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Victor Hernandez Martinez and Kaixin Liu

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The Value of Unemployment Insurance: Liquidity vs. Insurance Value

Victor Hernandez Martinez†
Kaixin Liu‡

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Abstract

This paper argues that the value of unemployment insurance (UI) can be decomposed into a liquidity component and an insurance component. While the liquidity component captures the value of relieving the cost to access liquidity during unemployment, the insurance component captures the value of protecting the worker against a potential permanent future income loss. We develop a novel sufficient statistics method to identify each component that requires only the labor supply responses to changes in the potential duration of UI and severance payment and implement it using Spanish administrative data. We find that the liquidity component represents half of the value of UI, while the insurance component captures the remaining half. However, the relevance of each component is highly heterogeneous across different groups of workers. Poorer and wealthier workers are both similarly liquidity-constrained, but poorer workers place a higher value on UI because the insurance component is significantly more important for them. On the other hand, wealthier workers and workers with more cash-on-hand value additional UI equally, but the wealthier value its liquidity, while those with more liquidity care about its insurance value. Finally, from a welfare perspective, we show that extending the potential duration of Spain's UI would increase welfare. However, in our counterfactual case where UI is complemented with the provision of liquidity, the optimal potential duration of Spain's UI should be lower than its current level.

Keywords: Unemployment Insurance, Liquidity Constraints, Consumption Smoothing.
JEL Codes: H20, J64, J65.

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† Federal Reserve Bank of Cleveland, email: victor.hernandezmartinez@clev.frb.org
‡ University of Rochester, email: kliu24@ur.rochester.edu

1 Introduction

Unemployment typically features an instant drop in income and a potential deterioration of future lifetime income, generating a drop in consumption. To help individuals bridge this gap in consumption, an important share of government expenditures is dedicated to unemployment insurance (UI) programs.[1] This has led to a body of research studying both UI's distortionary costs[2] and its value.[3] Previous work shows that the mechanism behind this distortionary cost is a moral hazard effect – increases in the generosity of UI reduce the relative price of unemployment, decreasing unemployed workers' search effort. However, despite this extensive scrutiny of the cost side, there is little evidence of the mechanisms driving the value of UI. Do workers value UI because of the liquidity it provides? Is the lack of perfect insurance behind the value of UI?

This paper fills this gap by studying why workers value UI. More specifically, we aim to answer why workers value an additional unit of consumption more during unemployment than when employed. To do this, we argue that the value of UI arises through two different channels.[4] First, the cost of transferring resources over time (or the cost of liquidity) could be large when unemployed, making it hard to borrow against resources from future employment. We refer to this channel as the liquidity component.[5] Second, we consider the possibility that unemployment could have a permanent impact on lifetime resources, incentivizing workers to save while maintaining lower consumption. Therefore, we do not impose the condition that unemployment is a transitory income shock. Instead, during unemployment, workers face the risk of entering an absorbing bad state "out-of-labor-force," against which they are not perfectly insured.[6] We refer to this channel as the insurance component.[7].

[1]UI expenditures range from 0.2 percent of GDP in the US to almost 2 percent in Finland (OECD 2022).

[2]For a recent review of this literature, see Schmieder et al. (2016).

[3]See Gruber (1997), Chetty (2008), Landais (2015), Kolsrud et al. (2018), Ganong and Noel (2019), and Landais and Spinnewijn (2021).

[4]We are not the first to conceptually propose these two mechanisms behind the value of UI, previously discussed in Shimer and Ivan Werning (2008). We contribute to their characterization and their empirical separation.

[5]Chetty (2008) argues that the liquidity component is the major reason behind the cash-on-hand effect of UI. Landais and Spinnewijn (2021) develop a method, based on the MPC, to calculate a lower bound of the liquidity component, and use it as a lower bound for the value of UI.

[6]This idea is consistent with the findings of the literature studying the effects of displacement/unemployment. For instance, Bertheau et al. (2022) argue that most of the persistent effects of displacement on future earnings arise through the extensive margin (i.e., workers not returning to the labor market after unemployment). Their results show that, depending on the country, 4 to 19 percent of the workers that experience a displacement do not return to the labor market within 5 years of losing their job.

[7]Chetty (2008) mentions the potential relevance of the insurance market's failure in explaining unemployed workers' responses to cash-on-hand, but never analyzes it. Similarly, Landais and Spinnewijn (2021) argue that future income after an unemployment spell could be permanently lower, but falls short of disen-

To characterize this liquidity-insurance decomposition, we set up a partial equilibrium dynamic job search model where employment and unemployment differ in the cost of transferring resources over time. Moreover, when workers are unemployed they face the risk of exiting the labor force forever, receiving a persistently lower income than if they were working. Using our model, we explicitly show that the value of UI, expressed as the marginal rate of substitution between employment and unemployment, is affected by both the cost of liquidity and the risk of a permanently lower future income.[8]

To distinguish between the liquidity and insurance value of UI we rely on a simple but powerful idea. While increases in or extensions of UI change the resources available to the unemployed, affecting the value of UI through both the liquidity and the insurance channels, changes that only alter the timing when UI benefits are received only affect the value of UI through the liquidity channel. In the most extreme case, when workers can transfer resources over time without any friction, they will be indifferent between receiving benefits today or tomorrow (conditional on receiving them). However, when the cost of transferring resources over time is large, workers' response to today's transfer will be very different from their response to tomorrow's transfer.

Implementing this idea in our model, we show that the cost of transferring resources during unemployment (i.e., the liquidity value of UI) can be identified from a sufficient statistics method that takes as inputs only the labor supply responses to two UI transfers with differential timing and one unconditional income transfer. Once we identify this cost of liquidity, the insurance value is simply the part of the value of UI that is not explained by the liquidity cost. To directly calculate the value of UI, we follow the revealed preference method proposed by Chetty (2008). We implement these steps using Spanish administrative data, taking advantage of Spain's unique UI institutional features that provide multiple sources of exogenous variation in conditional and unconditional income transfers.

Our estimation results indicate that workers face significant additional liquidity costs during unemployment. Specifically, we estimate this cost to be 1.2 percent larger per month (15 percent annually) than during employment. However, this result masks significant heterogeneity across different groups of workers. Workers with more available liquidity at the start of the unemployment spell suffer no significant additional liquidity costs during un-

tangling the relevance of this mechanism to the value of UI.

[8]The liquidity-insurance decomposition we propose in this paper is, by construction, exhaustive and applies to most other social insurance programs. The reason is that in a dynamic setup, whether the response to a shock is driven by the liquidity or the insurance value depends on the nature of the shock. If it is temporary, the social insurance plays a liquidity role – it avoids the expensive cost of transferring resources from the future to today; if the shock is permanent, the social insurance acts as insurance – it transfers resources from good states to bad states.

employment, while for workers with less available liquidity this additional cost raises to 2.5 percent monthly (34 percent annually). Surprisingly, when we compare wealthier and poorer workers, we find the liquidity costs to be similar across both groups, and significantly different from the cost during employment (around 2.0 percent monthly – 27 percent annually – for both groups).

Nevertheless, unemployed workers also value the insurance component of UI. We find that workers' responses to UI are consistent with a future in which, if they faced a lower-income state, their marginal utility of consumption in that state would be 46 percent larger than during employment. This is equivalent to a 9 percent consumption difference if the CRRA coefficient of risk aversion is 4. As before, this result hides significant differences across different groups of workers. Richer workers' marginal rate of substitution between a future bad state and employment is indistinguishable from one, suggesting that they can perfectly self-insure against this risk, while for all other groups the insurance value ranges from 1.47 to 2.34.

Combining both previous results, we find that 53 percent of the value of UI arises because of its liquidity value, while the remaining 47 percent is driven by its insurance value. However, when considering workers with more available liquidity, the liquidity component represents only 33 percent of the value of UI. On the opposite side of this spectrum, we find wealthier workers, for whom the liquidity component captures 90 percent of the value of UI. Our results highlight how the marginal rate of substitution is not a perfect indicator of the degree of liquidity constraints or of the insurance value of UI. While both wealthier workers and workers with more liquidity value UI similarly, the former group does so because of the liquidity it provides, while for the latter group what matters is its insurance value. Similarly, a comparison between wealthier and poorer workers shows that the latter values UI significantly more, despite the liquidity value of UI being similar for both groups.

Finally, using the revealed preference approach introduced in Chetty (2008), we consider the welfare effects of extending UI's potential duration. We find that under current liquidity costs, this effect is positive, suggesting that the current potential duration is below the optimal level. More interestingly, we consider a counterfactual scenario in which we first eliminate the additional liquidity costs during unemployment, and then evaluate the welfare effects of an extension of UI's potential duration.[9] We calculate a negative welfare effect, suggesting that if additional policies are implemented to alleviate the liquidity concerns of

[9]The sufficient statistics approach is not well suited to analyzing policy counterfactuals far from the current policy. However, by removing the part driven by liquidity from all moments required to implement it, we are still able to use it to approximate the welfare effects of this counterfactual policy under certain assumptions.

unemployed workers (e.g., zero-interest loans), the potential duration of Spain's UI should be significantly reduced from its current level.

This paper contributes primarily to the literature studying the design of optimal unemployment insurance. Similar to Shimer and Iván Werning (2007), Chetty (2008), Landais (2015), and Landais and Spinnewijn (2021), we rely on the so-called "optimization approach" and propose a novel way to extend it, such that it allows us to directly identify the liquidity value of UI. While previous efforts focused on estimating the costs and benefits of increasing or extending UI, to our knowledge ours is the first paper to speak to the importance of the different mechanisms behind the value of UI using this approach. Our question of interest is similar to that in Shimer and Ivan Werning (2008) but we use a completely different approach to answer it. Shimer and Ivan Werning (2008) rely on a calibrated theoretical model to present their argument, while we extend the sufficient statistics approach and implement its empirical estimation. Nevertheless, our findings agree that liquidity constraints should not be the only rationale behind the provision of UI and that alleviating them does not necessarily imply a reduction in the optimal UI. As in their case, the importance of the insurance component in the value of UI indicates that workers assign a not insignificant probability to a future where their income is significantly lower and prepare for this option.

These results have important implications for policy design. First, the role of liquidity constraints in the value of UI directly informs us about the potential value of policies providing only liquidity during unemployment. Second, the importance of the insurance value of UI suggests that workers assign a not insignificant probability to a future where their income is significantly lower. This result suggests that policies targeted at improving unemployed workers' labor supply and future earnings, through training or by providing them with additional information about the labor market, could be of significant value. Finally, we highlight that increasing access to liquidity does not necessarily decrease the incentive for providing insurance. This implies that liquidity and UI policies are not necessarily substitutes, but could potentially be complementary to each other.

This paper also helps bridge the gap between the optimal unemployment insurance literature and the literature on the effects of displacement/unemployment. While the former tends to implicitly or explicitly assume that unemployment has no negative effects on lifetime income, the latter finds that dismissed workers suffer large and persistent changes in their labor supply and earnings.[10] For instance, in our sample we find that 15 percent of

[10] See Jacobson et al. (1993), Stevens (1997), Krolikowski (2017), Lachowska et al. (2020), and Bertheau et al. (2022).

workers do not return to the labor market within 2.5 years of losing their jobs, and that within this group, 90 percent still remain jobless after 5 years. We help reconcile both strands of the literature by explicitly considering the possibility of a bad future state while unemployed and its relevance to the value of UI.

Finally, this paper provides the first approach to directly assessing the relevance of liquidity constraints for the unemployed, separate from the income effect.[11] Compared to previous work, the advantage of our approach is that it makes no assumptions about workers' preferences and only some minor assumptions about the market structure.[12] Similar to Shapiro and Slemrod (1995) and Gelman et al. (2020), our approach relies on the idea that, in the absence of liquidity costs, future income shocks should have the same impact on today's consumption, regardless of when in the future they happen. We extend this idea to a job search model with conditional income transfers and develop a strategy to identify these liquidity costs.

The rest of the paper proceeds as follows: Section 2 proposes a job search model to illustrate the liquidity-insurance decomposition and introduces our framework to evaluate the effects on welfare of changes in UI. Section 3 explains how to separate the liquidity and insurance components in the value of UI using conditional and unconditional income transfers. Section 4 presents the institutional details of Spain's UI system, our data, empirical strategies, and results on estimating the labor supply responses of unemployed workers to exogenous changes in severance payments and the potential duration of UI. Section 5 shows how to map our estimates of the labor supply responses to the objects in our model to recover the relevance of the liquidity and insurance components, and presents the estimated results. Section 6 focuses on the welfare implications of these results. Section 7 concludes.

2 A Job Search Model

This section presents a job search model based on Chetty (2008). Our goal is to show that the value of unemployment insurance can be decomposed into a liquidity value and an insurance value. The liquidity value refers to the value of relieving liquidity constraints, by removing the cost workers face when borrowing against their future income. The insurance

[11]The previous literature, as in Card et al. (2007) and Chetty (2008), argues the importance of liquidity constraints in driving the value of UI by comparing the magnitude of the income effects of richer vs. poorer workers.

[12]Our key assumption is that workers never reach their borrowing limit. A different way to read this assumption is regardless of their debt levels, workers can always continue borrowing, even if it is at an extremely high price.

value refers to the utility the worker derives from UI as protection against the risk in which her future lifetime income decreases permanently. Then, we show a novel sufficient statistics approach that directly recovers the cost of transferring resources over time – the liquidity cost – during unemployment. Finally, we present the steps to separate the value of UI into the liquidity and insurance value components.

A. Agent's Problem

The model describes the job search and consumption behavior of an unemployed worker who lives for infinite periods ($t = 0, 1, \cdots, \infty$).

At the beginning of period t, an unemployed agent with assets A_t chooses a search intensity s_t, which is normalized as the probability of finding a job. If the search is successful, she stays on the job that pays w_t forever and gains the value of finding a job $V(A_t)$. If the job search is unsuccessful, with exogenous probability λ_t the agent permanently exits the labor force , collects b_t each period and gains the value $\underline{\mathcal{U}}_t(A_t)$. With probability $(1-\lambda_t)$ the agent remains unemployed, collects b_t during that period, and will search for a job again in the following period. When the agent is unemployed, her continuation value is $U_t(A_t)$. As shown in Equation (1), the agent chooses s_t such that the expected utility net of the search cost $\phi(s_t)$ is maximized.

$$J_t = \underset{s_t \in (0,1)}{max}\ s_t V_t(A_t) + (1-s_t)\left((1-\lambda_t)\cdot U_t(A_t) + \lambda_t \cdot \underline{\mathcal{U}}_t(A_t)\right) - \phi(s_t) \tag{1}$$

The key difference of our model with respect to that in Chetty (2008) is in the states of the world the agent faces when the search fails. While the previous literature implicitly assumes that all agents who do not find a job search again in the next period, we explicitly consider two possible states of the world for them. They may remain unemployed and continue searching for a job in the future, or they may drop out of the labor force and remain there forever.[13]

Equations (2), (3), and (4) describe the value function of an agent who finds a job, drops out of the labor force, or remains unemployed, respectively. Here, we explicitly show the second difference between this model and previous work. Agents' cost to transfer resources over time depends on the state of the world they face. An employed agent faces an interest rate r_e on her assets. Contrarily, if an agent is unemployed or drops out of the labor force,

[13]We build the model using three states (employment, unemployment, and out of the labor force) for simplicity of exposition. However, our structure is equivalent to a search cost function increasing in t, such that, at some point, the cost of searching for a job becomes arbitrarily large.

her interest rate is r_u. For simplicity, in the remainder of this paper, we assume that the interest rate the agent faces in the employment state, r_e, is close to zero,[14] such that $\beta(1+r_e) \approx 1$.[15]

$$V_t(A_t) = \max_{A_{t+1} \geq \underline{A}} u(A_t - A_{t+1}/(1+r_e) + w_t) + \beta V_{t+1}(A_{t+1}) \tag{2}$$

$$\underline{\mathcal{U}}_t(A_t) = \max_{A_t \geq \underline{A}} u(A_t - A_{t+1}/(1+r_u) + \underline{b}_t) + \beta \underline{\mathcal{U}}_{t+1}(A_{t+1}) \tag{3}$$

$$U_t(A_t) = \max_{A_t \geq \underline{A}} u(A_t - A_{t+1}/(1+r_u) + b_t) + \beta J_{t+1}(A_{t+1}) \tag{4}$$

In Equations (2), (3), and (4), $u(\cdot)$ denotes the flow utility from consumption, β denotes the discount factor. $b_t = b$ for the first B periods (unemployment insurance), and $b_t = \underline{b}$ afterward, where $\underline{b}$ refers to the income received when benefits have expired. $\underline{b}$ includes resources from social welfare programs, non-market or home production, unregistered employment, etc.

In sum, our model departs from the literature by adopting two simple but novel variations: One, when the worker is unemployed, there is a possibility that she will permanently drop out of the labor force, suffering a non-temporary loss in income. Two, the interest rate faced by the agents, representing the cost of transferring resources over time, differs depending on the state of the world they face.

Solving Equations (1), (2), (3), and (4), respectively, we get the four following equations for each period t characterizing the optimal solution for the model. Here c_t^u denotes the agent's optimal consumption if unemployed, $c_t^{\underline{u}}$ denotes the optimal consumption when out of the labor force, and c_t^e denotes the optimal consumption while employed.

$$\phi'(s_t) = V_t(A_t) - (1-\lambda_t)U_t(A_t) - \lambda_t \underline{\mathcal{U}}_t(A_t) \tag{5}$$

$$u'(c_t^e) = \beta(1+r_e)u'(c_{t+1}^e) \tag{6}$$

$$u'(c_t^{\underline{u}}) = \beta(1+r_u)u'(c_{t+1}^{\underline{u}}) \tag{7}$$

$$u'(c_t^u) = \beta(1+r_u)\left(s_{t+1}u'(c_{t+1}^e) + (1-s_{t+1})((1-\lambda_{t+1})u'(c_{t+1}^u) + \lambda_{t+1}u'(c_{t+1}^{\underline{u}})\right) \tag{8}$$

[14] For completeness and clarity, in all our derivations we maintain r_e instead of replacing it with zero.
[15] Note that β does not change regardless of whether the worker is employed or unemployed.

Given Equations (5), (6), (7), and (8), we can solve the optimal search path $\{s_t^*\}_{t=0,1,\cdots,\infty}$ associated with each $(A_0, \{b_t\}_{t=0,1,\cdots,\infty}, \{w_t\}_{t=0,1,\cdots,\infty})$.

B. Insurance Value vs. Liquidity Value of UI

To illustrate our idea, let's consider the value of increasing UI (or "value of UI" for short) at period 0 (MRS_0). Its value depends on the comparison between the marginal utility of consumption during employment and unemployment.

$$\text{MRS}_0 = \frac{(1-\lambda_0)u'(c_0^u) + \lambda_0 u'(c_0^{u_0})}{u'(c_0^e)}$$

This ratio in marginal utilities across employment and unemployment is at the center of Chetty's (2008) sufficient statistics approach to evaluate the effects on welfare of changes in unemployment insurance. It represents the value of one additional unit of consumption during unemployment, relative to employment, and captures the amount of resources a worker would be willing to trade during employment in return for one extra unit of resources during unemployment.

To decompose the value of UI into its liquidity and insurance components, we take advantage of Equations, (6), (7), and (8):[16]

$$\text{MRS}_0 = \sum_{j=1}^{t}\left(\frac{1+r_u}{1+r_e}\right)^j \text{pr}_{j|0}^W \cdot \overbrace{\frac{u'(c_t^e)}{u'(c_t^e)}}^{\text{Working}} + \left(\frac{1+r_u}{1+r_e}\right)^t \sum_{j=0}^{t} \text{pr}_{j|0}^{\mathcal{U}} \cdot \overbrace{\frac{u'(c_t^{\underline{u}})}{u'(c_t^e)}}^{\text{Out-of-Labor-Force}} + \left(\frac{1+r_u}{1+r_e}\right)^t \text{pr}_{t|0}^U \cdot \overbrace{\frac{u'(c_t^u)}{u'(c_t^e)}}^{\text{Unemployment}} \tag{9}$$

where $\text{pr}_{j|0}^W = s_j^* \prod_{i=0}^{j-1}(1-\lambda_i)\prod_{k=1}^{j-1}(1-s_k^*)$ is the probability of finding a job in period t conditional on the search being unsuccessful in period 0, $\text{pr}_{j|0}^{\mathcal{U}} = \lambda_j \prod_{i=0}^{j-1}(1-\lambda_i)\prod_{k=1}^{j}(1-s_k^*)$ is the cumulative probability of exiting the labor force from period 0 to period t, conditional on the search being unsuccessful in period 0, and $\text{pr}_{t|0}^U \equiv (1 - \text{pr}_{j|0}^{\mathcal{U}} - \text{pr}_{j|0}^W)$ denotes the probability of staying in unemployment and continue searching for a job until t.

We make two assumptions to simplify our expression of the value of UI in Equation (9). First, we assume that $(\frac{1+r_u}{1+r_e})^t \text{pr}_{t|0}^U \cdot \frac{u'(c_t^u)}{u'(c_t^e)} \to 0$ when $t \to \infty$. In the long run, unemployment is not an absorbing state and this assumption ensures that as t increases, the forces affecting

[16]Here, we do not keep track of the timing when workers find a new job, even though, in general, it will have an impact on their consumption. Our assumption that $r_e \approx 0$ guarantees that their consumption will be very similar regardless of when they find a job. In Appendix A.1, where we present the detailed derivations, we do not impose any assumptions on the value of r_e.

the MRS from the future unemployment state are negligible.[17] Second, suppose there exists a large enough T period, such that after T, the interest rate in the out-of-the-labor-force state becomes equal to the employment interest rate, r_e. This assumption guarantees that, regardless of the state of the worker, the consumption path after period T is stable and that we can use the pieces that contribute to the value of UI in the first T periods to approximate MRS_0. Finally, recall that we assumed that the employment interest rate, r_e, is very close to zero. Combined with our new assumptions, this implies that neither the initial asset level nor the period in which the individual finds a job or drops out of the labor force will have a significant impact on future consumption decisions, which will be entirely determined by w or b. Thus, we have $c_t^e \approx w$ and $c_t^u \approx \underline{b}$ when $t \geq T$.

Using these assumptions, we can approximate MRS_0 as:

$$\text{MRS}_0 \approx \underbrace{\sum_{j=1}^{T}(1+r_u)^j \text{pr}_{j|0}^{W} + (1+r_u)^T}_{\text{Liquidity Value}} \left(1 - \sum_{j=1}^{T} \text{pr}_{j|0}^{W}\right) \underbrace{\frac{u'(\underline{b})}{u'(w)}}_{\text{Insurance Value}} \tag{10}$$

Equation (10) presents our central argument: the value of UI can be decomposed into two components: the value of relieving the liquidity constraints (expressed by $1 + r_u$) and the value of insuring against the possibility of permanent future income loss (defined by $u'(\underline{b})/u'(w)$).

First, the liquidity constraint prevents workers from financing their consumption under unemployment by increasing the cost of accessing future resources, exacerbating the consumption gap across states. To illustrate the role of liquidity, we can shut down the insurance value by specifying $u'(\underline{b})/u'(w) = 1$, and compare the case where $r_u = r_e$ (no liquidity constraints) vs. that where $r_u > r_e$ (liquidity constraints). Absent the insurance value of UI, MRS_0 will be one when $r = r_e$, and larger than one when $r_u > r_e$. Therefore, with liquidity constraints, workers will have a strict gap in consumption between employ-

[17]Note that, when t increases, the forces coming from the future unemployment state become smaller, as long as the probability of remaining unemployed decreases faster than the interest-rate-weighted MRS_t increases (i.e., $\frac{(1+r_u)^t}{(1+r_e)^t}\frac{u'(c_t^u)}{u'(c_t^{e0})}$). This simply reflects the fact that unemployment is not an absorbing state, and, over time, workers will exit it to leave the labor force or find a job. If consumption during unemployment remains high enough in all periods, and the interest rate in unemployment is not extremely high, the decreasing probability of remaining in this state will make the forces affecting the MRS_0 from the unemployment state arbitrarily small after a certain period T. But this also implies that the forces affecting the MRS_0 after period T from the absorbing states will become arbitrarily small, since they too depend on the probability of remaining in unemployment in T. Therefore, we can approximate the marginal rate of substitution in period 0 as: $\text{MRS}_0 \approx \sum_{j=1}^{T}\frac{(1+r_u)^j}{(1+r_e)^j}\text{pr}_{j|0}^{W}\frac{u'(c_0^e)}{u'(c_0^e)} + \frac{(1+r_u)^T}{(1+r_e)^T}\sum_{j=1}^{T}\text{pr}_{j|0}^{\mathcal{U}}\frac{u'(c_T^u)}{u'(c_T^e)}$. This approximation becomes an equality if we specify that after T periods, workers lose their ability to search and all enter the out-of-labor-force state.

ment and unemployment, whereas, in their absence, workers will consume exactly the same amount regardless of their state.

Second, the insurance value arises as precautionary savings against the risk that the resources one could get access to in the future decrease permanently ($\underline{b} < w$). To see it, shut down the liquidity constraints by specifying $r_u = r_e$. The MRS_0 will be larger than one if the available resources after exiting the labor force are strictly smaller than the wage earned while employed ($\underline{b} < w$), and the possibility of reaching this bad state is positive ($(1 - \sum_{j=1}^{T} \text{pr}_{j|0}^{W}) > 0$).

The liquidity-insurance decomposition is, by construction, exhaustive and applies to most other social insurance programs.[18] The reason is that in a dynamic setup, whether the response to a shock is driven by the liquidity or the insurance value depends on the nature of the shock. If it is temporary, the social insurance plays a liquidity role – it avoids the expensive cost of transferring resources from the future to today; if the shock is permanent, the social insurance act as insurance – it transfers resources from good states to bad states.

C. Policy Implications

What does the dichotomy between the liquidity and the insurance components imply for policy design? In principle, each component originates from a different market failure (credit market vs. insurance market). Thus, it presents a possibility for policymakers to use multiple instruments – public loans and UI insurance – to help smooth consumption while minimizing the aggregate distortion. While the option of using two policy instruments will never decrease welfare compared to using only UI, how the optimal UI should change when liquidity is provided separately is not obvious and remains an important policy question.

At first glance, it seems intuitive that when workers are provided access to interest-free loans, the value of UI decreases, reducing the optimal level of UI. We can see this by comparing two extreme cases. In the first case, suppose that workers face no liquidity costs during unemployment and the insurance value accounts for 100 percent of the value of UI. In this case, providing access to loans does not change the optimal design of UI, since the liquidity component is irrelevant to the cost and benefit of UI. In the second case, suppose the liquidity value accounts for the entirety of the value of UI ($w = \underline{b}$). In this case, if workers can first borrow enough liquid assets to smooth out this temporary shock,

[18] For example, in health insurance, Lockwood (2022) argues that public health insurance in the US has a low insurance value, while Gross et al. (2022) present evidence of the high liquidity value of public health insurance.

the consumption-smoothing problem has been solved and there is no value in providing any additional cash transfers. Thus, policymakers in this scenario should decrease UI to zero if they have already provided enough liquidity.

However, from a theoretical perspective, the optimal level of UI does not always need to decrease when considering jointly the use of liquidity instruments and UI, compared to the case where the only option is UI. The simple reason is that when liquidity is provided during unemployment, the workers' search effort will respond to this change, potentially increasing the value of UI and decreasing the moral hazard effect. This indirect opposite effect makes the change in the optimal level of UI theoretically ambiguous.

To clarify these arguments, we start with an example where the social planner chooses the optimal benefit level, b_0. We consider two alternatives for designing the optimal b_0. In our first alternative, the social planner only chooses b_0 to maximize the following social welfare function:

$$W_1 = \max_{b_0} J_0 = \max_{b_0} s_0 \cdot V_0(A_0 - \tau) + (1 - s_0)((1 - \lambda_0) \cdot U_0(A_0) + \lambda_0 \underline{\mathcal{U}}_0(A_0)) - \phi(s_0) \quad (11)$$

$$\text{subject to: } b_0(1 - s_0(b_0, r_u)) = s_0(b_0, r_u)\tau$$

From this equation, we can solve for the optimal b_0^{*1}, with corresponding welfare W_1^*. As shown in Chetty (2008), the sufficient statistics that characterize the optimal UI are:

$$\frac{dW_1}{db_0} / \frac{dW_1}{dA_0}|_{(b_0^{*1})} \equiv \frac{1 - s_0}{s_0} \left[\text{MRS}_0 - 1 - \frac{\epsilon_{1-s,b}}{s_0} \right] = 0 \quad (12)$$

where s_0 is the optimal search effort and $\epsilon_{1-s,b}$ is the change in the probability of unemployment with respect to a change in the UI level.

In our second alternative, the social planner jointly decides b_0 and r (through the provision of public loans) to maximize the social welfare:

$$W_2 = \max_{b_0, r} J_0 = \max_{b_0, r_u} s_0 \cdot V_0(A_0 - \tau) + (1 - s_0)((1 - \lambda_0) \cdot U_0(A_0) + \lambda_0 \underline{\mathcal{U}}_0(A_0)) - \phi(s_0) \quad (13)$$

$$\text{subject to: } b_0(1 - s_0(b_0, r)) = s_0(b_0, r)\tau$$

$$\text{and } r \geq r_e$$

From this equation, we can solve for the optimal (b_0^{*2}, r^*), with corresponding welfare W_2^*. Here we assume that the government can provide interest-free loans without creating a behavioral cost. This implies that the government has the ability to perfectly enforce the repayment of the loans, such that the workers have no option to default. Since $\frac{\partial W_2}{\partial r} = (1-s_0)\frac{\partial U_0}{\partial r} < 0$, the social planner will provide enough loans such that no one is liquidity constrained, $r^* = r_e$. The reason is that there are only consumption smoothing gains from reducing the cost of liquidity because the moral hazard cost of offering loans is zero. Given this, the sufficient statistics characterizing the optimal choice of b_0 are:

$$\frac{dW_2}{db_0}/\frac{dW_2}{dA_0}|_{(b_0^{*2},r^*)} \equiv \frac{1-s_0^{'}}{s_0^{'}}\left[\underbrace{\text{MRS}_0(r^*=r_e, s')}_{\text{Pure Insurance Value}} - 1 - \frac{\epsilon_{1-s_0',b}}{s_0'}\right] = 0 \tag{14}$$

The expression in (14) differs from (12) in an important way. The optimal solution s' now is the one evaluated using the statistics for the case where there is no liquidity cost. This implies that MRS_0 and the moral hazard cost ($\epsilon_{1-s_0',b}$) will change at the same time.

To see how b_0^{*2} changes relative to b_0^{*1}, let's define the function $\frac{dW_2}{db_0}/\frac{dW_2}{dA_0}(b)$:

$$\frac{dW_2}{db_0}/\frac{dW_2}{dA_0}(b) \equiv \frac{1-s_0^{'}(b,r_e)}{s_0^{'}(b,r_e)}\left[\text{MRS}_0(r=r_e, s_0'(b,r_e)) - 1 - \frac{\epsilon_{1-s_0'(b,r_e),b}}{s_0'}\right]$$

Since W_2 is typically assumed to be a concave function of b, reaching $b_0^{*2} < b_0^{*1}$ is equivalent to proving $\frac{dW_2}{db_0}/\frac{dW_2}{dA_0}(b_0^{*1}) < 0$. In Appendix D we show that this is further equivalent to:

$$\frac{\partial\left[\text{MRS}_0(r, s_0(b_0^{*1}, r)) \cdot (1 - \frac{1}{s_0(b_0^{*1},r)(1-s_0(b_0^{*1},r))} b_0^{*1} \frac{u'(w)}{\phi''(s_0(b_0^{*1},r))})\right]}{\partial r} > 0 \tag{15}$$

b_0^{*2} will be smaller than b_0^{*1} if Equation (15) is satisfied. Since removing the liquidity constraints reduces the search effort ($s_0'(b_0^{*1}, r_e) > s_0(b_0^{*1}, r_u)$) by increasing the value of staying unemployed, whether Equation (15) will be satisfied will depend on the properties of the underlying search cost function $\phi(s)$. It is easy to show that when $\phi''(s) > 0$, and $\phi''(s)$ is large enough, and $\phi''(s)$ is an increasing function of s, $b_0^{*2} < b_0^{*1}$. However, when $\phi''(s) < 0$, or $\phi''(s)$ is a decreasing function of s, removing the liquidity constraint will not necessarily imply a lower optimal UI.[19] Therefore, how the optimal UI changes when policymakers use UI and liquidity instruments jointly is an empirical question that remains to be answered.

[19]For instance, Chetty (2008) simulates the case where $\phi(s) = 5s^{1.1}/1.1$. This violates this specific condition and makes the theoretical prediction of interest ambiguous.

3 Separating the Liquidity Value from the Insurance Value

3.1 Inferring the Interest Rate from the Timing of Shocks

We show in this section how we identify the cost of transferring resources over time during unemployment, our measure of liquidity constraints, by exploiting the timing of income shocks. More specifically, we combine individuals' job search responses to conditional and unconditional income transfers at different points in time. This method combines insights from two different literatures: first, the dynamic consumption-saving literature, where the internal interest rate can be recovered using jointly the responses of current consumption to variations in unconditional income at more than two different points in time; second, the literature that addresses the dichotomy between the liquidity effects and the moral hazard effects of conditional income transfers.

In a standard dynamic consumption and saving model, with time separability, we can back out the internal interest rate (r) through the following experiment. For a baseline consumer who reaches her optimal choice of consumption and savings, let's perturb her income by one dollar at time τ_1 and record the change in her first-period consumption ($\frac{\partial c_0}{\partial i_{\tau_1}}$). Alternatively, let's perturb her income by one dollar at time τ_2 ($\tau_2 > \tau_1$) and record the change in her first-period consumption ($\frac{\partial c_0}{\partial i_{\tau_2}}$). It turns out that the ratio of $\frac{\partial c_0}{\partial i_{\tau_2}}$ to $\frac{\partial c_0}{\partial i_{\tau_1}}$ is exactly the internal interest rate to the power of $\tau_2 - \tau_1$. The intuition is that if the worker is indeed liquidity constrained, a \$1 cash transfer today will be more helpful than a \$1 cash transfer tomorrow. When we move to the literature on job search, the idea is conceptually similar. We simply use a different measure of consumption: search intensity, instead of purchased goods. The relative size of the effect on search intensity of tomorrow's unconditional income transfer vs. that of today's unconditional income transfer is informative of the degree of liquidity constraints.

To illustrate this idea formally, let's first consider the effect on s_t of a \$1 increase in the benefit level, b_t, at period t. Using Equations (5), (6), (7), and (8) and the envelope theorem, we find that:

$$\frac{\partial s_t}{\partial b_t} = \frac{\partial s_t}{\partial A_t} - \frac{\partial s_t}{\partial w_t} \tag{16}$$

As explicitly explained in Chetty (2008), a conditional income transfer, like UI benefits, has an effect on the labor supply through two channels. First, there is an income effect $\frac{\partial s_t}{\partial A_t}$, just like the effect of an unconditional payment, since the cash-on-hand directly generates a consumption response. Second, there is an extra effect due to the changes in the relative price of leisure compared to having a job, $\frac{\partial s_t}{\partial w_t}$, referred to as the moral hazard effect.

Let us now consider the effect of a \$1 increase in the benefit level in a future period τ. Using the Euler equations and the envelope theorem, in Lemma 1 in Appendix A.2 we show that $\frac{\partial s_t}{\partial b_\tau}$ can be linked with $(\frac{\partial s_t}{\partial A_t}, \frac{\partial s_t}{\partial w_t})$ as follows:

$$\frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^{\tau-t}} \left[\frac{\partial s_t}{\partial A_t} - \frac{\partial s_t}{\partial w_t} (1 - \sum_{j=t+1}^{\tau} \text{pr}^W_{j|t} \left(\frac{1+r_u}{1+r_e} \right)^{(j-t)}) \right] \tag{17}$$

Equation (17) highlights how the response of the search effort in period t to a change in the benefit level in a future period τ is still a combination of the contemporary income effect and the contemporary moral hazard, but linked over time through the cost of transferring resources. Increasing the benefits in the future creates a response in today's search effort based on how frictionless it is to bring money from the future to today. In the extreme case of an agent who is fully constrained, an increase in tomorrow's benefit level will have no impact on her search effort today, since, for her, the cost of bringing the money to today is prohibitively high.

Combining Equations (16) and (17) we could recover the interest rate if we observed $(\frac{\partial s_t}{\partial b_t}, \frac{\partial s_t}{\partial b_\tau}, \frac{\partial s_t}{\partial A_t})$. While, in our data, we observe the two conditional income transfers with differential timing, the only variation in unconditional income transfers that we observe are changes to the severance payment, occurring at the start of the unemployment spell ($t = 0$). To exploit this variation from the data, we transform Equation (17). The following theorem describes how the effect of a conditional income transfer through changes in b_τ, and that of an unconditional income transfer at time 0 are linked together.[20]

Theorem 1. *The following equation holds for every $\tau \geq t$ and $\tau, t \in \mathbb{N}$:*

$$\frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^{\tau}} \frac{\partial s_t}{\partial A_0} - \frac{1}{(1+r_u)^{\tau-t}} \frac{\partial s_t}{\partial w_t} \left(1 - \sum_{j=t+1}^{\tau} \text{pr}^W_{j|t} (\frac{1+r_u}{1+r_e})^{j-t} \right)$$

The theorem first implies that if we know the moral hazard effect and the interest rate during employment, we can use an unconditional income transfer and a conditional one to recover r_u. However, without an exogenous change in wages, we cannot observe the moral hazard effect. Instead, we will treat it as an unknown. The second implication of the theorem is that if we have two conditional income shocks at different points in time, one

[20] Appendix A.2 shows how to connect $\frac{\partial s_t}{\partial A_t}$ with $\frac{\partial s_t}{\partial A_0}$.

unconditional income shock, and we know the interest rate during employment, we will be able to identify r_u and the moral hazard effect at the same time. The following proposition formalizes this statement.

Proposition 1. *(Exact Identification) Given t, τ_1, τ_2 where $\tau_1 \neq \tau_2$ and $\tau_1, \tau_2 \geq t$, if we know $\frac{\partial s_t}{\partial b_\tau}$ for $\tau = \tau_1, \tau_2$, $\mathrm{pr}^W_{j|t}$ for $j > t$ and $j \leq \max\{\tau_1, \tau_2\}$, $\frac{\partial s_t}{\partial A_0}$ and r_e, we can identify the interest rate during unemployment r_u.*

We illustrate intuitively the proof of Proposition 1 here as follows. For a given r_e, if we treat r_u and $\frac{\partial s_t}{\partial w_t}$ as unknowns, we have two equations by expressing $\frac{\partial s_t}{\partial b_{\tau_1}}$ and $\frac{\partial s_t}{\partial b_{\tau_2}}$ through Theorem 1. If we do not have perfect collinear equations, we can solve for r_u. In practice, we have multiple t and τ combinations. Since, for each t, in principle, we only need to have shocks at two different points in time to recover r_u, we end up with over-identification of r_u. Therefore, we use GMM to estimate $\hat{r_u}$ in our main results.

Interpretation of $\hat{r}_u$: The interpretation of $\hat{r}_u$ in the absence of heterogeneity is straightforward. It captures the marginal cost of accessing liquidity. However, what do we identify using Proposition 1 in a world with unobserved heterogeneity? In reality, it is likely that, even when unemployed, some workers are borrowing at the rate of r_b and others are saving at a much lower (potentially zero) rate of r_s. In this case, how can we interpret the term $\hat{r_u}$, identified using Proposition 1? We show that $\hat{r_u}$ is a weighted average of the cost of borrowing, r_b and the rate of return on savings r_s, and can be interpreted as an estimate of the group's cost of accessing liquidity.[21] To see it, suppose there are two types of workers $i = \mathrm{b}, \mathrm{s}.$, representing a share of the group p_b and p_s respectively. Workers $i = \mathrm{b}$ are borrowing at an interest rate r_b, while workers $i = \mathrm{s}$ are saving and receiving a return per dollar saved of r_s.

Suppose that we can back out $\hat{r_u}$ using the estimates of $(\frac{\partial s_t}{\partial b_t}, \frac{\partial s_t}{\partial b_{t+1}}, \frac{\partial s_t}{\partial A_t})$. From Theorem 1 we have that:

$$\frac{1}{1+\hat{r_u}} = \frac{\mathrm{w}_b}{\mathrm{w}_b + \mathrm{w}_s}\frac{1}{1+r_b} + \frac{\mathrm{w}_s}{\mathrm{w}_b + \mathrm{w}_s}\frac{1}{1+r_s} \tag{18}$$

where $\mathrm{w}_i = p_i \frac{\partial s_t}{\partial b_t}|_i$ for $i = \mathrm{b}, \mathrm{s}$. In this case the cost of liquidity we estimate from Proposition 1 is a local average of the borrowing and saving cost. The local weights are determined by the elasticity of the labor supply response to changes in UI benefits, as well as the proportion of workers of each type. In general, the larger r_b, the larger the labor supply response of this type, and the larger the weight of this type of worker in the estimate of $\hat{r_u}$.

[21] The basic idea of this case applies equally to more flexible specifications, where the marginal cost of borrowing/saving is a nonlinear function of the assets.

How far our estimate $\hat{r_u}$ will be from the average cost of liquidity ($E(r_i) \equiv p_s r_s + p_b r_b$) will depend on the relative size of the moral hazard distortions, and the liquidity and insurance components of the value of UI. In the extreme case in which there are no moral hazard distortions and the entire value of UI comes from the liquidity component, $\hat{r_u}$ will be equal to r_b even if the share of that type within the group is very small. But the opposite can be true if the moral hazard and/or the insurance value of UI are decreasing enough in r. Then our estimate $\hat{r}_u$ could be close to r_s, even if the proportion of this type is small. Finally, the larger the moral hazard distortions and the insurance value of UI, the smaller the deviation of $\hat{r}_u$ from $E(r_i)$.

3.2 Identifying the Insurance Value of UI

This section explains how we recover the insurance value component. The basic idea is to use Chetty's (2008) revealed preference method to calculate the total value of UI (MRS_t) directly. Then, given the cost of liquidity identified in the previous section, we back out the insurance value component using the decomposition in Equation (10).

First, we estimate the value of UI. Taking advantage of Equation (5) and the envelope theorem, we can express the $\text{MRS}_t = 1 - \frac{\partial s_t}{\partial A_t} / \frac{\partial s_t}{\partial w_t}$. Therefore, if we can recover $\frac{\partial s_t}{\partial A_t}$ and $\frac{\partial s_t}{\partial w_t}$, we can identify the MRS_t.[22]

Second, knowing the MRS_t, we proceed to back out the insurance value. Combining our estimates of MRS_t and r_u with a specific T, we can recover $\frac{u'(\underline{b})}{u'(w)}$ using the liquidity-insurance decomposition in Equation (19).

$$\text{MRS}_t = \sum_{j=t+1}^{T} (1+r_u)^{j-t} \text{pr}_{j|t}^{W} + (1+r_u)^{T-t} \left(1 - \sum_{j=1}^{T} \text{pr}_{j|t}^{W}\right) \frac{u'(\underline{b})}{u'(w)} \tag{19}$$

Using the results from the previous section, where we estimate r_u, and the moral hazard components, $\partial s_t / \partial w_t$, we construct multiple equations in the form of (19), one for each t. Since recovering the insurance value requires only the MRS_t for one t, we end up with over-identification of $\frac{u'(\underline{b})}{u'(w)}$, and use GMM to estimate it.

[22] In Appendix A.2 we show in Lemma 3 that $\frac{\partial s_t}{\partial A_t} = \frac{\partial s_t}{\partial A_0}(1+r_u)^t$ which allows us to connect the impact on search intensity in t of a change in A_t with that of a change in A_0, if we know r_u. Therefore, we can calculate MRS_t in the following way:

$$\text{MRS}_t = -\frac{1}{(1+r_u)^t} \frac{\partial s_t}{\partial A_0} / \frac{\partial s_t}{\partial w_t} + 1$$

4 Estimation of the Labor Supply Responses

The model in Section 2 details how to recover the cost of transferring resources over time and the insurance value of UI by analyzing the response of the search behavior to conditional and unconditional income transfers. Thanks to its institutional design and the changes it underwent in the last few decades, Spain's unemployment insurance system is the perfect candidate for bringing the model to the data.

4.1 Unemployment Insurance in Spain: Institutional Design

Each unemployment spell in Spain is defined by three different variables: the potential duration, the benefit level, and the magnitude of the severance payment. Importantly, workers are not entitled to receive any unemployment benefits or severance pay if they leave their previous job voluntarily.[23]

Potential duration refers to the maximum number of months the worker is allowed to collect unemployment benefits. As shown in Table 1 the potential duration is a function of one single magnitude, the number of days worked in the previous 6 years, regardless of whether it is full-time or part-time work. The relationship between the number of days worked in the previous 6 years and the potential duration is not smooth, but based on multiple large discrete changes. Workers qualify for four months of UI potential duration after working for 360 days. After this, every additional 180 days worked increase the potential duration of UI by an additional two months, up to a maximum UI potential duration of two years. For instance, if an individual works 539 days, she can collect unemployment benefits for up to 4 months, while if she works 540 days, she can collect unemployment benefits for up to 6 months. This institutional schedule allows us to estimate the impact of an exogenous increase in the potential duration of UI on the duration of unemployment using a regression discontinuity design.

The unemployment benefit level is determined as a replacement rate of the previous wage, and it is paid monthly until a) the worker finds a new job, or b) the worker reaches the potential duration she is entitled to. During the first 6 months that the worker is collecting unemployment benefits, the replacement rate is 70 percent, decreasing to 50 percent afterward.[24] Benefit levels are subject to minimum and maximum amounts that

[23] This fact relieves concerns about workers' intentionally choosing the optimal timing of unemployment (ex-ante moral hazard effect).

[24] The replacement rate after 6 months of collecting unemployment benefits was lowered to 50 percent in October 2012. Prior to that, it was 60 percent.

vary by year and number of children.

The severance payment is a lump-sum transfer, paid directly by the firm to the employee when she is dismissed. Severance payments are a function of previous firm tenure, previous wage, and a policy multiplier. The latter varies based on the reasons for the dismissal (justified, non-justified, and end of contract). In February 2012 the government changed the conditions that govern the policy multiplier, resulting in a reduction in the amount paid by firms to dismissed workers with permanent contracts, but leaving unchanged the severance payments of the vast majority of temporary workers. This change allows us to estimate the impact of exogenous changes in severance payments on the duration of unemployment, by instrumenting the magnitude of the severance payment with whether the dismissal happened before or after February 2012 interacted with the worker's type of contract (permanent or temporary). This effectively turns our instrumental variable's first stage into a difference-in-differences design, from which we estimate the predicted values of the severance pay to plug into the second stage.

Finally, the Spanish unemployment insurance system provides workers with the *right to choose* whether to create a new potential duration and benefit level bundle when entering unemployment or to carry over an unfinished old bundle.[25] To avoid this complication we restrict our sample to unemployment spells based on new work histories, ignoring carryovers.

4.2 Data

We take advantage of the *Muestra Continua de Vidas Laborales* (MCVL) for the years 2006 to 2017. Each year, the MCVL randomly selects 4 percent of the individuals who have a relationship with the Social Security Administration during the year (i.e., employed and unemployed workers, retired individuals, and recipients of other subsidies). Appendix B

[25] If a worker who enters unemployment has been unemployed in the previous 6 years, the worker can be given two choices for benefit level and potential duration. She can choose between the benefit level and potential duration that was generated since the last time she left unemployment. On the other hand, if the worker did not exhaust her potential benefit duration during the previous unemployment spell, she can choose to enjoy the leftover amount of the previous claim. For instance, suppose a worker in 2013 enters unemployment with a potential duration of 24 months and a benefit level of 1,050 EUR during the first 6 months and 750 EUR afterward (i.e., a previous salary of 1,500 EUR). The worker spends 4 months on unemployment and finds a new job. She works in the new job for 3 years with a wage of 1,400 EUR and is dismissed again. She now has the *"right to choose"* which bundle of benefits she wants to use. She can choose to reuse the leftover amount of the old claim and enjoy 20 months of potential duration, with a benefit level of 1,050 EUR for two months and 750 EUR for the remaining potential duration. On the other hand, she could choose to create a new bundle of benefit level and potential duration (i.e., new claim) based on the last 3 years of employment. Therefore, her second choice has a potential duration of 12 months, but a benefit level of 980 EUR during the first 6 months and 700 EUR for the remaining potential duration. The worker is free to choose whichever bundle she considers best, but cannot combine them in any way.

describes our data and details the data-cleaning process.

Our final sample contains over 226,000 unemployment spells corresponding to over 175,000 different workers. Table 2 provides summary statistics of our main variables of interest, by UI potential duration and in the aggregate. Over 58 percent of all spells are males, with college-educated workers representing 26 percent of them. The average age at the start of the unemployment spell is 35 years. Since we observe lifetime wages for all workers in our sample, we compute a proxy for wealth based on the discounted sum of real-lifetime wages (up to entry into unemployment). The average wealth is 46,000 euros, with the 25th percentile, median, and 75th percentile at 17,000, 34,000, and 62,000 euros, respectively.

For each unemployment spell, we collect several variables of interest. First, we collect variables related to the previous working spell that determine the UI benefit level, the UI potential duration, and the amount of the severance payment. On average, the previous daily wage was 47.9 euros per day. Within the previous 6 years, on average, individuals worked 2.82 years. Second, we look at covariates related to our search outcomes of interest. On average, workers collect unemployment benefits for 5.8 months and remain without a job for 9.8 months, with 53 percent of them finding a new job within 6 months and 71 percent finding a new job within one year. The likelihood of a worker exhausting benefits is 27.5 percent, a magnitude larger than that in Card et al. (2017) for Austria for a similar period of time, but with a very different UI policy schedule. But not all workers return to the labor market. We find that 8.5 percent of workers in our sample never find a new job after unemployment.[26]

4.3 Labor Supply Responses to Changes in Potential Duration of UI

Identification of the labor supply responses to changes in the potential duration of unemployment benefits is provided by several discontinuities in the potential duration schedule. These discontinuities are determined by the number of days worked in the previous 6 years, our running variable. Table 1 presents the detailed schedule, in which up to 10 discontinuities are present.[27]

[26] Keeping all workers in our sample, without any restriction regarding their previous tenure, the share of workers who do not return to the labor market within 5 years is 12 percent. This magnitude is slightly below the 15-17 percent reported in Bertheau et al. (2022). The difference comes from the samples chosen in each paper. Bertheau et al. (2022) focus on the effects of displacement, and therefore they impose more restrictive conditions to include a worker in the sample, based on the reasons behind the dismissal. Here we do not have such conditions, simply focusing on workers who worked for long enough to qualify for UI.

[27] As explained in the Data Appendix, we do not exploit the discontinuity on the 359–360 days or 2159-2160 days worked in the previous 6 years.

We start by showing graphically the effects of crossing the discontinuities in our main outcome of interest: the duration of unemployment. Figure 1(a) shows the average duration of unemployment (in days) across the distribution of the previous tenure. The vertical red lines show the points in the distribution of the running variable where, to their right, the potential duration of UI increases by two months. In Figure 1(a) each individual point is calculated aggregating within a 30-day window and contains 2,000-5,000 different observations. From Figure 1(a), it is clear that an additional two months in the potential duration of UI increase the duration of unemployment from 30 to 60 days, depending on the cutoff of interest. To show the pattern more clearly, Figure 1(b) combines all discontinuities in one. We construct 1(b) by assigning individuals to their closest discontinuity. If the individual is to the right of it, the distance to the closest cutoff is positive. Similarly, if the worker is to the left of her closest cutoff, the distance will be negative. Crossing "zero" grants two additional months of UI potential duration, relative to those close to zero but without enough tenure to cross it. The graph shows a jump of approximately 40 days generated at the point of crossing the discontinuity, where the average duration of unemployment increases from 270 days to approximately 310 days. In Figure 1(b) each individual point is calculated aggregating within a 10-day window and contains approx. 13,000 different observations.

Empirical Strategy: Formally, we estimate the effects on the duration of unemployment of two additional months in the potential duration of UI using an RD design. We follow the ideas in Hahn et al. (2001) and Porter (2003), and construct a popular estimator of τ using kernel-based local polynomials on either side of the threshold. The local polynomial RD estimator of order p is:

$$\hat{\tau}(h_n) = \hat{\mu}_{+,p}(h_n) - \hat{\mu}_{-,p}(h_n) \tag{20}$$

where $\hat{\mu}_{+,p}(h_n)$ and $\hat{\mu}_{-,p}(h_n)$ denote the intercept (at the discontinuity point) of a weighted local p^{th}-order polynomial regression for only treated and only control units, respectively (for further detail, see Calonico et al. (2014a) and Calonico et al. (2014b)). Our main specification uses a local linear polynomial, with a bandwidth choice that minimizes an approximation to the mean squared error of the point estimator, as shown in Calonico et al. (2020).

Main Results: Table 3 presents the results where we combine all discontinuities into one single specification, following the ideas in Figure 1(b). Columns (1) and (2) show the estimated impact of a two-month extension in the potential duration of UI on the duration of unemployment, using the specification above (Method: "NP") with optimal bandwidth of 22 days.[28] Column (1) includes only discontinuity fixed effects as a control variable (Controls: "Disc"), while column (2) additionally controls for age, gender, education, wealth, previous tenure, previous experience, type of contract, previous wage, part-time coefficient and month-year fixed effects (Controls: "All"). We find that an additional two months in the potential duration of UI increase the duration of unemployment by 40 to 44 days, depending on the specification. All results are significant at the 1 percent level. The inclusion of controls in column (2) changes little the point estimator, suggesting that differences in observed characteristics play a very limited role in generating the observed effects. These effects represent approximately a 15 percent increase over the baseline average duration of unemployment (293 days). Columns (1) and (2) in panel B use the time collecting UI as the outcome of interest. An additional two months in the potential duration of UI increase the time collecting UI by 24 days. The results are significant at the 1 percent confidence level and do not change regardless of whether we include additional covariates as controls.

Robustness: For additional robustness, the remaining columns in Table 3 show different alternatives to estimate the causal effect of a two-month extension of the UI potential duration on the unemployment duration. Column (3) uses a parametric RD specification with controls, in the form of separate linear regression on each side of the discontinuity. The chosen bandwidth matches the optimal MSE bandwidth described above. The results are identical to those described above. Columns (4) and (5) use again the non-parametric specification described above, but extend the bandwidth in the RD to 45 days. While the results increase slightly, they are still within the standard error of the original ones and are almost identical regardless of whether we include additional control variables or not. Column (6) keeps a bandwidth of 45 days but uses a parametric RD with controls, and shows almost identical results. In columns (7), (8) we extend the bandwidth to the largest possible one, 90 days[29] Again, we find very similar results, with both point estimates (with and without controls) being around 40 days. Extending the bandwidth triples the number of observations, decreasing the standard errors by almost 50 percent. Finally, column (9) uses again a parametric RD design, with a bandwidth of 90 days and controls. As before, the results remain extremely similar, without any important variations.[30]

Validity: The validity of the RD results shown above relies on all other factors being continuous at the discontinuity. We test this assumption in two different ways. First, we

[28]The $\diamond$ represents non-parametric specifications as in Equation (20) using optimal bandwidth.

[29]While technically, it is possible to extend the bandwidth on each side of the discontinuity to 180 days, doing so would imply that individuals are both treated and untreated at the same time. The maximum bandwidth in which an individual treatment status is fixed is 90 days.

[30]For additional robustness, Table E.1 presents the results of the RD design separately for each of the discontinuities.

test the balance of several observed covariates around the cutoff. Second, we check for manipulation of individuals around the discontinuity. Table 4 presents the balance test for different observables, also shown graphically in Figures 2 and 3. The structure of Table 4 matches that of Table 3. Looking at column (1), where we use the empirical specification described above with an optimal bandwidth of 22 days, we find no significant differences between treatment and control groups in their age, gender, previous wage, previous tenure, previous experience, or type of contract. We find a 1.8 percent difference in the probability of attending college (only significant at the 10 percent level) between workers to the right and left of the discontinuity, but this difference vanishes once we increase or decrease the bandwidth slightly. As evidenced in Table 3 the effects of crossing the discontinuity on the duration of unemployment are almost identical regardless of whether we include controls, suggesting that the small difference in college education is not an important determinant of our results. For further robustness of the results, in column (2) we include a parametric specification with a bandwidth of 22 days and find very similar conclusions.[31] In columns (3) and (4) we extend the bandwidth to 45 days and use the same specifications as in columns (1) and (2), respectively. Again, we find no important differences between treatment and control groups. Finally, in columns (5) and (6) we extend the bandwidth to 90 days. Here we find a significant difference in our measure of wealth between our treatment and control groups, as well as a small difference in their age. While these differences are significant, the inclusion of all controls in our main regression does not affect our conclusions, leaving the point estimates almost unchanged.[32] In summary, we find very little evidence of imbalances in observed characteristics between the treatment and control groups, regardless of the method and bandwidth chosen.[33]

One potential concern of the RD design is the potential manipulation of individuals around the discontinuity. If individuals can select themselves to the right of the discontinuity, receiving two additional months in the potential duration of UI, our estimates could be biased. To check for manipulation we first follow the ideas in McCrary (2008) and visually analyze the density of the running variable around the discontinuities. Figure 4(a) shows the density throughout the distribution of tenure in the previous 6 years, our running vari-

[31]In this case we find a small difference in previous wages but no difference in college education.

[32]For additional robustness, Table E.2 presents the balance test separately for each of the RD discontinuities.

[33]Of the 60 different point estimates in Table 4, 5 show significant differences at the 10 percent confidence level, 1 at the 5 percent confidence level, and 1 at the 1 percent confidence level. When the chosen bandwidth is smaller than 90 days, there are no differences at the 5 or 1 percent confidence level between treatment and control. Moreover, when we observe significant differences between treatment and control, they appear in different variables depending on the type of specification and chosen bandwidth, and their inclusion as additional controls in our estimation leaves the results unchanged.

able, while Figure 4(b) plots the density when we rearrange workers relative to their closest discontinuity. Neither of these figures suggests a clear pattern of manipulation. This is especially clear in Figure 4(b), where we do not observe any bunching after the cutoff nor a missing mass of observations before it. To formally test for manipulation, we implement the test proposed by Cattaneo et al. (2018). Figure 4(c) shows the density (relative to the closest discontinuity) overlapped by the point estimators and confidence intervals on both sides of the discontinuity. Cattaneo et al.'s (2018) manipulation tests with optimal bandwidth show a t-statistic of 1.59 (p-value=0.11) for the conventional estimate and a t-statistic of 0.63 (p-value=0.53) for the robust estimate. Therefore, we cannot reject, at the 10 confidence level, that there is no manipulation, regardless of whether we consider the conventional or robust estimates.

In summary, this section shows that an additional two months in the potential duration of UI increase the duration of unemployment by 40-45 days, as well as the time collecting UI by approximately 24 days. These results are robust to different empirical specifications and bandwidth choices, as well as to the inclusion of a vast array of controls. Moreover, observed worker characteristics are balanced across the discontinuity, and we do not find evidence of manipulation in the running variable.

4.4 Labor Supply Responses to Changes in Severance Payments

Severance payments (P) in Spain[34] are a function of three different variables: previous tenure at the firm (T_f), average daily wages in the previous 365 days ($dWage$), and a policy multiplier (θ).[35]

$$P = \theta \times dWage \times T_f \tag{21}$$

Our main source of variation to estimate the causal effect of changes in severance payments on the labor supply is a change in the policy multiplier, θ. Prior to 2012, the severance payments of workers in permanent contracts used a policy multiplier of 45 if the dismissal was unjustified and of 20 if the firm could show the separation was justified for financial or production reasons.[36] The same set of rules applied to workers in temporary contracts when

[34] See the section titled "Unemployment Insurance in Spain" for a detailed description of severance payments.

[35] While severance payments are bounded to certain maximums, this restriction does not bind for the vast majority of workers (the most restrictive boundary requires at least 18 years of tenure at the firm, which affects less than 0.1 percent of the dismissals in our sample); thus, we will ignore it for simplicity.

[36] A multiplier of 20 implies that the worker will receive 20 days of her most current daily wages for each year worked at the firm as her severance payment.

the dismissal happened prior to the contract's deadline. However, if the contract expired, the policy multiplier used in the severance payment ranged from 8 to 12.

In February 2012 the Spanish central government, elected in a snap election in November 2011, introduced changes to the policy multiplier governing severance payments. The main goals were to reduce the burden on firms when dismissing workers and to make permanent contracts more attractive for firms. The new policy made two main changes. First, it reduced the policy multiplier used in unjustified dismissals (i.e., separations that are not justified for financial or production reasons). Second, it relaxed the conditions required for firms to classify a dismissal as justified. Finally, it made no changes to the policy multiplier used in separations that happened due to the expiration of temporary contracts.[37]

Since we observe all dimensions that determine the magnitude of the severance payment, we can calculate the policy multiplier used in each dismissal for which we observe a severance payment.[38] Calculating the policy multipliers in each dismissal allows us to clearly see the 2012 policy change in the data. We show this in Figure 5(a) (and Figure 5(b)), which presents the estimated median (mean) policy multiplier over time, separately for workers entering unemployment from temporary contracts and those entering from permanent contracts.[39] The median policy multiplier for workers entering unemployment from permanent contracts remains stable at around 45 for most of the period before the policy change is introduced. Once the new policy is implemented, the policy multiplier drops to 20-25 and slowly recovers to 30 by the end of the sample period. The mean policy multiplier shows a similar pattern, but the drop at the policy change is more nuanced and continuous.[40]

Empirical Strategy: To identify the effects on the duration of unemployment of exogenous changes to severance payments, we propose an IV strategy. We instrument for the severance payment (in logs) using the policy change in February 2012 interacted with both a dummy

[37] In the last years of our sample, over 82 percent of dismissals of workers in temporary contracts happened due to the expiration of their contracts. Prior to 2012, we cannot observe the reasons for dismissal.

[38] This calculation is not perfect, but a noisy approximation. The reasons for the discrepancy come from four sources. First, workers can change firms and contracts without actually changing their jobs. Most of those cases result in the new firm preserving the tenure of the worker and prior benefits, despite showing in the data as a new affiliation and firm. Second, workers can work for the same firm with multiple temporary and permanent contracts over time, even with temporal gaps, leading to measurement error in our measure of the relevant firm tenure applied to the severance payment calculation. Third, firms and workers can potentially bargain over the severance payment. While not very common, especially for individual dismissals, it is possible that workers are paid at a different policy multiplier (almost always over 20 but below 45) than the one that should have been applied to their specific case. Finally, workers might report severance payments incorrectly in their taxes.

[39] For additional evidence, Figure E.1 shows the evolution of the median policy multiplier separately for workers in each potential duration group.

[40] The mean policy multiplier is heavily affected by outliers, likely generated by measurement error. While removing the top and bottom 10 percentiles of the policy multiplier alleviates this issue, it does not solve it completely.

variable representing whether the worker entered unemployment from a temporary or a permanent contract, and a categorical variable representing the type of dismissal (justified, unjustified, or other). We control for firm tenure and previous wage (both in logs), such that our instrument affects the severance payment only through the policy multiplier.

Our first stage is simply a difference-in-differences estimator, with controls, for the effect of the policy implementation on the magnitude of the severance payment (conditional on firm tenure and previous wage) for different types of dismissals (justified, unjustified, and other dismissals). The treatment group is workers entering unemployment from permanent contracts. The control group is workers entering unemployment from temporary contracts with similar characteristics, and the "post" period starts once the new severance payment policy enters into effect. The interaction of these two variables with the type of dismissal allows the effect of the severance payment policy to vary depending on the type of dismissal the worker experienced. In the second stage, we use the predicted values of the severance payment from this difference-in-differences approach, along with a vast array of controls, to estimate the causal impact of changes to the severance payment on the duration of unemployment.

We generate a dummy variable $PostPolicy$ that takes a value of 1 if the unemployment spell starts after the policy implementation and 0 otherwise.[41] Similarly, we create a dummy variable $Perm$ that takes a value of 1 if the worker enters unemployment from a permanent contract and 0 otherwise (i.e., temporary contracts). Finally, we interact $PostPolicy$ and $Perm$ with the type of dismissal (justified, unjustified, or other).

Formally, we estimate the following IV regression:

$$Y = \beta_0 + \beta_1 \hat{lnP} + \boldsymbol{X\sigma} + \alpha_t + u_2 \tag{22}$$

where our first stage is:

$$lnP = \eta_0 + \sum_{j \in J} \eta_j PostPolicy \times Perm \times \mathbb{1}\{dismissal = j\} + \boldsymbol{X\tau} + \alpha_t + u_1 \tag{23}$$

where lnP refers to the log of the severance payment, and $\boldsymbol{X}$ includes two groups of controls. The first group contains variables that determine the magnitude of the severance payment (previous wage and firm tenure in logs). The second group adds aggregated controls, such as the local unemployment rate, and demographic characteristics (gender, education, age, wealth, the location of the last job, potential duration, part-time coefficient, experience,

[41] Changing the starting point of the policy to the day following the election in November 2011, once the absolute majority of the new government was revealed, does not change the results.

contract length, and the number of children).[42] Finally, we add a categorical variable representing the type of dismissal, a dummy for whether the worker enters unemployment from a permanent or temporary contract, and α_t representing time fixed effects. The last two controls render our first stage a difference-in-differences with controls, while their interaction with the type of dismissal creates a different first-stage estimate for workers with permanent contracts in each dismissal category. We can interpret this estimate as the change in the severance payment created by the policy for permanent workers entering unemployment after being dismissed in a specific way, relative to the change for temporary workers. For instance, for permanent workers under justified dismissals, the first-stage estimate represents the change in the average severance payment (conditional on previous tenure and wage) from the pre-policy average severance payment of all permanent workers, relative to the change in severance payment of workers entering unemployment from temporary contracts.

For our instrument to be valid, we require that nothing else changed around February 2012 that systematically affected the duration of unemployment for workers with previous permanent contracts (regardless of the type of dismissal), relative to workers in temporary contracts. Thus, our specification allows workers in temporary and permanent contracts to have differential search outcomes while also accounting for the fact that the labor market in Spain after 2012 was very different from what it was prior to that date (the unemployment rate rose quickly and consistently from 2008 to the end of 2012, then started decreasing slowly but constantly for all remaining periods in our sample). On the other hand, other changes in the labor market that happened when the new severance policy was approved, and affected workers entering unemployment from permanent and temporary contracts differentially, would invalidate the exogeneity of our instrument. Furthermore, the interaction with the type of dismissal in the first stage imposes additional conditions to guarantee the validity of our instrument. Specifically, our instrument will be valid only if the justified dismissals we observe after the policy is implemented would have been classified as unjustified in the absence of the policy.

Main Results: Columns (4), (5), and (6) in panel A of Table 5 present the IV estimates of the effects of changes to the severance payment on the duration of unemployment and on the time collecting UI. Looking at the first stage of the IV in column (4), our instrument is highly relevant, with an F statistic of 261, well above the suggested relevance threshold in

[42] Adding firm characteristics as additional controls leaves the results unchanged. We do not include them in our main specification because we do not observe firm characteristics at the time the dismissal takes place, but only by the end of the sample period. For instance, while we observe firm size in 2017, we do not observe firm size by the time a worker is dismissed. Since firms that decrease employment more will be smaller afterward, and they are also more likely to qualify for justified dismissals after the new policy regime, we avoid including firm size (or whether the firm is alive as of 2017) as a control.

the literature. The results of the first stage indicate that the introduction of the 2012 policy significantly decreased the average severance payment of workers entering unemployment from permanent contracts. The average severance payment of workers with permanent contracts in unjustified dismissals decreased by 30 percent ($e^{-0.356} - 1$), relative to the pre-policy average severance payment of all workers in permanent contracts. In the case of workers with permanent contracts in justified dismissals, this decrease was 72 percent. The second-stage estimates in column (5) show that a 1 percent increase in the severance payment increases the duration of unemployment by 0.15 percent, and the time collecting UI (column (6)) by 0.09 percent. Both results are significant at the 1 percent confidence level.

Robustness: For additional robustness, in Table 5, Panel A, columns (1), (2), and (3) we show an additional set of IV estimates that only include controls for firm tenure, previous wages, type of contract, type of dismissal, and time fixed effects (i.e., a difference in differences first stage without controls). Using this specification, the first stage remains virtually identical to the one in our main results. The second stage estimates, in Panel A column (2), show that a 1 percent increase in the severance payment increases the unemployment duration by 0.12 percent. This estimate is very similar to the one in our main results.[43] Additionally, Panel B shows the OLS estimates of the effects of changes to the severance payment on the unemployment duration and on the time collecting UI. Looking at the OLS results, we find that a 1 percent increase in severance pay is associated with a 0.11 percent increase in the unemployment duration (column (2)) and a 0.11 percent increase in the time collecting UI (column (3)). Adding all additional controls (columns (5) and (6)) changes the results very little. The comparison between the IV and the OLS results suggests that the OLS estimate is slightly downward biased. One potential explanation is that highly motivated individuals can achieve larger severance payments but also find a job relatively quickly, compared to similar but less motivated workers. This behavior would result in the type of downward bias that we observe in OLS.

Finally, Table 6 shows the effects of a 1 percent increase in severance payment on the unemployment duration using a simplified version of our original estimation equation. Specifically, we remove from our instrument the interaction with the type of dismissal, resulting in the following first stage:

$$lnP = \eta_0 + \eta_1 PostPolicy \times Perm + \boldsymbol{X\tau} + \alpha_t + u_1 \tag{24}$$

[43] For additional robustness Tables E.3 and E.4 present the estimated effects of changes in the severance payment on the unemployment duration, and on the time collecting UI, separately, for workers around each of the RD discontinuities.

The estimate of the effect of a change in severance payment on the unemployment duration in Table 6 is virtually identical to the one in our main results, while the standard error increases by 25 percent.

Validity: To test the validity of our instrumental variable approach, we employ three different strategies. First, since our first stage is a difference in differences, we test for differential pre-trends in our first stage. To do this, we estimate the following specification:

$$lnP = \eta_0 + \sum_{t \in Pre} \eta_t Perm + \sum_{t \in Post} \eta_t Perm + \boldsymbol{X\tau} + \alpha_t + e \tag{25}$$

where $\boldsymbol{X\tau}$ includes the same set of controls described in Equation (23). We fix the baseline period to the last month prior to the policy change and estimate all other coefficients. Each η_t coefficient represents the difference in severance payments, in month t, between workers entering unemployment from permanent vs. temporary contracts, relative to the difference in the baseline period. The point estimates of η_t are shown in Figure 6(a). We do not find any significant difference in the years prior to the policy implementation, with all estimated coefficients in the pre-period being insignificantly different from zero. Once the new policy takes effect, the point estimates for η_t quickly decrease and become significantly negative.

One important detail is that during the first 4 to 6 months after the policy change, the estimates of η_t are negative but insignificantly different from zero. While this would be a problem in a setting where the policy is designed to create a discrete change, we understand this result as consistent with the design of the policy for two reasons. First, part of the change in severance payments from the new policy arose because firms could more easily dismiss workers under justified dismissals. This change should have created a discrete drop after the policy implementation shown in Figure 6(a). But in our data, this change was not immediate, since justified dismissals increased steadily in the months after the policy was implemented, instead of shooting up dramatically right after the policy change. This suggests that firms required some time to understand and implement dismissal practices that took advantage of the new policy. Second, severance payments from unjustified dismissals only changed the policy multiplier for the length of the tenure after the new policy was implemented. The severance payments of workers dismissed after the policy change, in unjustified dismissals, used the new policy multiplier only for the duration of firm tenure accumulated after the new policy took effect. The remaining firm tenure, accumulated prior to the policy change, was compensated using the old policy multiplier. As time passed, and a larger share of the previous firm tenure took place after the policy change, the average policy multiplier smoothly decreased. Therefore, the fact that the policy effects became more pronounced over time (i.e., η_t post-policy change becoming more negative over time in Figure 6(a)) was a design feature and does present a threat to the validity of our empirical strategy. This argument is supported by Figure 6(b), which presents an identical robustness test to the one described above, but separates the effects of the policy by dismissal type and estimates a different η_t for each type of dismissal (by quarter).

As a second validity test, we present the IV results from Equation (22) using a different number of months around the policy change. Therefore, instead of using all unemployment claims in our sample, we start by restricting our estimation to those claims within a certain number of months before/after the new policy was implemented. From there, we extend the time frame, until all observations in our sample are included. The results are shown in Figure 7. Figure 7(a) shows the first stage, where each point on the x-axis represents the number of months around the policy implementation included in the estimation. The value on the y-axis shows the point estimate of the first stage for each dismissal group, along with the 99.9 percent confidence interval. Regardless of the chosen time frame, the instrument is not weak and shows a time pattern consistent with the design of the policy. Figure 7(b) shows the point estimates of the second stage on the y-axis, along with the OLS estimates for comparison. Our IV estimates range from 0.1 to 0.28, with the majority of point estimates in the neighborhood of 0.15. The IV estimates become significantly different from zero once we include 31 (or more) months around the policy implementation in the estimation.

One concern with the previous results is whether the estimated elasticity of the duration of unemployment could be capturing something other than changes to the severance payment. Of special concern is a second policy change, introduced in August 2012, that changed the replacement rate from 60 to 50 percent after 6 months of claiming unemployment benefits. This change applied only to individuals entering unemployment in or after September 2012 and not to those already claiming unemployment benefits. This is a potential source of bias in our results because it happened at a very similar point in time, and its effects are more relevant for workers entering unemployment from permanent contracts.[44] Yet, each individual worker is not affected equally. Workers whose previous wage puts them above or below the maximum/minimum benefit level under both replacement rates will not be affected by this change, and workers close enough to those bounds will only be partially

[44]The reason is that workers dismissed from permanent contracts tend to have longer tenures, which allows them to claim unemployment benefits for longer periods, making them more susceptible to changes in the replacement rate after 6 months of collecting benefits. On the other hand, workers entering unemployment from temporary contracts have shorter labor stories, which makes changes to the replacement rate after 6 months less relevant to them. In our data, 88 percent of permanent workers qualify for more than 6 months of unemployment benefits, while only 54 percent of temporary workers do.

affected (i.e., the "real replacement" rate for those close to the maximum might change from 55 percent to 50 percent, instead of 10 percentage points).

Since we can observe this information for each worker (it only depends on their previous wage), we compute a measure of how much the replacement rate has really changed for workers at that wage level. Looking at workers with a potential duration of UI longer than 6 months, the replacement rate effectively changes, on average, by approximately 6.6 percentage points, after considering the effects of the maximum and minimum in the benefit level. When we add this additional variable as a control in our specification (by itself and interacted with a dummy taking a value of one after the policy changing the replacement rate takes place), our results remain virtually unchanged, as shown in Table 7.

In summary, this section shows that a 1 percent increase in severance payment increases the duration of unemployment by approximately 0.15 percent, as well as the time collecting UI by approximately 0.09 percent. These results are robust to different empirical specifications and to the inclusion of a vast array of controls, and they remain unchanged even if we restrict our analysis to a short period around the policy change. When we test the validity of our first stage, we do not find any evidence of differential pre-trends in the magnitude of the severance payment across groups.

4.5 Heterogeneous Labor Supply Responses

The size of our data set along with the institutional features of Spain's UI system allows us to causally estimate the heterogeneous effects of changes to the potential duration of UI and severance payments for different groups of workers. Our goal with this exercise is twofold.

First, the heterogeneous labor supply responses estimated in this section are the inputs we require to estimate the cost of liquidity during unemployment and the insurance value of UI for different wealth or liquidity groups. Following the model above, and the mapping between model and labor supply responses described in the next section, they allow us to disentangle the cost of transferring resources over time during unemployment, the moral hazard effect, and the insurance value of UI for each group of interest.

Second, this exercise allows us to use the heterogeneous effects of an unconditional transfer to indirectly infer the existence of liquidity constraints and compare these results with those from the strategy proposed in this paper. The previous literature, as in Chetty (2008), used the differential labor supply responses to the severance payment for richer vs. poorer households as an indication of the income effects being driven by credit constraints. But, as we argue in this paper, these cash-on-hand effects could be driven by the liquidity or the insurance value of UI. Therefore, the results in this section combined with our estimates of the cost of liquidity allow us to test whether a larger income effect is associated with larger liquidity constraints.

Ideally, we would divide workers based on their available liquid assets at the time of entering unemployment, but we do not observe any measure of assets or savings. Since we can observe lifetime labor earnings for each worker, for our first division, we construct a measure of wealth based on the sum of individual real earnings up to the individual's entry into unemployment. Then we divide individuals based on their wealth, relative to the median wealth by age, year in which they were dismissed, and type of contract (permanent vs. temporary). Those above the conditional median are classified as wealthier, while those below it are classified as poorer. All our empirical specifications here mimic those described above. We estimate the labor supply responses to changes in potential duration and severance pay using the same RD and IV strategies described above, using separate specifications for each group.

Our second division of workers attempts to directly measure the available liquidity when workers start an unemployment spell. Severance payments are paid at the point of dismissal, right before the worker enters unemployment, and they provide cash-on-hand to workers at the beginning of the unemployment spell. Therefore, we divide workers based on the magnitude of their severance payment, relative to the median severance payment by age, year in which the worker is dismissed, type of contract, and worker's wealth decile at the point of entering unemployment. Those above the conditional median are classified as workers with more liquidity, while those below it are classified as workers with less liquidity. As in the previous case, we estimate the labor supply responses to changes in potential duration and severance pay using the same RD and IV strategies described above, using separate specifications for each group.

Table 8 presents the main results. Starting from the labor supply responses to a 60-day increase in the potential duration of UI, in Panel A, we find that wealthier workers present a larger effect compared to poorer workers (45 additional days vs. 33). A similar conclusion can be extracted from comparing workers with conditionally larger and smaller severance payments, where we find that in the former group the duration of unemployment increases by 35 days vs. by 29 days for the latter. Looking next at Panel B of Table 8, the labor supply responses to changes in severance payments show that all groups across all divisions (wealth and severance payment) react to unconditional transfers. A 1 percent increase in severance pay increases the duration of unemployment by 0.17 percent for poorer workers and by 0.14 percent for richer ones. Similarly, a 1 percent increase in severance pay increases the duration of unemployment by 0.11 percent for workers with conditionally smaller severance payments and by 0.12 percent for those with larger severance payments. However, comparing the effects of a 1 percent change in severance payments across groups does not allow us to account for the large differences in the average severance payments between groups. A 1 percent change in severance payment for richer workers is 3 times the amount of money as an equivalent 1 percent change for poorer workers. To account for this, the bottom rows of Panel B in Table 8 display the effect on the duration of unemployment of an additional two months of UI benefits via severance payment. The differences between poorer and wealthier workers or between workers with larger and smaller severance payments become more pronounced due to the difference in average severance payments across groups. An amount equivalent to two extra months of UI benefits via severance payment increases the duration of unemployment by 9.6 days for conditionally richer workers and by 7.2 days for workers with conditionally larger severance payments, but by 22.5 days for conditionally poorer workers and by 17.7 days for those with conditionally smaller severance payments.[45] Finally, we look at the ratio of the labor supply response to changes in severance payment relative to the labor supply response to changes in the potential duration of UI. For our entire sample, the income effect (from the IV estimates) represents 33 percent of the total labor supply responses derived from the RDD estimates. But the estimate for the entire sample hides significant heterogeneity across groups. For wealthier workers and for workers with larger severance payments, this ratio is approximately 21 percent. On the other hand, looking at poorer workers or workers with less available liquidity, this ratio increases to 68 and 61 percent, respectively.

In summary, wealthier workers or workers with more liquidity show larger labor responses to 60 extra days' of potential duration of UI, compared to poorer workers or workers with smaller severance payments. Furthermore, we find that all groups react to unconditional transfers, but that poorer workers or workers with less liquidity show much larger responses per additional dollar transferred via unconditional payment than richer workers or workers with more available liquidity. Finally, the ratio between the labor supply responses to unconditional and conditional transfers shows that income effects represent a relatively small part of the response to an extension of the potential duration of UI for wealthier workers and workers with more liquidity. On the other hand, the relevance of income effects is much larger for poorer workers and workers with less liquidity.

[45]The conclusion remains the same when we instead consider the effects of this transfer on the duration of unemployment, expressed as a percentage increase over the average duration of unemployment in each group.

5 Estimating the Cost of Liquidity and Insurance Value

5.1 Estimating the Cost of Liquidity

In this section, we use an example to show how we link Proposition 1 with the reduced-form estimates of the labor supply responses to three policy parameters. In Appendix C.1 we show the general case that we will use to derive the estimation results.

We use two months as our unit of one period. The search intensity in 0–2 months, 2–4 months, 4–6 months, 6–8 months,$\cdots$ corresponds to $t = 0, 1, 2, 3, \cdots$[46]. Finally, suppose that we know the employment interest rate r_e. To facilitate our exposition, consider a worker who has 10 months of UI potential duration and receives benefit b^* bi-monthly. Suppose that the search intensity we are interested in is the probability of finding a job in months 6 to 8, (s_3).

The estimate of the effect of changes in the severance payment on the probability of finding a job in months 6 to 8, IV_{s_3}, is mapped to the following theoretical counterpart:

$$\frac{\partial s_3}{\partial A_0} = IV_{s_3}$$

According to Proposition 1, to estimate r_u, we also need to estimate the labor supply responses to two conditional UI shocks from different points in time. First, we can shock the worker's benefit level in period 4, i.e., the benefit received in the period from 8–10 months. We consider an extreme case where we change the benefit from the predetermined level b^* to 0. This is equivalent to reducing the potential duration from 10 months to 8 months, as illustrated in Landais (2015). We estimate the effect of changing the potential duration from 8 months to 10 months on the probability of finding a job in months 6 to 8 and denote it by $RD_{s_3,8-10}$. Thus, we have the following equation:

$$b \cdot \frac{\partial s_3}{\partial b_4} = RD_{s_3,8-10}$$

Second, we can also shock the worker's benefit level in period 5. Here again, we consider an extreme case where we change the benefit received in the period from 10–12 months from 0 to b. This is equivalent to increasing the UI potential duration from 10 months to 12 months. By estimating the effect on the probability of finding a job in months 6 to 8 of changing the potential duration from 10 months to 12 months from RD_{10-12}, we have the

[46] Empirically, this is the probability of finding a job in the period t, conditional on arriving at t unemployed.

following:

$$b \cdot \frac{\partial s_3}{\partial b_5} = RD_{s_3,10-12}$$

Having two conditional shocks with different timing and one unconditional shock, we combine them and estimate the r_u (i.e., the liquidity cost). We solve our two unknowns, r_u and $\frac{\partial \mathbf{s_3}}{\partial \mathbf{w_3}}$, from the following two equations:

$$RD_{s_3,8-10}/b = \frac{1}{(1+r_u)^4} IV_{s_3} + \frac{\partial \mathbf{s_3}}{\partial \mathbf{w_3}} \sum_{j=4}^{4} (1 - \text{pr}_{j|3}^{W}) \frac{(1+r_e)^{(3-j)}}{(1+r_u)^{(4-j)}}$$

$$RD_{s_3,10-12}/b = \frac{1}{(1+r_u)^5} IV_{s_3} + \frac{\partial \mathbf{s_3}}{\partial \mathbf{w_3}} \sum_{j=4}^{5} (1 - \text{pr}_{j|3}^{W}) \frac{(1+r_e)^{(3-j)}}{(1+r_u)^{(5-j)}}$$

In practice, instead of restricting our estimation to a specific person with 10 months of potential duration, we exploit all the empirical estimates at the same time to estimate the interest rate, r_u.[47] Appendix C.1 shows how we generalize the example above, and use it to estimate the results in this section.

5.2 Estimated Interest Rate: Main Results

Table 9 column (1) presents the estimated results of the monthly interest rate during unemployment (r_u) and the moral hazard components for the complete sample using an annual β of one. We find a monthly interest rate of 1.2 percent, significantly different from zero at the 95 percent confidence level. The rest of the terms in column (1) show the estimates for the moral hazard effects from period 1 to 10.[48] Columns (2) and (3) show the estimated results for workers who received smaller and larger severance payments, conditional on their age, type of contract, year, and their wealth when dismissed. The results suggest that the cost of transferring resources over time for liquidity-constrained workers is over 8 times larger than that for liquidity-unconstrained workers. Workers with smaller severance payments show a 2.5 percent monthly interest rate, while workers with larger ones show an insignificant 0.3 percent monthly interest rate. We find the difference between both groups, shown in column (4), to be 2.2 percentage points on average. These results are consistent with our expectations. Workers with cash on hand can frictionlessly move resources over time, while workers without it find it costly to bring their future income to today. This

[47]The empirical estimates of all the moments used in the GMM estimation are shown in Appendix C.1 Tables C.2 and C.1

[48]For estimation purposes, we restrict the moral hazard terms to be larger or equal to zero.

comparison verifies that our identification recovers a moment strongly tied to the cost of accessing liquidity in the present.

Columns (5) and (6) show the estimated results for poorer vs. wealthier workers, conditional on their age, type of contract, and dismissal year. The cost of liquidity during unemployment for poorer workers is almost identical to that of wealthier workers (2.0 vs. 2.2 percent, respectively), although for poorer workers the result is only significantly different from zero at the 90 percent confidence level. The difference between these two groups is insignificant, with a point estimate of -0.2 percent, as shown in column (7). Our result for wealthier workers argues in favor of a "rich hand to mouth" behavior. One potential explanation is that wealthier workers hold primarily illiquid assets, which are costly to use to smooth consumption during unemployment.

Our estimate of r_u for the complete sample (15 percent annually) is below the average credit card rate in Spain (21 percent), and above the average rate for a personal consumption loan during that period (9 percent). Compared to the previous literature, Warner and Pleeter (2001) present empirical evidence on the personal discount rate for multiple subgroups of workers in the US military. Their estimates range from 0 to 30 percent annually and vary with education, age, race, sex, number of dependents, ability test score, and the size of payment. Closer to our setup, Harrison et al. (2002) document a discount rate of 25 percent for unemployed workers in Denmark, with the 90 percent confidence interval at 21 to 27 percent. Finally, Laibson et al. (2007) estimate a model and find a 40 percent annualized discount rate for the short term. These values are much smaller than those in Wang and He (2018) for China, with estimates over 140 percent annually, estimated from survey responses. When looking at the heterogeneity results, our only benchmark is Harrison et al. (2002). Their results show a 22 percent annual personal discount rate for the richest quartile of experiment participants vs. 33 percent for the poorest quartile. In our case, the estimated r_u for wealthier workers is 29 percent annually vs. 27 percent for poorer workers.

Finally, Table 10 presents the estimates of r_u using difference values of r_e (i.e., different values of β). We find very small differences in the estimated r_u when r_e changes, with the estimate for the complete sample ranging from 1.2 to 1.5 percent monthly (15 to 19 percent annually) for values of β between 1 and 0.89 annually (1 and 0.98 bimonthly).

5.3 Estimating the Insurance value of UI

After recovering the unemployment interest rate and moral hazard effects in the previous section, we first use an example to show how we link the insurance value of UI with the reduced-form estimates of the labor supply responses to changes in the severance payment, the unemployment interest rate, and the moral hazard effect. Then we show the general case, which we will use to derive the estimation results.

As before, suppose we have a worker with an initial 10 months of potential duration of UI. Suppose that the search intensity we are interested in is the probability of finding a job in months 0 to 2, s_0. Again, assume we know the employment interest rate, r_e. The effect of changes in the severance payment for workers who have 10 months of potential duration $IV|_{i=10}$ on the probability of finding a job in months 0 to 2 will give us an estimate of $\frac{\partial s_0}{\partial A_0}$. In the previous section, we recovered an estimate of $\frac{\partial s_0}{\partial w_0} = MH_0$, as well as an estimate for the cost of liquidity during unemployment, $\hat{r_u}$. We can recover the insurance value of UI by substituting in Equation (19):

$$-\frac{IV|_{i=10}}{MH_0} = \sum_{j=1}^{T} \frac{(1+\hat{r_u})^j}{(1+r_e)^j} \text{pr}^W_{j|1}|_{i=10} + \frac{(1+\hat{r_u})^T}{(1+r_e)^T} \left(1 - \sum_{j=1}^{T} \text{pr}^W_{j|1\,i=10}\right) \frac{u'(\underline{b})}{u'(w)}$$

In practice, instead of restricting our estimation to a specific person with 10 months of potential duration, we combine all empirical estimates for workers with all potential durations. Similarly, we do not restrict ourselves to only using the labor supply responses to unconditional transfers for periods 0 to 2 months, but instead, use the labor supply responses for all two-month periods for which we previously estimated the moral hazard component. Appendix C.3 shows how we generalize the example above, and use it to estimate the results in this section.

Finally, we need to determine T. Conceptually, T is the period such that, after it, no unemployed worker returns to a job. Since T does not exist in practice (i.e., there's no period after which the probability of finding a job is exactly zero), we propose two alternatives to approximate it. Our first option determines T based on the share of initially unemployed workers leaving unemployment in a period. We define T as the last period in which the increase in this share is larger than 1 percentage point. In our sample, this corresponds to 26 months after entering unemployment (period $T = 13$), since in the following two months the share of employed workers only rises from 84.1 to 84.8 percent.[49]

[49]For additional robustness, we also estimate the results of the insurance value of UI for $T = 12$, 14, and 15.

Second, we allow for this share to depend on the worker's potential duration of UI. Here, we define T as the last period in which the increase in the group's share of re-employed workers is larger than 1 percentage point. This creates significant heterogeneity in T across the distribution of the potential duration. T is as low as 20 months (period $T = 10$) for workers with 4 months of potential duration of UI (87.0 to 87.8 percent) and increases over the distribution of the potential duration, reaching 30 months (period $T = 15$) for the group with the longest potential duration of UI (75.7 to 76.5 percent).

5.4 Estimated Insurance Value of UI: Main Results

Table 11, column (1) presents the estimated results of the insurance value of UI for the complete sample using an annual β of one ($r_e = 1$). The results in the first row, with T equal to 13, suggest that workers would value one additional unit of consumption 46 percent more in a future bad state, relative to the value of one additional unit of consumption if they had a job in the future. This result is significantly different from one at the 95 percent confidence level,[50] and remains unchanged when we allow T to vary depending on the worker's potential duration of UI. This estimate translates into a 9 percent consumption gap between the future bad state and employment if the CRRA coefficient of risk aversion is 4. Therefore, workers assign a not insignificant probability to a future where their income is significantly lower and prepare for this option.

Looking at columns (2) and (3) we observe that, regardless of their available liquidity, workers' valuation of one additional unit of consumption is larger in the future bad state compared to if they were employed. This result is significantly different from 1 for both groups. Moreover, workers with less available liquidity show a larger insurance value compared to those with more liquidity. While the difference is not significant, the point estimates suggest that low liquidity workers would value an additional unit of consumption during a future bad state (relative to the employment state) 60 percent more than workers with more liquidity. These conclusions hold whether we consider a homogeneous T or one that changes with the worker's potential duration of UI.

In columns (5) and (6) we see that there's a large difference in the insurance value of UI for conditionally poorer and richer workers. While poorer workers would value one more unit of consumption by 130 percent more in the future bad state (relative to being employed in the future), richer workers show little difference, valuing one additional unit of consumption

[50] To calculate the confidence intervals displayed in Tables 11, 12, 13 and 14 we fix r_u and the moral hazard terms to be the point estimates shown in Table 9 while calculating all other moments directly from the bootstrapped sample.

almost equally regardless of the future state.[51] The result for wealthier workers strengthens the validity of the "rich hand to mouth" explanation. While they might lack short-term liquidity, the low insurance value suggests that these workers either have enough assets to overcome the possibility of a bad future state without altering their consumption or simply do not consider they will ever reach such a bad state.

Finally, Table 12 shows additional robustness results of the estimated insurance value of UI, for a homogeneous T across groups ranging from 24 to 30 months ($T = 12$ to $T = 15$). Our conclusions remain unchanged regardless of the choice of T.

5.5 Share of Liquidity in the Value of UI

Table 13 combines the previous estimates and presents the relevance of the liquidity component in the value of UI. Column (1) looks at the complete sample and finds that the relevance of the liquidity component ranges from 50 to 53 percent of the value of UI, depending on whether we consider a homogeneous or heterogeneous T. Both estimates are significantly different from both zero and one,[52] indicating that liquidity constraints are important but do not represent the entirety of the value UI.

However, this is not true for all subgroups in our sample. When looking at workers with more liquidity, in column (3), we find that the relevance of the liquidity component is relatively small, at 33 percent, and insignificantly different from zero. The opposite is true for wealthier workers, in column (6), for whom the cost of liquidity represents almost the entirety of the value of UI (79 to 90 percent, both insignificantly different from one). In the case of poorer workers or workers with less liquidity, in columns (5) and (2), respectively, the liquidity component represents 63 to 75 percent of the value of UI and is significantly different from one.

Finally, Table 14 shows additional robustness results of the estimated liquidity share, where the insurance value corresponds to that of a homogeneous T across groups ranging from 24 to 30 months ($T = 12$ to $T = 15$). The point estimates are very similar, leaving our conclusions unchanged.

In conclusion, the large heterogeneity in the relevance of the liquidity component highlights how the marginal rate of substitution is not a perfect indicator of the degree of liquidity constraints or of the insurance value of UI. Unemployed workers may value UI

[51] As before, whether we impose the same T for all workers or we allow it to vary with potential duration does not change our conclusions.

[52] See footnote 50.

similarly, but for different reasons. While wealthier workers care about the liquidity it provides, workers with more liquidity enjoy its insurance value. However, even when the value of UI is vastly different across workers, the degree of liquidity constraints can be very similar. Both poorer and wealthier workers show similar liquidity costs, but the importance of the insurance value for poorer workers makes the value of UI much larger for them.

These results suggest that while liquidity costs are an important component of the value of UI, so is the insurance value of UI, and that simply assuming that liquidity constraints capture all the value of UI could be misguided.

6 Welfare Effects of Extending the Potential Duration of UI

This section first considers the effects on welfare of extending the potential duration of UI. After that, we consider a counterfactual exercise where we evaluate the welfare implications of extending the potential duration of UI after removing the cost of liquidity during unemployment.

The goal of this section is twofold. First, we are interested in understanding whether the potential duration of unemployment insurance is set at its optimal level or if it should be increased/decreased. Second, we aim to answer whether the provision of loans and unemployment insurance combined would result in an optimal level of potential duration of UI that is below the current one.

6.1 Sufficient Statistics for the Welfare Effect of Extending UI

The social planner chooses the optimal potential duration of UI, B (taking the benefit level as given):

$$W = \max_B J_0 = \max_B s_0 \cdot V_0(A_0 - \tau) + (1 - s_0)((1 - \lambda_0) \cdot U_0(A_0) + \lambda_0 \underline{\mathcal{U}}_0(A_0)) - \phi(s_0)$$

$$\text{subject to: } D_B \cdot b = (T - D)\tau$$

where D_B denotes the expected duration of paid UI, T denotes the potential lifetime duration of taxed employment, and D denotes the expected duration of unemployment. As shown in Appendix D, the sufficient statistics to evaluate the welfare impact of increasing the potential duration of UI are:

$$\frac{dW}{dB}/(bv'(c_B^e)) = -\underbrace{(1-\text{pr}_{B|0}^W)\frac{\partial s_0^*}{\partial B}/(b\frac{\partial s_0^*}{\partial A_B} - \frac{\partial s_0^*}{\partial B})}_{\text{Value}} - \underbrace{(\frac{\partial D_B}{\partial B} + \frac{D_B}{T-D}\frac{\partial D}{\partial B})}_{\text{Cost}} \qquad (26)$$

where $1 - \text{pr}_{B|0}^W$ represents the probability of reaching the exhaustion of unemployment insurance benefits without a job.

To calculate the value part, we require estimates of the labor supply response in the first period to an extension in the potential duration of UI and to an increase in assets in period B ($\frac{\partial s_0}{\partial B}$ and $\frac{\partial s_0}{\partial A_B}$). The former is a straightforward application of our RD design, where the outcome is the probability of finding a job within the first two months. For the latter, we have exogenous variation in severance payments – unconditional income transfers in period 0 – to recover $\frac{\partial s_0}{\partial A_0}$. This allows us to derive $\frac{\partial s_0}{\partial A_B}$, following Theorem 2 in Appendix A.2. We find $\frac{\partial s_0}{\partial B} = -0.016$ and $\frac{\partial s_0}{\partial A_B} = -0.006$. Moreover, the final column in Table 2 provides an estimate of the probability of reaching the exhaustion of UI benefits without a job, $(1 - \text{pr}_{B|0}^W) \approx 0.72$.

To calculate the cost part, we require estimates of the responses of the time collecting unemployment benefits, and the duration of unemployment to a change in the potential duration of UI. From Table 3, $\frac{\partial D_B}{\partial B} \approx 25/60$ and $\frac{\partial D}{\partial B} \approx 45/60$. Finally, to estimate $\frac{D_B}{T-D}$, the insured unemployment rate, we follow Landais (2015) and Huang and Yang (2021), and we approximate by using the total number of UI recipients divided by the total number of employees paying payroll taxes in the wage records during our period of interest from EPA (2022). This yields a value of 0.196 for our sample period.

We find that an extension of the potential duration of UI has a positive effect on welfare (point estimate = 0.13). This means that extending the potential duration of UI results in a welfare increase that is 13 percent larger than the one that would result from an equivalent increase in consumption during employment. To compare this number to the literature, we turn to Hendren and Sprung-Keyser (2020) and express this welfare gain in terms of the marginal value of public finance (MVPF). The MVPF measures a policy's bang-for-buck through the ratio of the beneficiaries' willingness to pay and the net cost to the government. We find a MVPF of 1.27. Compared to previous work, our estimate is larger than the results reported in Hendren and Sprung-Keyser (2020) for extensions of UI benefits (0.45 to 0.83), but smaller than the estimate in Huang and Yang (2021) for an extension of UI benefits in Taiwan (1.33 to 2).

6.2 Counterfactual Analysis

In this section, we propose two approximation methods to estimate the counterfactual effects on welfare of an extension of the potential duration of UI in the absence of credit constraints. At its core, the welfare evaluation exercise simply compares the utility gains from increasing the potential duration of UI to the costs of doing so. The basic idea of our approximation is that we can think of the sufficient statistics that determine the value and cost of UI as created by three fundamentals: the insurance value of UI, the liquidity value of UI, and the moral hazard distortions.[53] Therefore, if we shut down the liquidity channel in both the value of UI and its cost, we can approximate the welfare gains from extending the potential duration of UI in the absence of liquidity constraints.

Method 1: Our first method "mechanically" shuts down the liquidity channel while keeping the other components constant. To calculate the counterfactual value, we keep 47 percent of the original value of UI, as our estimate of the gains from extending the potential duration of UI when there are no liquidity constraints. The reason is that we find that 53 percent of the value of UI can be attributed to the liquidity component (Table 13). Moreover, to estimate the counterfactual probability of exhausting UI insurance, we use the estimated probability of exhausting UI for the only group we find to not suffer from liquidity constraints, those with conditionally larger severance payments.

To calculate the counterfactual cost, we directly shut down the liquidity component within $\frac{\partial D}{\partial B}$ and $\frac{\partial D_b}{\partial B}$. Using the results from Table 8 we find that approximately 67 percent of $\frac{\partial D}{\partial B}$ is driven by the moral hazard distortions. Of the remaining 33 percent, 47 percent comes from the insurance value of UI and the remaining 53 percent comes from the liquidity component. Thus, we shut down 17.5 percent ($(1 - 0.67) \times 0.53$) of the original response of the unemployment duration to an extension of the potential duration of UI for our counterfactual exercise. We follow the same exact reasoning to remove the part driven by liquidity from $\frac{\partial D_b}{\partial B}$. Finally, we use the same insured unemployment rate as in our original welfare calculation.[54]

Using this first method, we find that, in the absence of liquidity constraints, the effect on welfare of an extension in the potential duration of UI is -0.11. This means that, after removing the liquidity costs, extending the potential duration of UI results in a welfare increase that is 11 percent smaller than the one that would result from an equivalent increase

[53] The gains – the "value of UI" – are driven by the liquidity and insurance components. Similarly, the costs are a combination of moral hazard distortions and the liquidity and insurance components.

[54] While we would expect the insured unemployment rate to increase in this situation, small changes to the insured unemployment rate do not change the conclusions from this exercise.

in consumption during employment. Compared to estimates from previous work, Chetty (2008) simulates the effect of providing interest-rate-free loans to workers with limited available liquidity and finds that when workers have access to $10,000 in loans, the welfare gains from an increase in the benefit level of UI are still positive. However, in his case, these gains are 80 percent smaller than his baseline welfare gains from increasing the benefit level without access to these loans, and extremely close to zero. Translating this finding into the MVPF, we find a value of 0.75, similar to the estimates from previous work reported in Hendren and Sprung-Keyser (2020).

Method 2: The main limitation of Method 1 is that it does not address how the sufficient statistics change when credit constraints are removed, a question that cannot be answered in a simple way.[55] The reason is that by removing the liquidity constraints the search effort will decrease, changing the elasticities underlying these sufficient statistics. As shown in Section 2 a reduced search effort will change the moral hazard distortion, which is held constant in our previous method. Whether the moral hazard distortions will increase or decrease will depend on the curvature of the search cost function, which is unknown.

Our second method approximates the moral hazard distortion that would result from removing the credit constraints, without dealing with the curvature of the search cost function. Specifically, we approximate the counterfactual moral hazard distortion in the absence of liquidity constraints to that of the group of workers with more available liquidity. The assumption we make for this approximation is that the only difference between workers with more liquidity and our complete sample is the availability of cash on hand. Under this assumption, removing the liquidity costs would make workers in our entire sample behave like those in the groups with more liquidity. This allows us to use the labor supply responses for this subsample as estimates of the sufficient statistics of our entire sample in the absence of liquidity constraints.

Using this approach, we calculate the welfare effects of an extension of the potential duration and find a value of -0.14 (MVPF = 0.69), a slight decrease from our counterfactual welfare results using Method 1. The reason for a welfare effect that is further decreased is that the moral hazard distortion is, empirically, a weakly increasing function of liquidity cost. As shown in Section 2, a sufficient condition for this is that the curvature of the search cost function ($\phi(s)''$) weakly increases with the search effort. As shown in Table 9 the moral hazard distortion at 0 is larger in the group with more available liquidity, compared to our

[55] While we can evaluate the welfare effects of local changes to the potential duration of UI, this approach can only answer questions on the optimality of changes to the unemployment insurance system around the current policy and solutions.

entire sample.[56] Similarly, the probability of exiting unemployment within the first two months is lower in the groups with more liquidity, compared to our complete sample (22.2 vs. 22.5 percent). These results suggest that the curvature of the search cost function is empirically increasing in the search intensity. Therefore, an extension of the potential duration of UI, after alleviating the liquidity costs, would result in an even larger welfare decrease than that in our baseline counterfactual result.

In conclusion, we find that an extension of the potential duration of UI would increase welfare, suggesting that Spain's potential duration of UI is below its optimal level. However, we find that extending the potential duration of UI after alleviating the liquidity constraints, would have a negative effect on welfare, indicating that in this case, the optimal potential duration of UI should be lower than its current level. Finally, we consider the effect of removing the liquidity costs on the moral hazard distortions. We find that moral hazard increases, implying that the curvature of the search cost function is increasing in the search effort. Our results suggest that removing the liquidity costs exacerbates the moral hazard distortions, which would reduce even further the optimal potential duration of UI in the absence of liquidity costs.

7 Conclusion

This paper proposes and implements a method to differentiate between the liquidity and the insurance value in the value of UI. We show that it is possible to use conditional and unconditional income shocks at different points in time to identify the cost of transferring resources over time – the liquidity value of UI. Combined with the MRS, which captures the entirety of the value of UI, it allows us to estimate the relevance of the insurance component of UI. Using data from Spain, we find that there is significant heterogeneity in the value of UI, as well as in its liquidity and insurance value across different groups of unemployed workers. For some groups, the value of UI arises entirely from the liquidity it provides, while, for others, all the value of UI emanates from its insurance component. Moreover, we argue that the value of UI is not a sufficient statistic for the degree of liquidity constraints during unemployment. Finally, we find that Spain's current potential duration of UI is below its optimal level, but that if we could remove the liquidity constraints of the unemployed, the optimal potential duration would be significantly lower than the current level.

Our results raise several new questions, for instance, whether investing in job training

[56] Restricting our estimation of $\partial s_t/\partial w_t$ to be equal for all t leads to a moral hazard estimate of 0.022 for our complete sample and 0.024 for our sample of workers with more liquidity.

programs has any effect on the value of UI. Our finding that a significant part of the value of UI is driven by the insurance component suggests there's ample room for these programs to have an effect on the value of UI.

More generally, in this paper, we emphasize the importance of explicitly differentiating between income effects and liquidity constraints, both conceptually and in practice. Conceptually, income effects denote the optimal consumption responses to an enlarged budget set, while liquidity constraints represent a form of market failure. Several mechanisms can drive the income effects, each with different policy implications. In this paper, we focus on the insurance component in the provision of UI, but our point applies more generally. Any shock that affects available income (or required spending) can also affect future income (or spending) prospects. That individuals' consumption reacts to these shocks does not necessarily mean they lack the available liquidity to face them; they could also be optimally responding to the different future they expect. An equivalence between income effects and liquidity constraints can lead to ineffective policy implementations because the targeted mechanism was not relevant.

Finally, our method to identify liquidity costs has broad applicability in many other fields of study, such as education, health, and finance. While theory driven, it does not rely on any parameterization of individuals' preferences or beliefs and requires only minor assumptions about market structure. Any setup where researchers can observe exogenous variation in the timing of income shocks is a potential candidate for analyzing liquidity constraints using this approach.

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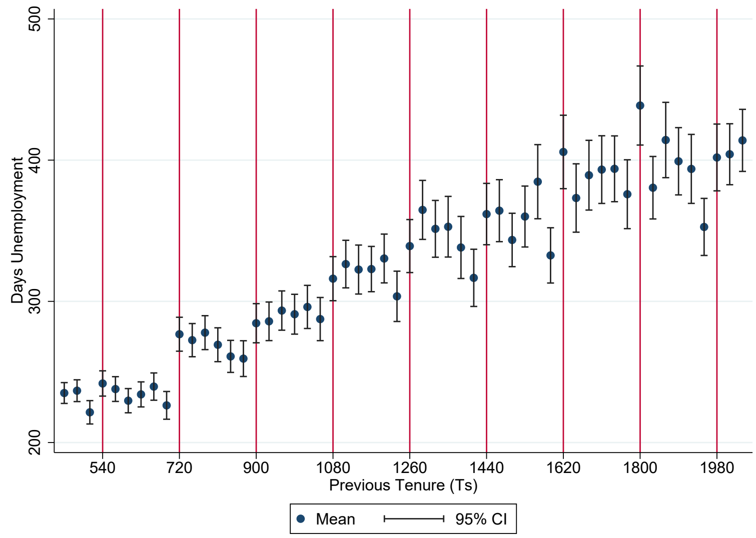
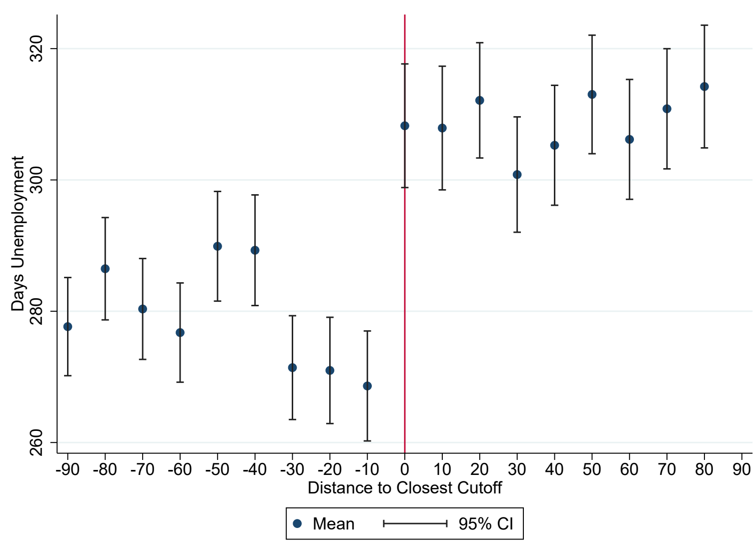
Figures

Figure 1: Unemployment Duration across the Distribution of the Previous Tenure



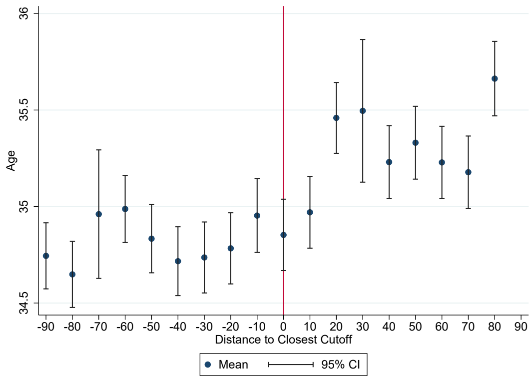
(a) By Cutoff



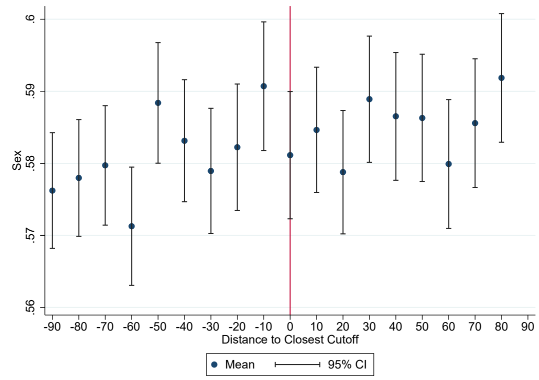
(b) All Cutoffs Combined

Note: This figure presents the average unemployment duration across the distribution of the running variable. Each individual point is the calculated average outcome variable at each value of the running variable (i.e., previous 6 years' tenure), using a 30-day and 10-day window, respectively. Panel (a) directly plots the relationship between the outcome variable and the running variable. We plot red vertical lines at 540 days, $\cdots$, 1980 days, to denote the location of each cutoff threshold, after which workers can collect an additional two months of UI benefits. Panel (b) pools all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker. We use a red vertical line at zero to denote the location of the cutoff.

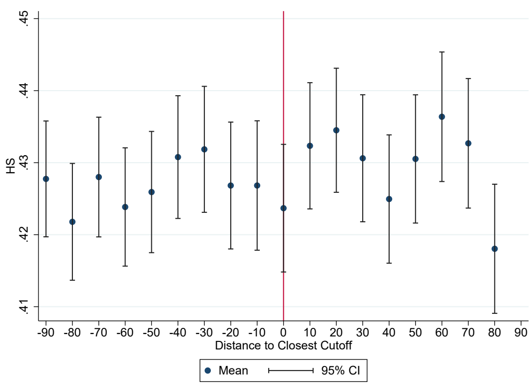
Figure 2: Regression Discontinuity Design: Graphical Balance Check



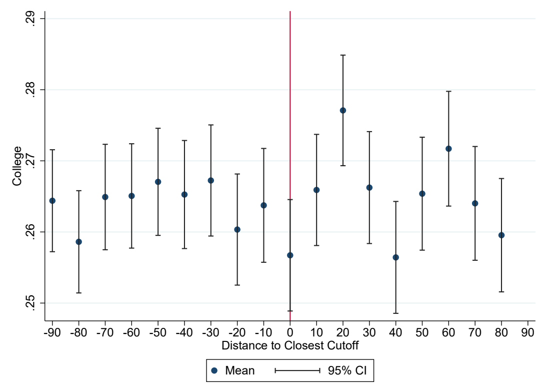
(a) Age



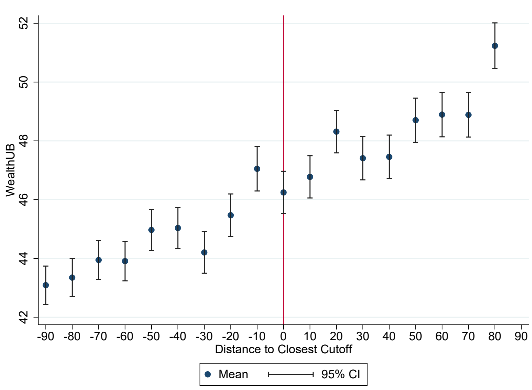
(b) Male



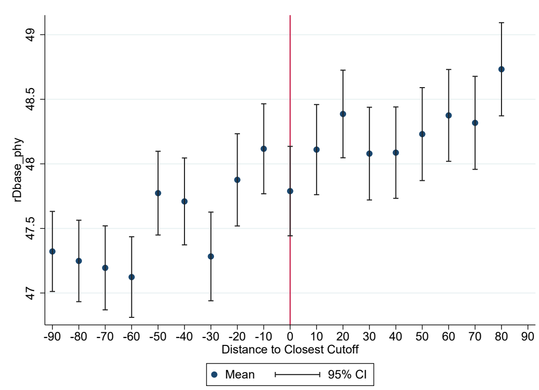
(c) High School Education



(d) College Education



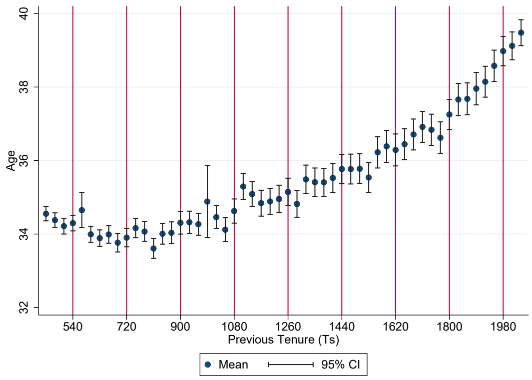
(e) Wealth (ln)



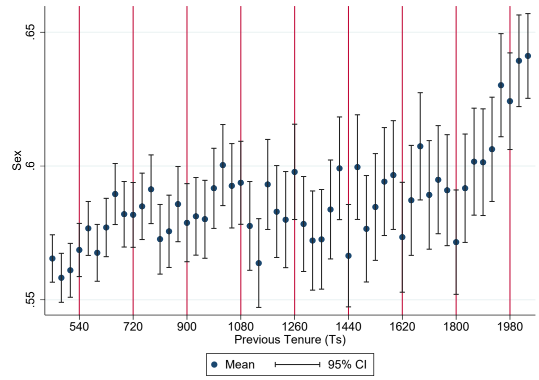
(f) Previous Wage

Note: This figure presents the balance test for six different observed characteristics: age, gender, high school education, college education, wealth, and previous daily wage. Each individual point is the calculated average outcome variable at each value of the running variable (i.e., previous 6 years' tenure), using a 10-day window. We pool all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker. We use a red vertical line at zero to denote the location of the cutoff.

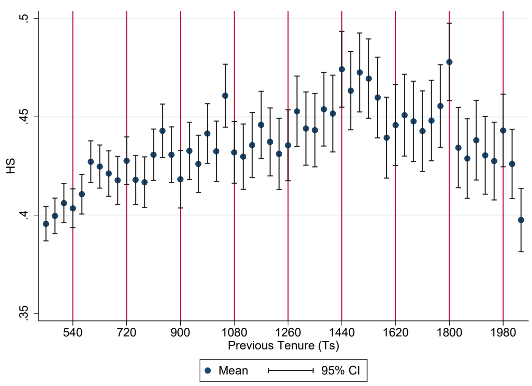
Figure 3: Regression Discontinuity Design: Graphical Balance Check



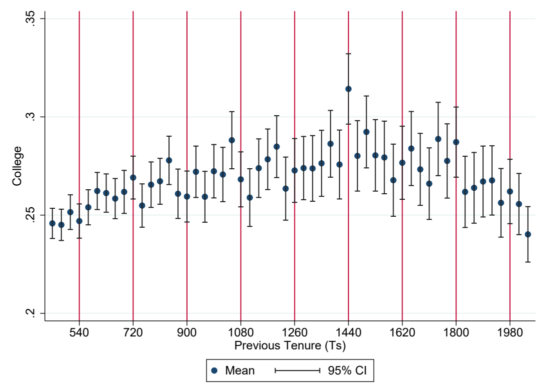
(a) Age



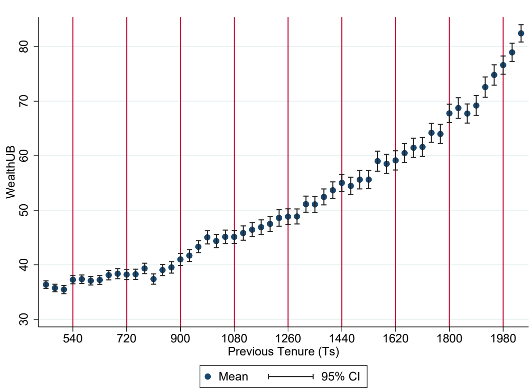
(b) Male



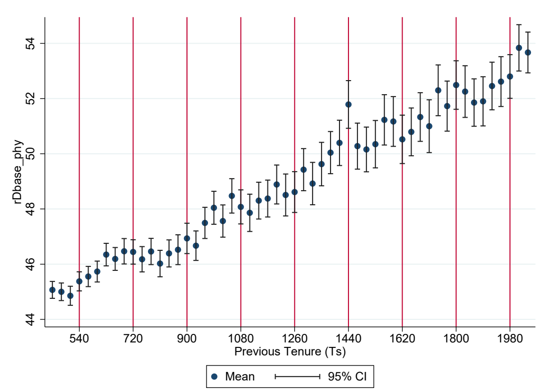
(c) High School Education



(d) College Education



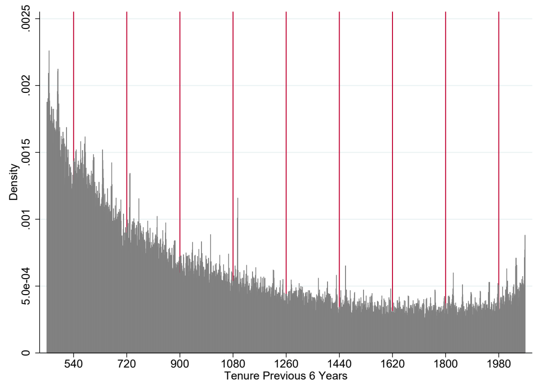
(e) Wealth (ln)



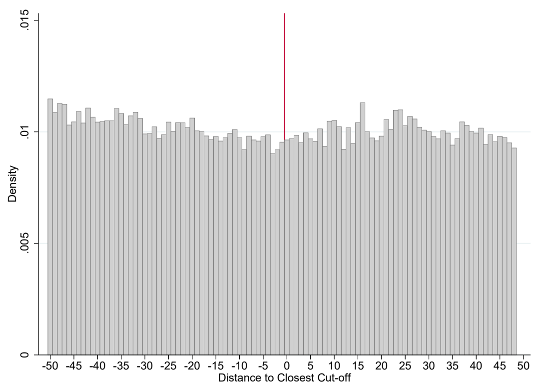
(f) Previous Wage

Note: This figure presents the balance test for six different observed characteristics: age, gender, high school education, college education, wealth, and previous daily wage. Each individual point is the calculated average outcome variable at each value of the running variable (i.e., previous 6 years' tenure), using a 30-day window. We directly plot the relationship between the outcome variable and the running variable. We plot red vertical lines at 540 days, $\cdots$, 1980 days, to denote the location of each cutoff threshold, after which workers can collect an additional two months of UI benefits

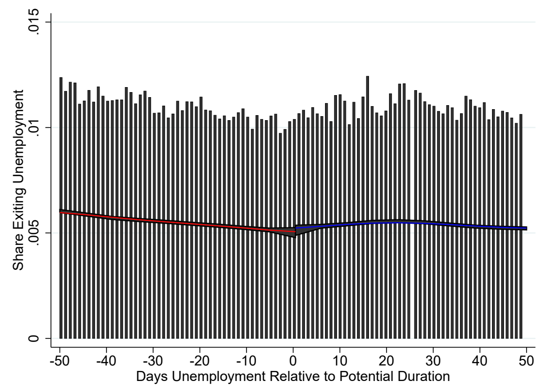
Figure 4: Distribution of the Previous Tenure



(a) Previous Tenure



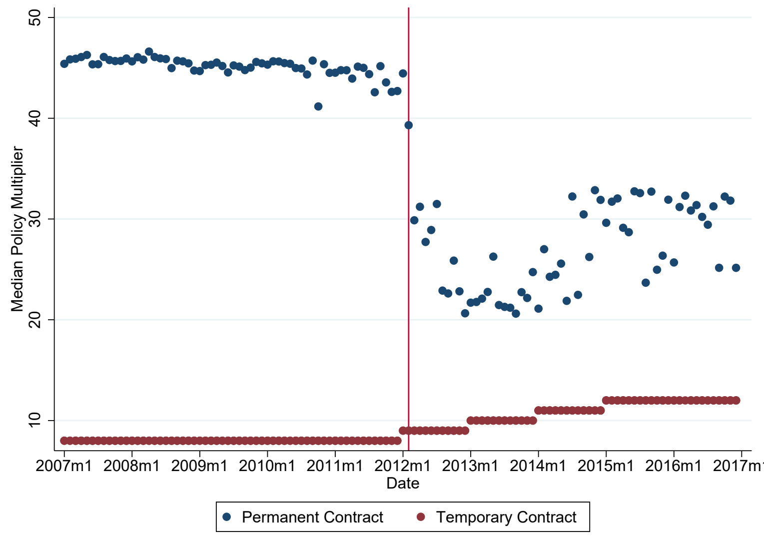
(b) Previous Tenure (Relative to Discontinuities)



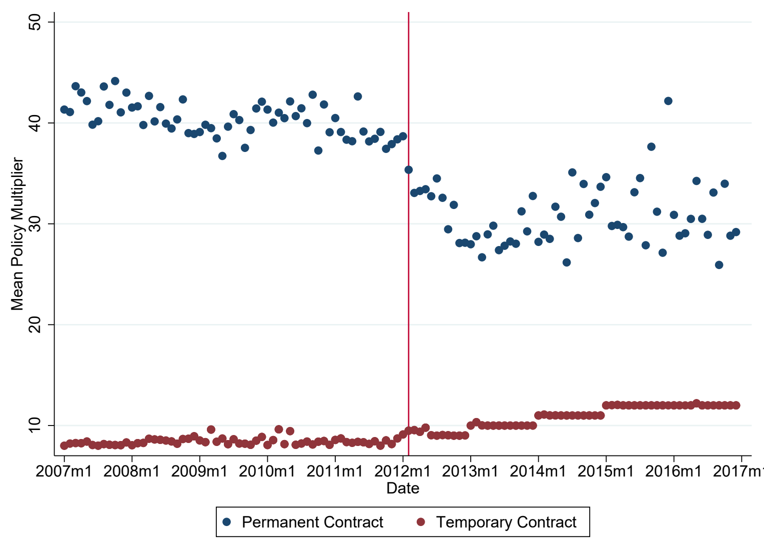
(c) Manipulation Test: Previous Tenure

Note: These figures plot the distribution of tenure in the previous 6 years (the running variable) for our final sample. Panel (a) presents it separately for each discontinuity, with red lines marking the location of each of the cutoff thresholds. Panel (b) presents the distribution when we pool all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker. Panel (c) presents the distribution when we pool all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker, and adds the point estimates and confidence intervals of the manipulation test as in Cattaneo et al. (2018). Both the conventional and the bias-corrected robust estimate do not reject no manipulation.

Figure 5: Policy Multiplier over Time



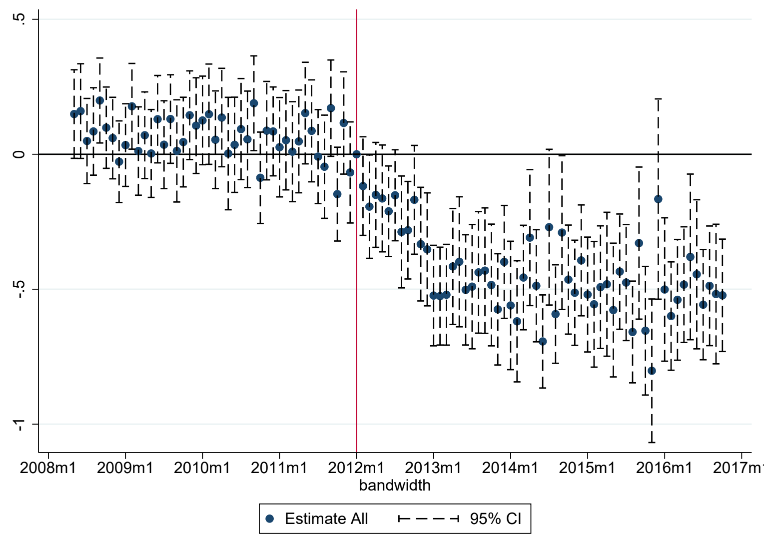
(a) Median



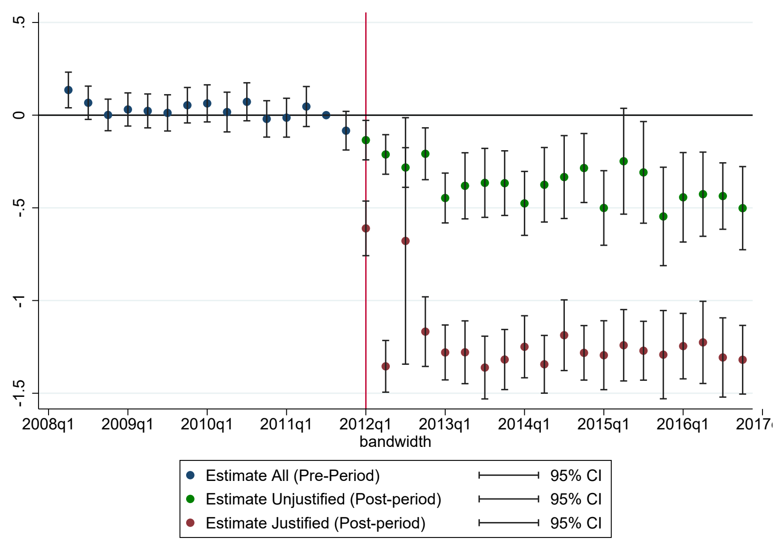
(b) Mean

Note: This figure shows the evolution over time of the severance payment's policy multiplier, from 2007 to 2017, separately for workers entering unemployment from permanent contracts and those entering from temporary contracts. Panels (a) and (b) show, respectively, the median policy multiplier and the trimmed mean (removing the top and bottom 10% of the observations).

Figure 6: Robustness Test



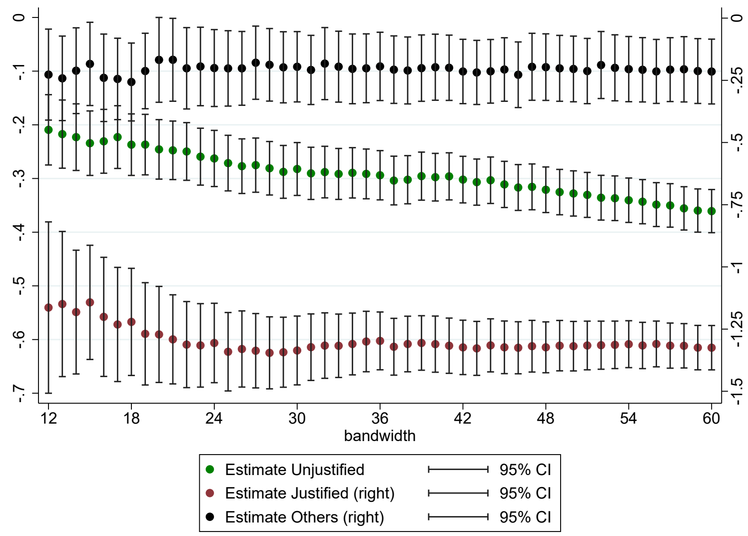
(a) First Stage Pre-Trends



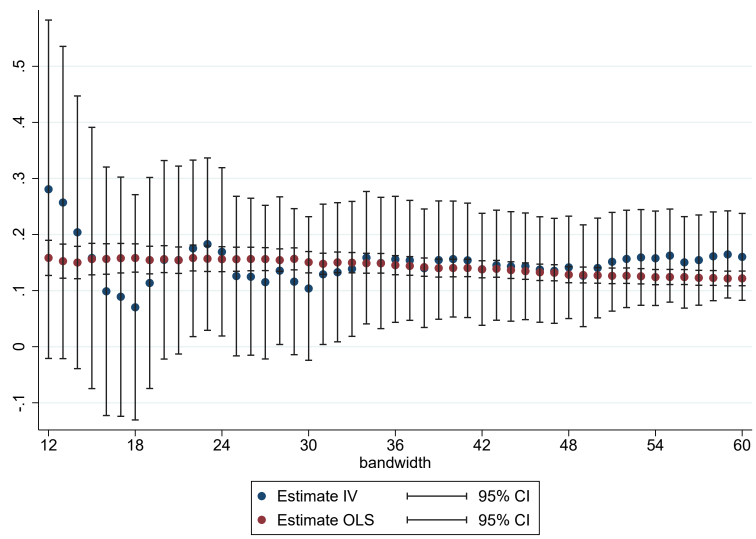
(b) First Stage Pre-Trends, by Dismissal type

Note: These figures plot the pre-trends test for the first stage. In Panel (a) all types of dismissals are combined. Each point on the y-axis represents the estimated coefficient of η_t from Equation 25 along with the 95% confidence interval. Panel (b) differentiates between dismissal type (justified vs. unjustified) post-policy implementation. Here, each point on the y-axis represents the estimated coefficient of η_t for each type of dismissal from our extension of Equation 25 (see text) along with the 95% confidence interval. The baseline (zero) is set to the month prior to the policy implementation (January 2012).

Figure 7: First- and Second-Stage Estimates with Varying Number of Months Around Policy Implementation



(a) First Stage



(b) Second Stage: Unemployment Duration

Note: This figure plots the first- and second-stage estimates for different time frames around the policy implementation, ranging from 12 to 60 months. Figure 7 (a) shows the first-stage estimates for each dismissal type. All values are relative to the average pre-policy change in the severance payment of permanent workers. Figure 7(b) shows the IV estimates of the effect of the severance payment on the unemployment duration (in blue), following the specification in Equation 22 and including all additional controls. Figure 7(b) also includes the equivalent OLS estimates (in red). Black bars represent the 95% confidence intervals.

Tables

Table 1: UI Potential Duration Schedule

	Days Worked in Previous 6 Years										
From	360	540	720	900	1080	1260	1440	1620	1800	1980	>2160
To	539	719	899	1079	1259	1439	1619	1799	1979	2159	
	Potential Duration (B) (Months)										
	4	6	8	10	12	14	16	18	20	22	24

Note: This table summarizes the schedule of the potential duration (B) for UI in Spain. For instance, in the first column: Workers whose work experience over the past 6 years is between 360 and 539 days are allowed to collect UI for up to 4 months.

Table 2: Summary Statistics

Potential Duration	120	180	240	300	360	420	480	540	600	660	All
Days Collecting UI	94.90	115.7	143.9	168.5	200.0	223.6	249.6	275.9	298.8	318.8	175.7
	(49.01)	(70.11)	(92.23)	(115.2)	(138.0)	(161.7)	(185.1)	(209.3)	(229.7)	(249.6)	(151.9)
Days Unemployment	231.8	235.4	270.1	289.6	320.4	344.5	357.9	388.7	396.7	407.2	293.2
	(402.0)	(403.1)	(440.1)	(454.1)	(471.1)	(522.8)	(507.6)	(550.2)	(558.0)	(583.8)	(466.4)
Re-employment in 4 months	0.454	0.481	0.431	0.409	0.365	0.355	0.337	0.324	0.309	0.310	0.406
Re-employment in 6 months	0.647	0.607	0.549	0.520	0.472	0.454	0.427	0.411	0.394	0.389	0.526
Re-employment in 12 months	0.816	0.802	0.761	0.725	0.661	0.635	0.604	0.572	0.553	0.544	0.713
Re-employment in 24 months	0.890	0.881	0.857	0.846	0.815	0.796	0.775	0.754	0.729	0.710	0.832
Share Exhausting UI	0.427	0.306	0.270	0.241	0.243	0.224	0.215	0.213	0.193	0.177	0.276
Previous Daily Wage	44.98	45.89	46.33	47.50	48.32	49.48	50.83	51.28	52.27	53.47	47.85
	(16.33)	(17.06)	(17.36)	(18.21)	(19.26)	(19.96)	(20.70)	(20.98)	(21.38)	(21.89)	(18.74)
Previous (6 Years) Tenure	491.4	622.0	804.3	986.3	1165.0	1347.2	1527.3	1709.6	1890.4	2027.9	1029.3
	(25.67)	(51.00)	(51.53)	(51.36)	(51.88)	(51.66)	(52.01)	(51.66)	(52.60)	(26.09)	(475.2)
Age	34.40	34.13	33.96	34.39	34.94	35.29	35.90	36.64	37.88	39.21	35.03
	(10.72)	(13.69)	(10.28)	(16.10)	(10.30)	(10.21)	(10.29)	(10.27)	(10.62)	(10.67)	(12.00)
Share Male	0.562	0.576	0.582	0.587	0.582	0.584	0.586	0.591	0.600	0.636	0.583
Share College	0.247	0.257	0.266	0.270	0.271	0.276	0.286	0.278	0.267	0.252	0.264
Share High School	0.400	0.417	0.427	0.435	0.435	0.447	0.464	0.448	0.440	0.420	0.428
Wealth*	35.90	37.51	38.59	43.34	46.64	50.92	56.31	61.81	70.17	79.57	46.25
	(37.71)	(37.24)	(36.62)	(38.10)	(39.06)	(39.12)	(41.94)	(42.13)	(45.11)	(46.85)	(40.98)
Share Permanent Contract	0.192	0.223	0.284	0.325	0.390	0.432	0.464	0.491	0.501	0.500	0.328
ln Severance Payment	4.737	4.956	5.207	5.482	5.736	5.951	6.166	6.372	6.439	6.438	5.415
	(1.468)	(1.563)	(1.692)	(1.759)	(1.870)	(1.943)	(2.010)	(2.048)	(2.145)	(2.140)	(1.829)
Cross	0	0.561	0.540	0.528	0.535	0.519	0.519	0.501	0.497	1	0.476
N	32661	48058	33365	25146	20047	16562	14244	13402	14184	9326	226995

Note: Table 2 presents the summary statistics by potential duration of UI and in the aggregate. Means and standard deviations (in parentheses) are shown.
* Wealth is constructed as the sum of real lifetime wages up to the worker's entry in unemployment.

Table 3: Effect of a 2-Month Extension of the Potential Duration of UI. All Discontinuities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Panel A: Unemployment Duration				
RD Estimate	43.62***	38.59***	42.82***	47.44***	44.71***	47.45***	40.46***	39.91***	35.11***
	[9.78]	[9.76]	[8.56]	[6.66]	[6.64]	[5.88]	[4.60]	[4.58]	[4.08]
Controls	Disc	All	All	Disc	All	All	Disc	All	All
Method	NP	NP	P	NP	NP	P	NP	NP	P
Bandwidth	22 ⋄	22 ⋄	22	45	45	45	90	90	90
N	47630	44912	44912	100297	93408	93408	207356	190994	190990
					Panel B: Time Collecting UI				
RD Estimate	24.66***	24.03***	24.11***	24.22***	24.49***	24.92***	23.77***	23.47***	21.95***
	[2.63]	[2.66]	[2.44]	[1.82]	[1.85]	[1.68]	[1.27]	[1.29]	[1.17]
Controls	Disc	All	All	Disc	All	All	Disc	All	All
Method	NP	NP	P	NP	NP	P	NP	NP	P
Bandwidth	22 ⋄	22 ⋄	22	45	45	45	90	90	90
N	53118	48658	48658	110922	101564	101564	226995	208139	208132

Note: Table 3 presents the estimation of the causal effect of a 2-month extension of the potential duration of UI on the unemployment duration (Panel (a)) and on the time collecting UI (Panel (b)). Controls "Disc": Discontinuity fixed effects. Controls "All": All controls included (see text). Method "NP": Non-parametric estimation following Calonico et al. (2019) with local polynomial. Method "P": Parametric estimation, linear regression. Bandwidth: Indicates the length of the bandwidth. The diamond (⋄) indicates optimal bandwidth following Calonico et al. (2020), for a specification without controls, for the effect on time in unemployment of two additional months' potential duration. Standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table 4: Balance Test. All Discontinuities.

	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Age			
RD Estimate	0.053	-0.160	-0.146	-0.080	0.168*	0.188*
	[0.200]	[0.181]	[0.140]	[0.145]	[0.098]	[0.102]
N	53118	53118	110922	110922	226995	226995
			Panel B: Male			
RD Estimate	-0.008	-0.010	-0.008	-0.006	-0.006	-0.005
	[0.010]	[0.009]	[0.007]	[0.006]	[0.005]	[0.004]
N	53118	53118	110922	110922	226995	226995
			Panel C: High School			
RD Estimate	-0.013	-0.003	-0.004	-0.002	-0.001	0.002
	[0.010]	[0.009]	[0.007]	[0.006]	[0.005]	[0.004]
N	52974	52974	110616	110616	226356	226356
			Panel D: College			
RD Estimate	-0.018*	-0.009	-0.007	-0.000	-0.001	0.001
	[0.009]	[0.008]	[0.006]	[0.005]	[0.004]	[0.004]
N	52974	52974	110616	110616	226356	226356
			Panel E: *ln* Wealth			
RD Estimate	0.005	-0.002	0.005	0.011	0.018**	0.019***
	[0.016]	[0.015]	[0.011]	[0.010]	[0.008]	[0.007]
N	53088	53088	110860	110860	226873	226873
			Panel F: *ln* Previous Daily Wage			
RD Estimate	-0.011	-0.013*	-0.006	-0.001	-0.001	0.000
	[0.007]	[0.007]	[0.005]	[0.004]	[0.003]	[0.003]
N	48832	48832	101904	101904	208828	208828
			Panel G: *ln* Previous Tenure			
RD Estimate	-0.032	-0.026	0.001	0.017	0.014	0.006
	[0.061]	[0.056]	[0.043]	[0.039]	[0.030]	[0.027]
N	53118	53118	110922	110922	226995	226995
			Panel H: *ln* Previous Experience			
RD Estimate	0.055	0.072	0.054	0.045	0.021	0.003
	[0.055]	[0.051]	[0.038]	[0.035]	[0.027]	[0.025]
N	53118	53118	110922	110922	226995	226995
			Panel I: Previous Contract: Permanent			
RD Estimate	-0.024	-0.003	0.008	0.021*	0.012	0.009
	[0.019]	[0.018]	[0.013]	[0.012]	[0.009]	[0.009]
N	53118	53118	110922	110922	226995	226995
Controls	Disc	Disc	Disc	Disc	Disc	Disc
Method	NP	P	NP	P	NP	P
Bandwidth	22 ⋄	22	45	45	90	90

Note: Table 4 presents the balance test of a 2-month extension of the potential duration of UI on different observed worker characteristics. Controls "No": No controls. Controls "Disc": Discontinuity fixed effects. Method "NP": Non-parametric estimation following Calonico et al. (2019). Method "P": Parametric estimation, linear regression. Bandwidth: Indicates the length of the bandwidth. The diamond (⋄) indicates optimal bandwidth, defined as in Table 3. Standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table 5: Effect of Changes in Severance Payments. All Discontinuities

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: IV					
	First Stage	Second Stage		First Stage	Second Stage	
		ln Unemployment Duration	*ln* Time Collecting UI		*ln* Unemployment Duration	*ln* Time Collecting UI
Post×Perm×Unjustified	-0.358***			-0.356***		
	[0.021]			[0.020]		
Post×Perm×Justified	-1.315***			-1.307***		
	[0.046]			[0.046]		
Post×Perm×Unknown	-0.171**			-0.196**		
	[0.068]			[0.067]		
ln Severance Payment		0.132***	0.080**		0.151***	0.088***
		[0.039]	[0.032]		[0.039]	[0.030]
F-stat	261.9			261.7		
Controls	No	No	No	All	All	All
N	143338	143338	15572	131636	131636	142609
	Panel B: OLS					
		ln Unemployment Duration	*ln* Time Collecting UI		*ln* Unemployment Duration	*ln* Time Collecting UI
ln Severance Payment		0.105***	0.105***		0.112***	0.094***
		[0.006]	[0.004]		[0.006]	[0.004]
Controls		No	No		All	All
N		143338	155721		131636	142609

Note: This table presents the estimates for the causal effect of the severance payment on the unemployment duration and on the time collecting UI, following the specification in Equation 22. The top panel presents the IV estimates using the policy change as the exogenous instrument, with and without additional controls. The bottom panel presents the estimates from OLS regressions with and without controls (see text for details). Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table 6: Effect of Changes in Severance Payments. All Discontinuities

	(1)	(2)	(3)
	First Stage	Second Stage	
		ln Unemployment Duration	*ln* Time Collecting UI
Post×Perm	-0.465***		
	[0.019]		
ln Severance Payment		0.154***	0.051
		[0.048]	[0.038]
F-stat	643.9		
Controls	All	All	All
N	131636	131636	142609

Note: This table presents the IV estimates for the effect of the severance payment on the unemployment duration and on the time collecting UI, using the policy change as the exogenous instrument, with additional controls, as described in Equation 24. Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table 7: Effect of Changes in Severance Payments. All Discontinuities Controls for Replacement Rate Change in October 2012

Panel A: IV			
		ln Unemployment Duration	*ln* Time Collecting UI
Post×Perm×Unjustified	-0.395***		
	[0.020]		
Post×Perm×Justified	-1.354***		
	[0.045]		
Post×Perm×Unknown	-0.251*		
	[0.066]		
ln Severance Payment		0.165***	0.102***
		[0.039]	[0.030]
Change RR		0.049	0.050
		[0.088]	[0.052]
Change RR × Post Policy RR		-0.508***	-0.576***
		[0.087]	[0.068]
F-stat	305.5		
Controls	All	All	All
N	131636	131636	142609

Panel B: OLS			
		ln Unemployment Duration	*ln* Time Collecting UI
ln Severance Payment		0.112***	0.095***
		[0.006]	[0.004]
Change RR		0.051	0.050
		[0.064]	[0.052]
Change RR × Post Policy RR		-0.505***	-0.576***
		[0.087]	[0.068]
Controls		All	All
N		131636	142609

Note: This table presents the estimates for the causal effect of the severance payment on the unemployment duration and on the time collecting UI, following the specification in Equation 22 after including controls for the change in the replacement rate and its interaction with a dummy reflecting the timing of the policy implementation. The top panel presents the IV estimates using the policy change as the exogenous instrument, with additional controls. The bottom panel presents the estimates from the equivalent OLS regressions (see text for details). Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table 8: Heterogeneous Effects on the Duration of Unemployment

Division	All Sample	Conditional Severance Payment		Conditional Wealth	
	Panel A: Effect of a 2-month Extension of the Potential Duration of UI				
	All Sample	Below Median	Above Median	Below Median	Above Median
RD Estimate	39.91***	29.25***	34.80***	32.54***	45.45***
	[4.58]	[6.89]	[6.65]	[7.07]	[5.95]
Method	NP	NP	NP	NP	NP
Bandwidth	90	90	90	90	90
N	185866	58996	67344	87727	98139
	Panel B: Effect of Changes in Severance Payment				
	All Sample	Below Median	Above Median	Below Median	Above Median
Post×Perm×Unjustified	-0.356***	-0.419***	-0.313***	-0.358***	-0.351***
	[0.020]	[0.026]	[0.021]	[0.027]	[0.030]
Post×Perm×Justified	-1.307***	-1.040***	-1.193***	-1.350***	-1.276***
	[0.046]	[0.079]	[0.041]	[0.066]	[0.061]
Post×Perm×Unknown	-0.195***	-0.656***	-0.081	-0.524***	-0.053
	[0.067]	[0.099]	[0.055]	[0.073]	[0.092]
$lnSP$	0.152***	0.107*	0.118**	0.172***	0.140**
	[0.039]	[0.068]	[0.052]	[0.056]	[0.055]
	Effect 2 Months Benefits Via Severance Payment on Unemployment Duration				
Days in Unemployment	13.26	17.68	7.22	22.52	9.65
Δ Days in Unemployment (%)	4.5	7.0	2.5	7.3	3.5
Ratio Inc. Effect to Total LSR	**0.33**	**0.61**	**0.21**	**0.68**	**0.21**
N	131636	63989	67644	62134	69489

Note: This table presents the causal effects on the duration of unemployment of changes in the potential duration of UI and in the severance payments for 5 different groups of workers, separately. Column 1 shows the results for our complete sample. Column 2 (3) shows results for workers below (above) the conditional median severance payment in our sample, by age, year, type of contract, and wealth decile. Column 4 (5) shows results for workers below (above) the conditional median wealth in our sample, by age, year, and type of contract. All the regression results include controls as specified in the respective estimation section in the main text. Panel (A) presents the causal effect on the duration of unemployment of a two-month extension in the potential duration of UI, using local linear RD with the maximum possible bandwidth (90 days). Panel (B) presents the IV estimates (first and second stages) regarding the causal impact of changes in severance payment, as well as the effect of 2 additional months of benefits (via severance payment) on the duration of unemployment. Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table 9: Estimates of r_u and Moral Hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All Sample	Conditional Severance Payment			Conditional Wealth		
		Below Median	Above Median	Difference	Below Median	Above Median	Difference
r_u	0.012**	0.025*	0.003	0.022	0.020*	0.022***	–0.002
	[0.000,0.032]	[–0.003,0.056]	[–0.015,0.020]	[–0.014,0.060]	[–0.004,0.051]	[0.009,0.034]	[–0.033,0.034]
$\frac{\partial s_0}{\partial w_0}$	0.023	0.005	0.053	–0.048	0.005	0.079	–0.074
	[0.000,0.053]	[0.000,0.044]	[0.027,0.085]	[–0.086,-0.003]	[0.000,0.044]	[0.017,0.118]	[–0.118,-0.014]
$\frac{\partial s_1}{\partial w_1}$	0.036	0.059	0.015	0.045	0.009	0.057	–0.048
	[0.007,0.058]	[0.000,0.102]	[0.000,0.043]	[–0.023,0.087]	[0.000,0.049]	[0.021,0.087]	[–0.081,0.009]
$\frac{\partial s_2}{\partial w_2}$	0.038	0.064	0.050	0.014	0.046	0.034	0.012
	[0.018,0.058]	[0.021,0.097]	[0.018,0.076]	[–0.039,0.062]	[0.021,0.074]	[0.002,0.063]	[–0.029,0.051]
$\frac{\partial s_3}{\partial w_3}$	0.011	0.031	0.015	0.016	0.005	0.045	–0.040
	[0.000,0.032]	[0.000,0.072]	[0.000,0.044]	[–0.036,0.052]	[0.000,0.016]	[0.006,0.076]	[–0.076,-0.006]
$\frac{\partial s_4}{\partial w_4}$	0.023	0.060	0.005	0.054	0.025	0.025	0.000
	[0.005,0.041]	[0.029,0.097]	[0.000,0.029]	[0.013,0.091]	[0.004,0.043]	[0.006,0.047]	[–0.031,0.025]
$\frac{\partial s_5}{\partial w_5}$	0.024	0.031	0.026	0.005	0.014	0.036	–0.022
	[0.008,0.041]	[0.000,0.059]	[0.005,0.049]	[–0.031,0.045]	[0.000,0.030]	[0.007,0.055]	[–0.046,0.010]
$\frac{\partial s_6}{\partial w_6}$	0.026	0.020	0.041	–0.021	0.025	0.028	–0.003
	[0.007,0.045]	[0.000,0.044]	[0.014,0.065]	[–0.053,0.016]	[0.003,0.048]	[0.005,0.053]	[–0.035,0.025]
$\frac{\partial s_7}{\partial w_7}$	0.026	0.045	0.019	0.026	0.005	0.049	–0.044
	[0.011,0.043]	[0.011,0.081]	[0.001,0.042]	[–0.015,0.070]	[0.000,0.028]	[0.023,0.068]	[–0.068,-0.012]
$\frac{\partial s_8}{\partial w_8}$	0.005	0.018	0.005	0.013	0.005	0.007	–0.002
	[0.000,0.017]	[0.000,0.058]	[0.000,0.027]	[–0.021,0.054]	[0.000,0.023]	[0.000,0.031]	[–0.030,0.018]
$\frac{\partial s_9}{\partial w_9}$	0.018	0.005	0.033	–0.028	0.005	0.039	–0.034
	[0.002,0.039]	[0.000,0.039]	[0.000,0.060]	[–0.060,0.011]	[0.000,0.019]	[0.007,0.064]	[–0.064,-0.004]

Note: This table presents the estimates of r_u and the moral hazard effects ($\frac{\partial S_0(t)}{\partial w_t}$ for $j = 1, 2, \cdots, 10$). Column (1) presents the results for the complete sample. Columns (2), (3), and (4) present the estimated results for a sample of workers with conditionally smaller severance payments, and a sample with conditionally larger severance payments, and their difference, respectively. Columns (5), (6), and (7) present the estimated results for a sample of conditionally poorer workers, and a sample of conditionally richer workers, and their difference, respectively. Bootstrapped 95 percent confidence interval in brackets. p-value: * 0.10 ** 0.05, *** 0.01 (Only first row).

Table 10: Estimates of r_u and Moral Hazard. Different β

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All Sample	Conditional Severance Payment			Conditional Wealth		
		Below Median	Above Median	Difference	Below Median	Above Median	Difference
r_u ($\beta = 1.000$)	0.012**	0.025*	0.003	0.022	0.020*	0.022***	–0.002
	[0.000,0.032]	[–0.003,0.056]	[–0.015,0.020]	[–0.014,0.060]	[–0.004,0.051]	[0.009,0.034]	[–0.033,0.034]
r_u ($\beta = 0.995$)	0.013**	0.026*	0.004	0.022	0.020*	0.023***	–0.003
	[0.000,0.033]	[–0.003,0.057]	[–0.014,0.021]	[–0.014,0.060]	[–0.004,0.051]	[0.010,0.035]	[–0.034,0.033]
r_u ($\beta = 0.990$)	0.013**	0.027*	0.005	0.022	0.021*	0.024***	–0.004
	[0.001,0.034]	[–0.002,0.057]	[–0.014,0.022]	[–0.015,0.059]	[–0.003,0.052]	[0.011,0.037]	[–0.035,0.033]
r_u ($\beta = 0.985$)	0.014**	0.027*	0.006	0.022	0.021*	0.026***	–0.005
	[0.002,0.035]	[–0.001,0.058]	[–0.013,0.023]	[–0.015,0.059]	[–0.003,0.053]	[0.012,0.039]	[–0.036,0.032]
r_u ($\beta = 0.980$)	0.015**	0.028*	0.007	0.021	0.022*	0.027***	–0.005
	[0.003,0.036]	[–0.001,0.059]	[–0.013,0.024]	[–0.016,0.059]	[–0.003,0.053]	[0.013,0.040]	[–0.037,0.032]

Note: This table presents the estimates of r_u for different values of β (i.e., different values of r_e), expressed bimonthly. Column (1) presents the results for the complete sample. Columns (2), (3), and (4) present the estimated results for a sample of workers with conditionally smaller severance payments, and a sample with conditionally larger severance payments, and their difference, respectively. Columns (5), (6), and (7) present the estimated results for a sample of conditionally poorer workers, and a sample of conditionally richer workers, and their difference, respectively. Bootstrapped 95 percent confidence interval in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table 11: Estimates of Insurance Value

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		All Sample	Conditional Severance Payment			Conditional Wealth		
			Below Median	Above Median	Difference	Below Median	Above Median	Difference
$u'(b)/u'(w)$	$T = 13$	1.456	2.046	1.469	0.577	2.298	1.046	1.252
		[1.228,1.987]	[1.156,3.085]	[1.316,2.067]	[–0.669,1.624]	[1.744,3.023]	[0.873,1.446]	[0.437,1.938]
$u'(b)/u'(w)$	$T = Het$	1.485	2.097	1.469	0.627	2.322	1.098	1.224
		[1.259,2.014]	[1.212,3.132]	[1.319,2.050]	[–0.599,1.675]	[1.776,3.042]	[0.929,1.496]	[0.415,1.902]

Note: This table presents the estimates of the insurance value of UI ($u'(b)/u'(w)$). Column (1) presents the results for the complete sample. Columns (2), (3), and (4) present the estimated results for a sample of workers with conditionally smaller severance payments, and a sample with conditionally larger severance payments, and their difference, respectively. Columns (5), (6) and (7) present the estimated results for a sample of conditionally poorer workers, and a sample of conditionally richer workers, and their difference, respectively. T indicates the last period when the worker can still find a job, before finally finding herself in an absorbing state (employed or out of the labor force). $T = 13$ indicates this last period is after 26 months unemployed. $T = Het$ uses T= 10, 10, 11, 12, 12, 12, 13, 14, 15 for potential duration groups D= 120, 180, 240, 300, 360, 420, 480, 540, 600 respectively. Bootstrapped 95 percent confidence interval in brackets (calculated fixing r_u and the moral hazard terms to the sample point estimates in all bootstraps).

Table 12: Estimates of Insurance Value

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		All Sample	Conditional Severance Payment			Conditional Wealth		
			Below Median	Above Median	Difference	Below Median	Above Median	Difference
$u'(b)/u'(w)$	$T = 12$	1.480	2.102	1.466	0.636	2.336	1.111	1.225
		[1.258,1.997]	[1.217,3.134]	[1.319,2.038]	[–0.581,1.676]	[1.786,3.056]	[0.940,1.504]	[0.415,1.906]
$u'(b)/u'(w)$	$T = 13$	1.456	2.046	1.469	0.577	2.298	1.046	1.252
		[1.228,1.987]	[1.156,3.085]	[1.316,2.067]	[–0.669,1.624]	[1.744,3.023]	[0.873,1.446]	[0.437,1.938]
$u'(b)/u'(w)$	$T = 14$	1.434	1.984	1.476	0.508	2.252	0.991	1.251
		[1.200,1.977]	[1.096,3.022]	[1.316,2.099]	[–0.762,1.560]	[1.697,2.977]	[0.816,1.394]	[0.445,1.949]
$u'(b)/u'(w)$	$T = 15$	1.411	1.918	1.478	0.440	2.204	0.937	1.206
		[1.173,1.964]	[1.036,2.949]	[1.313,2.123]	[–0.847,1.489]	[1.650,2.927]	[0.762,1.342]	[0.452,1.954]
$u'(b)/u'(w)$	$T = Het$	1.485	2.097	1.469	0.627	2.322	1.098	1.224
		[1.259,2.014]	[1.212,3.132]	[1.319,2.050]	[–0.599,1.675]	[1.776,3.042]	[0.929,1.496]	[0.415,1.902]

Note: This table presents the estimates of the insurance value of UI ($u'(b)/u'(w)$) for different values of T. Column (1) presents the results for the complete sample. Columns (2), (3) and (4) present the estimated results for a sample of workers with conditionally smaller severance payments, and a sample with conditionally larger severance payments, and their difference, respectively. Columns (5), (6), and (7) present the estimated results for a sample of conditionally poorer workers, and a sample of conditionally richer workers, and their difference, respectively. T indicates the last period when the worker can still find a job, before finally finding herself in an absorbing state (employed or out of the labor force). $T = i$ indicates this last period is after $i * 2$ months unemployed. $T = Het$ uses T= 10, 10, 11, 12, 12, 12, 13, 14, 15 for potential duration groups D= 120, 180, 240, 300, 360, 420, 480, 540, 600 respectively. Bootstrapped 95 percent confidence interval in brackets (calculated fixing r_u and the moral hazard terms to the sample point estimates in all bootstraps).

Table 13: Estimates of Share of Liquidity on Value of UI

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		All Sample	Conditional Severance Payment			Conditional Wealth		
			Below Median	Above Median	Difference	Below Median	Above Median	Difference
ls	$T = 13$	0.528	0.755	0.331	0.424	0.631	0.902	–0.271
		[0.151,0.696]	[0.354,0.906]	[–0.043,0.540]	[–0.017,0.862]	[0.488,0.743]	[0.381,1.327]	[–0.719,0.259]
ls	$T = Het$	0.498	0.743	0.331	0.412	0.624	0.790	–0.166
		[0.130,0.663]	[0.281,0.882]	[–0.041,0.532]	[–0.103,0.827]	[0.470,0.736]	[0.302,1.181]	[–0.578,0.320]

Note: This table presents the estimates of the liquidity share in the value of UI. Column (1) presents the results for the complete sample. Columns (2), (3), and (4) present the estimated results for a sample of workers with conditionally smaller severance payments, and a sample with conditionally larger severance payments, and their difference, respectively. Columns (5), (6), and (7) present the estimated results for a sample of conditionally poorer workers, and a sample of conditionally richer workers, and their difference, respectively. T indicates the last period when the worker can still find a job, before finally finding herself in an absorbing state (employed or out of the labor force). $T = 13$ indicates this last period is after 26 months unemployed. $T = Het$ uses T= 10, 10, 11, 12, 12, 12, 13, 14, 15 for potential duration groups D= 120, 180, 240, 300, 360, 420, 480, 540, 600 respectively. Bootstrapped 95 percent confidence interval in brackets (calculated fixing r_u and the moral hazard terms to the sample point estimates in all bootstraps).

Table 14: Estimates of Share of Liquidity on Value of UI

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		All Sample	Conditional Severance Payment			Conditional Wealth		
			Below Median	Above Median	Difference	Below Median	Above Median	Difference
ls	$T = 12$	0.503	0.742	0.335	0.406	0.620	0.763	–0.142
		[0.146,0.666]	[0.277,0.881]	[–0.017,0.541]	[–0.115,0.802]	[0.462,0.733]	[0.290,1.147]	[–0.536,0.327]
ls	$T = 13$	0.528	0.755	0.331	0.424	0.631	0.902	–0.271
		[0.151,0.696]	[0.354,0.906]	[–0.043,0.540]	[–0.017,0.862]	[0.488,0.743]	[0.381,1.327]	[–0.719,0.259]
ls	$T = 14$	0.551	0.770	0.322	0.448	0.644	1.020	–0.376
		[0.167,0.722]	[0.395,0.916]	[–0.072,0.536]	[0.034,0.894]	[0.516,0.754]	[0.453,1.500]	[–0.867,0.194]
ls	$T = 15$	0.575	0.785	0.318	0.466	0.658	1.134	–0.476
		[0.194,0.761]	[0.431,0.935]	[–0.094,0.536]	[0.065,0.920]	[0.527,0.766]	[0.525,1.663]	[–1.033,0.144]
ls	$T = Het$	0.498	0.743	0.331	0.412	0.624	0.790	–0.166
		[0.130,0.663]	[0.281,0.882]	[–0.041,0.532]	[–0.103,0.827]	[0.470,0.736]	[0.302,1.181]	[–0.578,0.320]

Note: This table presents the estimates of the liquidity share in the value of UI for different values of T. Column (1) presents the results for the complete sample. Columns (2), (3), and (4) present the estimated results for a sample of workers with conditionally smaller severance payments, and a sample with conditionally larger severance payments, and their difference, respectively. Columns (5), (6), and (7) present the estimated results for a sample of conditionally poorer workers, and a sample of conditionally richer workers, and their difference, respectively. T indicates the last period when the worker can still find a job, before finally finding herself in an absorbing state (employed or out of the labor force). $T = i$ indicates this last period is after $i * 2$ months unemployed. $T = Het$ uses T= 10, 10, 11, 12, 12, 12, 13, 14, 15 for potential duration groups D= 120, 180, 240, 300, 360, 420, 480, 540, 600 respectively. Bootstrapped 95 percent confidence interval in brackets (calculated fixing r_u and the moral hazard terms to the sample point estimates in all bootstraps).

Appendix

A Theory

A.1 Liquidity-Insurance Decomposition

By definition of MRS_0:

$$\text{MRS}_0 = \frac{(1-\lambda_0)u'(c_0^u) + \lambda_0 u'(c_0^{u_0})}{u'(c_0^{e_0})}$$

where $c_t^{e_j}$ ($c_t^{u_j}$) is the consumption in period t of a worker who finds a job (drops out of the labor force) in period j.

Substituting repetitively from period 0 to period t using the Euler Equation (8):

$$u'(c_0^u) = I + II + III$$

$$I = \sum_{j=1}^{t} [s_j^* \prod_{i=1}^{j-1}(1-\lambda_i) \prod_{k=1}^{j-1}(1-s_k^*)] \cdot (\beta(1+r_u))^j u'(c_j^{e_j}) = \sum_{j=1}^{t} \text{pr}_{j|0}^{W}/(1-\lambda_0) \cdot (\beta(1+r_u))^j u'(c_t^{e_j})$$

$$II = \sum_{j=1}^{t} [\lambda_j \prod_{i=1}^{j-1}(1-\lambda_i) \prod_{k=1}^{j}(1-s_k^*)] \cdot (\beta(1+r_u))^j u'(c_j^{u_j}) = \sum_{j=1}^{t} \text{pr}_{j|0}^{\mathcal{U}}/(1-\lambda_0) \cdot (\beta(1+r_u))^j u'(c_j^{u_j})$$

$$III = \prod_{i=1}^{t}(1-\lambda_i) \prod_{k=1}^{t}(1-s_k^*)(1+r_u)^t u'(c_t^u) = \text{pr}_{t|0}^{U}/(1-\lambda_0)(\beta(1+r_u))^t u'(c_t^u)$$

where $\text{pr}_{j|0}^{W} = s_j^* \prod_{i=0}^{j-1}(1-\lambda_i) \prod_{k=1}^{j-1}(1-s_k^*)$ is the probability of finding a job in period t conditional on the search being unsuccessful in period 0, $\text{pr}_{j|0}^{\mathcal{U}} = \lambda_j \prod_{i=0}^{j-1}(1-\lambda_i) \prod_{k=1}^{j}(1-s_k^*)$ is the cumulative probability of exiting the labor force from period 0 to period t, conditional on the search being unsuccessful in period 0, and $\text{pr}_{t|0}^{U} \equiv \prod_{i=0}^{t}(1-\lambda_i) \prod_{k=1}^{t}(1-s_k^*)$ denotes the probability of staying in unemployment and continue searching for a job until t.

From Equation (6), we know $u'(c_t^{e_j}) = u'(c_j^{e_j})$ since $\beta(1+r_e) = 1$. From Equation (7), we know $u'(c_j^{u_j}) = (\beta(1+r_u))^{t-j} u'(c_t^{u_j})$. Therefore, we have:

$$u'(c_0^u) = \sum_{j=1}^{t} \mathrm{pr}_{j|0}^{W}/(1-\lambda_0) \cdot (\beta(1+r_u))^j u'(c_t^{e_j}) \\ + (\beta(1+r_u))^t \sum_{j=1}^{t} \mathrm{pr}_{j|0}^{\mathcal{U}}/(1-\lambda_0) \cdot u'(c_t^{u_j}) + \mathrm{pr}_{t|0}^{U}/(1-\lambda_0)(\beta(1+r_u))^t u'(c_t^u) \tag{A.1}$$

From Equation (6), we have $u'(c_0^{e_0}) = (\beta(1+r_e))^t u'(c_t^{e_0})$. Therefore, plugging these new expressions for $u'(c_0^u)$, $u'(c_0^{e_0})$ and $u'(c_0^{u_0})$ into MRS_0 in the numerator and denominator, we reach the decomposition in Equation (9).

$$\mathrm{MRS}_0 = \sum_{j=1}^{t} \frac{(1+r_u)^j}{(1+r_e)^j} \mathrm{pr}_{j|0}^{W} \cdot \frac{u'(c_t^{e_j})}{u'(c_t^{e_0})} + \frac{(1+r_u)^t}{(1+r_e)^t} \sum_{j=0}^{t} \mathrm{pr}_{j|0}^{\mathcal{U}} \cdot \frac{u'(c_t^{u_j})}{u'(c_t^{e_0})} + \frac{(1+r_u)^t}{(1+r_e)^t} \mathrm{pr}_{t|0}^{U} \cdot \frac{u'(c_t^u)}{u'(c_t^{e_0})}$$

A.2 Identification of Liquidity Cost

Theorem 1. *The following equation holds for every $\tau \geq t$ and $\tau, t \in \mathbb{N}$:*

$$\frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^\tau} \frac{\partial s_t}{\partial A_0} - \frac{1}{(1+r_u)^{\tau-t}} \frac{\partial s_t}{\partial w_t} \left(1 - \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^{W} (\frac{1+r_u}{1+r_e})^{j-t}\right)$$

$$\frac{\partial s_0}{\partial b_\tau} = \frac{1}{(1+r_u)^\tau} \frac{\partial s_0}{\partial A_0} - \frac{1}{(1+r_u)^\tau} (\frac{\partial s_0}{\partial A_0} - \frac{\partial s_0}{\partial b_0}) \left(1 - \sum_{j=1}^{\tau} \mathrm{pr}_{j|0}^{W} (\frac{1+r_u}{1+r_e})^j\right)$$

To prove Theorem 1, we prove the following two lemmas. Combining Lemmas 1 and 2, we derive Theorem 1.

Lemma 1.

$$\frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^{\tau-t}} \left(\frac{\partial s_t}{\partial A_t} - \frac{\partial s_t}{\partial w_t} \left(1 - \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^{W} (\frac{1+r_u}{1+r_e})^{j-t}\right)\right)$$

Proof. **Lemma 1** Using implicit differentiation in Equation (5),

$$\phi''(s_t) \cdot \frac{\partial s_t}{\partial b_\tau} = \frac{\partial V_t(A_t)}{\partial b_\tau} - (1-\lambda_t) \frac{\partial U_t(A_t)}{\partial b_\tau} - \lambda_t \frac{\partial \underline{\mathcal{U}}_t(A_t)}{\partial b_\tau} \tag{A.2}$$

Applying the envelope theorem,

$$\frac{\partial V_t(A_t)}{\partial b_\tau} = 0 \tag{A.3}$$

$$\frac{\partial \mathcal{U}_t(A_t)}{\partial b_\tau} = \beta^{\tau-t} u'(c_\tau^{u_t}) \tag{A.4}$$

$$\begin{aligned}
\frac{\partial U_t(A_t)}{\partial b_\tau} &= \beta \frac{\partial J_{t+1}}{\partial b_\tau} \\
&= \beta^{\tau-t} \sum_{j=t+1}^{\tau} (\lambda_j \prod_{i=t+1}^{j-1} (1-\lambda_i) \prod_{k=t+1}^{j} (1-s_k^*)) u'(c_\tau^{u_j}) + \beta^{\tau-t} \prod_{i=t+1}^{\tau} (1-\lambda_i) \prod_{k=t+1}^{\tau} (1-s_k^*) u'(c_\tau^u) \\
&= \beta^{\tau-t} \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^{\mathcal{U}_j} / (1-\lambda_t) u'(c_\tau^{u_j}) + \beta^{\tau-t} \mathrm{pr}_{\tau|t}^{U} / (1-\lambda_t) u'(c_\tau^u)
\end{aligned} \tag{A.5}$$

Plugging A.5, A.4, and A.3 into A.2, we find:

$$\phi''(s_t) \cdot \frac{\partial s_t}{\partial b_\tau} = -\beta^{\tau-t} \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^{\mathcal{U}_j} u'(c_\tau^{u_j}) - \beta^{\tau-t} \mathrm{pr}_{\tau|t}^{U} u'(c_\tau^u) - \lambda_t \beta^{\tau-t} u'(c_\tau^{u_t}) \tag{A.6}$$

Using the Euler equation we have:

$$\begin{aligned}
\beta^{\tau-t} \mathrm{pr}_{\tau|t}^{U} u'(c_\tau^u) = \frac{1}{(1+r_u)^{\tau-t}} ((1-\lambda_t) u'(c_t^u) &- \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^{W} (\beta(1+r_u))^{j-t} u'(c_\tau^{e_j}) \\
&- \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^{\mathcal{U}} (\beta(1+r_u))^{j-t} u'(c_j^{u_j}))
\end{aligned} \tag{A.7}$$

From Equation (3) we have:

$$\beta^{\tau-t} u'(c_\tau^{u_t}) = 1/(1+r_u)^{\tau-t} u'(c_t^{u_t}) \tag{A.8}$$

Plugging A.7 and A.8 into A.6:

$$\phi''(s_t) \cdot \frac{\partial s_t}{\partial b_\tau} = -\beta^{\tau-t} \mathrm{pr}_{\tau|t}^{U} u'(c_\tau^u) - \lambda_t \beta^{\tau-t} u'(c_\tau^{u_t}) \tag{A.9}$$

$$\phi''(s_t) \cdot \frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^{\tau-t}} \left(u'(c_t^e) - \lambda_t u'(c_t^{\underline{u}_t}) - (1-\lambda_t) u'(c_t^u) \right) - \frac{1}{(1+r_u)^{\tau-t}} (u'(c_t^e) - \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^W (\beta(1+r_u))^{j-t} u'(c_\tau^{e_j}) \tag{A.10}$$

Given the assumption that r_e is close to zero, consumption during employment will be the same regardless of the period in which the worker finds a job, $c_\tau^{e_j} = c_\tau^{e_t}$. Plugging the Euler Equation (6) into A.10:

$$\phi''(s_t) \cdot \frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^{\tau-t}} \left(u'(c_t^e) - \lambda_t u'(c_t^{\underline{u}_t}) - (1-\lambda_t) u'(c_t^u) \right) - \frac{1}{(1+r_u)^{\tau-t}} u'(c_t^e) \left(1 - \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^W (\frac{1+r_u}{1+r_e})^{j-t} \right) \tag{A.11}$$

From the definition of s_t, we have $\phi''(s_t) \frac{\partial s_t}{\partial A_t} = u'(c_t^e) - \lambda_t u'(c_t^{\underline{u}_t}) - (1-\lambda_t) u'(c_t^u)$ and $\phi''(s_t) \frac{\partial s_t}{\partial w_t} = u'(c_t^e)$. Plugging them into A.11, we can derive:

$$\frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^{\tau-t}} \left(\frac{\partial s_t}{\partial A_t} - \frac{\partial s_t}{\partial w_t} \left(1 - \sum_{j=t+1}^{\tau} \mathrm{pr}_{j|t}^W (\frac{1+r_u}{1+r_e})^{j-t} \right) \right) \tag{A.12}$$

□

Lemma 2.

$$\frac{\partial s_t}{\partial A_0} = (1+r_u)^t \frac{\partial s_t}{\partial A_t}$$

Proof. **Lemma 2.** Using implicit differentiation and the envelope theorem,

$$\phi''(s_t) \frac{\partial s_t}{\partial A_0} = \frac{\partial V_t(A_t)}{\partial A_0} - (1-\lambda_t) \frac{\partial U_t(A_t)}{\partial A_0} - \lambda_t \frac{\partial \underline{U}_t(A_t)}{\partial A_0} \tag{A.13}$$

$$\frac{\partial V_t(A_t)}{\partial A_0} = (1+r_u)^t u'(c_t^{e_t}) \tag{A.14}$$

$$\frac{\partial U_t(A_t)}{\partial A_0} = (1+r_u)^t u'(c_t^{u_t}) \tag{A.15}$$

$$\frac{\partial \underline{U}_t(A_t)}{\partial A_0} = (1+r_u)^t u'(c_t^{\underline{u}_t}) \tag{A.16}$$

Plugging A.14, A.15, and A.16 into A.13

$$\frac{\partial s_t}{\partial A_0} = (1 + r_u)^t \frac{\partial s_t}{\partial A_t} \tag{A.17}$$

□

Theorem 2. *The following equation holds for every $\tau \geq t$ and $\tau, t \in \mathbb{N}$:*

$$\frac{\partial s_t}{\partial A_\tau} = \frac{1}{(1+r_u)^{\tau-t}} \frac{\partial s_t}{\partial A_t} + \frac{1}{(1+r_e)^{\tau-t}} \frac{\partial s_t}{\partial w_t} [(1 - (\frac{1+r_e}{1+r_u})^{\tau-t}) - \sum_{j=t+1}^{\tau} \text{pr}^W_{j|t} (1 - (\frac{1+r_e}{1+r_u})^{\tau-j})]$$

Proof. To prove Theorem 2, we combine Theorem 1 and the following Lemma 3. □

Lemma 3.

$$\frac{\partial s_t}{\partial w_\tau} = \frac{1}{(1+r_e)^{\tau-t}} \frac{\partial s_t}{\partial w_t} (1 - \sum_{j=t+1}^{\tau} \text{pr}^W_{j|t})$$

Proof. **Lemma** 3

$$\phi''(s_t) \frac{\partial s_t}{\partial w_\tau} = \frac{\partial V_t(A_t)}{\partial w_\tau} - (1 - \lambda_t) \frac{\partial U_t(A_t)}{\partial w_\tau} - \lambda_t \frac{\partial \underline{\mathcal{U}}_t(A_t)}{\partial w_\tau} \tag{A.18}$$

$$\frac{\partial V_t(A_t)}{\partial w_\tau} = \beta^{\tau-t} u'(c^e_\tau) = \frac{1}{(1+r_e)^{\tau-t}} u'(c^e_\tau) = \frac{1}{(1+r_e)^{\tau-t}} \frac{\partial s_t}{\partial w_t} \tag{A.19}$$

$$\frac{\partial U_t(A_t)}{\partial w_\tau} = \sum_{j=t+1}^{\tau} \text{pr}^W_{j|t} \beta^{\tau-t} u'(c^e_\tau) = \frac{1}{(1+r_e)^{\tau-t}} \frac{\partial s_t}{\partial w_t} \sum_{j=t+1}^{\tau} \text{pr}^W_{j|t} \tag{A.20}$$

Plugging A.19 and A.20 into A.18, we reach Lemma 3. □

B Data Description and Data-Cleaning Process

We take advantage of the *Muestra Continua de Vidas Laborales* (MCVL) for the years 2006 to 2017. Each year, the MCVL randomly selects 4 percent of the individuals with a relationship with the Social Security Administration during the year (i.e., employed and unemployed workers, retired individuals, and recipients of other subsidies).

If an individual is selected for a given MCVL year, both her daily lifetime record of Social Security affiliations (i.e., work spells, unemployment spells, self-employment, retirement spell, and other subsidy spells up to the sample year) and her lifetime record of monthly wages per employer are provided. Observed wages are capped at a maximum, which varies by year. This is not a problem in our setting, since for workers entering unemployment, less than 1 percent of observations show a previous wage at the maximum cap. The combination of daily labor histories and monthly compensation allows us to create precise measures of tenure and daily compensation by job, even if the individuals change jobs (and contracts) within the same firm. During the unemployment spells, we do not observe the actual unemployment insurance payments, but the associated previous wage from which the Social Security Administration calculates the benefit level. Since we know the exact mapping from previous wages to UI benefit levels, we can perfectly calculate unemployment insurance benefit levels from the MCVL data. The MCVL also provides demographic information, both at the individual and the household level. We observe workers' age, household composition, location, migration status, and their highest achieved educational level.

In addition to the Social Security data, for a large part of our sample, we observe individuals' tax records for the specific year in which they are included in the sample. The fiscal section contains only information on labor income, but at a great level of detail. This allows us to exactly measure severance payments, since these are classified in a specific category. Unfortunately, we cannot observe the severance payment of temporary workers who exhaust their contracts.[57] However, we know the rule it follows, and we have all the information needed to determine their severance payment amount, which allows us to calculate severance payments for all temporary workers for whom we do not observe specific severance payments in the tax records.

Using the historical records of the MCVL we build a sample of displacements (i.e., unemployment insurance claims preceded by a working spell) for the years 1994 to 2016. We impose several restrictions when constructing our sample. First, we eliminate individuals

[57] For tax purposes, "end of contract" payments are considered taxable income and reported in a different category, combined with multiple other income sources.

who have been self-employed at some point in the 6 years prior to unemployment, or who exit unemployment into self-employment. Furthermore, we discard any individual who presents negative wages.[58] We also discard those who simultaneously work and collect unemployment benefits, something that was possible at certain points due to very specific programs implemented by Social Security. To deal with the right of choice in the Spanish system, we focus the analysis only on the first unemployment spell for each UI claim. This last restriction decreases the number of entries into unemployment we use by over 40 percent.

We discard spells whose unemployment insurance records are not consistent with their "calculated" previous tenure. Specifically, we discard any unemployment spell where: a) the worker collects unemployment insurance for a period of time longer than what we would expect based on the policy schedule and her "calculated" working experience in the previous 6 years, and the amount of time the worker collects UI benefits corresponds to the maximum potential duration of UI of a different tenure group; and the worker does not start a job right after she stops collecting UI (but eventually starts a new job); and b) the worker collects unemployment insurance for a period of time shorter than what we would expect based on the policy schedule and her "calculated" working experience in the previous 6 years; and the amount of time the worker collects UI benefits corresponds to the maximum potential duration of UI of a different tenure group; and the worker does not start a job right after she stops collecting UI (but eventually starts a new job). We find that approximately 3 percent of the UI claims left in our sample fall under the category a), while another 4 percent correspond to b).

We exclude all unemployment spells whose tenure in the previous 6 years is less than 450 days or more than 1970 days and do not take advantage of two of the policy discontinuities (359-360 days and 2159-2160 days). We avoid using these discontinuities because of the evidence of manipulation we observe around them. For the former, there's a clear manipulation of workers to its right (where workers are entitled to 4 months of potential duration of UI instead of no UI). Moreover, during our sample period, there were several changes to the rules governing the subsidies for those without enough tenure to qualify for unemployment benefits, which would complicate the analysis even further. In the case of the latter, the policy schedule dictates that only tenure in the previous 6 years should be considered. This creates a mechanical bunching of workers to the right of the discontinuity. Extending the window where we count the previous tenure to seven or eight years would

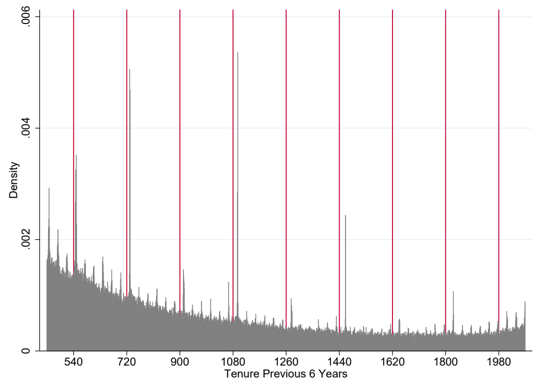
[58]While no individual receives negative wages, corrections to the Social Security records show up as negative wages in some instances. Moreover, manual entry of data can result in typos showing negative wages.

solve the mechanical bunching, but at the cost of misclassification of workers across the discontinuities. After we remove these spells, the number of observations decreases by over 40 percent.

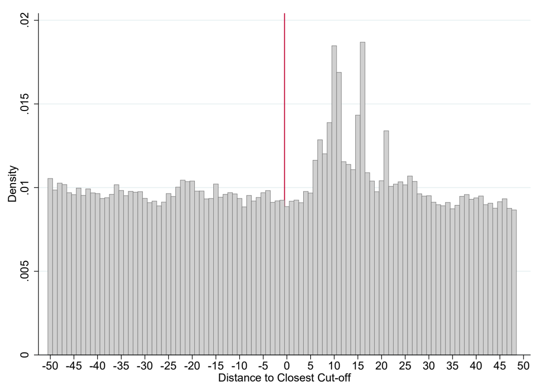
To reach our final sample, we make one additional sample restriction. We remove workers entering unemployment after exhausting the predetermined length of certain temporary contracts. We impose this restriction for two reasons. First, these workers are aware of the expiration date of their contracts and are more likely to start searching for new jobs before their previous employment spell finishes. Second, workers exhausting temporary contracts have a much higher probability of exactly having 6, 12, 18, 24, or 36 months of previous tenure. While this is not a problem in itself, combined with the UI schedule in Spain, this results in these workers usually being located just to the right of our discontinuities of interest and receiving an additional two months of potential duration of UI.[59] As shown in Figure B.1 keeping these workers in our sample would create manipulation in the running variable. Removing these workers results in a much smoother distribution of the running variable, as shown in Figure B.2.

[59]For instance, a worker exhausting a 2-year contract would have 730 days of previous tenure. Since the cutoff between 8 and 10 months of UI is located at 720 days of previous tenure, this results in bunching 10 days to the right of the discontinuity (as shown in Figure B.1(a)).

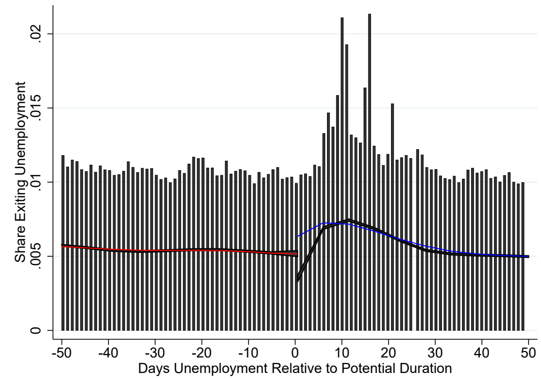
Figure B.1: Distribution of Previous Tenure: Original Sample



(a) Previous Tenure



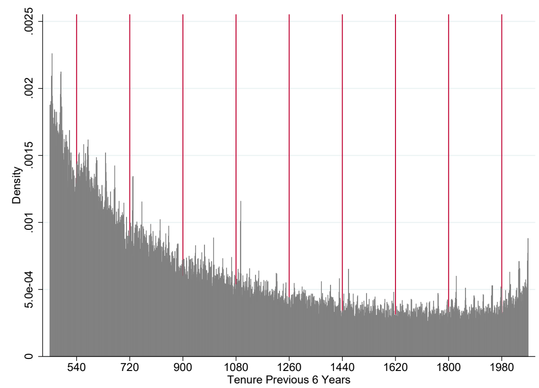
(b) Previous Tenure (Relative to Discontinuities)



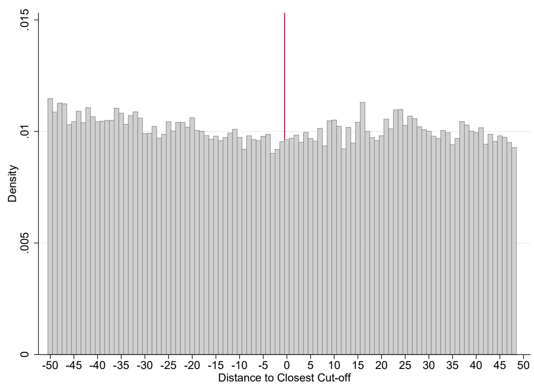
(c) Manipulation Test Previous Tenure

Note: These figures plot the distribution of the tenure in the previous 6 years (the running variable) for our original sample, prior to the removal of unemployment spells of temporary workers with previous contracts of certain length. Panel (a) presents it separately for each discontinuity, with red lines marking the location of each of the cutoff thresholds. Panel (b) presents the distribution when we pool all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker. Panel (c) presents the distribution when we pool all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker, and adds the point estimates and confidence intervals of the manipulation test as in Cattaneo et al. (2018). Both the conventional and the bias-corrected robust estimate reject no manipulation.

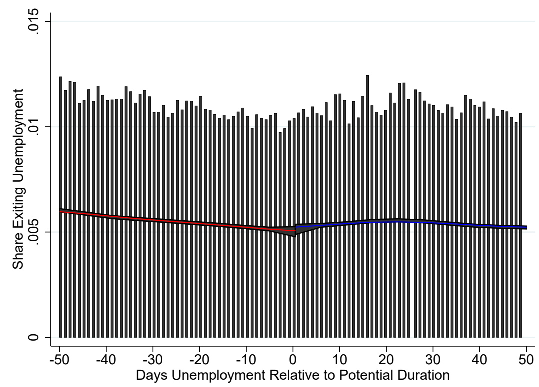
Figure B.2: Distribution of Previous Tenure: Final Sample
Removes Temporary Contracts with Predetermined Length from Original Sample



(a) Previous Tenure



(b) Previous Tenure (Relative to Discontinuities)



(c) Manipulation Test Previous Tenure

Note: These figures plot the distribution of the tenure in the previous 6 years (the running variable) for our final sample, after all sample restrictions have been applied. Panel (a) presents it separately for each discontinuity, with red lines marking the location of each of the cutoff thresholds. Panel (b) presents the distribution when we pool all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker. Panel (c) presents the distribution when we pool all cutoff thresholds together, re-centering the running variable relative to the closest cutoff threshold of the worker, and adds the point estimates and confidence intervals of the manipulation test as in Cattaneo et al. (2018). Both the conventional and the bias-corrected robust estimate do not reject no manipulation.

C Matching Moments

C.1 Algorithm to Estimate r_u

Proposition 1 states that we can use the equation below to estimate r_u.

$$\frac{\partial s_t}{\partial b_\tau} = \frac{1}{(1+r_u)^\tau}\frac{\partial s_t}{\partial A_0} - \frac{\partial s_t}{\partial w_t}(1 - \sum_{j=t+1}^{\tau} \text{pr}^W_{j|t})\frac{(1+r_e)^{(t-j)}}{(1+r_u)^{(\tau-j)}}$$

The key is to find exactly two of $\frac{\partial s_t}{\partial b_\tau}$ at different times and an unconditional shock $\frac{\partial s_t}{\partial A_0}$. Our job here is to first find the corresponding estimates of the labor supply responses and match them with the above equation.

Let $RD_{s_t,d-d+2}$ be the estimated change in the probability of remaining unemployed before period t, with respect to a change in potential duration from d months to $d+2$ months. Let IV_{s_t} denote the estimated change in the probability of remaining unemployed at t, with respect to a change in the severance payment. The following expressions show the mapping between $RD_{s_t,d-d+2}$ and IV_{s_t} and the ideal inputs required in the above equation.

$$IV_{s_t} \Longleftrightarrow \frac{\partial s_t}{\partial A_0}$$

$$1/b^* RD_{s_t,d-d+2} \Longleftrightarrow \frac{\partial s_t}{\partial b_\tau}|\tau = d$$

The first correspondence is easy to establish, since the effect of severance pay is exactly the income transfer unconditionally at period 0. The idea of the second correspondence comes from Landais (2015): changing the potential duration is equivalent to a reduction in benefits in the last period. Enlightened by this, we develop the following GMM estimation process to back out the unemployment interest rate.

1. Construct the following matrix function $\mathbf{M}(r_u, \mathbf{v}) = (\mathbf{m}(r_u, \mathbf{v}))_{(T_0+1)\times(T_0+2)}$:

$$\begin{pmatrix} \mathbf{m}_{0,0}(r_u,\mathbf{v}) & \mathbf{m}_{0,1}(r_u,\mathbf{v}) & 0 & 0 & \cdots & 0 \\ \mathbf{m}_{1,0}(r_u,\mathbf{v}) & \mathbf{m}_{1,1}(r_u,\mathbf{v}) & \mathbf{m}_{1,2}(r_u,\mathbf{v}) & 0 & \cdots & 0 \\ \mathbf{m}_{2,0}(r_u,\mathbf{v}) & \mathbf{m}_{2,1}(r_u,\mathbf{v}) & \mathbf{m}_{2,2}(r_u,\mathbf{v}) & \mathbf{m}_{2,3}(r_u,\mathbf{v}) & \cdots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ \mathbf{m}_{T_0,0}(r_u,\mathbf{v}) & \mathbf{m}_{T_0,1}(r_u,\mathbf{v}) & \mathbf{m}_{T_0,2}(r_u,\mathbf{v}) & \cdots & \mathbf{m}_{T_0,T_0}(r_u,\mathbf{v}) & \mathbf{m}_{T_0,T_0+1}(r_u,\mathbf{v}) \end{pmatrix}$$

where

$$\mathbf{m}_{i,j}(r_u, \mathbf{v}) = 1/b^* \cdot RD_{s_j,(2i+2)-(2i+4)} - [1/(1+r_u)^{i+1} \cdot IV_{s_t} - \mathbf{v}_j (1 - \sum_{k=j+1}^{i+1} \mathrm{pr}^W_{k|j}) \cdot \frac{(1+r_e)^{j+1-t}}{(1+r_u)^{i+1-t}}]$$

2. Seek to solve the following minimization problem:

$$\min_{(r_u,\mathbf{v})} \|\mathbf{M}(r_u, \mathbf{v}))\|^2$$

With T_0 unknowns and $1/2(T_0+3)T_0$ equations, we can solve this problem and get $(r_u, (MH_t)) = \arg\min_{(r_u,v)} \|\mathbf{M}(r_u, \mathbf{v}))\|^2$, where MH_t is our estimate of the moral hazard distortion in period t.

C.2 Moments r_u and Moral Hazard

Table C.1: Moments. Effect of Conditional Income Transfers. $RD_{s_t,d-d+2}$

d/t	s0	s1	s2	s3	s4	s5	s6	s7	s8	s9
4-6	0.011**	-0.003								
	[0.005]	[0.006]								
6-8	-0.043***	-0.040***	-0.044***							
	[0.005]	[0.006]	[0.007]							
8-10	-0.020***	-0.022***	-0.019**	-0.025***						
	[0.006]	[0.007]	[0.008]	[0.008]						
10-12	-0.019***	-0.036***	-0.017**	-0.019**	-0.019***					
	[0.006]	[0.007]	[0.008]	[0.008]	[0.006]					
12-14	-0.019***	-0.021***	-0.022**	-0.013	-0.019***	-0.010				
	[0.007]	[0.008]	[0.009]	[0.009]	[0.007]	[0.009]				
14-16	-0.018**	-0.030***	-0.018**	-0.011	-0.018**	-0.004	-0.027***			
	[0.008]	[0.009]	[0.009]	[0.010]	[0.008]	[0.010]	[0.010]			
16-18	-0.015*	-0.013	-0.004	-0.012	-0.015*	-0.012	-0.017*	-0.034***		
	[0.008]	[0.009]	[0.009]	[0.010]	[0.008]	[0.010]	[0.010]	[0.010]		
18-20	-0.026***	-0.006	-0.006	0.003	-0.026***	-0.017*	-0.005	-0.018*	-0.025***	
	[0.008]	[0.009]	[0.009]	[0.010]	[0.008]	[0.010]	[0.010]	[0.010]	[0.010]	
20-22	-0.015**	-0.008	-0.015*	-0.005	-0.015**	-0.010	-0.014	-0.021**	-0.015*	-0.002
	[0.007]	[0.008]	[0.009]	[0.009]	[0.007]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]

Note: This table presents the RD moments used to estimate r_u and the moral hazard components for our entire sample. Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table C.2: Moments. Effect of Unconditional Income Transfers. $IV_{s_t,d}$

d/t	s0	s1	s2	s3	s4	s5	s6	s7	s8	s9
4-6	-0.021*	-0.022								
	[0.013]	[0.015]								
6-8	-0.032**	-0.004	0.008							
	[0.013]	[0.015]	[0.016]							
8-10	-0.037***	-0.008	0.020	-0.020						
	[0.013]	[0.015]	[0.017]	[0.017]						
10-12	-0.040***	-0.011	0.014	-0.033*	0.019					
	[0.013]	[0.015]	[0.017]	[0.017]	[0.018]					
12-14	-0.038***	-0.016	0.004	-0.022	0.025	-0.007				
	[0.013]	[0.015]	[0.016]	[0.017]	[0.018]	[0.019]				
14-16	-0.052***	-0.019	-0.006	-0.031*	0.013	-0.014	-0.023			
	[0.013]	[0.015]	[0.016]	[0.016]	[0.017]	[0.018]	[0.018]			
16-18	-0.044***	-0.016	-0.005	-0.009	0.015	0.012	-0.027	0.013		
	[0.012]	[0.014]	[0.015]	[0.016]	[0.017]	[0.017]	[0.016]	[0.017]		
18-20	-0.052***	-0.028**	-0.003	-0.034**	0.008	0.004	-0.021	0.008	-0.003	
	[0.012]	[0.014]	[0.015]	[0.016]	[0.016]	[0.017]	[0.016]	[0.017]	[0.018]	
20-22	-0.064***	-0.031**	-0.003	-0.029*	0.004	0.002	-0.020	0.013	-0.016	-0.031**
	[0.012]	[0.014]	[0.015]	[0.015]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.014]

Note: This table presents the IV moments used to estimate r_u and the moral hazard components for our entire sample. Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

C.3 Algorithm to Estimate $\frac{u'(\underline{b})}{u'(w)}$

Equation 19 provides the basis to estimate the insurance value of UI if we know MRS_t, r_u, the moral hazard components ($\partial s_t/\partial w_t$), and T.

$$\text{MRS}_t = \sum_{j=t+1}^{T}(1+r_u)^{j-t}\text{pr}^W_{j|t} + (1+r_u)^{T-t}\left(1-\sum_{j=1}^{T}\text{pr}^W_{j|t}\right)\frac{u'(\underline{b})}{u'(w)}$$

As in the previous section, let $RD_{s_t,d-d+2}$ be the estimated change in the probability of remaining unemployed before period t, with respect to a change in potential duration from d months to $d+2$ months. Let IV_{s_t} denote the estimated change in the probability of remaining unemployed at t, with respect to a change in the severance payment. Let MH_t be our estimate of the moral hazard distortion in period t, and let $\hat{r_u}$ be our estimate of the interest rate during unemployment. Finally, let T be our estimate of the last period where workers can exit to an absorbing state (employment or out of the labor force).

The following expressions show the mapping between $RD_{s_t,d-d+2}$ and IV_{s_t} and the ideal inputs required in the above equation.

$$IV_{s_t} \Longleftrightarrow \frac{\partial s_t}{\partial A_0}$$

$$1/b^* RD_{s_t,d-d+2} \Longleftrightarrow \frac{\partial s_t}{\partial b_\tau}|\tau = d$$

$$MH_t \Longleftrightarrow \frac{\partial s_t}{\partial w_t}$$

We develop the following GMM estimation process to back out the insurance value of UI.

1. Construct the following matrix function $\mathbf{M'}(v) = (\mathbf{m'}(v))_{T_0\times T_0+1}$:

$$\begin{pmatrix}
\mathbf{m'}_{0,0}(v) & \mathbf{m'}_{0,1}(v) & \mathbf{m'}_{0,2}(v) & \mathbf{m'}_{0,3}(v) & \cdots & \mathbf{m'}_{0,T_0+1}(iv) \\
\mathbf{m'}_{1,0}(v) & \mathbf{m'}_{1,1}(v) & \mathbf{m'}_{1,2}(v) & \mathbf{m'}_{1,3}(v) & \cdots & \mathbf{m'}_{1,T_0+1}(iv) \\
\mathbf{m'}_{2,0}(v) & \mathbf{m'}_{2,1}(v) & \mathbf{m'}_{2,2}(v) & \mathbf{m'}_{2,3}(v) & \cdots & \mathbf{m'}_{2,T_0+1}(v) \\
\vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\
\mathbf{m'}_{T_0,0}(v) & \mathbf{m'}_{T_0-1,1}(v) & \mathbf{m'}_{T_0,2}(v) & \cdots & \mathbf{m'}_{T_0,T_0+1}(v) & \mathbf{m'}_{T_0,T_0+1}(v)
\end{pmatrix}$$

where

$$\mathbf{m'}_{i,j}(v) = \frac{IV_{s_t}|i}{MH_j} + \sum_{l=j+1}^{T} (\frac{1+\hat{r_u}}{1+r_e})^{l-j} \text{pr}^W_{l|j}|_i + (\frac{1+\hat{r_u}}{1+r_e})^{T-j} \left(1 - \sum_{l=j+1}^{T} \text{pr}^W_{l|j}|_i\right) v$$

2. Seek to solve the following minimization problem:

$$\min_v \left\|\mathbf{M'}(v))\right\|^2$$

With one unknown and $(T_0+1)T_0$ equations, we can solve this problem and $\frac{\hat{u'(b)}}{u'(w)} = \arg\min_v \left\|\mathbf{M'}(v))\right\|^2$

C.4 Moments Insurance Value

Table C.3: Moments. Effect of Unconditional Income Transfers. $IV_{s_t,d}$

d/t	s0	s1	s2	s3	s4	s5	s6	s7	s8	s9
4-6	-0.021*	-0.022	-0.005	-0.058***	-0.009	-0.005	-0.027	0.027	-0.007	-0.029*
	[0.013]	[0.015]	[0.016]	[0.017]	[0.017]	[0.018]	[0.018]	[0.018]	[0.018]	[0.016]
6-8	-0.032**	-0.004	0.008	-0.028	-0.004	0.005	-0.028	0.014	-0.007	-0.034**
	[0.013]	[0.015]	[0.016]	[0.017]	[0.018]	[0.019]	[0.019]	[0.019]	[0.020]	[0.017]
8-10	-0.037***	-0.008	0.020	-0.020	-0.005	-0.011	-0.006	0.013	-0.027	-0.015
	[0.013]	[0.015]	[0.017]	[0.017]	[0.018]	[0.018]	[0.019]	[0.018]	[0.018]	[0.017]
10-12	-0.040***	-0.011	0.014	-0.033*	0.019	-0.006	-0.041**	0.017	-0.011	-0.034*
	[0.013]	[0.015]	[0.017]	[0.017]	[0.018]	[0.019]	[0.019]	[0.019]	[0.020]	[0.017]
12-14	-0.038***	-0.016	0.004	-0.022	0.025	-0.007	-0.005	-0.001	-0.025	-0.030*
	[0.013]	[0.015]	[0.016]	[0.017]	[0.018]	[0.019]	[0.019]	[0.019]	[0.019]	[0.017]
14-16	-0.052***	-0.019	-0.006	-0.031*	0.013	-0.014	-0.023	0.014	-0.017	-0.028*
	[0.013]	[0.015]	[0.016]	[0.016]	[0.017]	[0.018]	[0.018]	[0.018]	[0.019]	[0.017]
16-18	-0.044***	-0.016	-0.005	-0.009	0.015	0.012	-0.027	0.013	-0.017	-0.049***
	[0.012]	[0.014]	[0.015]	[0.016]	[0.017]	[0.017]	[0.016]	[0.017]	[0.017]	[0.015]
18-20	-0.052***	-0.028**	-0.003	-0.034**	0.008	0.004	-0.021	0.008	-0.003	-0.035**
	[0.012]	[0.014]	[0.015]	[0.016]	[0.016]	[0.017]	[0.016]	[0.017]	[0.018]	[0.016]
20-22	-0.064***	-0.031**	-0.003	-0.029*	0.004	0.002	-0.020	0.013	-0.016	-0.031**
	[0.012]	[0.014]	[0.015]	[0.015]	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.014]

Note: This table presents the IV moments used to estimate the insurance value of UI for our entire sample. Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

D Welfare Analysis

D.1 Theoretical Implications for Welfare

Implication 1. *If $\phi''(s)$ is large enough and $\phi'''(s) \geq 0$, then $b^{*1} > b^{*2}$*

Proof. To see how b_0^{*2} changes relative to b_0^{*1}, let's define the following function $\frac{dW_2}{db_0} / \frac{dW_2}{dA_0}(b)$

$$\frac{dW_2}{db_0} / \frac{dW_2}{dA_0}(b) \equiv \frac{1 - s_0^{'}(b, r_e)}{s_0^{'}(b, r_e)} \left[\text{MRS}_0(r = r_e, s_0^{'}(b, r_e)) - 1 - \frac{\epsilon_{1 - s_0^{'}(b, r_e), b}}{s_0^{'}} \right]$$

Since W_2 is typically assumed to be a concave function of b, reaching $b_0^{*2} < b_0^{*1}$ is equivalent to proving $\frac{dW_2}{db_0} / \frac{dW_2}{dA_0}(b_0^{*1}) < 0$:

$$\text{MRS}_0(r = r_e, s_0(b_0^{*1}, r_e)) - 1 - \frac{\epsilon_{1 - s_0(b_0^{*1}, r_e), b}}{s_0(b_0^{*1}, r_e)} < 0 \tag{A.21}$$

Substituting in Equation A.22 using the definition of $\epsilon_{1-s,b} = \frac{1}{1-s} b \frac{u'(w)}{\phi''(s)}$:

$$\text{MRS}_0(b^{*1}, r_e) \cdot (1 - \frac{1}{s_0(b_0^{*1}, r_e)(1 - s_0(b_0^{*1}, r_e))} b_0^{*1} \frac{u'(w)}{\phi''(s_0(b_0^{*1}, r_e))}) - 1 < 0 \tag{A.22}$$

By the definition of b^{*1}, the following equation holds:

$$\text{MRS}_0(b^{*1}, r_u) \cdot (1 - \frac{1}{s_0(b_0^{*1}, r_u)(1 - s_0(b_0^{*1}, r_u))} b_0^{*1} \frac{u'(w)}{\phi''(s_0(b_0^{*1}, r_u))}) - 1 = 0 \tag{A.23}$$

$s_0(b_0^{*1}, r_u) > s_0(b_0^{*1}, r_e)$ since removing the liquidity cost during unemployment reduces the search intensity. With this information and A.23, proving equation A.22 is equivalent to showing that:

$$\frac{\partial \left[\text{MRS}_0(r, s_0(b_0^{*1}, r)) \cdot (1 - \frac{1}{s_0(b_0^{*1}, r)(1 - s_0(b_0^{*1}, r))} b_0^{*1} \frac{u'(w)}{\phi''(s_0(b_0^{*1}, r))}) \right]}{\partial r} > 0 \tag{A.24}$$

It is usually the case that $s(1-s)$ is increasing in s since $s < 0.5$. When $\phi''(s)$ is large enough, and the search elasticity to changes in r_u is limited, we can have that MRS_0 is increasing in r. Therefore, whether equation A.24 holds depends on the search cost curvature $\phi''(s)$. If $\phi''(s)$ is increasing in s, equation A.24 holds. However, if we don't have such a condition, whether equation A.24 holds is ambiguous.

□

D.2 Welfare Analysis in Practice: Extension of the Potential Duration of UI

The social planner chooses the optimal potential duration of UI B, taking the benefit level as given:

$$W \equiv \max_B J_0 = \max_B s_0 \cdot V_0(A_0 - \tau) + (1 - s_0)((1 - \lambda_0) \cdot U_0(A_0) + \lambda_0 \underline{\mathcal{U}}_0(A_0)) - \phi(s_0)$$

$$\text{subject to: } D_B \cdot b = (T - D)\tau$$

where D_B denotes the expected duration of claiming UI, T denotes the potential lifetime taxed employment, and D denotes the expected duration in unemployment. Using the envelope theorem,

$$\frac{dW}{dB} = (1-s_0)(1-\lambda_0)\frac{\partial U_0}{\partial B} + (1-s_0)\lambda_0 \frac{\partial \underline{\mathcal{U}}_0}{\partial B} + s_0 \frac{\partial V_0}{\partial B} - ((1-s_0)(1-\lambda_0)\frac{\partial U_0}{\partial w} + (1-s_0)\lambda_0 \frac{\partial \underline{\mathcal{U}}_0}{\partial B} + s_0 \frac{\partial V_0}{\partial w})\frac{d\tau}{dB}$$

Since $\frac{\partial V_0}{\partial B} = 0$ and $\frac{\partial \underline{\mathcal{U}}_0}{\partial w} = 0$,

$$\frac{dW}{dB} = (1 - s_0)(1 - \lambda_0)\frac{\partial U_0}{\partial B} + (1 - s_0)\lambda_0 \frac{\partial \underline{\mathcal{U}}_0}{\partial B} - ((1 - s_0)(1 - \lambda_0)\frac{\partial U_0}{\partial w} + s_0 \frac{\partial V_0}{\partial w})\frac{d\tau}{dB}$$

$$\frac{dW}{dB} = (1 - s_0)(1 - \lambda_0)\frac{\partial U_0}{\partial B} + (1 - s_0)\lambda_0 \frac{\partial \underline{\mathcal{U}}_0}{\partial B} - (T - D)v'(c_B^e)\frac{d\tau}{dB} \tag{A.25}$$

Moreover, by implicit differentiation, we have:

$$\frac{\partial s_0^*}{\partial B} = -1/\phi''(s_0^*)((1 - \lambda_t)\frac{\partial U_0}{\partial B} + \lambda_t \frac{\partial \underline{\mathcal{U}}_0}{\partial B}) \tag{A.26}$$

$$\frac{\partial s_0}{\partial w_B} = -1/\phi''(s_0)((1 - \lambda_t)\frac{\partial U_0}{\partial w_B} + \lambda_t \frac{\partial \underline{\mathcal{U}}_0}{\partial w_B}) = -1/\phi''(s_0)(1 - \text{pr}_{B|0}^W)u'(c_B^e) \tag{A.27}$$

Decomposing the labor supply response to a conditional transfer into the moral hazard and cash-on-hand effects:

$$\frac{\partial s_0}{\partial B}1/b + \frac{\partial s_0}{\partial w_B} = \frac{\partial s_0}{\partial A_B} \tag{A.28}$$

Using the definition of $\tau \equiv \frac{D_B b}{T-D}$, we have:

$$\frac{d\tau}{dB} = \frac{b}{T-D}\frac{\partial D_B}{\partial B} + \frac{D_B b}{(T-D)^2}\frac{\partial D}{\partial B}$$

$$\frac{d\tau}{dB} = \frac{b}{T-D}\frac{\partial D_B}{\partial B} + \frac{\tau}{T-D}\frac{\partial D}{\partial B} \tag{A.29}$$

Therefore, plugging A.29 into A.25, we have:

$$\frac{dW}{dB}/(b(1-\text{pr}^W_{B|0})v'(c^e_B)) = \frac{(1-s_0)[(1-\lambda_0)\frac{\partial U_0}{\partial B} + \lambda_0\frac{\partial \mathcal{U}_0}{\partial B}]}{bS^*(B|0)v'(c^e_B)} - 1/(1-\text{pr}^W_{B|0})(\frac{\partial D_B}{\partial B} + \frac{\tau}{b}\frac{dD}{dB})$$

Combining the above equation with A.26 and A.27:

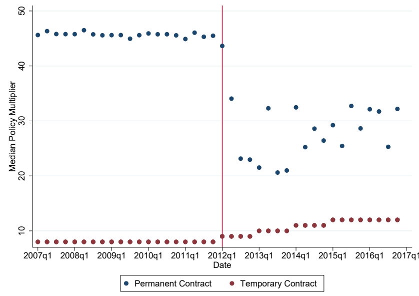
$$\frac{dW}{dB}/(b(1-\text{pr}^W_{B|0})v'(c^e_B)) = \frac{\partial s_0}{\partial B}/(b\frac{\partial s_0}{\partial w_B}) - 1/(1-\text{pr}^W_{B|0})(\frac{\partial D_B}{\partial B} + \frac{\tau}{b}\frac{dD}{dB})$$

Combining the previous expression with A.28, we finally have:

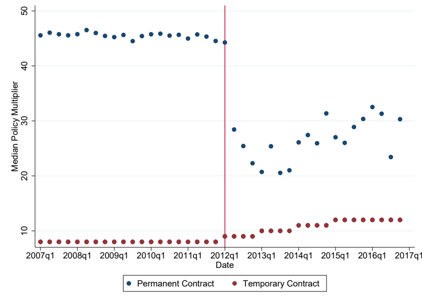
$$\frac{dW}{dB}/(b(1-\text{pr}^W_{B|0})v'(c^e_B)) = \frac{\partial s_0}{\partial B}/(b\frac{\partial s_0}{\partial A_B} - \frac{\partial s_0}{\partial B}) - 1/(1-\text{pr}^W_{B|0})(\frac{\partial D_B}{\partial B} + \frac{\tau}{b}\frac{dD}{dB})$$

Additional Figures

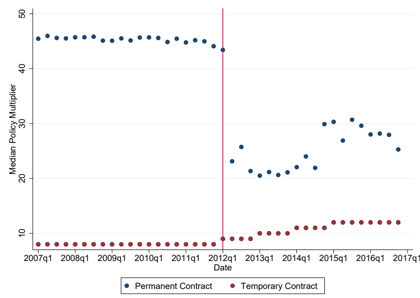
Figure E.1: Policy Multiplier over Time by Potential Duration of UI



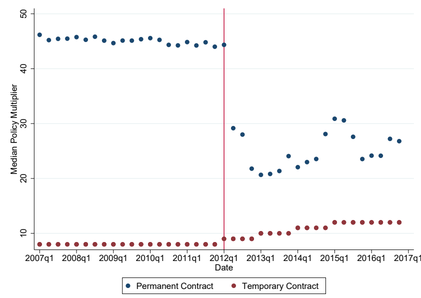
(a) Potential Duration = 720 days



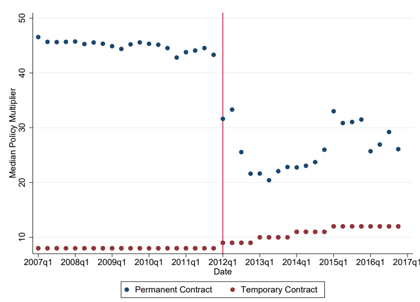
(b) Potential Duration = 900 days



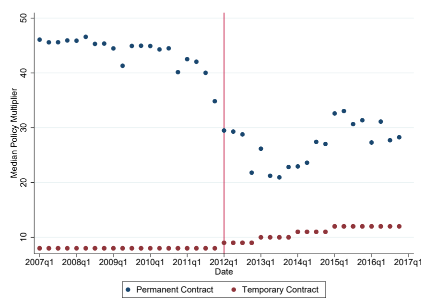
(c) Potential Duration = 1080 days



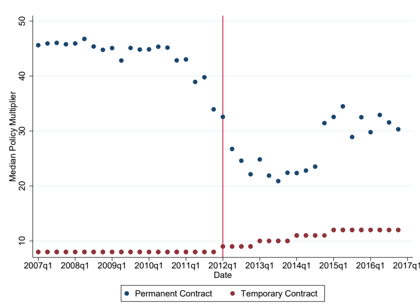
(d) Potential Duration = 1260 days



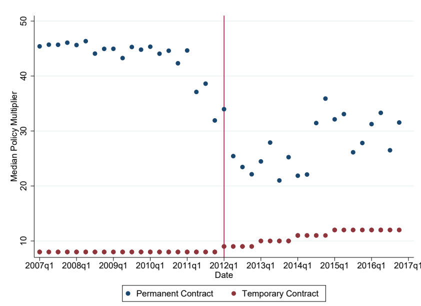
(e) Potential Duration = 1440 days



(f) Potential Duration = 1620 days



(g) Potential Duration = 1800 days



(h) Potential Duration = 1980 days

Note: This figure shows how the evolution over time of the severance payment's policy multiplier, from 2007 to 2017, separately for workers entering unemployment from permanent and temporary contracts. Each panel shows the median policy multiplier for a different potential duration group.

Additional Tables

Table E.1: Effect of a 2-Month Extension of the Potential Duration of UI. By Discontinuity

Panel A: Unemployment Duration									
Potential Duration	180	240	300	360	420	480	540	600	660
RD Estimate	29.06***	38.27***	32.25***	19.13	44.57***	54.91***	58.68***	25.49	32.11*
	[6.95]	[8.87]	[10.89]	[12.98]	[15.47]	[18.09]	[19.62]	[20.62]	[19.03]
Controls	All	All	All	All	All	All	All	All	All
Method	P	P	P	P	P	P	P	P	P
Bandwidth	90	90	90	90	90	90	90	90	90
N	51047	33481	24225	19119	14965	12702	11102	11044	13203
Panel B: Time Collecting UI									
RD Estimate	21.06***	23.21***	20.77***	22.16***	28.16***	25.84***	28.41***	17.81**	12.25*
	[1.02]	[1.71]	[2.54]	[3.39]	[4.56]	[5.64]	[6.80]	[7.42]	[7.47]
Controls	All	All	All	All	All	All	All	All	All
Method	P	P	P	P	P	P	P	P	P
Bandwidth	90	90	90	90	90	90	90	90	90
N	53891	35630	26027	20807	16556	14199	12582	12768	15568

Note: Table E.1 presents the estimation of the causal effect of a 2-month extension of the potential duration of UI on the duration of unemployment (Panel (a)) and on the time collecting UI (Panel (b)), separate for each of the discontinuities. Controls "All": All controls included (see text). Method "P": Parametric estimation, linear regression. Bandwidth: Indicates the length of the bandwidth. Standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table E.2: Balance Test. By Discontinuity

Potential Duration	180	240	300	360	420	480	540	600	660
Panel A: Age									
RD Estimate	0.477**	0.209	0.121	0.612	0.041	0.236	-0.654*	0.048	-0.377
	[0.224]	[0.210]	[0.248]	[0.443]	[0.310]	[0.332]	[0.356]	[0.355]	[0.339]
N	59615	39119	28630	22587	17924	15350	13569	13735	16466
Panel B: Male									
RD Estimate	0.008	-0.012	-0.009	0.004	0.025*	-0.020	-0.028	-0.029*	-0.014
	[0.008]	[0.010]	[0.012]	[0.013]	[0.015]	[0.016]	[0.017]	[0.017]	[0.015]
N	59615	39119	28630	22587	17924	15350	13569	13735	16466
Panel C: High School									
RD Estimate	-0.011	0.014	-0.015	-0.025*	0.011	0.011	0.006	0.028*	0.032**
	[0.008]	[0.010]	[0.012]	[0.013]	[0.015]	[0.016]	[0.017]	[0.017]	[0.016]
N	59429	38998	28534	22521	17870	15305	13543	13720	16436
Panel D: College									
RD_Estimate	-0.008	0.008	-0.002	-0.021*	0.007	0.020	0.015	0.001	0.013
	[0.007]	[0.009]	[0.011]	[0.012]	[0.014]	[0.015]	[0.015]	[0.015]	[0.014]
N	59429	38998	28534	22521	17870	15305	13543	13720	16436
Panel E: *ln* Wealth									
RD Estimate	0.075***	0.006	0.010	0.006	-0.001	-0.002	-0.019	0.006	-0.036*
	[0.017]	[0.018]	[0.020]	[0.021]	[0.022]	[0.023]	[0.023]	[0.022]	[0.020]
N	59572	39101	28618	22568	17914	15345	13564	13730	16461
Panel F: *ln* Previous Daily Wage									
RD Estimate	0.008	0.003	-0.004	-0.007	0.005	0.011	-0.024*	-0.008	-0.008
	[0.006]	[0.007]	[0.009]	[0.010]	[0.011]	[0.012]	[0.013]	[0.013]	[0.012]
N	54095	35770	26139	20899	16628	14257	12629	12801	15610
Panel G: *ln* Previous Tenure									
RD Estimate	0.148***	-0.036	-0.068	0.131	0.071	-0.040	-0.105	-0.254**	-0.113
	[0.051]	[0.066]	[0.079]	[0.087]	[0.100]	[0.106]	[0.112]	[0.110]	[0.096]
N	59615	39119	28630	22587	17924	15350	13569	13735	16466
Panel H: *ln* Previous Experience									
RD Estimate	0.135***	-0.052	0.021	-0.020	-0.081	-0.092	0.030	-0.143	-0.044
	[0.048]	[0.060]	[0.072]	[0.080]	[0.092]	[0.099]	[0.102]	[0.093]	[0.074]
N	59615	39119	28630	22587	17924	15350	13569	13735	16466
Panel I: Previous Contract: Permanent									
RD Estimate	0.000	0.022**	0.048***	0.062***	0.030*	0.004	-0.038*	-0.036	-0.051*
	[0.012]	[0.011]	[0.013]	[0.016]	[0.018]	[0.021]	[0.022]	[0.022]	[0.027]
N	59615	39119	28630	22587	17924	15350	13569	13735	16466
Controls	Disc	Disc	Disc	Disc	Disc	Disc	Disc	Disc	Disc
Method	P	P	P	P	P	P	P	P	P
Bandwidth	90	90	90	90	90	90	90	90	90

Note: Table E.2 presents the balance test of a 2-month extension of the potential duration of UI on different observed worker characteristics, separate for each discontinuity. Controls "Disc": Discontinuity fixed effects. Method "P": Parametric estimation, linear regression. Bandwidth: Indicates the length of the bandwidth. Standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01

Table E.3: Effect of Changes in Severance Payments. By Discontinuity

Potential Duration	180	240	300	360	420	480	540	600
Panel A: OLS. *ln* Unemployment Duration								
ln Severance Payment	0.089***	0.095***	0.103***	0.114***	0.113***	0.131***	0.143***	0.159***
	[0.010]	[0.010]	[0.011]	[0.012]	[0.012]	[0.013]	[0.012]	[0.013]
Controls	All	All	All	All	All	All	All	All
N	44579	40812	29296	22572	18447	15920	14808	12687
Panel B: IV First Stage. *ln* Time in Unemployment								
Post×Perm×Unjustified	-0.436***	-0.420***	-0.450***	-0.447***	-0.441***	-0.346***	-0.324***	-0.268***
	[0.027]	[0.027]	[0.030]	[0.035]	[0.042]	[0.046]	[0.047]	[0.052]
Post×Perm×Justified	-1.250***	-1.335***	-1.405***	-1.446***	-1.486***	-1.436***	-1.450***	-1.394***
	[0.051]	[0.055]	[0.066]	[0.074]	[0.082]	[0.090]	[0.111]	[0.123]
Post×Perm×Unknown	-0.798***	-0.614***	-0.424***	-0.166	-0.271***	-0.095	-0.070	0.043
	[0.157]	[0.122]	[0.122]	[0.113]	[0.104]	[0.103]	[0.097]	[0.098]
Controls	All	All	All	All	All	All	All	All
N	44579	40812	29296	22572	18447	15920	14808	12687
Panel C: IV Second Stage. *ln* Unemployment Duration								
ln Severance Payment	0.138**	0.129**	0.080	0.114*	0.125**	0.268***	0.260***	0.348***
	[0.058]	[0.056]	[0.061]	[0.065]	[0.063]	[0.077]	[0.084]	[0.103]
Controls	All	All	All	All	All	All	All	All
N	44579	40812	29296	22572	18447	15920	14808	12687

Note: This table presents the estimates for the causal effect of the severance payment on the duration of unemployment. The top panel presents the estimates from separate OLS regressions with controls (see text for details) for each group. Panel B presents the first-stage estimates with controls. The bottom panel presents the IV estimates from separate regressions using the policy change as the exogenous instrument, for each group (see text for details). Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.

Table E.4: Effect of Changes in Severance Payments. By Discontinuity

Potential Duration	180	240	300	360	420	480	540	600
				Panel A: OLS. *ln* Time Collecting UI				
ln Severance Payment	0.052***	0.067***	0.086***	0.095***	0.100***	0.121***	0.136***	0.157***
	[0.007]	[0.007]	[0.008]	[0.009]	[0.009]	[0.010]	[0.010]	[0.010]
Controls	All	All	All	All	All	All	All	All
N	48559	44802	32676	25532	21170	18411	17400	15026
				Panel B: IV First Stage. *ln* Time in Unemployment				
Post×Perm×Unjustified	-0.436***	-0.420***	-0.450***	-0.447***	-0.441***	-0.346***	-0.324***	-0.268***
	[0.027]	[0.027]	[0.030]	[0.035]	[0.042]	[0.046]	[0.047]	[0.052]
Post×Perm×Justified	-1.250***	-1.335***	-1.405***	-1.446***	-1.486***	-1.436***	-1.450***	-1.394***
	[0.051]	[0.055]	[0.066]	[0.074]	[0.082]	[0.090]	[0.111]	[0.123]
Post×Perm×Unknown	-0.798***	-0.614***	-0.424***	-0.166	-0.271***	-0.095	-0.070	0.043
	[0.157]	[0.122]	[0.122]	[0.113]	[0.104]	[0.103]	[0.097]	[0.098]
Controls	All	All	All	All	All	All	All	All
N	48559	44802	32676	25532	21170	18411	17400	15026
				Panel C: IV Second Stage. *ln* Time Collecting UI				
ln Severance Payment	0.099**	0.074*	0.058	0.082*	0.125**	0.234***	0.240***	0.271***
	[0.040]	[0.042]	[0.046]	[0.049]	[0.051]	[0.058]	[0.065]	[0.077]
Controls	All	All	All	All	All	All	All	All
N	48559	44802	32676	25532	21170	18411	17400	15026

Note: This table presents the estimates for the causal effect of the severance payment on the time collecting UI. The top panel presents the estimates from separate OLS regressions with controls (see text for details) for each group. Panel B presents the first-stage estimates with controls. The bottom panel presents the IV estimates from separate regressions using the policy change as the exogenous instrument, for each group (see text for details). Robust standard errors in brackets. p-value: * 0.10 ** 0.05, *** 0.01.