S)$ that determines the number of matches in a submarket with vacancies v and aggregate search effort S, we define the job-finding rate and the vacancy-filling rate as $f(w, y) = \frac{M(v(w,y),S(w,y))}{S(w,y)}$ and $q(w, y) = \frac{M(v(w,y),S(w,y))}{v(w,y)}$, respectively.[28] Once a match is formed in a submarket (w, y), the pair (w, y) determine the constant wage w of the worker and the exogenous job-separation probability $\gamma(y)$. The firm-worker pair produces output F, the amount of which is determined by a worker's productivity y and capital

[25] While it is possible for unemployed workers to exert very low job-search effort and diminish their chances of finding a job in the model, our model abstracts from a discrete labor force participation decision. This assumption is common in models in this literature (e.g., Krusell et al., 2010; Nakajima, 2012a; Mitman and Rabinovich, 2015; Braxton et al., 2024). Moreover, the model's focus on unemployment is appropriate for our purposes, since the eligibility, take-up, and replacement-rate patterns we target in the data are measured among unemployed job seekers. In the data, among the non-employed, those who cycle between unemployment and non-participation (excluding those who retire) are not very different from those who remain unemployed in terms of their assets.

[26] The process for y is calibrated to be very persistent, lasting on average forty years, the typical working life of an individual. This captures long-lasting productivity differences across workers. Since y is not permanent, we do not need to make assumptions about the weights the planner assigns to worker types in our welfare analysis.

[27] The presence of foreign asset supply allows us to obtain an equilibrium real interest rate r that is low enough to convince individuals to borrow. Models without this assumption (see, for example, Krusell et al., 2010 and Nakajima, 2012a) do not allow for borrowing and set $a_l = 0$. As we will discuss in Section 4, our model features an empirically plausible borrowing limit and fraction of individuals who are net borrowers.

[28] The constant-returns-to-scale assumption guarantees that the equilibrium θ is sufficient to determine job-finding rate $f(\theta) = \frac{M(v,S)}{S} = M(\theta, 1)$ and vacancy-filling rate $q(\theta) = \frac{M(v,S)}{v} = M\left(1, \frac{1}{\theta}\right)$.

input k. We note that, unlike the standard model, which assumes uniform unemployment risk across workers, heterogeneity in job-separation and job-finding probabilities across workers with different productivity levels gives rise to heterogeneous unemployment risk in our model.

An unemployed individual's UI eligibility and benefit amount depend on her previous wage. To capture the fact that not all job losers are eligible and that eligibility requires sufficient past earnings, we assume that a worker with previous wage w is ineligible with probability $g(w)$. An eligible unemployed who takes up receives a fraction $b(w)$ of her previous wage w. To capture the limited UI duration, we track the total duration of UI receipt. An eligible individual is guaranteed UI for $\overline{x}$ periods, after which eligibility terminates at rate ϑ. The parameter $\overline{x}$ is common across individuals, irrespective of prior wages, as in the current UI policy. To account for longer baseline UI durations in some states and for extensions triggered by state-level unemployment thresholds, we allow additional eligibility beyond $\overline{x}$ periods, subject to termination at rate ϑ. Formally, the UI expiration process as a function of the duration of UI receipt x is:

$$e(x;\overline{x}) = \begin{cases} 0 & \text{if } x < \overline{x}, \\ \vartheta & \text{if } x \geq \overline{x}. \end{cases}$$

The government finances the UI program and some exogenous spending G through labor income taxation. Following Benabou (2002) and Heathcote et al. (2014), the after-tax labor income is $\widetilde{p} = (1-\tau)\,p^{1-\Upsilon}$, where $p = w$ for an employed individual and $p = b(w)\,w$ for a UI recipient, τ determines the level of taxation, and $\Upsilon \geq 0$ determines the tax system's progressivity.

Five comments on our modeling of UI policy instruments are in order. First, as explained in detail in Section 2, monetary eligibility rules require sufficient employment duration and sufficient earnings in one or more quarters of the BP, as well as earnings during the BP. Clearly, incorporating all these different rules into the model is challenging, as this would require keeping track of employment and earnings in different quarters prior to job loss as additional state variables. Moreover, in the data, individuals may qualify for eligibility under one condition (e.g., BP earnings) but may not qualify under another condition (e.g., highest-quarter earnings). For this reason, in the model, we cannot assume a single wage threshold for eligibility, as such an assumption would imply that any unemployed with previous wages above that threshold would be eligible. Thus, we model the ineligibility probability, $g(\cdot)$, which will be a declining function of w, as a parsimonious way to capture the likelihood of being eligible based on previous wages. Importantly, in our data, previous earnings are a strong predictor of eligibility. In addition, in our data, workers with lower previous earnings are more likely to have shorter employment spells and be ineligible for UI. As such, our modeling choice of the ineligibility probability, $g(\cdot)$, allows us to both avoid tracking all potential quarter-specific employment and earnings requirements and acknowledge that even those with reasonably high previous wages may not be eligible.[29]

[29]In Section 4, we calibrate the job-separation probability $\gamma(\cdot)$ to match the heterogeneity in the job-separation

Second, as discussed in Section 2, replacement rates are calculated using quarter-specific earnings and are subject to a cap. For similar reasons, we avoid modeling these elements directly and instead capture how replacement rates change with previous wages using the function $b(\cdot)$. In Section 4, we calibrate the functions $g(\cdot)$ and $b(\cdot)$ to match the average and previous-wage heterogeneity of eligibility upon job loss and replacement rates. For comparison, we note that, in the standard model, eligibility is either random or universal, and the replacement rate is identical across recipients (i.e., neither $g(\cdot)$ nor $b(\cdot)$ depends on past wages, and $g(\cdot)$ is often zero).

Third, unlike many papers in this literature that use the standard model, we do not assume fully stochastic UI expiration; instead, we track the total duration of UI receipt. As we discuss in Section 5.1, this element is necessary to capture the FEU dynamics in Figure 3.

Fourth, as our empirical results suggest, the take-up decision is mainly driven by wealth levels. Motivated by this finding, we model take-up as being subject to a utility cost, so claiming signals demand for insurance. Clearly, it is possible to introduce alternative mechanisms that may influence take-up, such as heterogeneity in take-up costs or biased beliefs about expected unemployment durations. As our goal is to stay close to the standard model in this literature, we parsimoniously model take-up costs to capture several potential reasons for imperfect take-up. Critically, our main message is that our baseline model, which captures the characteristics of UI recipients, prescribes a substantially different optimal policy compared with the standard model that does not. As shown in Section 7, while the exact optimal policy in our model changes under different specifications, the gap between optimal policies in the two models remains large.

Finally, as discussed in Section 2, rules on UI eligibility, benefit amount, and benefit duration vary across U.S. states and over time. While our empirical work allows various empirical and quantitative evaluations of state-level UI policy differences, our focus in this paper is to quantitatively evaluate whether matching the dynamics of the average eligibility, take-up, and replacement rates—using state-level averages as shown in Figures 3 and 4—alters the design of UI policy. Hence, neither the model nor the UI policy instruments feature locational differences.

Timing. At the start of each period, an ω fraction of individuals dies and is replaced with newborn individuals and all individuals learn their productivity y.[30] Next, job separation and UI-eligibility shocks realize, and some eligible unemployed experience UI exhaustion. Then, in the labor market stage, the unemployed choose a wage submarket w for their own productivity y within which to look for a job, while firms select the submarket in which to post a vacancy, and the matching between vacancies and unemployed workers occurs. Next, the production and consumption stage commences: firms rent capital, each firm-worker pair produces output, wages are paid to workers, UI-eligible unemployed decide on their take-up effort, benefits are paid to

rate across workers with different wage levels in the data. Thus, our model modeling of $g(\cdot)$ and $\gamma(\cdot)$ capture that those with lower wages have shorter employment spells and lower eligibility rates.

[30]Newborn individuals obtain the wealth and productivity of their offspring and enter into labor market as unemployed eligible with a previous wage drawn from a uniform distribution.

recipients, and all unemployed receive the monetized value of non-market activity, h. Individuals then make consumption and saving decisions. Finally, the unemployed choose the search effort s they will exert in the next period, where the utility cost is incurred in the current period.

Before moving to the discussion of agents' optimization problems, we comment on specific features of the model that will allow it to generate the empirical findings in Section 2. First, the heterogeneity in job-separation and job-finding probabilities based on productivity will be used to generate higher unemployment risk for individuals with low income and wealth, while the heterogeneity in eligibility probability based on previous wages will be used to obtain lower eligibility rates for unemployed with lower previous earnings. Second, the endogenous take-up effort decision together with the utility cost of take-up will imply that eligible individuals will self-select into claiming UI based on their labor market prospects and wealth. As the unemployment spell lengthens, individuals who do not claim UI upon job loss may start increasing their take-up effort once they deplete their wealth. Third, we discuss in Section 5.1 that if we assume that UI expiration is completely random—as in other models in the literature—the dynamics of eligibility and take-up rates deviate substantially from those observed in the data.

Since our goal is to stay close to the standard model, our model omits at least two features one might otherwise expect. First, we do not model human capital dynamics. We note that our model will be disciplined to match the pool of UI recipients, which consists of income- and wealth-poor individuals with relatively low levels of human capital. Thus, the decline in human capital upon job loss would not be sizable compared with a model where high-income workers face high unemployment risk. Further, our main message is that the optimal policies in a model *with* and *without* heterogeneity among the unemployed are largely different. If we were to incorporate human capital dynamics, the decline in human capital over the spell would further widen the gap between the two optimal policies. This is because lower human capital would further increase the insurance value of UI and lower its incentive costs, as the surplus from employment relative to unemployment would widen (see Section 6.2). Second, we do not model endogenous quits. This limitation would be concerning if rises in UI encouraged low-wage workers to quit and collect UI while searching for a high-wage job. However, we find that the surplus from employment even at low-wage jobs remains positive under reasonable rises in UI.

Individual's problem. The recursive problem of an employed individual is given by

$$\begin{aligned} V^{W}\left(a,w,y\right) \;&=\; \max_{c,\,a'\geq a_{l}} \quad u\left(c\right)+\beta\left(1-\omega\right)\mathbb{E}_{y'}\Bigg[\left(1-\gamma\left(y'\right)\right)V^{W}\left(a',w,y'\right) \\ &\qquad +\gamma\left(y'\right)\Big[\left(1-g\left(w\right)\right)V^{B}\left(a',w,y',0\right)+g\left(w\right)V^{NB}\left(a',y'\right)\Big]\Bigg] \end{aligned}$$

subject to

$$c+a'\leq\left(1+r-\delta\right)a+\left(1-\tau\right)w^{1-\Upsilon}. \tag{1}$$

We note that we keep track of previous wages w and completed duration of UI receipt x (which is 0 upon job loss) only for the UI-eligible unemployed.

The value function of a UI-eligible unemployed at the start of a period is given by

$$V^B(a, w, y, x) = \max_{d\in[0,1]} \quad dV_T^B(a, w, y, x) + (1-d)\, V_{NT}^B(a, w, y, x) - \nu_d(d)\,. \tag{2}$$

A UI-eligible unemployed individual chooses a take-up effort level, d, which determines her likelihood of receiving UI. We model the take-up decision this way—rather than as a discrete choice—for two reasons. First, in practice, the effort exerted by UI applicants in providing documentation to demonstrate compliance with eligibility criteria and ongoing requirements plays a key role in determining the success of a UI application.[31] Second, the UI system includes an experience rating mechanism that penalizes firms for additional layoffs by increasing their tax rates. This creates an incentive for firms to challenge workers' UI claims (Auray and Fuller, 2020). As a result, the success of a claim can sometimes depend on the amount of effort the worker puts into contesting the firm's challenge. Moreover, UI applicants incur a utility cost, $\nu_d(d)$, when exerting positive take-up effort. This cost reflects the time and effort required to file an initial UI claim and to provide proof of ongoing compliance for continued UI receipt. Note that we keep track of previous wages, w, even if the unemployed individual does not take up UI in this period, as she may claim UI in the future—consistent with current UI policy in the U.S.

All unemployed individuals decide on their job-search effort s and direct their search toward a wage submarket $\widetilde{w}$ based on their productivity y, with tightness $\theta(\widetilde{w}, y)$ and job-finding rate $f(\theta(\widetilde{w}, y))$. The recursive problem of an eligible unemployed who takes up UI is given by

$$\begin{aligned} V_T^B(a, w, y, x) \quad = \quad & \max_{c,\, a'\geq a_l,\, s} \quad u(c) - \nu_s(s) + \beta(1-\omega)\,\mathbb{E}_{y'}\Bigg[\max_{\widetilde{w}} \Bigg\{ sf(\theta(\widetilde{w}, y'))\, V^W(a', \widetilde{w}, y') \\ & + (1 - sf(\theta(\widetilde{w}, y')))\left[(1-e(x+1;\overline{x}))V^B(a', w, y', x+1) + e(x+1;\overline{x})V^{NB}(a', y')\right]\Bigg\}\Bigg] \end{aligned}$$

subject to

$$c + a' \leq (1+r-\delta)\, a + h + (1-\tau)\left[b(w)\, w\right]^{1-\Upsilon}, \tag{3}$$

where the choice of $\widetilde{w}$ reflects a trade-off: higher-paying jobs have lower job-finding probabilities.

Next, the problem of an eligible unemployed who does not take up UI is given by

$$\begin{aligned} V_{NT}^B(a, w, y, x) \quad = \quad & \max_{c,\, a'\geq a_l,\, s} \quad u(c) - \nu_s(s) + \beta(1-\omega)\,\mathbb{E}_{y'}\Bigg[\max_{\widetilde{w}} \Bigg\{ sf(\theta(\widetilde{w}, y'))\, V^W(a', \widetilde{w}, y') \\ & + (1 - sf(\theta(\widetilde{w}, y')))\left[(1-e(x;\overline{x}))V^B(a', w, y', x) + e(x;\overline{x})V^{NB}(a', y')\right]\Bigg\}\Bigg] \end{aligned}$$

subject to

$$c + a' \leq (1+r-\delta)\, a + h, \tag{4}$$

[31] An eligible unemployed individual must file an application when she decides to take up UI. In addition, while she is taking up UI, she needs to provide proofs or documentation of ongoing job search activities.

which differs from Equation (3) in two ways: the duration of UI receipt x does not increase when individuals do not take up benefits and UI benefits do not enter the budget constraint.

Finally, the recursive problem of an ineligible unemployed is given by

$$\begin{aligned} V^{NB}(a,y) \;\; = \;\; & \max_{c,a'\geq a_l,s} \;\; u\left(c\right)-\nu_s\left(s\right)+\beta\left(1-\omega\right)\mathbb{E}_{y'}\Bigg[\max_{\widetilde{w}}\Big\{sf\left(\theta\left(\widetilde{w},y'\right)\right)V^{W}\left(a',\widetilde{w},y'\right) \\ & +\left(1-sf\left(\theta\left(\widetilde{w},y'\right)\right)\right)V^{NB}\left(a',y'\right)\Big\}\Bigg] \end{aligned}$$

subject to

$$c+a'\leq\left(1+r-\delta\right)a+h. \tag{5}$$

Ineligible unemployed individuals do not make any take-up decision and are unable to gain eligibility if their job search fails, which is in accordance with current UI policy in the U.S.

Firm's problem. A firm can either be matched with a worker or be posting a vacancy to hire one. A firm that is matched with a worker decides how much capital to rent each period at interest rate r and uses it in production together with labor. The problem of a firm that is matched with a worker in submarket (w,y) is given by

$$J\left(w,y\right) \;\; = \;\; \max_{k\geq 0} \;\; F\left(y,k\right)-w-rk+\frac{1}{1+r}\left(1-\omega\right)\mathbb{E}_{y'}\Big[\left(1-\gamma\left(y'\right)\right)J\left(w,y'\right)\Big]. \tag{6}$$

Second, the value of a firm that posts a vacancy in submarket (w,y) is given by

$$V\left(w,y\right)=-\kappa+q\left(\theta\left(w,y\right)\right)J\left(w,y\right), \tag{7}$$

where κ is a fixed cost of posting a vacancy. We assume that firms are owned by foreign entrepreneurs who pay the cost of creating a vacancy and collect firm profits.[32] When profit-maximizing firms decide which wage submarket to post vacancies in, they face a trade-off between the probability of filling a vacancy and the level of surplus from a possible match. A firm that is posting a vacancy in a high-wage submarket would enjoy a higher probability of filling the job at the expense of extracting a lower surplus from the match.

We assume free entry of firms to the labor market, implying that the expected profits are just enough to cover the cost of filling a vacancy. Thus, $V\left(w,y\right)=0$ for any submarket such that $\theta\left(w,y\right)>0$. The free-entry condition allows us to back out the equilibrium market tightness, which is sufficient for unemployed individuals to evaluate the job-finding rate in each submarket.

Government. The UI policy $\left\{b\left(\cdot\right),g\left(\cdot\right),e\left(\cdot\right)\right\}$, exogenous government spending G, and the labor-income tax parameters $\left\{\tau,\Upsilon\right\}$ are such that the government budget constraint holds:

$$G+\int(1-\tau)\left[b(w(\iota))\,w(\iota)\right]^{1-\Upsilon}d(\iota)\,\mathbf{1}_{\{l(\iota)=B\}}\,d\mu(\iota)=\int\left[w(\iota)-(1-\tau)\,w(\iota)^{1-\Upsilon}\right]\mathbf{1}_{\{l(\iota)=W\}}\,d\mu(\iota), \tag{8}$$

[32] If these firms were to be owned by individuals, individuals would need to make a portfolio choice decision between investing on capital (assets) or equity (claims to firm profits). As such, assuming that firms are owned by foreign entrepreneurs simplifies the computational algorithm for solving the model as it allows us to disregard firm profits and valuations and refrain from a portfolio choice decision for individuals.

where μ is the distribution of individuals over individual states ι. The left-hand side shows the total government spending for *net* UI payments and other expenses, and the right-hand side shows the total government revenue generated through taxation of wages.

Equilibrium. We provide the definition of equilibrium for our model as well as the computational algorithm employed to solve it in Appendix B. When solving this model, we utilize the model structure and use the notion of a block recursive equilibrium (BRE) developed by Menzio and Shi (2010, 2011). The BRE allows us to back out the equilibrium labor market tightness using the free-entry condition from the firm's problem and feed it to the individual's problem. As such, it saves us a fixed point problem in solving for the market tightness.

4 Calibration

We calibrate our model to the period before the Great Recession. As discussed below, our calibration of UI policy instruments target state-level averages as shown in Figures 3 and 4. Table 1 lists internal parameters and Table A2 in Appendix C.1 summarizes external parameters.

Preferences. We set the model period to one month and the death probability ω to 0.21 percent, implying an expected working life of 40 years. The utility function is

$$U(c, s, d) = u(c) - \nu_s(s) - \nu_d(d) = \frac{c^{1-\sigma}}{1-\sigma} - \alpha_s \frac{s^{1+\chi_s}}{1+\chi_s} - \alpha_d \frac{d^{1+\chi_d}}{1+\chi_d},$$

where σ is the coefficient of relative risk aversion, α_s and χ_s govern the level and curvature of the search cost, and α_d and χ_d govern the level and curvature of the take-up cost. We set $\sigma = 2$, a standard value in the literature. We normalize the level parameter of the search cost α_s to 1.[33]

We choose the curvature parameter of the search cost function χ_s to match the elasticity of non-employment duration to changes in UI duration estimated by microeconometric studies. The range of estimates for this elasticity is between 0.03 months and 0.25 months to a one-month change in UI duration.[34] We take the median value of 0.15 across available estimates as our target. To measure this elasticity in the model, we reduce the UI duration for a randomly selected group by decreasing $\overline{x}$ by one month. We then compute the difference in the average non-employment duration between the two groups to calculate the elasticity.[35] Importantly, given

[33] This is because job-finding probability $sf(\cdot)$ is a multiplicative function of the search effort s and the matching efficiency $\lambda(\cdot)$, as discussed below. This implies that we cannot separately identify the level parameter of the search cost from parameters of $\lambda(\cdot)$. Hence, we choose to normalize the former.

[34] In particular, Nekoei and Weber (2017) use the age variation for UI payment duration in Austria and estimate that a 9-week increase in UI duration leads to 0.29 week longer non-employment duration (an elasticity of 0.03). Card and Levine (2000) use the 13-week extension of UI benefits in New Jersey as a test case and identify an elasticity of 0.08. Valletta (2014) uses differences in UI duration across U.S. states and over time and Schmieder et al. (2016) exploit the age variation for UI duration in Germany to measure this elasticity, and they both obtain 0.15. Moffitt (1985) and Katz and Meyer (1990) analyze differences in UI duration across states and time, and differences in UI recipients and non-recipients, respectively, and identify an elasticity of 0.16. Finally, Johnston and Mas (2018) utilize an unexpected cut in UI duration in Missouri and estimate an elasticity of 0.25.

[35] In the model, we calculate this elasticity using a sample of UI recipients. The elasticity is 0.11 when we

Table 1: Internally calibrated parameters

Parameter	Explanation	Value	Target	Data	Model
β	Discount factor	0.994	Fraction of individuals with non-positive net liquid wealth	0.28	0.28
χ_s	Curvature of disutility of search	1.490	Elasticity of nonemp. duration with respect to UI duration	0.15	0.15
α_d	Level of disutility of take up	0.350	UI take-up rate (month 1)	0.58	0.61
χ_d	Curvature of disutility of take up	1.360	UI take-up rate (month 2)	0.65	0.69
a_l	Borrowing limit	-9.100	Median ratio of credit limit to quarterly income	0.74	0.74
$\overline{\gamma}$	Average job separation rate	0.011	Average monthly EU rate	0.013	0.012
η_y^γ	Heterogeneity of job separation rate	-1.768	EU ratio of low- (Q1) vs high-income (Q5) workers	5.38	5.51
$\overline{\lambda}$	Average matching efficiency	0.909	Average monthly UE rate	0.37	0.35
η_y^λ	Heterogeneity of job finding rate	-0.453	UE ratio of low- (Q1) vs high-income (Q5) workers	0.98	0.63
σ^y	Dispersion of labor productivity	0.052	Ratio of 90th to 10th percentiles of earnings distribution	6.77	6.31
h	Value of nonmarket activity	0.001	Consumption drop upon job loss	0.093	0.084
m_0^b	UI replacement rate level	1.028	Average UI replacement rate	0.52	0.55
m_w^b	Heterogeneity of replacement rate	-0.199	Ratio of rep. rate of low- (Q1) vs high-income (Q5) workers	2.13	2.38
m_0^g	Level of UI ineligibility	0.611	Average eligibility rate (month 1)	0.58	0.61
m_w^g	Heterogeneity of UI ineligibility	-0.066	Ratio of elig. rate (month 1) of low- (Q1) vs high-income (Q5) workers	0.58	0.62
ϑ	Expiration probability after $\overline{x}$	0.194	Average eligibility rate (month 9)	0.38	0.38
G/N	Other gov. spending per capita	1.415	Total government spending/total output	0.197	0.197

Note: This table summarizes internally calibrated parameters. See the main text for a detailed discussion.

the wide range of empirical elasticities in the literature, in Section 7, we consider an alternative calibration with a much higher average elasticity, as in Hagedorn and Manovskii (2008). In this case, we show that while the optimal policy in the baseline model changes in an intuitive way, the gap between the optimal policies in the baseline and standard models remains large.

We calibrate the level of the disutility of take-up, α_d, to match the TUR in the first month of job loss in the data, which is 58 percent. The curvature of take-up disutility, χ_d, is calibrated to match the TUR in the second month of job loss, which is 65 percent. This parameter is informative about the TUR dynamics since the more convex the cost of take-up is, the greater the incentives to smooth take-up effort over time, rather than exerting maximum effort initially.

Borrowing and saving, and value of nonmarket activity. We use the discount factor β to target a fraction of population with non-positive net liquid wealth of 28 percent, which we obtain using the SIPP. We choose the borrowing limit a_l to target a median value of credit-limit-to-quarterly-income ratio of 74 percent in the Survey of Consumer Finances. Capital is set to depreciate at a monthly rate of $\delta = 0.0051$, which implies an annual depreciation of 6 percent. Finally, we choose total asset supply by foreigners A such that the real monthly interest rate net of depreciation is $r - \delta = 0.0033$ in equilibrium, which implies a net annual return of 4 percent.

The value of non-market activity h influences the size of the consumption drop upon job loss in the model. Using Panel Study of Income Dynamics (PSID) data from 1999–2019, we estimate an average consumption drop of 9.3 percent in the year of job loss.[36] We choose h to obtain the same value in the model by estimating the same regression using the model-simulated data.[37]

compute it using a sample of UI-eligible unemployed.

[36]Details on data, variables, and estimation are provided in Appendix C.1.

[37]In Section 7, we show how our main results vary with alternative values of h.

Labor productivity. We assume that the logarithm of the idiosyncratic labor productivity y follows an AR(1) process: $\ln y' = \rho^y \ln y + \sigma^y v'$ with the mean of y normalized to 1. We set $\rho^y = 0.9867$ so that individuals stay in the same productivity level for an expected duration of 40 years, i.e., during their working life. We choose σ^y to match the dispersion in labor earnings in the data, measured by the ratio of 90th to 10th percentiles of the labor earnings distribution among the employed individuals in the SIPP between 1996 and 2007, which we find as 6.77.

UI policy, other government spending, and taxation. Since the typical maximum UI duration is 6 months, we set the guaranteed UI duration $\overline{x} = 6$. After $\overline{x}$ periods, individuals face a positive probability of expiration ϑ. This parameter is calibrated to match eligibility among the long-term unemployed, targeting a ninth-month FEU of 38 percent, as shown in Section 2.

We assume that the probability of UI ineligibility upon job loss $g(\cdot)$ and the UI replacement rate $b(\cdot)$ are linear in wages w prior to job loss:

$$g(w) = m_0^g + m_w^g w, \quad b(w) = m_0^b + m_w^b w.$$

The intercepts m_0^g and m_0^b are calibrated to match the FEU upon job loss and the average replacement rate in the data, respectively. As discussed in Section 2, we estimate the first-month FEU at 58 percent and the replacement rate among UI recipients at 52 percent.

The slope parameters m_w^g and m_w^b are disciplined to capture heterogeneity in UI eligibility upon job loss and replacement rates across the earnings distribution. In the data, we rank the unemployed by their average weekly wage (AWW) during the BP and compute the first-month FEU by quintile. To discipline m_w^g, we then target the ratio of the FEU in the bottom quintile to that in the top quintile, which equals 0.58, implying that eligibility at job loss for the bottom quintile is a little more than half that of the top. Similarly, we use the bottom-to-top quintile ratio of replacement rates to discipline m_w^b. This ratio is 2.13 in our data, implying that the average replacement rate for the bottom quintile is about twice that of the top.

Finally, we discuss how we discipline the fiscal policy parameters G, τ, and Υ. We calibrate the exogenous government spending amount G to target the ratio of total government spending to total output (GDP) in the data. We measure this ratio to be 19.7 percent in the 2006 National Income and Product Accounts (NIPA). As a baseline, we adopt linear taxation, i.e., $\Upsilon = 0$, and let the tax level parameter τ satisfy the government budget constraint in Equation (8).[38]

Labor market. Hagedorn and Manovskii (2008) estimate the combined capital and labor costs of vacancy creation to be 58 percent of average labor productivity. Following them, we set the vacancy cost $\kappa = 0.58$. We assume the production function as $F(y, k) = yk^{\xi}$ and set $\xi = 1/3$.

The job-separation probability varies with productivity such that $\gamma(y) = \overline{\gamma} \times \exp\left(\eta_y^{\gamma} \times (y - \overline{y})\right)$, where (i) $\overline{\gamma}$ is the average job-separation rate and $\overline{y}$ is the mean productivity, respectively; (ii) η_y^{γ}

[38] Our baseline model uses linear taxation to examine the properties of optimal UI under a tax system without redistributive motives. In Section 7, we explore how progressive taxation affects optimal UI policy.

captures the variation of the job-separation rate by labor earnings in the data. We choose $\overline{\gamma}$ and η_y^γ to match the average monthly employment-to-unemployment (EU) rate and the heterogeneity of EU rate across the earnings distribution in the data, respectively. Because the CPS and the SIPP differ in the levels of monthly transition probabilities, as also pointed out by Fujita et al. (2007), we use the level of the average monthly EU rate from the CPS between 1996 and 2007 and the heterogeneity in monthly EU rates from the SIPP for the same period, as in Krusell et al. (2017). To calculate the latter, we first rank the employed by their current earnings and assign them into quintiles of the earnings distribution. For each quintile, we calculate the EU rate as the fraction of employed who report being unemployed in the next month. We find the bottom-to-top quintile EU rate ratio to be 5.38, indicating that job-separation probability is around 5.4 times higher for workers in the bottom quintile than for those in the top.

We assume a CES labor market matching function as in den Haan et al. (2000), which is extended to incorporate the heterogeneity in matching efficiency by productivity:

$$M\left(v\left(w,y\right),S\left(w,y\right)\right)=\lambda\left(y\right)\frac{v\left(w,y\right)S\left(w,y\right)}{\left[v\left(w,y\right)^{\zeta}+S\left(w,y\right)^{\zeta}\right]^{1/\zeta}},$$

where $\lambda\left(y\right)=\overline{\lambda}\times\exp\left(\eta_y^\lambda\times\left(y-\overline{y}\right)\right)$; $\overline{\lambda}$ is the average matching efficiency; and η_y^λ captures the variation of the job-finding rate by labor earnings in the data. We choose $\overline{\lambda}$ and η_y^λ to match the average monthly unemployment-to-employment (UE) rate in the CPS between 1996 and 2007 and the heterogeneity of UE rate across the previous labor earnings distribution in the SIPP for the same period, respectively. To calculate the latter, we first rank unemployed individuals based on their previous earnings and assign them into quintiles of the distribution. For each quintile, we calculate the UE rate as the fraction of unemployed who report being employed in the next month. We find the bottom-to-top quintile ratio of the UE rate as 0.98, implying that the UE rate is slightly lower for unemployed individuals in the bottom quintile than for those in the top quintile. Finally, we set the matching function parameter $\zeta=0.5$, as in Hagedorn and Manovskii (2008) and Mitman and Rabinovich (2015), who also use the CES matching function.

5 Model Predictions

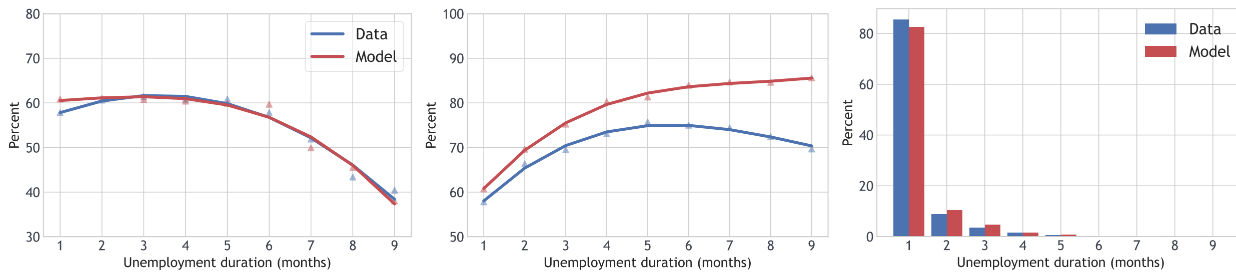
Before the normative analysis, we compare our model's positive predictions with the empirical results in Section 2 and assess how well our model captures non-targeted moments in the data. Next, we consider a nested model that approximates the standard model widely used in the literature and discuss that it fails to capture these moments. In Section 6, we will show that a model's ability to capture these moments has key implications for the optimal UI policy.

5.1 Baseline model

Average eligibility and take-up rates. Panels (a) and (b) of Figure 5 compare eligibility (FEU) and take-up rates (TUR) over unemployment duration in the data and the model.

Figure 5: Eligibility and take-up dynamics over unemployment duration: Data vs model

(a) Eligibility rate (b) Take-up rate (c) Timing of initial take-up



Note: Panels (a) and (b) show eligibility and take-up dynamics over the duration of unemployment in the data and the model. Panel (c) presents the distribution of the month of the spell during which UI is taken up for the first time in the data and the model.

Our baseline model is calibrated to match FEU in the first and ninth month, while the dynamics in between are left untargeted. As shown in Panel (a), the model (red line) reproduces the observed profile (blue line) well, especially the flat pattern up to month six followed by a sharp decline. A key feature that enables the model to perform well is the deterministic nature of UI expiration, with a guaranteed benefit duration of $\overline{x}$. By contrast, a nested, simpler, and more tractable version of the model where UI expiration is purely stochastic performs poorly in replicating the FEU dynamics.[39] Under this common assumption, the simplified model imposes a smooth, gradual decay in the FEU as workers face a per-period risk of expiration. As a result, it cannot capture the flat-then-decline pattern of FEU observed in the data.

Turning to TUR dynamics in Panel (b), our model is calibrated to match the TUR in the first and second months of unemployment, while leaving the remainder of the spell untargeted. The model reproduces the upward slope of the TUR in the data as duration increases, but the rise is more pronounced in the model. This discrepancy arises because the link between take-up incentives and self-insurance levels is stronger in the model. This is because the model abstracts from other sources of insurance beyond wealth and from information frictions that may leave individuals unaware of their eligibility, both of which can limit the rise in the TUR in the data. While it is certainly possible to introduce these elements into our model to better match the TUR dynamics, we refrain from doing so to keep our model closer to the standard model.

Finally, Panel (c) shows that our model captures the timing of initial take-up well, with most agents taking up UI by the first month and almost none by the fifth month.

Heterogeneity in eligibility and take-up rates. Next, we compare how eligibility and take-up rates by earnings and wealth groups change over the spell in the data and the model.

Our model is calibrated to match the ratio of the average first-month FEU for the first quintile of the previous earnings distribution relative to the FEU for the highest quintile. However, differences in eligibility rates of these two groups over other months of unemployment are untargeted. Figure A6 in Appendix D shows that the model generates the magnitude and the

[39] Specifically, we refer to a version of the model with $\overline{x} = 0$ and $\vartheta > 0$, where ϑ is set to match the typical UI payment duration of 26 weeks observed in the data—i.e., $\vartheta = 1/(26/4)$—as is common in the literature.

persistence of the gap in eligibility rates between workers below and above the median of the earnings distribution of the employed over the months of unemployment. Nonetheless, we note that above-median earners in the model do experience slightly higher eligibility in the model.

Our model is also calibrated to match only the *average* TUR during the first two months of job loss. Unlike the FEU, no specific moments regarding the heterogeneity or long-term dynamics of TUR are targeted. Figure A7 demonstrates that our model successfully captures two key features of the data. First, the model predicts that unemployed individuals with lower self-insurance have a persistently higher TUR than their wealthier counterparts. Second, for both below- and above-median groups, the TUR increases as the unemployment spell lengthens. However, the gap in TUR between the two wealth groups is larger in the model, as the link between UI claiming incentives and self-insurance levels is stronger than in the data.

As mentioned in Section 3, because our goal is to stay as close as possible to the standard model widely used in this literature, we parsimoniously model a constant utility cost of take-up across individuals. It is feasible to introduce heterogeneity in this cost, which would dampen the strong link between UI claiming incentives and self-insurance levels in our model and help our model better capture the magnitude of this link in the data, which would then improve the comparison of outcomes between the model and the data in Figure A7. However, even in this case, our model would still generate the empirical finding that those who take up UI have substantially lower wealth holdings compared with those who do not take up despite being eligible. It is also crucial to notice that the standard model with full take-up naturally cannot capture this empirical finding. Hence, while the exact optimal policy may differ in versions of our model with homogeneous versus heterogeneous take-up costs, our main message—the gap between optimal policies in our model and in the standard model—would remain intact.

Another way to dampen the strong link between take-up incentives and self-insurance levels in our model would involve introducing other sources of insurance into the model. For instance, if the level of the monetized value of non-market activity received by the non-employed h—which can be thought of as home production or other transfers—is set to a much higher level, individuals' reliance on their own assets for consumption-smoothing purposes would be less. This dampens the link between take-up incentives and self-insurance levels in our model. We implement this exercise in Section 7. We find that, under this parameterization of our model, the TUR dynamics by wealth groups become much closer to the data in Figure A7. Importantly, as Section 7 shows, while the exact optimal policy in our model in this case changes in an intuitive way, the gap between optimal policies in our model and in the standard model remains large.

Wealth holdings by employment and UI status. Next, Table A5 compares the model's asset-to-income ratio distributions by employment and UI status against the data. We emphasize two results that are relevant for quantifying the insurance-incentive trade-off of UI in our model.

First, as in the data, the model predicts that the unemployed have less of a buffer stock of savings to replace the monthly income than the employed. When compared with the data, the model underestimates the level of available self-insurance at the top of the distribution. This result is expected, as the model is not designed to capture individuals with very high levels of wealth. Second, the model also predicts that, among the eligible, those who are wealth poor are more likely to take up UI, as in the data. While the gap in asset-to-income ratios between those who take up UI and those who do not is larger in the model than in the data, an alternative calibration of h brings the model closer to the data in this dimension and still produces a similar gap between optimal policies in our model and in the standard model, as discussed above.

Overall, our model is broadly consistent with the data in terms of the (i) dynamics of eligibility and take-up rates over the unemployment duration, (ii) differences in how eligibility and take-up rates change over the unemployment spell by income and wealth groups, and (iii) levels of self-insurance by employment and UI status.

5.2 Standard model

Compared to our baseline model, the standard model commonly used in the literature to study the positive and normative implications of UI policy changes incorporates several critical simplifications. In particular, the standard model assumes: (i) full take-up (i.e., $\alpha_d = 0$, so $d = 1$ for all eligible unemployed); (ii) homogeneous job-separation and job-finding probabilities (i.e., $\eta_y^\gamma = 0$, so $\gamma(y) = \overline{\gamma}$, and $\eta_y^\lambda = 0$, so $\lambda(y) = \overline{\lambda}$); (iii) homogeneous eligibility rates (i.e., $m_w^g = 0$, so $g(w) = m_0^g$); and (iv) homogeneous replacement rates (i.e., $m_w^b = 0$, so $b(w) = m_0^b$).

To understand the implications of these assumptions on the optimal policy, we recalibrate the baseline model under these restrictions to match the same set of moments—approximating the standard model in the literature. Table A3 in Appendix C.2 summarizes the calibration outcomes of this model. Specifically, the standard model is recalibrated to match *the same* heterogeneity in income and wealth, but *only* average job-finding and job-separation rates and average eligibility and replacement rates. Importantly, we also recalibrate the curvature of the search disutility function, χ_s, to match the elasticity of non-employment duration to UI duration.[40]

As a result of entirely random job loss, entirely random eligibility, and full UI take-up, the standard model severs the endogenous link between heterogeneity in income and wealth and heterogeneity in unemployment risk, eligibility, take-up, and replacement rates observed in the data and captured by our baseline model. It also cannot speak to TUR dynamics, nor can it match the wealth differences between employed and unemployed with different UI statuses. Thus, the standard model cannot reproduce any of the moments discussed in Section 5.1. That is, it cannot generate the differences in labor market prospects, prior income and wealth levels, and UI status within the pool of the unemployed—i.e., the heterogeneity among the unemployed.

[40] In the standard model, to match the elasticity of 0.15, χ_s must be set to a very high value of 11.95. This arises because selective UI receipt among low-elasticity, wealth-poor individuals is absent in this model where take-up is costless. Nonetheless, the results presented in Section 6 are similar when we do not recalibrate χ_s.

Next, we compare the optimal policies and welfare outcomes from the baseline model to those from the standard model to evaluate the normative implications of capturing these moments.

6 Normative Implications of Heterogeneity

In this section, we solve for the optimal UI policy in both the baseline and standard model and draw out intuition why optimal policy differs in both environments.

We emphasize that the optimal policy will not be a solution to a Ramsey problem, as that problem is computationally infeasible to solve with our model. Thus, we instead work with a restricted class of linear UI policies, as parameterized in Section 4, and solve for the combination of these instruments that maximizes a utilitarian welfare function. We detail our approach below.

We first discuss how we evaluate the welfare effects of a UI policy reform. As in Krusell, Mukoyama, and Şahin (2010), we compare steady states under different UI policy parameters. However, following their approach, we refrain from comparing average utilities across steady states that would naturally have differing stationary distributions and equilibrium outcomes. Instead, we consider a number of different economies, each under a steady state with a different UI policy.[41] Rather than computing full transition dynamics, we use an alternative welfare measure proposed by Krusell, Mukoyama, and Şahin (2010). The welfare experiment is as follows: We move each agent (along with their individual states) from the stationary distribution of the economy under the current policy to alternate economies with different policies and compare utilities. A desirable feature of this "helicopter drop" of individuals from the economy with the current policy to another economy with a different policy is that it captures the short- and long-term effects of the change in UI policy on an individual's welfare.[42] For example, if we move an unemployed individual with low previous earnings making her ineligible under the current policy to another economy that makes her eligible, she may benefit in the short run from collecting UI, but she might suffer in the future if this economy also features less vacancies or higher taxes.

We calculate the economy-wide welfare gain/loss π using the following equation:

$$\int E_0 \left[\sum_{t=0}^{\infty} \beta^t U \left(c_t^o \left(1+\pi\right), s_t^o, d_t^o \right) \right] d\mu = \int E_0 \left[\sum_{t=0}^{\infty} \beta^t U \left(c_t^n, s_t^n, d_t^n \right) \right] d\mu, \tag{9}$$

where $\{c_t^o, s_t^o, d_t^o\}$ refer to allocations under the old (current) policy, while $\{c_t^n, s_t^n, d_t^n\}$ refer to those under the new (proposed) policy. Here, the distribution of the individual states μ is taken from the steady-state distribution under the current policy. Then, the optimal policy is a combination of values for UI policy instruments $\left\{m_0^b, m_w^b, m_0^g, m_w^g, \vartheta\right\}$ and the tax rate τ that

[41] We assume that changes in UI policy do not affect the total asset supply A by foreigners but alter the real rate r. This assumption implies that the change in the equilibrium level of r upon a UI policy change will be limited. We believe that this is a plausible assumption given that changes in UI policy—which is a small fraction of total government budget—are unlikely to have a significant impact on the economy-wide interest rate.

[42] A separate advantage of using this welfare measure for our purposes is that it makes the comparison of our results later in Section 6.1 with those in Krusell, Mukoyama, and Şahin (2010) meaningful.

Table 2: Optimal UI policy in baseline model, standard model, and random take-up model

	Baseline model		Standard model		Random take-up model	
	Current UI	Joint optimal UI	Current UI	Joint optimal UI	Current UI	Joint optimal UI
Panel A: UI policy parameters and welfare effects of optimal policy						
Level of UI replacement rate m_0^b	1.028	1.273	0.524	0.107	0.782	0.990
Het. of UI replacement rate m_w^b	-0.199	-0.223	0	0	-0.062	-0.172
Level of UI ineligibility rate m_0^g	0.611	0.080	0.422	0.180	0.611	0.080
Het. of UI ineligibility rate m_w^g	-0.066	-0.125	0	0	-0.066	-0.146
Minimum UI duration $\overline{x}$	6.000	6.000	6.000	6.000	6.000	6.000
UI expiration rate ϑ	0.194	0.040	0.257	0.050	0.200	0.288
Tax rate τ	0.313	0.323	0.300	0.291	0.313	0.312
Interest rate r (%)	0.839	0.841	0.839	0.839	0.839	0.838
Average welfare gains (%)	-	2.09	-	0.39	-	0.05
Fraction with positive gain (%)	-	38.61	-	97.53	-	38.23
Panel B: UI replacement and eligibility rates, and realized UI payment duration						
Replacement rate						
Average	0.55	0.74	0.52	0.11	0.50	0.45
Q1	0.72	0.94	0.52	0.11	0.68	0.72
Q2	0.67	0.88	0.52	0.11	0.63	0.60
Q3	0.51	0.70	0.52	0.11	0.59	0.53
Q4	0.51	0.68	0.52	0.11	0.52	0.30
Q5	0.30	0.37	0.52	0.11	0.32	0.08
Eligibility rate						
Average	0.61	1.00	0.58	0.82	0.61	1.00
Q1	0.49	1.00	0.58	0.82	0.49	1.00
Q2	0.54	1.00	0.58	0.82	0.54	1.00
Q3	0.56	1.00	0.58	0.82	0.56	1.00
Q4	0.65	1.00	0.58	0.82	0.66	1.00
Q5	0.80	1.00	0.58	0.82	0.80	1.00
UI payment duration (months)	2.94	3.41	3.06	2.75	3.12	2.90

Note: This table summarizes the optimal UI policy results in the baseline model, the standard model, and in a version of the baseline model with random UI take up. The first two columns provide results under the current UI policy and the optimal UI policy in the baseline model. The other four columns repeat these results in the other two models. Panel A reports values of the UI policy instruments, along with the equilibrium tax rate and interest rate, the average consumption-equivalent welfare gains, and the share of the population experiencing positive welfare gains under the optimal policy relative to the current policy. Panel B presents the implied UI replacement rate and the eligibility rate in the first month of job loss, both on average and by quintiles of the previous earnings distribution, as well as the realized UI payment duration in months.

maximize the utilitarian welfare, i.e., the right-hand side of Equation (9), and thus π.[43] Due to the computational burden of jointly optimizing over five parameters, we first hold the guaranteed UI duration $\overline{x}$ fixed. To understand the welfare effects of this restriction, we later vary $\overline{x}$ as well, taking as given the optimal policy described above (see discussion in Section 6.1).

6.1 Properties of optimal UI policy

Table 2 presents welfare and UI outcomes under the current and optimal policies for both the baseline model (columns 1 and 2) and the standard model (columns 3 and 4).

Panel A shows that the following parameter values are optimal under the baseline model: $m_0^b = 1.273$, $m_w^b = -0.223$, $m_0^g = 0.080$, $m_w^g = -0.125$, $\vartheta = 0.04$, with a tax rate $\tau = 0.323$. As shown in Panel B, these values imply that, relative to the current policy, the optimal policy features (i) more generous average replacement and eligibility rates, (ii) much larger increases in replacement and eligibility rates at the bottom quintiles of the previous-wage distribution,

[43] It is important to reiterate that all economies satisfy all equilibrium conditions including Equation (8).

(iii) a longer realized UI payment duration, and (iv) a slightly higher tax rate.[44] In particular, the average replacement rate increases to 74 percent under the optimal policy, compared to 55 percent under the current policy. The optimal policy also features full eligibility upon job loss (first month), significantly higher than the 61 percent under the current policy. Overall, the optimal policy yields a 2.1 percent average consumption-equivalent welfare gain, with around 40 percent of the population experiencing positive gains relative to the current policy.

In contrast, under the standard model, when all UI policy parameters (i.e., m_0^b, m_0^g, and ϑ) are jointly optimized, we find that the optimal policy (column 4) is much less generous than the current policy in the standard model (column 3). More importantly, the optimal policy in the standard model is also much less generous than the optimal policy in the baseline model (column 2), especially in terms of replacement rates. The average replacement rate and eligibility rate upon job loss under the optimal policy are 11 and 82 percent in the standard model, compared with 74 and 100 percent in the baseline model.[45] In addition, both the expected and realized durations of UI payments are shorter under the standard model's optimal policy, both due to the higher value of ϑ and the lower benefit generosity in this specification. Overall, we conclude that the optimal UI policy is much more generous in the baseline model, which matches empirical moments on heterogeneity among the unemployed, than in the standard model, which does not.

Finally, while we do not optimize over the guaranteed UI duration $\overline{x}$, we conduct an ex post welfare analysis. In particular, taking as given the optimal policies in each model, we vary $\overline{x}$ and compute the resulting welfare gains. In both models, aggregate welfare is maximized at $\overline{x} = 6$. We recognize that this does not imply that $\overline{x} = 6$ would remain optimal if all parameters were jointly optimized. Rather, the exercise offers reassurance that our conclusion, that heterogeneity calls for a more generous policy, is not simply an artifact of holding $\overline{x}$ fixed.[46]

Optimizing over a limited set of instruments. In order to be able to benchmark our findings against those in comparable studies, we now examine the effects of optimizing over a limited set of UI instruments. Specifically, we solve for welfare-improving policies in the standard model when the government optimizes only a single UI parameter. This exercise is useful since comparable studies in the literature typically (i) abstract from heterogeneity among the unemployed and (ii) optimize over a narrower set of instruments than in our exercise above.

Columns three to five of Table A6 in Appendix E report the welfare-improving policies and

[44] In this model, UI expenses account for only a small share of total government spending as in the data, since we also include other government expenditures G. Thus, changes in UI policy have only a modest effect on overall government expenditures. In addition, the baseline model features selective and imperfect take-up, so not all workers receive UI, and those who do often have lower prior wages, reducing the government's replacement costs.

[45] Notice that, in both models, workers may have short employment spells and still become eligible upon job loss. Full eligibility upon job loss may not be optimal if we kept track of employment duration before job loss as a state variable. However, even then, the gap between the optimal policies in the two models would remain large.

[46] In a separate model with purely stochastic expiration, where duration is governed by a single parameter ϑ, we are able to jointly optimize over all UI policy parameters. There, too, we find that the optimal policy is more generous once empirically observed heterogeneity among the unemployed is taken into account.

outcomes in the standard model when optimizing over a single parameter (m_0^b, m_0^g, or ϑ). These policies yield an even less generous UI system than the joint optimal policy in the standard model. This is because, in the standard model, when the government cannot optimize over all parameters jointly, it must choose a less generous policy for the single parameter over which it can optimize. For instance, when optimizing only over m_0^g, the government is constrained to maintain a relatively high replacement rate of 52 percent for a long duration ($\overline{x} = 6$, $\vartheta = 0.26$). Given that the unemployed are not concentrated among low-wealth individuals with lower incentive costs in the standard model (see Section 6.2), the government drives m_0^g to very high levels, sharply limiting eligibility. A similar logic also applies when optimizing over m_0^b or ϑ alone.

Comparison with Krusell, Mukoyama, and Şahin (2010). Results in Table A6 also allow us to compare our findings with those from existing studies. This analysis is the most comparable to Krusell, Mukoyama, and Şahin (2010) who develop an incomplete markets model combined with a random search and matching framework in general equilibrium and use it to solve for the optimal UI benefit level.[47] Their model, however, does not account for the heterogeneity among the unemployed as (i) unemployment risk is homogeneous across workers, (ii) all unemployed workers are eligible and take up UI, and (iii) UI benefit amount is the same for all unemployed. As such, the standard model here approximates to their model. They find that the optimal replacement rate is 12 percent with associated average welfare gains of around 0.12 percent.[48]

The third column in Table A6 is our most comparable exercise to that in Krusell, Mukoyama, and Şahin (2010), as it presents the case where we optimize only over the replacement rate level. We find that the welfare-improving replacement rate in this case is 19 percent and that this policy yields an average of 0.25 percent consumption-equivalent welfare gains. These findings are very close to those in Krusell, Mukoyama, and Şahin (2010), as mentioned above.

Our main point is *not* to literally compare the welfare-improving replacement rate and associated welfare gains to those in Krusell, Mukoyama, and Şahin (2010), as the two models differ in other aspects. Instead, we emphasize that accounting for the heterogeneity among the unemployed *and* optimizing over a richer set of instruments largely change the optimal policy. First, in our baseline model, the optimal policy features much more generous replacement and eligibility rates as well as payment duration (second column in Table 2) than the welfare-improving replacement rate in the standard model (third column in Table A6) or the optimal replacement rate in Krusell, Mukoyama, and Şahin (2010). Second, welfare gains from the optimal policy in our baseline model (2.1 percent) are around 10 times larger than those from the welfare-improving $m_0^b = 0.192$ in the standard model (0.25 percent) and around 20 times larger than those from

[47]Importantly, as discussed previously, we also adopt the same welfare criteria as in their paper.

[48]Krusell, Mukoyama, and Şahin (2010) find that the optimal value of h in their model is 0.30. This corresponds to a 12 percent average replacement rate given that the average wage is around 2.5, as reported in their Table 1. Moreover, Table 2 reports that average welfare gains at $h = 0.25$ are 0.12 percent. We take this number to approximate average welfare gains at the optimal $h = 0.30$ as they do not mention welfare gains at $h = 0.30$.

the optimal replacement rate in Krusell, Mukoyama, and Şahin (2010) (0.12 percent).

6.2 Why does heterogeneity call for a more generous optimal policy?

In the remainder of this section, we provide insights into why accounting for heterogeneity among the unemployed yields a much more generous optimal UI policy. To do so, we present three sets of results from the baseline model. First, we show that the insurance-incentive tradeoff of UI is largely heterogeneous, depending on the position of the unemployed in the wealth distribution. Second, we show that the heterogeneity among the unemployed generates a larger redistributive role for UI policy changes, producing heterogeneous welfare effects from the optimal policy across individuals with different employment statuses and income and wealth levels. Finally, we show that the key mechanism driving the large differences between the optimal policies in the baseline and standard models is the endogeneity of the UI take-up decision in the baseline model.

6.2.1 Heterogeneity in the insurance-incentive tradeoff

First, we evaluate the insurance value of the optimal policy relative to the current policy in the baseline model across job losers with different levels of wealth holdings. To do so, we focus on the dynamics of average consumption around job loss under these two policies. Specifically, we estimate the following distributed-lag regression specification using model-simulated data, separately under the current UI policy and the optimal UI policy:

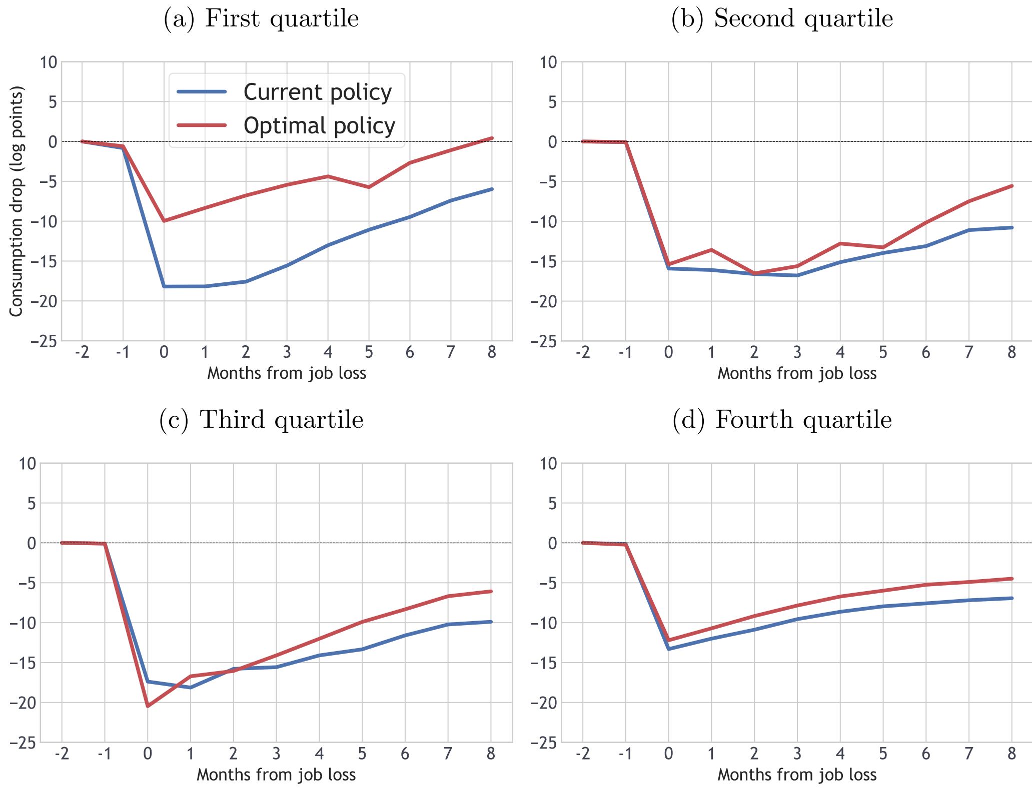
$$\log(c_{it}) = \sum_{g=1}^{4} \sum_{k=-2}^{8} \psi_{k,g}\, D^{(g)}_{i,t+k} + \beta\, w_{it} + \gamma' y_{it} + \varepsilon_{it}, \tag{10}$$

where $D^{(g)}_{i,t+k}$ are employment-to-unemployment (EU) transition dummies at lag/lead k for individual i who is in asset quartile $g \in \{1, 2, 3, 4\}$ based on the asset distribution of all EU transitions at the time of job loss, w_{it} is the past wage, and y_{it} is productivity. The estimated coefficients of interest $\psi_{k,g}$ are normalized to zero at month -2 for each quartile to remove level differences relative to the control group of non-job-losers.

Figure 6 reports the estimated coefficients $\psi_{k,g}$ under each policy. As expected, workers with the lowest self-insurance at job loss experience the largest improvements in consumption under the optimal policy relative to the current policy, while those in higher quartiles see more modest consumption gains over the spell. Due to heterogeneous unemployment risk and selection in take-up, low-income and low-wealth individuals are more likely to become unemployed and UI recipients—generating larger improvements in average consumption upon job loss when the UI policy is more generous. However, in the standard model where unemployment and eligibility are entirely random and take-up is full, the composition of UI recipients differs substantially, diminishing the insurance gains observed in the baseline model.

Second, we analyze the heterogeneity in the incentive costs of the optimal policy. To do so, we focus on the magnitude of the decline in the job-finding rates of unemployed individuals with

Figure 6: Consumption dynamics after job loss: Current vs. optimal policy



Note: The figure presents the dynamics of consumption following job loss across asset quartiles $g = 1, 2, 3, 4$, based on the asset distribution of all employment-to-unemployment (EU) transitions at the time of job loss. Specifically, the consumption paths are obtained from a distributed-lag regression estimated on model-simulated data, separately under the current and optimal UI policy, regressing log consumption on EU indicators over multiple lags and leads using the specification in Equation (10). The estimates are normalized to zero at month -2 for each quartile to remove level differences relative to the control group of non-job-losers.

different wealth levels under the more generous optimal policy relative to the current policy. Figure 7 shows the dynamics of job-finding rates over the unemployment spell for job losers, grouped by the same wealth quartiles as above, under each policy.[49] A key finding from this figure is the non-monotonic change in job-finding rates across the distribution.

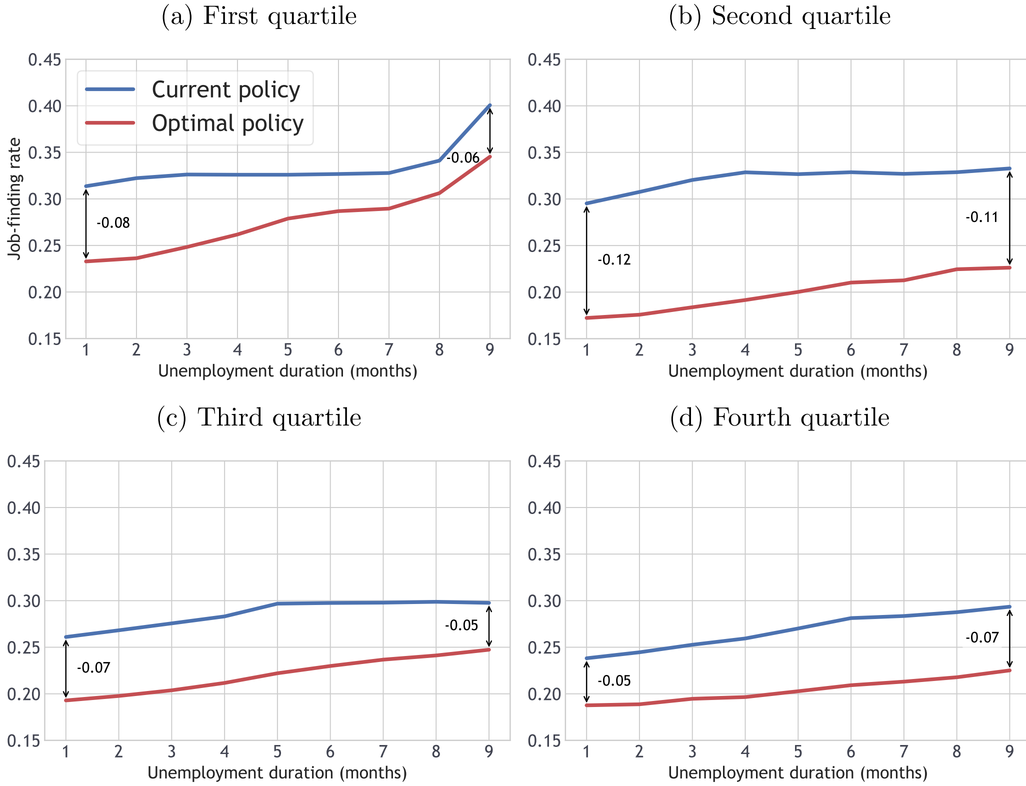
The lowest-wealth unemployed exhibit a relatively modest decline in their job-finding rates.[50] Moreover, the gap in job-finding rates between the baseline and optimal policies narrows over the spell, indicating that asset depletion disciplines search behavior even in the presence of generous UI. The reason the lowest-wealth unemployed exhibit limited changes in their job-finding rates is that the surplus from employment relative to unemployment (i.e., $V^W - V^B$) is large for them, as they hold limited wealth upon job loss. In this sense, holding limited wealth during unemployment disciplines their job search activities even under a reasonably generous UI policy.

Workers in the second quartile respond more strongly. They hold some wealth to supplement

[49]To isolate behavioral patterns under both policies, we use a balanced panel of workers with nine months of unemployment. As a result, the average job-finding rate is slightly lower for this sample when compared with the full sample. Results presented here are robust to shorter or longer balanced panels.

[50]Recall from Table 2 that low-income, low-wealth workers face the largest increase in UI generosity under the optimal policy. Figure A8 shows that, if we adjust for the differential changes in UI generosity across groups, the non-monotonic pattern observed in Figure 7 becomes even stronger.

Figure 7: Job-finding rate dynamics after job loss: Current vs. optimal policy



Note: This figure presents the dynamics of job-finding rates over the unemployment spell for job losers, by asset quartile $g = 1, 2, 3, 4$ at the time of job loss, based on the asset distribution of all employment-to-unemployment (EU) transitions at the time of job loss. The dynamics from model-simulated data are compared between the current and the optimal UI policy. To isolate behavioral patterns over the unemployment spell under both policies, we use a balanced panel of workers with nine months of unemployment.

higher UI payments, which allows them to reduce search effort and become more selective in wage offers. The third quartile responds similarly to the first quartile, although the rise in UI generosity for this group is much smaller, as shown in Table 2. Finally, the wealthiest unemployed show only small responses, but for a different reason: Being well insured, they rarely take up UI, and therefore their labor market choices are less affected by UI policy changes.[51] Importantly, this heterogeneity in incentive costs is absent in the standard model and UI recipients are not concentrated among the lowest-wealth workers who exhibit limited incentive costs.

Does this non-monotonic change in job-finding rates across the wealth distribution in our model hold in the data? Chetty (2008) argues that the elasticity of the job-finding rate with respect to UI benefit level is decreasing in wealth. However, this result only holds in specifications where he uses either average or maximum WBA to measure the UI benefit level. Importantly, when he uses the simulated individual-level WBA—which is arguably the more relevant measure

[51] Overall, in this exercise, assuming away the UI duration extensions under by the optimal policy, the implied elasticities of unemployment duration with respect to the replacement rate range from 0.36 to 2.5. The smallest elasticities occur among workers in the lowest and highest quintiles, while the largest elasticities arise in the middle quintiles, consistent with the discussion above. This range should be viewed as an upper bound since the optimal policy raises not only replacement rates but also UI payment duration. Notably, these elasticities span the range of estimates of non-employment duration elasticities with respect to replacement rate reported across a broad set of studies, as summarized by the meta-analysis conducted by Cohen and Ganong (2026).

and also closest to our approach—he finds a non-monotonic pattern (see Table 2 column 5 in Chetty, 2008). In particular, Chetty (2008) states (page 207) that: "In the individual simulated benefit specification, UI benefits are estimated to have little effect on durations in the highest wealth quartile, and the elasticity estimates are declining in quartiles 2–4. However, the estimate for the first quartile is smaller than that in the second quartile, breaking the monotonic declining pattern obtained with the other measures of benefits." Importantly, notice that this result exactly aligns with the ordering of the elasticity magnitudes in Figure 7. Further, since our approach to measuring eligibility, take-up, and replacement rates substantially improves upon Chetty (2008), we estimate his regressions using our data. We show in our previous work (Birinci and See, 2023) that this elasticity exhibits a non-monotonic pattern in wealth in the data.[52]

6.2.2 Heterogeneous welfare effects of the optimal policy

Next, we show that the heterogeneity in the insurance-incentive tradeoff of UI leads to substantial differences in the welfare effects from the optimal policy relative to the current policy. To do so, we calculate group-specific average consumption-equivalent welfare gains using Equation (9).

Panel A in Table 3 shows welfare gains and the fractions of the population with positive gains from the optimal policy in the baseline model across quintiles of wage and asset-to-income ratio distributions, separately for all individuals as well as employed and unemployed individuals.[53] We highlight two results. First, welfare gains and fractions with positive gains are larger in the bottom quintiles than in the top quintiles. In particular, average welfare gains are 5.17 percent and 3.90 percent in bottom quintiles of the wage and asset-to-income ratio distributions, while they are -1.06 percent and 0.92 percent in top quintiles. The optimal policy yields larger gains for those with low wages and levels of self-insurance, as insurance value is largest while incentive costs are relatively weak for them. The insurance value of UI is larger for them as they have the highest marginal utility of consumption. However, incentive costs are relatively small for them as holding limited wealth during unemployment disciplines their job search. Second, welfare gains are much larger for the unemployed than for the employed. The unemployed enjoy a more generous UI, while the employed with high wages and low unemployment risk (i.e., those with high productivity) have much less to gain from this policy but suffer from higher taxes.

Panel B presents the same statistics in the standard model. The results highlight two stark differences relative to the baseline model. First, welfare gains are much lower and more homo-

[52]Quantitatively, Chetty (2008) analyzes a much simpler framework in which individuals decide when to become permanently employed. In his model, as individuals no longer face unemployment risk after employment, the size of the surplus from employment relative to unemployment (i.e., $V^W - V^B$) is small for all individuals to begin with. As such, in his model, the elasticity of the job-finding rate with respect to UI is driven only by the magnitude of the change in this surplus, which is declining in wealth both in his model and in our model. A key difference in our model, however, is that because wealth-poor individuals have larger surpluses, they exert maximal search effort and search for low-wage jobs to find employment quickly across a wide range of UI parameters. As such, the larger surplus for these individuals mitigates the elasticity of their job-finding rates to changes in UI.

[53]Table A7 repeats this exercise for quintiles of productivity and asset distributions and finds similar results.

Table 3: Heterogeneous welfare effects of optimal policy

	Wage					Asset-to-income ratio				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Panel A: Baseline model										
All										
Average welfare gains (%)	5.17	2.05	-0.17	-0.78	-1.06	3.90	1.95	1.83	0.29	0.92
Fraction with positive gain (%)	99.9	83.3	6.7	2.2	1.0	72.1	39.9	39.5	19.0	22.6
Employed										
Average welfare gains (%)	5.01	1.91	-0.19	-0.84	-1.23	3.71	1.81	1.80	0.18	0.83
Fraction with positive gain (%)	100.0	78.5	5.3	1.5	0.2	69.0	38.1	39.3	17.1	22.0
Unemployed										
Average welfare gains (%)	6.68	5.21	3.59	1.33	1.45	6.00	4.28	4.01	3.25	2.90
Fraction with positive gain (%)	97.8	98.4	95.3	72.8	24.9	96.5	87.6	79.4	72.4	53.2
Panel B: Standard model										
All										
Average welfare gains (%)	0.25	0.26	0.49	0.51	0.25	0.25	0.35	0.38	0.39	0.33
Fraction with positive gain (%)	98.2	97.9	98.1	97.9	95.4	97.0	97.5	98.1	98.3	96.6
Employed										
Average welfare gains (%)	0.29	0.30	0.51	0.56	0.54	0.33	0.43	0.43	0.44	0.36
Fraction with positive gain (%)	100.0	100.0	99.7	99.4	99.2	100.0	100.0	100.0	100.0	98.3
Unemployed										
Average welfare gains (%)	-0.90	-0.71	-0.53	-1.11	-2.27	-1.02	-1.11	-1.45	-1.21	-0.60
Fraction with positive gain (%)	43.9	44.4	39.0	42.9	33.2	51.9	43.6	35.8	31.7	40.3

Note: This table presents average consumption-equivalent welfare gains and fractions of populations with positive welfare gains under the optimal policy relative to the current policy in the baseline model (Panel A) and the standard model (Panel B) across quintiles of wage and asset-to-income ratio distributions for all individuals, employed individuals, and unemployed individuals. Cutoffs for quintiles of both distributions and employment status of individuals are based on the economy under the current policy.

geneous across the distributions in the standard model. Second, welfare gains and the fractions with positive gains are much lower for the unemployed than for the employed in the standard model. Since the pool of unemployed comprises more individuals with higher levels of wealth in the standard model, the optimal policy that features a lower tax rate and a higher eligibility rate is preferable by almost all individuals, despite a lower replacement rate. In addition, the government's inability to use slope parameters m_w^b and m_w^g as well as the absence of heterogeneity among the unemployed in this model make it difficult to target those who assign higher insurance value to UI. Thus, the optimal policy is much less redistributive in the standard model.

6.2.3 Key mechanism: Endogenous UI take up as a selection tool

The standard model differs from the baseline model in that it assumes full take-up, homogeneous unemployment risk, and homogeneous eligibility and replacement rates. We now show that the main channel leading to the large difference between the optimal policies in the two models is endogenous take-up. To do so, we consider a version of our baseline model where we *only* replace the endogenous take-up effort decision with an exogenous take-up assumption. In particular, we assume that 61 percent of eligible individuals upon job loss are randomly assigned as UI recipients. These individuals incur the same take-up cost as in the baseline model and collect benefits until exhaustion.[54] We then recalibrate the parameters of this "random take-up" model

[54] In doing so, we set the take-up effort to $d = 0.61$ for all UI-eligible individuals to match the same UI take-up rate upon job loss as in the baseline model.

to match the same moments as in the baseline model, except for the parameters that govern take-up dynamics. Table A4 in Appendix C.3 summarizes this model's calibration outcomes.

The last two columns of Table 2 present outcomes under the current UI policy and the optimal UI policy of this model. We find that although the optimal UI policy in this model still grants eligibility to all job losers, it provides substantially less generous replacement rates and a shorter expected UI duration (higher value of ϑ) compared with the optimal policy in the baseline model. In particular, the average replacement rate under the optimal policy in the random take-up model is only 45 percent, whereas it is 74 percent in the baseline model. This result indicates that roughly half of the gap between the optimal replacement rates in the baseline model and the standard model is accounted for by the selection of UI recipients arising from endogenous and incomplete take-up, while the remainder is due to full take-up, heterogeneous unemployment risk, and heterogeneous eligibility and replacement rates.

Why does the presence of endogenous and incomplete take-up lead to a more generous optimal policy? One might expect that when the take-up decision is endogenous and entails a utility cost as in the baseline model, higher take-up rates mechanically reduce average welfare. For this reason, the planner might prefer to lower the UI generosity to discourage individuals from claiming UI. While this intuition is correct, a separate mechanism dominates. When take-up is endogenous and costly, only those who assign a high insurance value to UI collect it. Thus, the take-up decision functions as a selection mechanism, separating those with higher marginal utility of consumption from those with lower marginal utility. As a result, the planner increases the generosity of UI when this mechanism is active. In contrast, when take-up is random or full, this mechanism is absent, leading to a much less generous optimal UI policy.

7 Optimal UI Policy under Different Specifications

The previous section showed that the optimal policy prescribed by a standard model that does not discipline the pool of UI recipients with the data is substantially less generous from the optimal policy in a baseline model that does. In this section, we solve for the optimal UI policy under different model specifications for two purposes. First, we evaluate whether other features of our baseline model alter the optimal policy. This allows us to identify which model elements—beyond the heterogeneity among the unemployed—that vary across studies in this literature are pivotal for optimal UI policy prescriptions. Second, and more importantly, we explore whether our main conclusion—that the optimal UI policy is much more generous in the baseline model than in the standard model—remains robust under different modeling assumptions and parameterizations. In the following discussion, we focus on four different model specifications and solve for the optimal policy in each case, separately in baseline and standard models. We briefly discuss our results here and relegate further details to Appendix F. Results are summarized in Table A8.

Partial equilibrium in asset market. We start with a version of the baseline model where we instead assume partial equilibrium in the asset market. To do so, we fix the interest rate to its value under the current UI policy regardless of the UI policy being evaluated. The optimal policy in this case (third column in Table A8) is very similar to that under general equilibrium (first column), with only slightly lower replacement rates due to a lower value of m_0^b.[55]

Next, we solve for the optimal policy in the partial equilibrium model under the assumptions of the standard model. We find that the optimal policy (fourth column) is nearly identical to that under the standard model version of the general equilibrium model (second column).

We conclude that modeling the general equilibrium in the asset market is not pivotal for the optimal policy prescription and that the optimal policy is more generous in the baseline model than in the standard model even under the partial equilibrium model of the asset market.

No borrowing. Our model assumes that individuals can borrow up to a limit in the asset market. The ability to borrow for consumption-smoothing may dampen the incentives to provide a more generous policy. On the other hand, a more generous policy may be desirable as it moves agents away from the borrowing constraint. To see whether the ability to borrow affects the optimal policy, we set the borrowing limit to $a_l = 0$ and solve for the optimal policy. The optimal policy in this case (fifth column) features (i) similar eligibility rates and UI payment duration as in the optimal policy when borrowing is permitted and (ii) a slightly higher replacement rate level parameter m_0^b with a slightly less negative slope parameter m_w^b.[56] The optimal policy in the standard model version of this model (sixth column) is also nearly identical to that in the standard model with borrowing (second column). Thus, allowing individuals to borrow is not at all pivotal for the optimal policy and that the gap between the optimal policies in the baseline and the standard model remains large when borrowing is not allowed.

Progressive income taxation. In our baseline model, all government expenses are funded by a constant tax rate on wages and benefits. We now consider a progressive tax system using the tax function proposed by Benabou (2002) and Heathcote et al. (2014). Optimal policy in this case (seventh column) features very similar eligibility rates as the optimal policy under linear income taxation. However, the optimal policy now features lower replacement rates especially at bottom quintiles, and a slightly shorter payment duration.[57] This is because, under progressive taxation, there already exists redistribution from the tax system as the tax rate is now lower for low-income individuals, dampening the gains from providing higher replacement rates for them.

[55] This result is expected because our general equilibrium model assumes that changes in UI policy do not alter the total asset supply A by foreigners, leading to a small change in the equilibrium level of real rate.

[56] Note that the heterogeneity parameter of UI ineligibility rate m_w^g is also different between the optimal policies in this model and the baseline model. However, this difference does not create almost any difference in eligibility rates, as shown in Panel B of Table A8, because almost all job losers are eligible due to low level of m_0^g.

[57] We note that the optimal UI policy under progressive taxation also prescribes a more-generous UI system when compared with the current UI policy, driven by much higher eligibility rates and payment duration.

The optimal policy in the standard model version of this model (eighth column) is nearly identical to that in the standard model with linear taxation (second column). Comparing it with the baseline model's optimal policy under progressive taxation (seventh column), the optimal policy is much more generous in the baseline model. This result is critical as it implies that *even* when the redistributive role of UI is reduced, the optimal policy is still more generous in a model that accounts for our empirical findings than in a model that does not.

High value of unemployment. We calibrate the monetary value of nonmarket activity h to match the drop in consumption upon job loss. Under this strategy, the value of h is small. We now explore how an alternative value of $h = 0.39$—which makes the value of unemployment close to the value of employment, as proposed by Hagedorn and Manovskii (2008)—affects the optimal policy.[58] This exercise is useful for two purposes. First, it analyzes a case in which the average disincentive effect of UI is larger because the unemployed have a lower opportunity cost of employment, which could be due to a high value of leisure, home production, or other transfers. Second, as discussed in Section 5.1, this parameterization dampens the strong link between take-up incentives and self-insurance levels in our baseline model, allowing it to better capture the TUR dynamics by wealth groups observed in the data.

Relative to the optimal policy under the baseline calibration of h (first column), the optimal policy in this case (ninth column) features (i) a similar parameter of replacement rate m_0^b but a less negative slope m_w^b, (ii) the same level parameter of ineligibility rate m_0^g with a less negative slope parameter m_w^g, and (iii) much higher expiration rate ϑ. The replacement rate rises due to the less negative slope m_w^b, but the optimal policy is less generous in terms of expected duration (due to a much higher ϑ) since the surplus from employment is now smaller. At the same time, a high value of h reduces precautionary savings, leading to lower wealth among the unemployed. Thus, the optimal policy maintains high replacement rates, but for a shorter expected duration. Critically, the optimal policy remains more generous in the baseline model (ninth column) than in the standard model version of this model (tenth column). Hence, even when the disincentive effect of UI is larger and TUR dynamics by wealth groups are better captured, the optimal policy is more generous when the model accounts for heterogeneity among the unemployed.[59]

Overall, the results in this section reveal that while the precise optimal policy prescription changes in some versions of our model (especially when taxation is progressive or when the opportunity cost of employment is high), the *gap* between the optimal policies in our model and the standard model is robust across all of these alternative plausible specifications.

[58] In particular, $h = 0.39$ is obtained such that the average flow value of unemployment is equal to 95.5 percent of the flow value of employment, as in Hagedorn and Manovskii (2008).

[59] Higher-income households may derive greater utility from leisure, as rising expenditures on leisure goods have increased the productivity of each leisure hour (Boerma and Karabarbounis, 2021), offsetting the decline in total leisure time noted by Aguiar and Hurst (2007). To align with these findings, if we assume that h is heterogeneous in productivity y and calibrate it to be higher for high-productivity workers, the gap between optimal policies in the baseline and standard models would be further amplified.

8 Conclusion

We digitize state-level, time-varying UI laws on initial eligibility, payment amounts, and payment duration for around three decades and combine them with microdata from the SIPP. We document how income and wealth levels affect UI eligibility, take-up, and replacement rates both upon job loss and over the unemployment spell. We show that the eligibility rate increases with previous earnings but declines over unemployment duration, while the take-up rate declines with wealth but increases over unemployment duration. To evaluate the implications of these findings for optimal UI, we build a general-equilibrium, heterogeneous-agent, directed-search model with incomplete markets that matches these empirical findings. Our main finding is that matching these findings significantly alters optimal UI policy prescriptions. A standard model that fails to match them yields a substantially less generous optimal policy than the baseline model.

We believe our data work is relevant to a large and active empirical literature that estimates the effects of UI policy changes on labor market outcomes based solely on variations in UI payment duration. This is because our data reveal that eligibility rules substantially differ across U.S. states and that states often implement simultaneous changes in these rules with UI extensions. We hope the eventual publication of our data will be useful to researchers estimating the effects of UI policy changes on labor market outcomes. This resource can also be useful for a separate literature analyzing taxes and transfer policies across U.S. states and over time.

Our quantitative results have implications for the design of UI over the business cycle. During a recession, if more unemployed deplete wealth during prolonged spells, our findings imply that the insurance benefits of UI would increase while the incentive costs would decrease, supporting greater UI generosity. We leave the quantification of these mechanisms to future research.

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Online Appendix

A Data

In this section, we provide details about our data sources and our calculations of the empirical moments described in Section 2. We also present additional results to supplement our discussions.

A.1 SIPP data

In the SIPP, individuals are followed longitudinally for a period of up to five years. Until the 2014 panel, interviews were held at four-month intervals called waves. The respondents were then divided into four rotation groups. Rotation groups determined in which month a respondent was interviewed within a wave. Interviews covered information about the four months (reference months) preceding the interview month. When a new SIPP panel launched and Wave 1 (the first four months of the new panel) began, the first rotation group was interviewed in the first month, the second rotation group in the second month, etc. The second interview of the first rotation group was conducted after all four rotation groups had been interviewed by the end of the fourth month of Wave 1. This way, all four rotation groups would have been interviewed at the end of each wave. The SIPP changed the interview structure starting with the 2014 panel. While the four-wave structure was maintained, the frequency of interviews was reduced to once a year (as opposed to thrice) and the reference period was extended to 12 months. Thus, each interview collected information for 12 months in the preceding calendar year. Overall, the SIPP provides monthly data on demographics, earnings, reason for job separation, state of residence, and UI receipt, and weekly data on employment status. In each panel, respondents also provide information about asset holdings in two to three waves, usually every year. In the 2014 panel, this information was collected once every year.

Our sample is restricted to individuals between the ages of 25 and 65 who are not business owners. If a respondent has missing information on a variable of interest, we drop observations after the first missing observation.[1] Our discussions in the next section supplement the analysis in the main text on our findings from the SIPP data merged with UI laws across states.

A.2 Details on measurement

UI eligibility, take-up, and replacement rates. Once we digitize all state-level and time-varying UI policy rules and merge this information with the SIPP data, we use information on employment, earnings, reason for unemployment, and state of residence from the SIPP to estimate one's UI eligibility status upon unemployment, maximum UI payment duration, and UI replacement rate.[2] We also use information on UI receipt in the SIPP to identify whether an

[1]This is because, for example, labor market flows of these individuals cannot be accurately identified.

[2]The state codes in the SIPP 1996 and 2001 panels merge Maine and Vermont, and merge North Dakota, South Dakota, and Wyoming. For these observations, because we cannot precisely identify the state of residence—which

eligible unemployed individual takes up UI. Here, we provide details on our measurement of UI eligibility, take-up, and replacement rates to supplement the discussions in Section 2.

In our sample, we require positive previous labor earnings in order to focus on individuals with sufficient labor market attachment. For observations that do not cover the entire base period but do contain information for at least one quarter prior to unemployment, we estimate base period earnings using the information available. Moreover, if earnings in the base period do not allow eligibility, some states also check earnings during the alternative base period. We implement the same rule for these states in our program. In addition, our program rarely classifies an unemployed individual as ineligible based on UI state laws when the respondent reports receiving UI benefits. In these rare instances, we consider the self-reported UI receipt as an indication of eligibility. Results remain similar when we consider these individuals ineligible.

When calculating the heterogeneity in take-up rates across the asset-to-income ratio distribution, because the SIPP data usually provide yearly information on asset holdings of the respondent, we approximate the respondent's asset holdings (described below) in each month using the SIPP wave with asset information closest to that month.

Assets and asset-to-income ratio distribution. We now discuss our measure of assets and the asset-to-income ratio. We focus on the net liquid assets of individuals. The SIPP contains information on liquid financial assets at the individual level, including interest-earning financial assets in banks and other institutions, checking account balances, stocks and mutual funds, and savings bonds. Moreover, for married individuals, the survey asks about the amounts of these assets in joint accounts. The joint accounts question is given to only one spouse; the response is divided by two and copied to both spouses' records. Likewise, the SIPP contains information about revolving debt on credit card balances at the individual level for both single and joint accounts. The summation of the amounts in liquid asset accounts net of revolving debt gives us the net financial asset holdings of the individual. Finally, the SIPP provides data on equity in cars at the household level. We divide that amount among the members of the household and recorded as equity in cars for each member. Adding this value to the net financial assets of the individual gives us the measure of net liquid assets for each SIPP wave with information on assets. Finally, dividing the net liquid asset holdings measure by monthly labor income yields the ratio of net liquid assets to monthly income. Here, if the individual is unemployed during the interview month, we use the individual's previous average labor income associated with the last employment in earlier waves. The asset-to-income ratio provides a useful metric of self-insurance in that it measures how many months of labor earnings net liquid assets can replace.

is necessary to estimate UI eligibility and replacement rates—we do not include them in our estimation. For this reason, the state-level average eligibility, replacement, and take-up rates in Figures 2 and A4 for these states represent averages from the 2004-2014 SIPP panels.

Job-finding and job-separation rates. Next, we provide details on how we obtain the job-finding and job-separation rates both on average and across the earnings distribution. In the SIPP, we calculate the monthly job-finding (UE) and job-separation (EU) rates as follows. We first classify an individual as employed (E) if he/she reports having a job and is either working or not on layoff, but is absent without pay during the first week of the month. We classify the individual as unemployed (U) if he/she reports either having no job and actively looking for work or having a job but is currently laid off in the first week of the month. For each month, we calculate the average job-separation rate as the ratio of total EU transitions from that month to the next, divided by the total number of employed individuals in the current month. Similarly, we compute the average job-finding rate as the ratio of total UE transitions from that month to the next, relative to the total number of unemployed in the current month.[3] Once we obtain the monthly transition rates, we account for seasonality by removing monthly fixed effects.[4]

To calculate the heterogeneity of job-finding and job-separation rates across the earnings distribution, which are reported in Section 4, we use monthly labor earnings data to measure the current labor earnings of employed workers as well as the previous labor earnings of unemployed workers, which is calculated as the average labor earnings three months before a job loss.[5] We require positive labor earnings for the employed and positive previous labor earnings for the unemployed in order to focus on individuals who have sufficient attachment to the labor market.

Unemployment spell duration. Finally, we provide details on how we measure the duration of each unemployment spell. Again, we require positive previous labor earnings in order to focus on individuals with sufficient labor market attachment. Spells that are left-truncated and spells with missing information for which we cannot ascertain respondents' employment status are dropped. We define spells as uninterrupted months of unemployment and thus do not consider time spent out of the labor force, since we do not model the non-participation margin.

A.3 Additional results

In this section, we provide additional results to supplement our discussions in Section 2.

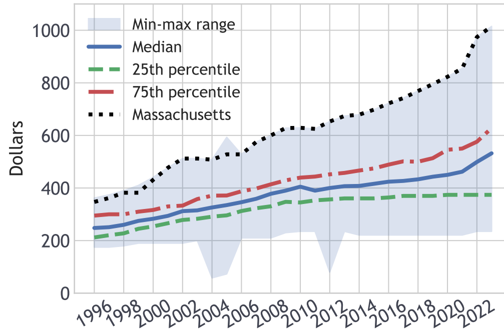
State-level and time-varying maximum WBA. Figure 1 in the main text shows state-level and time-varying earnings requirements for UI eligibility. In Figure A1, we present state-level and time-varying maximum weekly benefit amounts (WBA). Although all states maintained a maximum WBA between 1996 and 2023, the levels of this threshold varied significantly. In 2023, the maximum WBA varied between \$235 (MS) and \$1,015 (MA) with the median value of \$532

[3] Even if this EU rate measure captures both voluntary and involuntary separations, our UI program is able to filter out those who quit their jobs from being eligible for UI, as we observe the reason of unemployment.

[4] For our calibration exercise in Section 4, we calculate the job-finding and job-separation probabilities from the CPS using the same methodology.

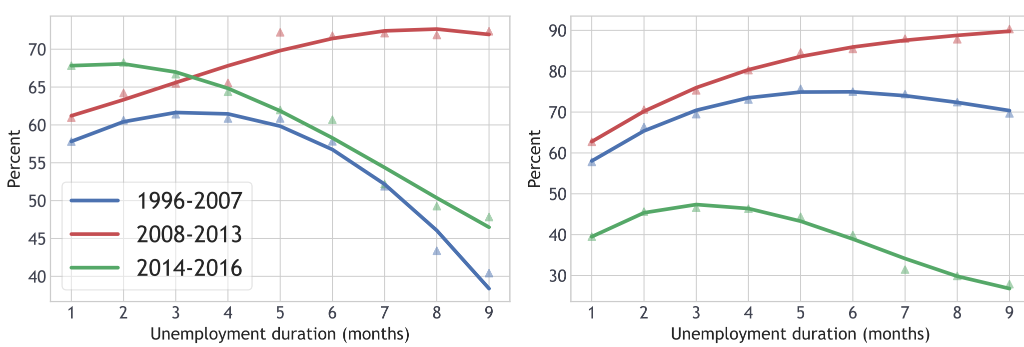
[5] The result for the heterogeneity in job-finding rates across earnings groups is similar if we take previous employment income as the labor earnings from the month prior to job loss.

Figure A1: State-level and time-varying maximum weekly benefit amounts



Note: This figure presents the maximum weekly benefit (nominal dollar) amounts across states and over time. We show minimum and maximum range of these amounts as well as the median, 25th, and 75th percentiles of distributions of these amounts. We also present these amounts for one state—for which we chose Massachusetts—to demonstrate changes over time within a state.

Figure A2: Eligibility and take-up dynamics across different periods



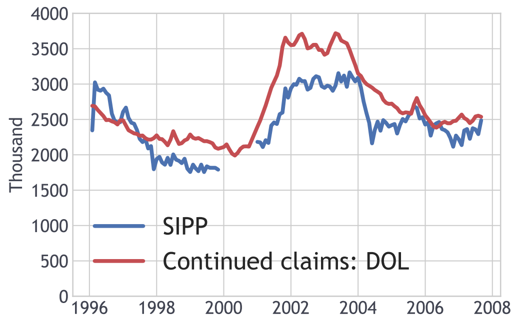
Note: This figure reproduces our results in Figure 3 for other SIPP panels, namely the 2008 and 2014 panels. Panel (a) and (b) document how the eligibility rate (FEU) and take-up rate (TUR) change over months of unemployment, respectively. To generate the dynamics of average FEU, we restrict our panel data to unemployed individuals and first regress a dummy of being UI eligible on dummies of unemployment duration (in months) using individual weights and then fit a cubic polynomial (solid-blue line) to the resulting coefficients of duration dummies (blue triangles). We repeat the same process to obtain the average TUR dynamics where we use the same data but restrict the sample to those who are eligible and change the dependent variable to a dummy of receiving UI instead.

(ID). Further, this threshold changed over time within a state: Relative to one year ago, MA increased it by 13 percent in 2000 but reduced it by 1 percent both in 2004 and 2011.

Eligibility and take-up dynamics during a downturn. In Section 2.2, we presented results using the SIPP panels covering 1996–2007. We focused on this period to align with the calibration of our model, ensuring comparability between the empirical data and the model's predictions. In this section, we extend the analysis using the SIPP 2008 panel (2008–2013) and the SIPP 2014 panel (2014–2016). The 2008 panel allows us to examine how eligibility and take-up dynamics evolve during a major economic downturn, while the 2014 panel illustrates how a major survey redesign renders it unsuitable for our analysis. Figure A2 presents the results.

We find that results obtained using data between 2008 and 2013 are different from our baseline results in two ways. First, while the UI eligibility rate at the onset of the unemployment spell is very similar to our baseline estimate using data between 1996 and 2007, the UI eligibility rate does not decline as the unemployment duration becomes longer. This result is expected, as the

Figure A3: Number of people receiving UI: SIPP vs aggregate data



Note: This figure plots the number of people receiving UI in the U.S. population. The blue line plots this moment using the SIPP data. The red line shows the continued claims reported by the Department of Labor (DOL). The discontinuity in the blue line is due to the fact that the end of the SIPP 1996 panel and the beginning of the SIPP 2001 panel do not overlap.

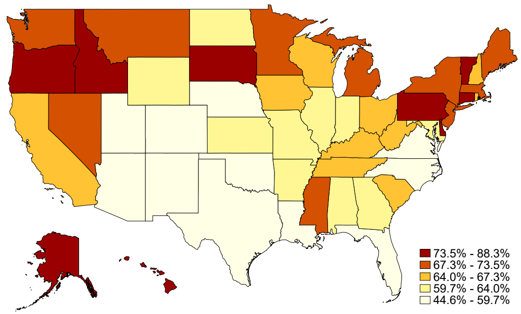
period between 2008 and 2013 covers the Great Recession and the subsequent recovery episode when the UI payment duration was extended from about six months to as high as two years. Second, the increase in the take-up rate over duration is now larger and the take-up rate remains higher as the unemployment duration lengthens during this episode. This result is also intuitive as UI-eligible unemployed should be more motivated to take up UI in an economy where jobs are more difficult to find. Overall, we view these differences between the results from our baseline period and from the Great Recession as a validation of our own UI program that estimates UI eligibility and take-up rates. Because our model abstracts from aggregate fluctuations, it is natural that we use empirical results from an episode without a large economic downturn.

Turning to data from 2014 to 2016, the 2014 redesign of the SIPP changed the survey structure: Instead of interviewing respondents three times a year to capture the prior four months, it shifted to a single annual interview covering the previous 12 months. While the eligibility rate over the unemployment spell remains roughly comparable to that observed during non-recessionary periods from 1996 to 2007, and the dynamics of the take-up rate are similar, there is a sizable downward shift in the level of the take-up rate. This shift is likely due to greater recall difficulties over longer reporting horizons, potentially causing additional measurement error.

Number of people receiving UI: SIPP vs aggregate data. In Section 2.1, we discuss our estimation of UI eligibility, take-up, and replacement rates at the individual level. Since our analysis involves many steps, we provide several results that help validate our approach. One of these results compares the number of UI recipients in the SIPP with the number of continued claims (insured unemployment) reported by the Department of Labor. We present this result in Figure A3, which shows that the number of UI recipients in the SIPP closely tracks the number of continued claims between 1996 and 2007, which is the period we use to calibrate our model.

State-level average UI take-up rates. Figure 2 in the main text shows state-level average eligibility and replacement rates in the data. In Figure A4, we now provide state-level average take-up rates. We find large differences in take-up rates across states. In particular, the average

Figure A4: State-level average take-up rates



Note: This figure plots the average take-up rates between 1996 and 2016 across states. We obtain these averages by taking the mean of monthly rates between 1996 and 2016, separately for each state. We group states based on the quintiles of unweighted distributions of average rates across states. Lighter colors represent lower values and darker colors indicate higher values of these rates.

take-up rate varies across states between 44.6 percent and 88.3 percent.

Controlling for observable characteristics. In Section 2.2, we present how eligibility and take-up rates change over unemployment duration. Those results do not control for observable characteristics of individuals in our estimation. We now present the same results with controls in Figure A5. In particular, for the eligibility rate dynamics in Panel (a), we restrict our panel data to unemployed individuals and first regress a dummy of being UI eligible on dummies of unemployment duration (in months), control variables, and time dummies, using individual weights. The control variables are the following: gender, a fifth-degree polynomial in age, four race dummies (white, black, Asian, and other), four education category dummies (less than high school, high school graduate, some college, and college graduate and above), and gender interactions for all of the age, race, and education variables. This specification closely follows that in Kroft, Lange, Notowidigdo, and Katz (2016). Once we obtain the coefficients on how the eligibility rate changes for each month of unemployment relative to the first month, we then fit a cubic polynomial (red-solid line) to the resulting coefficients of duration dummies (red triangles). We compare this result to the result in the main text, which does not control for observables (blue-solid line and triangles). We also repeat this process separately for take-up rate dynamics in Panel (b). Here, we use the same data but restrict the sample to those who are UI eligible and change the dependent variable to a dummy of receiving UI instead.

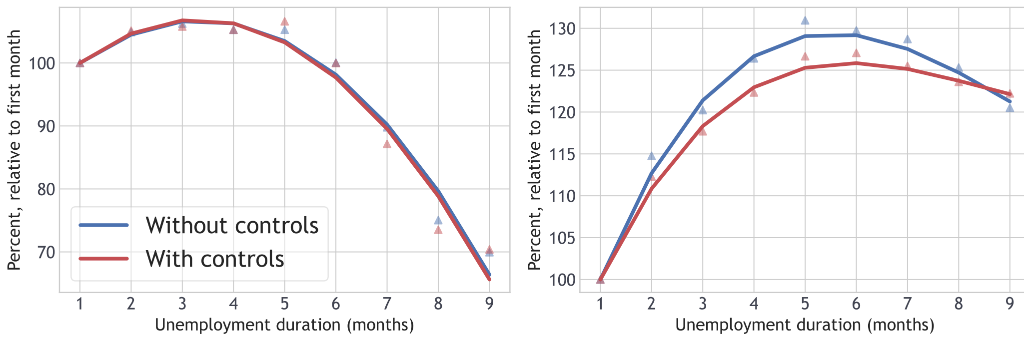
Overall, results in Figure A5 reveal that controlling for observable individual characteristics does not lead to substantial changes especially in the eligibility rate. In terms of take-up rate dynamics, controlling for observables slightly dampens the rise in the take-up rate over the spell.

Wealth holdings by employment and UI status. Finally, we conclude this section by showing that the level of self-insurance is lower among the unemployed relative to the employed, and, within the eligible unemployed, it is lower among those who take up UI relative to those who do not, as mentioned in Section 2.2 in the main text.

To measure the distribution of self-insurance for each group, we calculate the mean and various percentiles of the asset-to-income ratio distribution separately for the employed, unemployed,

Figure A5: Eligibility and take-up dynamics: With and without controls

(a) Eligibility rate (b) Take-up rate



Note: This figure presents how eligibility (Panel (a)) and take-up (Panel (b)) rates change over unemployment duration relative to the first month of unemployment, with and without controlling for observable characteristics of individuals. For the eligibility rate dynamics in Panel (a), we restrict our panel data to unemployed individuals and first regress a dummy of being UI eligible on dummies of unemployment duration (in months), individual control variables (gender, age, race, education), and time dummies, using individual weights. Once we obtain the coefficients on how the eligibility rate changes for each month of unemployment relative to the first month, we then fit a cubic polynomial (red-solid line) to the resulting coefficients of duration dummies (red triangles). We compare this result to our result in the main text which does not control for observables (blue-solid line and blue triangles). We also repeat this process separately for take-up rate dynamics in Panel (b). Here, we use the same data but restrict the sample to those who are UI eligible and change the dependent variable to a dummy of receiving UI instead.

Table A1: Distribution of asset-to-income ratio by employment and UI status

	p10	p20	p25	p30	p40	p50	p60	p70	p75	p80	p90	Mean
Employed	-1.55	-0.31	0.00	0.10	0.49	0.98	1.66	2.73	3.55	4.79	10.72	3.32
Unemployed	-2.18	-0.47	-0.07	0.00	0.18	0.55	1.06	1.88	2.48	3.52	8.50	2.28
Take up	-1.96	-0.52	-0.15	0.00	0.19	0.53	0.93	1.62	2.18	2.94	6.49	1.55
Non-take up	-2.15	-0.48	-0.11	0.00	0.24	0.63	1.23	2.09	2.80	4.06	8.81	2.84

Note: This table documents the distributions of asset-to-income ratio by employment and UI status from the SIPP 1996, 2001, and 2004 panels.

take-up, and non-take-up groups for each month. Then, we average the monthly outcomes across all months of the SIPP 1996, 2001, and 2004 panels. Table A1 presents the results.

We highlight two main takeaways from this table. First, unemployed individuals have substantially lower levels of self-insurance than employed individuals. This result is in line with the previous findings in Krusell, Mukoyama, Rogerson, and Şahin (2017) and Birinci and See (2023) that show that the job-separation rate is higher at the lower end of the wealth distribution. Second, those who take up UI have lower levels of self-insurance than those who are eligible but do not take up, reinforcing our findings in Figure 4. For instance, we find that the mean asset-to-income ratio is 1.55 for the former group, while it is 2.84 for the latter group.

B Model

In this section, we provide the definition of equilibrium for our model and the computational algorithm used to solve it.

Equilibrium. A recursive stationary equilibrium for this economy is a list of value functions of individuals and of firms; a list of policy functions of individuals for assets, wage choice, search effort, and UI take-up decision, and capital choice policy function of firms; a labor market tightness function $\theta(w, y)$; and the distribution of agents across individual states μ such that:

1. Given government policy $\left\{b(\cdot), g(\cdot), e(\cdot), G, \tau\right\}$, market tightness θ, and interest rate r, value functions of individuals solve problems given by Equations (1), (2), (3), (4), and (5) with associated policy functions.

2. Given interest rate r, value functions of firms solve Equation (6) with associated capital choice policy function and Equation (7).

3. The number of vacancies posted in each submarket v satisfies the free-entry condition $V = 0$, which yields the equilibrium labor market tightness θ.

4. The government budget constraint given by Equation (8) holds.

5. The interest rate r clears the asset market such that $\int a d\mu + A = \int k \times 1_{\{l=W\}} d\mu$, where the left-hand side is the net asset supply of individuals and foreigners and the right-hand side is the sum of total capital demand of firms.

6. The stationary distribution of individuals across states μ is consistent with all policy functions and job-finding and job-separation rates.

Computational algorithm. The computational algorithm for solving the model under any UI policy change from the current policy is given as follows:

1. Guess the tax rate τ and the interest rate r.

2. Solve for the value function of the matched firm $J(w, y)$.

3. Using the free-entry condition $0 = -\kappa + q(\theta(w, y)) J(w, y)$ and the functional form of $q(\theta)$, we can solve for market tightness for any given submarket (w, y):
$$\theta(w, y) = q^{-1}\left(\frac{\kappa}{J(w, y)}\right),$$
where we set $\theta(w, y) = 0$ when the market is inactive.

4. Given the function θ, we can then solve for individuals' value functions V^W, V^B, V_T^B, V_{NT}^B, and V^{NB} using standard value function iteration.

5. Once policy functions are obtained, we simulate the model to obtain moments of interest.

6. Check whether the government budget constraint and asset market clearing conditions are satisfied. If not, go back to Step 1 and iterate until convergence.

Table A2: Externally calibrated parameters

Parameter	Explanation	Value	Reason
ω	Death probability	0.0021	40 years of working life
σ	Curvature in utility function	2	Standard
α_s	Level of utility cost of search	1	Normalization
δ	Capital depreciation rate	0.0051	6 percent annual depreciation rate
ρ^y	Persistence of labor productivity	0.9867	40 years of expected duration
$\overline{x}$	Guaranteed UI payment duration	6	Typical maximum UI duration of 6 months
κ	Vacancy creation cost	0.58	Hagedorn and Manovskii (2008)
ξ	Exponent to capital in production function	1/3	Standard
ζ	Matching function parameter	0.5	Set
Υ	Tax progressivity	0	Set

Note: This table summarizes externally calibrated parameters. See the main text for a detailed discussion.

We note that the solution algorithm for the model's steady state imposes $r - \delta = 0.0033$ so that the net annual return is 4 percent in equilibrium. Then, we back out the total asset supply by foreigners A in equilibrium, which is kept constant for any other UI policy. This eliminates the loop over r in the above algorithm when solving for the steady state under the current UI policy. However, when we solve our model under different UI policies, the loop over r is necessary to satisfy the asset market clearing condition.

C Calibration

We now provide further details on the calibration of the baseline and standard models.

C.1 Baseline model

External parameters. Table A2 provides a list of externally calibrated parameters discussed in Section 4.

Consumption drop upon job loss. In Section 4, we target the magnitude of the consumption drop upon unemployment. Here, we detail how we measure this moment in the data.

We use data from the PSID between 1999 and 2019 to estimate the consumption drop upon job loss. The PSID is available annually between 1968 and 1997 and biannually since 1997. It provides information on labor earnings, consumption expenditures, and demographics. Consumption expenditures include expenditures on food consumed inside and outside the home, health expenditures, housing expenditures (utilities, taxes, maintenance, etc.), transportation, education, and childcare.[6] Prior to 1999, expenditure information was only available for the food category, while the other categories were added after 1999. For this reason, we estimate the dynamics of consumption upon job loss based on biannual data between 1999 and 2019.

We construct variables for job loss using a question that asks individuals who are either jobless or have been employed in their current job for less than a year about the reason for the loss of their previous job. Since our model does not distinguish between reasons for unemployment,

[6] Since 2005, additional categories have been included (clothing, recreation, alcohol, and tobacco). These categories are not included in the consumption expenditure measure to maintain consistency over time.

our definition of a job loss in the data incorporates unemployment arising from any reason (for example, voluntary/expected separations like quits, firings, and the end of temporary/seasonal employment, as well as involuntary/unexpected separations like layoffs and business closures).

Our sample consists of household heads between the ages of 25 and 65. We drop households observed for only one year and those with labor earnings or consumption expenditures that exceed the 99th percentile. Using this sample, we estimate the following distributed-lag regression:

$$\log(c_{it}) = \beta X_{it} + \sum_{k=-2}^{10} \psi_k D_{it}^k + \iota_i + \xi_t + \epsilon_{it},$$

where the outcome variable is the logarithm of real annual consumption expenditures c_{it} of household i in year t; the variable X_{it} is a vector of time-varying household characteristics, including a quadratic term of the head's age and the head's marital status; the variable ι_i captures a time-invariant unobserved error component associated with household i; and ξ_t is an error component common to all households in the sample at year t. The indicator variables D_{it}^k identify all household heads k periods prior to or after a job loss, where $k = 0$ is the period in which the job loss occurs. For instance, $D_{it}^2 = 1$ for a household head i who experiences job loss in year $t-2$, and it equals zero otherwise. Thus, ψ_k captures the effect of job loss on the outcome variable k years prior to or after household heads separate from a job (treatment group) relative to household heads with no job separation (control group).

C.2 Standard model

Table A3 provides a list of internally calibrated parameters of the standard model. Externally calibrated parameters in this model are identical to their values in the baseline model.

By construction, all parameters in the baseline model that govern the heterogeneity of job-separation and job-finding rates, the heterogeneity of UI eligibility and replacement rates, as well as the level parameter of disutility from take-up effort are set to zero. In our calibration of the remaining parameters of this model, we find that all parameters—except those related to UI policy (i.e., m_0^g, m_0^b, and ϑ) and the curvature parameter of the disutility of job search—are identical to those in the baseline model. This similarity is useful, as it allows us to remain close to the baseline model once the heterogeneity parameters and the take-up effort choice are turned off. As discussed in the main text, the curvature parameter of the disutility of job search, χ_s, in the standard model must be higher in the standard model to match the same elasticity as in the baseline model. In a separate exercise, we instead use the baseline model's value for this parameter and find that the main results in Section 6 from the standard model remain mostly similar.

C.3 Random take-up model

Table A4 provides a list of internally calibrated parameters of the random take-up model introduced in Section 6.2.3. Externally calibrated parameters in this model are identical to their

Table A3: Internally calibrated parameters: Standard model

Parameter	Explanation	Value	Target	Data	Model
β	Discount factor	0.994	Fraction of individuals with non-positive net liquid wealth	0.28	0.23
χ_s	Curvature of disutility of search	11.95	Elasticity of nonemp. duration with respect to UI duration	0.15	0.17
a_l	Borrowing limit	-9.100	Median ratio of credit limit to quarterly income	0.74	0.74
$\overline{\gamma}$	Average job separation rate	0.011	Average monthly EU rate	0.013	0.011
$\overline{\lambda}$	Average matching efficiency	0.909	Average monthly UE rate	0.37	0.36
σ^y	Dispersion of labor productivity	0.052	Ratio of 90th to 10th percentiles of earnings distribution	6.77	6.62
h	Value of nonmarket activity	0.001	Consumption drop upon job loss	0.093	0.062
m_0^b	UI replacement rate level	0.524	Average UI replacement rate	0.52	0.52
m_0^g	Level of UI ineligibility	0.422	Average eligibility rate (month 1)	0.58	0.58
ϑ	Expiration probability after $\overline{x}$	0.257	Average eligibility rate (month 9)	0.38	0.36
G/N	Other gov. spending per capita	1.346	Total government spending/total output	0.197	0.197

Note: This table summarizes internally calibrated parameters in the standard model. See the main text for a detailed discussion.

values in the baseline model.

Given the assumptions of this model, we set the parameters that govern take-up rate dynamics (i.e., α_d and χ_d) to their values in the baseline model. We then recalibrate all the other internally calibrated parameters of this model to match the same data moments as in the calibration of the baseline model. In our calibration of the remaining parameters of this model, we find that all parameters—except m_0^b, m_w^b, ϑ, and h—are identical to those in the baseline model. This similarity is useful, as it allows us to remain close to the baseline model.

The reason we had to adjust these four parameters is straightforward. Unlike in the baseline model, individuals with relatively higher previous earnings are more likely to end up receiving benefits in this model. Because replacement rates are relatively lower for them, we need to reduce the rate at which replacement rates decline with previous earnings—that is, reduce the magnitude of m_w^b—to match the same heterogeneity in replacement rates across previous-earnings quintiles in the data. This change then requires an adjustment to the level parameter m_0^b to match the same average replacement rate in the data. These changes in the replacement-rate parameters then require an adjustment to the value of nonmarket activity h to match the same consumption drop upon job loss in the data. Finally, because there is no decision about when to collect UI during an unemployment spell in this model, we slightly adjust the parameter ϑ, which governs the UI expiration probability after $\overline{x}$ periods of UI receipt, to match the same average eligibility rate at month 9. Overall, because these changes in parameter values are small, this model is able to produce calibration outcomes that are quite similar to those in the baseline model, without requiring any changes to the remaining parameter values.

D Model validation

This section provides results to supplement the discussions in Section 5.1. Figure A6 shows eligibility rates over the unemployment spell, separately for spells starting below or above the median of the earnings distribution of the employed, in the data and the baseline model. Figure A7 reports take-up rates over the spell, separately for UI-eligible spells starting below or above the median of the asset-to-income ratio distribution, in the data and the baseline model. Finally,

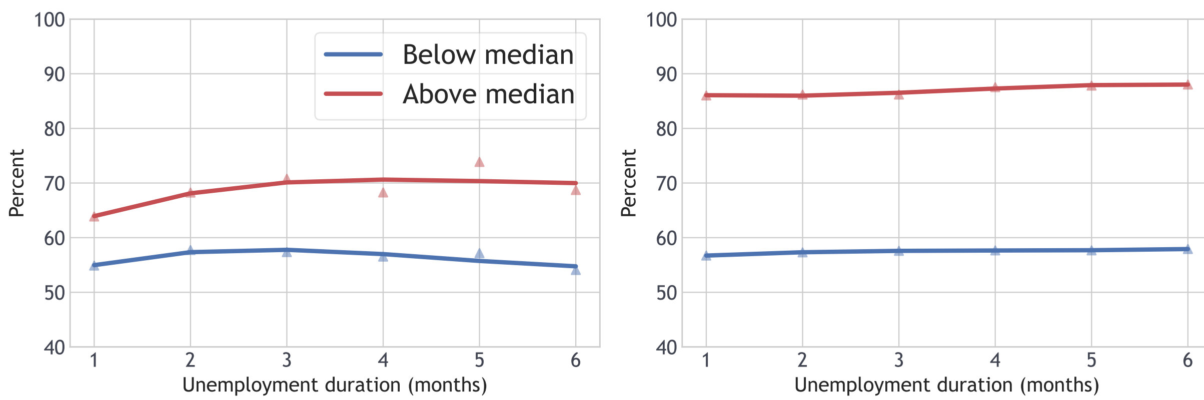
Table A4: Internally calibrated parameters: Random take-up model

Parameter	Explanation	Value	Target	Data	Model
β	Discount factor	0.994	Fraction of individuals with non-positive net liquid wealth	0.28	0.30
χ_s	Curvature of disutility of search	1.490	Elasticity of nonemp. duration with respect to UI duration	0.15	0.13
a_l	Borrowing limit	-9.100	Median ratio of credit limit to quarterly income	0.74	0.74
$\overline{\gamma}$	Average job separation rate	0.011	Average monthly EU rate	0.013	0.012
η_y^γ	Heterogeneity of job separation rate	-1.768	EU ratio of low- (Q1) vs high-income (Q5) workers	5.38	5.60
$\overline{\lambda}$	Average matching efficiency	0.909	Average monthly UE rate	0.37	0.34
η_y^λ	Heterogeneity of job finding rate	-0.453	UE ratio of low- (Q1) vs high-income (Q5) workers	0.98	0.67
σ^y	Dispersion of labor productivity	0.052	Ratio of 90th to 10th percentiles of earnings distribution	6.77	6.31
h	Value of nonmarket activity	0.03	Consumption drop upon job loss	0.093	0.081
m_0^b	UI replacement rate level	0.782	Average UI replacement rate	0.52	0.50
m_w^b	Heterogeneity of replacement rate	-0.062	Ratio of rep. rate of low- (Q1) vs high-income (Q5) workers	2.13	2.11
m_0^g	Level of UI ineligibility	0.611	Average eligibility rate (month 1)	0.58	0.61
m_w^g	Heterogeneity of UI ineligibility	-0.066	Ratio of elig. rate (month 1) of low- (Q1) vs high-income (Q5) workers	0.58	0.61
ϑ	Expiration probability after $\overline{x}$	0.200	Average eligibility rate (month 9)	0.38	0.42
G/N	Other gov. spending per capita	1.406	Total government spending/total output	0.197	0.197

Note: This table summarizes internally calibrated parameters in the random take-up model. See the main text for a detailed discussion.

Figure A6: Heterogeneity in eligibility rates over unemployment duration: Data vs model

(a) Eligibility rate by previous earnings: Data (b) Eligibility rate by previous earnings: Model



Note: Panel (a) plots the eligibility rate—measured as the fraction of UI eligible within the unemployed—over unemployment duration separately for spells originating from below or above the median of the earnings distribution of the employed in the data. Panel (b) repeats the same calculations in the baseline model.

Table A5 presents the distribution of the asset-to-income ratio by employment and UI status in the data and the baseline model.[7] Discussions of these results are provided in Section 5.1.

E Optimal UI policy in baseline and standard models

In this appendix, we provide results to supplement our discussions in Section 6.

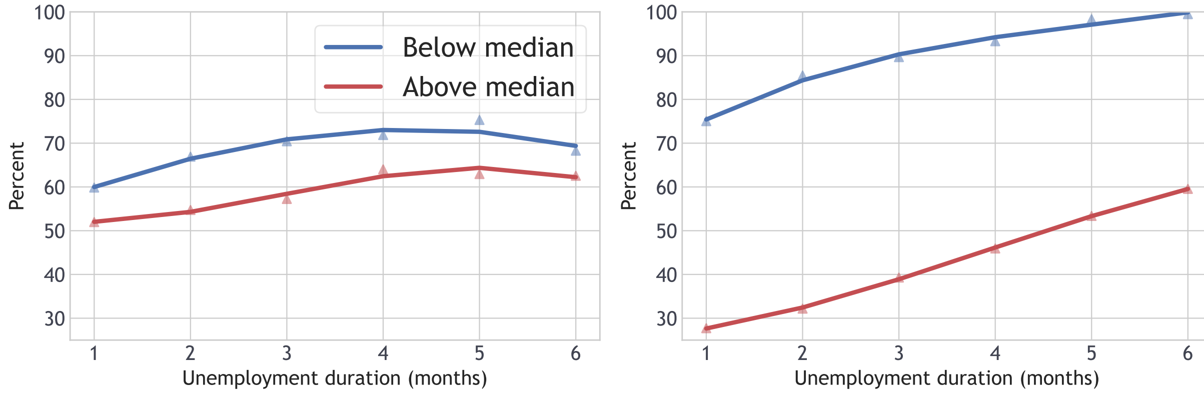
E.1 Optimizing over one UI instrument at a time in the standard model

Table A6 presents results from the standard model in which only one UI policy instrument is optimized at a time. A discussion of these results is provided in Section 6.1.

[7] Clearly, our model is not designed to capture high levels of wealth at the top. For this reason, while it does a reasonable job of matching various percentiles below the median—by employment and UI status—it underestimates the level of wealth above the median, especially at the top of the distribution.

Figure A7: Heterogeneity in take-up rates over unemployment duration: Data vs model

(a) Take-up rate by asset-to-income ratio: Data (b) Take-up rate by asset-to-income ratio: Model



Note: Panel (a) plots the take-up rate—measured as the fraction of UI eligible who take up UI—over unemployment duration separately for spells originating from below or above the median of the asset-to-income ratio distribution in the data. Panel (b) repeats the same calculations in the baseline model.

Table A5: Distribution of asset-to-income ratio by employment and UI status: Data vs model

Data	p10	p20	p25	p30	p40	p50	p60	p70	p75	p80	p90	Mean
Employed	-1.55	-0.31	0.00	0.10	0.49	0.98	1.66	2.73	3.55	4.79	10.72	3.32
Unemployed	-2.18	-0.47	-0.07	0.00	0.18	0.55	1.06	1.88	2.48	3.52	8.50	2.28
Take up	-1.96	-0.52	-0.15	0.00	0.19	0.53	0.93	1.62	2.18	2.94	6.49	1.55
Non-take up	-2.15	-0.48	-0.11	0.00	0.24	0.63	1.23	2.09	2.80	4.06	8.81	2.84

Model	p10	p20	p25	p30	p40	p50	p60	p70	p75	p80	p90	Mean
Employed	-0.79	-0.16	-0.01	0.09	0.31	0.50	0.71	1.09	1.15	1.20	1.33	0.53
Unemployed	-2.28	-1.34	-1.03	-0.79	-0.42	-0.13	0.08	0.33	0.47	0.64	1.45	-0.31
Take up	-1.83	-1.15	-0.96	-0.84	-0.52	-0.27	-0.02	0.20	0.33	0.46	1.38	-0.18
Non-take up	-0.50	-0.24	-0.15	-0.08	0.05	0.24	0.49	0.75	0.91	1.15	1.87	0.17

Note: This table shows asset-to-income ratio distributions by employment and UI status in the data and in the baseline model.

E.2 Measuring incentive costs when accounting for differential UI changes

Figure 7 in Section 6.2 presents the dynamics of the job-finding rate over the duration of unemployment across asset quartiles, under both the current and optimal policies in the baseline model. These results provide insight into the magnitude of the incentive costs associated with the more generous optimal policy, in terms of its impact on unemployment exits for individuals with different levels of available self-insurance.

As discussed in the main text, however, the change in UI generosity is not uniform across these worker groups. For example, increases in replacement and eligibility rates under the optimal policy relative to the current policy in the baseline model are larger for low-income and low-wealth individuals, as shown in Table 2.

To further evaluate the heterogeneity in incentive costs in the baseline model, we now present additional results that account for differential changes in UI generosity across the wealth distribution. In particular, Figure A8 shows the change in the job-finding rate between the current

Table A6: Optimal UI policy in standard model: Joint optimal vs one parameter at a time

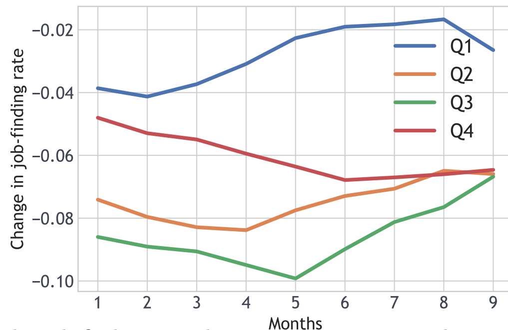
Panel A: UI policy parameters and welfare effects of optimal policy					
UI policy instrument	Current UI	Joint optimal UI	Only optimal m_0^b	Only optimal m_0^g	Only optimal ϑ
Level of UI replacement rate m_0^b	0.524	0.107	**0.192**	0.524	0.524
Het. of UI replacement rate m_w^b	0	0	0	0	0
Level of UI ineligibility rate m_0^g	0.422	0.180	0.422	**0.980**	0.422
Het. of UI ineligibility rate m_w^g	0	0	0	0	0
Minimum UI duration $\bar{x}$	6.000	6.000	6.000	6.000	6.000
UI expiration rate ϑ	0.257	0.050	0.257	0.257	**0.974**
Tax rate τ	0.300	0.291	0.291	0.288	0.299
Interest rate r (%)	0.839	0.839	0.838	0.836	0.839
Average welfare gains (%)		0.39	0.25	0.20	0.05
Fraction with positive gain (%)		97.53	97.45	96.60	96.02
Panel B: UI replacement and eligibility rates, and realized UI payment duration					
Replacement rate					
Average	0.52	0.11	0.19	0.52	0.52
Q1	0.52	0.11	0.19	0.52	0.52
Q2	0.52	0.11	0.19	0.52	0.52
Q3	0.52	0.11	0.19	0.52	0.52
Q4	0.52	0.11	0.19	0.52	0.52
Q5	0.52	0.11	0.19	0.52	0.52
Eligibility rate					
Average	0.58	0.82	0.58	0.02	0.58
Q1	0.58	0.82	0.58	0.02	0.58
Q2	0.58	0.82	0.58	0.02	0.58
Q3	0.58	0.82	0.58	0.02	0.58
Q4	0.58	0.82	0.58	0.02	0.58
Q5	0.58	0.82	0.58	0.02	0.58
UI payment duration (months)	3.06	2.75	2.69	3.06	2.80

Note: This table summarizes optimal UI policy results in the standard model. Panel A presents values of UI policy instruments and the equilibrium tax rate under different UI policies. The first column (current UI) represents the current policy; the second column (joint optimal UI) represents the optimal policy when all policy parameters are jointly optimized (i.e., m_0^b, m_0^g, and ϑ at the same time); and the third to fifth columns represent cases where we optimize only over one parameter (i.e., m_0^b, m_0^g, and ϑ one at a time), respectively. In columns three to five, the optimized parameter values are shown in bold, while the remaining UI policy instruments are held at their values under the current policy. Panel B presents the implied UI replacement rate and the eligibility rate upon job loss, both on average and by quintiles of the previous earnings distribution, as well as the realized UI payment duration in months.

and optimal policies in the baseline model over the months of the unemployment spell, scaled by multiples of a 10–percentage point (pp) change in replacement rates. For instance, if the job-finding rate falls by 0.08 while replacement rates rise by 20 pp when the UI policy shifts from the current to the optimal policy, the reported value is –0.04. These results are shown separately for unemployed individuals classified into asset quartiles ($g = 1, 2, 3, 4$) at the time of job loss, based on the asset distribution of all EU transitions.

Consistent with the results in Section 6.2, we find a non-monotonic pattern in the magnitude of changes in the job-finding rate in response to the UI policy change. Specifically, individuals in the bottom quartile exhibit the smallest incentive effects, while those in the second and third quartiles experience larger changes than those in the top quartile.

Figure A8: Change in job-finding rates by wealth quartiles over spell duration upon UI change



Note: This figure shows the change in the job-finding rate between the current and optimal policy in the baseline model over the months of the unemployment spell, scaled by multiples of a 10–percentage point (pp) change in replacement rates. For example, if the job-finding rate falls by 0.08 while replacement rates rise by 20 pp when the UI policy changes from the current to the optimal policy, the reported value is -0.04. Actual changes in replacement rates vary by quartile. Workers are classified into asset quartiles ($g = 1, 2, 3, 4$) at the time of job loss, based on the asset distribution of all employment-to-unemployment (EU) transitions. To isolate behavioral responses over the unemployment spell under both policies, we restrict the sample to a balanced panel of workers with nine months of unemployment.

E.3 Heterogeneous welfare effects of the optimal policy

In Table 3, we document the heterogeneous welfare effects of the optimal policies in the baseline and standard models across quintiles of the wage and asset-to-income ratio distributions. Here, in Table A7, we present the same results across quintiles of labor productivity and asset distributions. Overall, we find conclusions very similar to those in Table 3 for both the baseline and standard models. For the baseline model, welfare gains and the fractions of individuals with positive gains are heterogeneous in a way that they are larger in the bottom quintiles of both of these distributions. Further, welfare gains are larger for the unemployed than for the employed. For the standard model, welfare gains are smaller than those under the baseline model and are less spread out across the quintiles of these distributions, and almost all employed individuals at each quintile experience positive gains. Moreover, the majority of the unemployed experience welfare losses from the optimal policy in the standard model.

F Optimal UI policy under different specifications

Finally, in this section, we provide additional explanations to supplement our discussion of results in Section 7. Results are summarized in Table A8.

Partial equilibrium in asset market. As noted in Section 7, the optimal policy in partial equilibrium is nearly identical to that in the baseline model, except that it prescribes slightly lower replacement rates. The difference arises because, in the baseline model under general equilibrium, more generous optimal UI policy reduces precautionary savings by crowding out private insurance, which in turn slightly raises the equilibrium return on savings r, as shown in Table 2. This rise in r partially offsets the crowding-out effect. In partial equilibrium, where r is fixed, this dampening channel is absent, so the government scales back replacement rates slightly. Overall, however, the two optimal policies are very similar, indicating that the endogeneity of the real interest rate is not pivotal for the optimal UI prescription. Importantly, the gap between

Table A7: Heterogeneous welfare effects of optimal policy

	Labor productivity					Asset				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
Panel A: Baseline model										
All										
Average welfare gains (%)	5.22	2.04	-0.17	-0.83	-1.21	3.67	2.76	1.72	0.27	-0.08
Fraction with positive gain (%)	100.0	80.4	9.2	2.9	0.5	68.0	53.5	46.1	14.2	11.3
Employed										
Average welfare gains (%)	5.03	1.89	-0.17	-0.88	-1.21	3.54	2.58	1.65	0.13	-0.14
Fraction with positive gain (%)	100.0	74.6	8.2	2.3	0.5	66.0	51.5	44.9	12.4	10.8
Unemployed										
Average welfare gains (%)	7.16	5.44	2.94	1.28	-0.76	5.14	4.74	4.86	3.43	2.33
Fraction with positive gain (%)	100.0	100.0	100.0	72.0	17.2	89.6	87.1	88.8	82.0	41.6
Panel B: Standard model										
All										
Average welfare gains (%)	0.21	0.19	0.50	0.54	0.54	0.25	0.34	0.35	0.46	0.30
Fraction with positive gain (%)	96.8	96.7	97.6	98.1	98.3	97.0	98.0	98.5	98.5	95.5
Employed										
Average welfare gains (%)	0.29	0.27	0.54	0.58	0.56	0.33	0.39	0.39	0.51	0.40
Fraction with positive gain (%)	99.3	99.4	99.7	99.9	100.0	100.0	100.0	100.0	100.0	98.3
Unemployed										
Average welfare gains (%)	-1.40	-1.17	-0.94	-0.50	-0.49	-1.12	-0.93	-1.08	-1.16	-1.02
Fraction with positive gain (%)	40.6	44.3	38.0	39.0	41.6	55.7	39.5	37.3	34.5	36.4

Note: This table presents average consumption-equivalent welfare gains and fractions of populations with positive welfare gains under the optimal policy relative to the current policy in the baseline model (Panel A) and the standard model (Panel B) across quintiles of labor productivity and asset distributions for all individuals, employed individuals, and unemployed individuals. Cutoffs for quintiles of both distributions and employment status of individuals are based on the economy under the current policy.

optimal UI policies in baseline and standard models therefore remains unchanged as well.

No borrowing. We stated in Section 7 that the optimal policy when we do not allow individuals to borrow in the asset market is mostly similar to that under when borrowing is allowed. Since this model does not feature individuals who have negative wealth holdings and relatively higher marginal utility of consumption, insurance gains from the optimal policy is also smaller, while the incentive costs are larger given that being indebted during unemployment further disciplines the job search in the baseline model. Overall, we conclude that allowing individuals to borrow is not at all pivotal for the optimal UI policy prescription. Importantly, the gap between optimal UI policies in baseline and standard models remains the same.

Progressive income taxation. We also considered a progressive income taxation case in the main text. Here, we first provide additional details on this exercise. Following Benabou (2002) and Heathcote et al. (2014), the after-tax labor income of the individual is given by $\widetilde{x} = (1-\tau)\, x^{1-\Upsilon}$, where $x = w$ for an employed and $x = b\,(w)\, w$ for a UI recipient, τ determines the level of taxation, and $\Upsilon \geq 0$ determines the rate of progressivity built into the tax system. We set $\Upsilon = 0.151$, as in Heathcote et al. (2014). In the baseline model, we find that the equilibrium value of the level parameter of this tax system under the current UI policy is $\tau = 0.116$.

The reason behind less-generous replacement rates prescribed by the optimal policy under progressive income taxation relative to the optimal policy under linear income taxation is that, under progressive taxation, there already exists redistribution coming from the tax system. When individuals lose employment and receive UI, their benefits are also taxed at a lower tax rate compared with the case under linear taxation, dampening the government's incentives to offer as high a replacement rate under linear taxation. As a result, the welfare gains from the optimal policy in a model with fewer redistributive motives are also slightly smaller. Overall, we conclude that the taxation system plays a quantitatively important role in shaping optimal policy. However, its impact is not significant enough to substantially reduce the generosity of the optimal UI or overturn the baseline policy prescription. Under progressive taxation, the optimal policy still offers significantly higher eligibility rates and longer payment durations compared with the current UI system. Importantly, under progressive taxation, the optimal policy is still much more generous in the baseline model than in the standard model. Hence, we conclude that *even* when the redistributive role of UI is reduced, optimal policy is still more generous in a model that accounts for heterogeneity among the unemployed than in a model that does not.

High value of unemployment. Finally, we provide additional details on our experiment when we set the monetary value of non-market activity $h = 0.39$ in the model so that the average flow value of unemployment is equal to 95.5 percent of the flow value of employment, as in Hagedorn and Manovskii (2008).

In this scenario, the average consumption drop upon job loss becomes 7.6 percent instead of 8.4 percent under the baseline calibration. The decline in consumption is still not close to zero because when the value of h becomes much larger, the decline in precautionary savings leads to lower wealth holdings among the employed, generating a decline in consumption upon job loss.

We mentioned in Section 7 that the optimal policy in this case still offers high replacement rates but pays UI for a much shorter expected duration due to a higher expiration rate ϑ. The reason the optimal policy now offers a much shorter expected payment duration, rather than lowering replacement rates as seen under progressive taxation, is that there are still welfare gains from redistribution through higher replacement rates for those with low previous earnings. Note that unlike in the progressive taxation case, which explicitly redistributes toward low-income (low-wealth) workers, the high level of h is enjoyed by *all* unemployed individuals, and, as a result, low-wealth workers are still relatively worse-off. However, because of the lower surplus from employment, the incentive costs of a generous UI policy rise. Thus, these payments are only made for a shorter expected duration as the long-term unemployed are not in as dire a situation as their counterparts in the low h economy. Importantly, under high value of unemployment, we also show that the optimal policy is still more generous in the baseline model than in the standard model. As a result, we conclude that even when the opportunity cost of employment is low, the gap in optimal policies between the two models remains significant, underscoring the importance of accounting for heterogeneity among the unemployed.

Table A8: Optimal UI policy under different model specifications

	Baseline model		Partial equilibrium		No borrowing		Progressive tax		High unemployment value	
	Baseline	Standard	Baseline	Standard	Baseline	Standard	Baseline	Standard	Baseline	Standard
Panel A: UI policy parameters and welfare effects of optimal policy										
Level of UI replacement rate m_0^b	1.273	0.107	1.129	0.139	1.319	0.139	1.045	0.107	1.251	0.107
Het. of UI replacement rate m_w^b	-0.223	0	-0.179	0	-0.179	0	-0.179	0	-0.135	0
Level of UI ineligibility rate m_0^g	0.080	0.180	0.080	0.180	0.070	0.180	0.124	0.222	0.080	0.264
Het. of UI ineligibility rate m_w^g	-0.125	0	-0.049	0	-0.015	0	-0.108	0	-0.057	0
Minimum UI duration $\bar{x}$	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
UI expiration rate ϑ	0.040	0.050	0.040	0.100	0.040	0.050	0.078	0.100	0.400	0.050
Tax rate τ	0.323	0.291	0.320	0.292	0.328	0.292	0.125	0.084	0.324	0.289
Interest rate r (%)	0.841	0.839	0.839	0.839	0.844	0.839	0.844	0.839	0.844	0.839
Average welfare gains (%)	2.09	0.39	1.03	0.38	2.01	0.39	1.71	0.36	3.67	0.48
Fraction with positive gain (%)	38.61	97.53	38.75	97.52	60.90	97.53	62.78	97.61	67.99	97.39
Panel B: UI replacement and eligibility rates, and realized UI payment duration										
Replacement rate										
Average	0.74	0.11	0.69	0.14	0.85	0.14	0.62	0.11	0.87	0.11
Q1	0.94	0.11	0.85	0.14	1.04	0.14	0.78	0.11	1.04	0.11
Q2	0.88	0.11	0.79	0.14	0.94	0.14	0.73	0.11	0.95	0.11
Q3	0.70	0.11	0.67	0.14	0.86	0.14	0.58	0.11	0.90	0.11
Q4	0.68	0.11	0.61	0.14	0.68	0.14	0.57	0.11	0.75	0.11
Q5	0.37	0.11	0.40	0.14	0.51	0.14	0.33	0.11	0.58	0.11
Eligibility rate										
Average	1.00	0.82	1.00	0.82	0.98	0.82	1.00	0.78	1.00	0.74
Q1	1.00	0.82	1.00	0.82	0.95	0.82	1.00	0.78	1.00	0.74
Q2	1.00	0.82	1.00	0.82	0.96	0.82	1.00	0.78	1.00	0.74
Q3	1.00	0.82	1.00	0.82	0.97	0.82	1.00	0.78	1.00	0.74
Q4	1.00	0.82	1.00	0.82	0.99	0.82	1.00	0.78	1.00	0.74
Q5	1.00	0.82	1.00	0.82	1.00	0.82	1.00	0.78	1.00	0.74
UI payment duration (months)	3.41	2.75	3.19	2.74	4.04	2.87	3.32	2.69	3.61	2.94

Note: This table summarizes the optimal policy results under different model specifications. In particular, we provide the optimal UI policies in both baseline and standard models under the main specification and its four different versions: with exogenous interest rate r, where individuals cannot borrow in the asset market, with progressive income taxation, and where the monetary value of nonmarket activity h is set to 0.39 such that the value of unemployment becomes larger, respectively. In all models except the progressive tax model, τ refers to tax rate in the linear income taxation system, while in the progressive tax model, τ refers to the level parameter of the progressive tax function.