The Effects of Unemployment Insurance Benefits: New Evidence and Interpretation

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Abstract

The Great Recession has renewed interest in unemployment insurance (UI) programs around the world. At the same time, there have been important advances in both theory and measurement of UI. In this review, we first use the theory to present a unified treatment of the welfare effects of UI benefit levels and durations and derive convenient expressions of the full disincentive effect of UI. We then discuss recent estimates of the effect of UI benefit levels and durations on labor supply based on newly available administrative data and quasi-experimental research designs. Although our review of the new estimates confirms the range of negative labor supply effects of the previous literature, we show, based on the model, that these estimates are imperfect proxies for the actual disincentive effects. We also discuss several active areas of research on UI. These include the effect of UI on aggregate labor market outcomes, its effect on job outcomes, its long-term effects, its effects under nonstandard behavioral assumptions, and its interactions with other programs. We isolate several additional areas in need of further research, including estimates of the social value of UI, as well as the effects of UI in less developed countries.

1. INTRODUCTION

The Great Recession brought job loss and unemployment rates in many countries up to historically high levels. This created renewed interest among policy makers and economists in the design of unemployment insurance (UI), which typically constitutes the most important program to help jobless workers. It has long been recognized that although UI provides a clear welfare benefit by offering insurance and consumption smoothing that is unlikely to be provided by private markets,[1] UI benefits also come at the cost of distorting incentives to look for a job. A sizable literature from the 1970s to the 1990s estimated the magnitudes of these costs and benefits, and these papers have been summarized in excellent reviews (e.g., Krueger & Meyer 2002; Meyer 2002). However, recent years have seen a surge in research in UI, partly driven by the availability of new data and research designs. This research has led to significant new empirical findings, as well as new theoretical insights into the effects of UI.

In this article, we provide a review of the key findings on the effects of UI that have emerged from this recent literature. A central theme in this research has been the goal to connect the study of UI effects to welfare analysis. Building on work by Baily (1978), Chetty (2008) shows how a public economics model of UI can be used to derive which behavioral parameters are key to understanding the welfare effects of UI in the spirit of the so-called sufficient statistics approach. We develop a tractable version of the Baily-Chetty model that allows us to characterize the welfare effects of both UI benefit extensions and changes in benefit levels in a unified framework. Using this model, we derive the monetary efficiency loss from providing one additional dollar of UI transfer and show how typical estimates of the labor supply effects of UI are only imperfect proxies of this parameter. This parameter can be more easily compared between studies and can be implemented with existing data. We then use the model to guide our discussion of various theoretical extensions in the recent literature on UI. This work includes the importance of spillover effects in the labor market; the role of other job outcomes, such as reemployment wages; and new insights from behavioral economics.

The recent literature has been shaped by the availability of large administrative data sets and an emphasis on design-based estimation strategies exploiting sharp discontinuities in UI durations and kinks in UI benefit schedules. These estimates have greatly improved the plausibility and internal validity of estimates of the labor supply effect of UI parameters. The advances in estimating labor supply effects have helped highlight several additional key questions that cannot be easily answered with existing research designs. For example, the literature on spillovers has stressed the importance of estimating effects at the macro level, which is not possible in a regression discontinuity or regression kink design. Another example is that the welfare-enhancing side of UI depends on the consumption-smoothing effects of UI, but consumption is rarely available in administrative data sets. Finally, understanding the mechanisms of job search, such as the role of learning, or behavioral aspects like reference dependence or biased beliefs, would be greatly aided by additional micro data on the process of job search, in addition to information on outcomes such as rejected jobs and wages. Although the recent literature represents important advances in all these areas, there is much room for future progress.

Section 2 provides a short overview of the features of a typical UI system, while highlighting some of the variation observed across countries. In Section 3, we derive a convenient expression of the welfare costs of a transfer of one dollar of UI benefits to the unemployed. In Section 4, we first summarize the key results from the empirical literature and discuss their implications in the

[1] Hendren (2015) provides a discussion of evidence that UI could not be sustained as a private insurance scheme due to adverse selection.

Baily-Chetty model, as well as various key extensions and applications of this framework. Section 5 briefly discusses various other areas of active research on UI, such as spillovers between programs and insights from behavioral economics, with a particular emphasis on open questions that could be addressed in future work. Section 6 concludes.

2. THE STRUCTURE OF UNEMPLOYMENT INSURANCE SYSTEMS

Approximately 72 countries worldwide, including all OECD countries, have some form of UI designed to financially support unemployed individuals while they search for a job.[2] Although programs differ across countries, most UI systems exhibit a similar broad structure that determines eligibility, coverage, and generosity of benefits.

The typical UI system is a mandatory insurance system run at the national or state level that covers all salaried workers in the formal sector, with some variation in the coverage of public employees and the self-employed.[3] UI eligibility of an individual entering unemployment is typically determined by two types of criteria: (*a*) certain minimal employment history requirements[4] and (*b*) the reason for being unemployed.[5]

An unemployed individual may face a waiting period before being able to receive benefits, which ranges between 0 days (such as the United States, Germany, and Belgium) and 14 days (Canada). This waiting period effectively serves a similar purpose as a deductible in other forms of insurance by forcing individuals to bear some of the costs of unemployment. It also helps reduce the burden from processing very short UI claims. After the waiting period, individuals are eligible to receive benefits up to the potential benefit duration (PBD). The PBD varies significantly across and within countries. Within countries, the PBD is often a function of the duration of past contributions and sometimes varies with the age of the unemployed. In the United States, the PBD is uniform for all workers within a state, but can vary across states. In contrast, in Argentina, for example, 6 months of contribution duration generates a PBD of 2 months, which can increase up to 12 months for contribution durations of at least 36 months. Furthermore, the unemployed over age 45 can receive an extra 6 months of benefits. Similarly, the PBD in countries such as France, Germany, and South Korea is a function of age and contribution durations. In various countries, such as Chile, Korea, and the United States, the PBD also increases during times of high unemployment. The generosity of the PBD varies considerably. For example, the maximum PBD for a 40-year-old varies in OECD countries from the least generous, such as the United States (when not in a recession) and Slovakia with 6 months each, to the most generous, such as Sweden (35 months), Iceland (36 months), and Belgium (indefinite).

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[2]This section draws heavily from Carter et al. (2013) as well as from OECD (2015).

[3]Two interesting exceptions are Denmark and Finland, where UI is a voluntary program subsidized by the government. Another interesting example is Chile, where individual benefits are drawn from individual UI savings accounts supplemented by a traditional insurance component.

[4]The first set of eligibility criteria typically consists either of a minimum amount of previous work, sometimes at a minimum income level, or of a minimum amount of contributions to the UI system. Often countries require either 6 or 12 months of contributions over a certain specified time period (such as 2 years prior to unemployment) to qualify for UI. In the United States, states typically require at least 20 weeks of employment, as well as a minimum amount of earnings over a baseline period prior to unemployment.

[5]Accepted reasons for becoming unemployed usually consist of being laid off due to economic or business reasons, but most countries also accept being forced to leave employment due to unpaid wages, harassment, dangerous working conditions, or other misbehavior by the employer. Workers who become unemployed due to voluntarily quitting, or because they are fired for misconduct, are sometimes still eligible for benefits, but may face sanctions, such as lower benefit levels (Thailand) or a considerable waiting period before receiving UI benefits (e.g., 3 months in Germany and Japan, or 4 months in France).

UI benefits are typically calculated as a percentage—the replacement rate—of pre-unemployment gross or net earnings, subject to a maximum benefit level. Replacement rates and maximum levels vary considerably across countries. Most countries feature replacement rates between 50% and 65%, though some are significantly more generous (such as Denmark with 90%, Luxembourg with 80%, and the Netherlands with 75%). Furthermore, there are large differences in maximum benefit levels, ranging from 33% of the average wage in a country (Turkey) to 227% (France), with an average of 77% among OECD countries. The maximum benefit level can substantially reduce the mean replacement rate. For example, the United States offers a relatively high replacement rate of 53%, but benefits are capped at approximately 41% (varying by state) of the average wage level, making it effectively one of the less generous UI systems. Although the majority of countries pay a constant benefit level up to the PBD, some UI systems feature a declining benefit path. Benefits in the Netherlands, for example, drop from a 75% replacement rate to a 70% replacement rate after 2 months. Similarly, benefits in Sweden drop from 80% to 70% after 9 months, and similar step-downs can be found in Hungary, Slovenia, Spain, and Italy, among others. As discussed in Section 4.4, the effect and optimality of the path of UI benefits are an active area of research.

Most countries require workers to actively search for jobs while receiving UI benefits and monitor job search efforts in various ways (such as asking the recipient for documentation about job applications). If workers reject job offers deemed acceptable by the UI agency or fail to fulfill other search requirements, they may be sanctioned with benefit cuts. Furthermore, UI agencies often provide various forms of support to help job seekers find jobs or provide them with additional training and education programs to acquire skills valued in the labor market. The prevalence of such programs, often labeled active labor market programs (ALMPs), varies across countries but may constitute a very important part of the services provided by the UI system. Discussing ALMPs in depth is beyond the scope of this review, but readers are referred to, for example, Card et al. (2010, 2015b) for excellent surveys. Finally, some countries permit UI recipients to work part time while continuing to receive partial or full benefits. These provisions are often viewed as a way to reduce the disincentive effect of UI and to encourage workers to take on part-time work as a stepping stone toward full-time employment.

UI is typically financed through employer contributions and payroll taxes paid by workers. In many countries, the government supplements the UI funds from general tax revenue either regularly or during times of economic downturns. The contribution rates, as a percentage of gross earnings, vary between approximately 1% and 3% and are often split evenly between workers and employers (see Carter et al. 2013, graph 3). As discussed in Sections 4.2 and 4.6, the extent to which the financing of UI is separate from or integrated with overall budget considerations can make an important difference in calculating the welfare effects of UI.

3. AN INTEGRATED MODEL OF OPTIMAL UNEMPLOYMENT INSURANCE BENEFIT LEVELS AND DURATIONS

Designing a UI system and choosing the various parameters, such as benefit levels and durations, involve finding the right balance between providing insurance to the unemployed and avoiding distorting incentives to work too much. In this section, we develop a simple model of the optimal level and duration of unemployment benefits that formalizes this trade-off and identifies the empirical parameters to be estimated to analyze the welfare aspects of UI. The model is based on Baily (1978), Chetty (2008), and Schmieder et al. (2012a), but we integrate the treatment of UI benefit levels and benefit durations and derive comparable expressions for the welfare effects of UI. To achieve this, we simplify the exposition relative to these papers by assuming that individuals are hand-to-mouth consumers (i.e., there is no saving). Furthermore, we follow Chetty (2008) and assume workers face a fixed wage that is high enough to ensure that any job offer will be accepted and search effort is the only choice variable by individuals. This allows for a straightforward setup and an intuitive derivation of the main results, even in a dynamic model. Below we briefly discuss how relaxing these assumptions affects the setup and results.

3.1. The Individual Job Search Problem

The model centers on a worker who becomes unemployed at time $t = 0$. The model is set in continuous time, and we assume that the horizon lasts until time T, when the individual retires. He or she chooses search effort s_t at each point in time, which we normalize to the arrival rate of job offers. Because any job offer is accepted, this also equals the exit rate from unemployment and therefore determines the survival probability S_t of remaining in unemployment at time t, which is given as $S_t = \exp(-\int_0^t s_t \mathrm{d}t)$. Search effort s_t results in a search cost of $\psi_t(s_t)$, which we assume to be differentiable, increasing, and convex.

While unemployed, the individual receives UI benefits b_t and consumes $c_{u,t} = b_t + y_u$, where y_u may be income from other sources such as home production.[6] We assume that y_u is exogenously given and constant throughout the unemployment spell. The corresponding flow utility is given as $u(c_{u,t})$. Once he or she finds a job, the worker receives a fixed wage w and has to pay taxes of τ, thus resulting in consumption $c_e = w - \tau$. The worker's flow utility then becomes $v(c_e)$, where $v(\cdot)$, like $u(\cdot)$, is assumed to be increasing and concave. Different flow utility functions in employment $v(\cdot)$ and unemployment $u(\cdot)$ capture the possible effort cost of working or the valuation of leisure, as well as possible complementarities between leisure (working) and consumption. To simplify notation, we assume that there is no discounting.

With this setup, lifetime expected utility of an individual is given as[7]

$$W = \int_0^T \left\{ S_t u(c_{u,t}) + [1 - S_t] v(c_e) - S_t \psi_t(s_t) \right\} \mathrm{d}t. \tag{1}$$

This equation captures the basic trade-off in the individual's decision problem. Higher search effort results in a faster exit rate from unemployment [lower S_t, which improves utility given $v(c_e) > u(c_{u,t})$], but also comes at a higher effort cost ψ_t.

3.2. The Social Planner's Problem

Social welfare in this problem is the unemployed individual's expected lifetime utility. The social planner sets the UI benefit path in order to maximize social welfare, while taking into account that the unemployed individual will adjust his or her search effort in response to the path of UI benefits. Furthermore, the social planner has to set the tax level τ to finance UI benefits. To simplify this problem further, we restrict the planner's choice set to benefit paths with constant benefit levels up to a finite time horizon P, so that $b_t = b$ for $t \leq P$ and $b_t = 0$ for $t > P$. Consumption during unemployment is then $c_{u,t \leq P} = b + y_u$ for $t \leq P$ and $c_{u,t>P} = y_u$ for $t > P$. As seen in the previous section, this corresponds to the structure of UI in most countries. Much of the policy debate (and

[6] y_t may also represent support from spouses or family members or self-insurance through savings. Allowing for such endogenous forms of consumption adjustments makes the model somewhat more complicated but provides very similar results.

[7] We obtain this simple expression for expected lifetime utility rather than having to rely on a recursive formulation as in Chetty (2008), Schmieder et al. (2012a), and others because the utility while employed does not depend on when an individual finds a job.

actual reforms) is about the optimal level and duration of UI benefits in this setup. However, as discussed below, the model can also be used to study more flexible benefit paths.

In the one-step UI system, Equation 1 can be rewritten as

$$W = \int_0^P S_t u(c_{u,t\le P})\,\mathrm{d}t + \int_P^T S_t u(c_{u,t>P})\,\mathrm{d}t + \int_0^T [1-S_t]v(c_e)\,\mathrm{d}t - \int_0^T S_t\psi_t(s_t)\,\mathrm{d}t, \tag{2}$$

where the first term on the right-hand side represents the expected utility while unemployed and receiving UI benefits, the second term the utility after benefits have expired, the third term the utility while employed, and the last term the expected search cost.

The social planner has to satisfy the constraint that total tax revenue has to equal the amount of UI benefits paid out plus some level of exogenous per capita government spending E. Because the social planner can smooth over many individuals, this budget constraint only has to hold in expectation. If we denote the expected duration of receiving UI benefits as $B = \int_0^P S_t\,\mathrm{d}t$ and the expected duration in unemployment as $D = \int_0^T S_t\,\mathrm{d}t$, then we can write the budget constraint as

$$(T - D)\tau = Bb + E. \tag{3}$$

The social planner maximizes Equation 2 subject to the budget constraint (Equation 3) and to the condition that the individual chooses search behavior optimally. Individual behavior is a function of UI benefits and durations, so we can write the tax implied by the budget constraint as a function of b and P: $\tau(b,P) = \frac{B(b,P)}{T-D(b,P)}b + \frac{E}{T-D(b,P)}$.[8] Plugging this into W, we can write the social planner's problem as an unconstrained problem:

$$\max_{b,P} W(b, P, \tau(b,P)), \tag{4}$$

where search effort is determined by b and P.

3.3. Characterizing Optimal Unemployment Insurance Levels and Durations

The marginal effect of increasing the level of UI benefits is given as

$$\begin{aligned}\frac{\mathrm{d}W}{\mathrm{d}b} &= \int_0^P S_t\,\mathrm{d}t\,u'(c_{u,t\le P}) - \int_0^T [1-S_t]\,\mathrm{d}t\,v'(c_e)\frac{\mathrm{d}\tau}{\mathrm{d}b} \\ &= B\,u'(b) - (T-D)\,v'\frac{\mathrm{d}\tau}{\mathrm{d}b},\end{aligned} \tag{5}$$

where we use the fact that changes in s_t (and therefore S_t) do not affect welfare at the margin due to the envelope theorem. By differentiating the budget constraint to get $\mathrm{d}\tau/\mathrm{d}b$, doing some rearranging, and dividing both sides by the marginal utility of the employed, we obtain

$$\frac{\mathrm{d}W}{\mathrm{d}b}\frac{1}{v'(c_e)} = \underbrace{\underbrace{B}_{\substack{\text{Mechanical increase}\\ \text{in transfer}}} \times \underbrace{\frac{u'(c_{u,t\le P}) - v'(c_e)}{v'(c_e)}}_{\substack{\text{Social value}\\ \text{of \$1 add. transfer}}}}_{\text{Mechanical transfer to unemployed}} - \underbrace{\left(\frac{\mathrm{d}B}{\mathrm{d}b}b + \frac{\mathrm{d}D}{\mathrm{d}b}\tau\right)}_{\text{Behavioral cost}}. \tag{6}$$

[8] The addition of E is more than just for completeness: It exemplifies that if other government expenditures are financed by taxes on earnings, the required tax to balance the budget—and hence the budget costs of a reduction in nonemployment benefits—is higher. We show in Section 4.2.1 that this can make an important difference.

The division by $v'(c_e)$ represents a rescaling of the marginal welfare effect, such that the left-hand side of this equation is the welfare effect of increasing UI benefit levels by \$1 in the unit of a \$1 increase in consumption of the employed. The equation has a simple interpretation: Increasing UI benefits by \$1 increases the total transfers to the unemployed by two components: $B + (\mathrm{d}B/\mathrm{d}b)b$. The first represents the mechanical increase in the transfer, if behavior were unchanged, and the second represents the increase in the transfer due to changes in behavior. Individuals who change their search effort in response to $\mathrm{d}b$ do not experience a first-order utility gain due to the envelope theorem (they were already optimizing with respect to search effort). Therefore, only the mechanical part of the transfer is valued by the social planner. This transfer of B dollars is valued at the gap in marginal utilities between the unemployed (who receive the transfer) and the employed (who pay for it). However, the transfer leads to distortions impacting the social planner's budget: on the one hand, the behavioral increase in the transfer ($\mathrm{d}B/\mathrm{d}b$) and, on the other hand, the decline in tax revenue due to the increase in nonemployment durations ($\mathrm{d}D/\mathrm{d}b$).

Notice that the behavioral cost (i.e., the marginal effect of UI benefits on nonemployment durations and UI durations) is not enough to gauge whether the distortion coming from UI is large relative to the benefit of increasing UI benefits by \$1. It is crucial to also take into account how much more is actually transferred to the unemployed, which is B dollars. A convenient normalization is therefore to divide Equation 6 by B, so that it expresses the marginal effect on welfare of increasing the transfers to the unemployed by \$1:

$$\frac{\mathrm{d}W}{\mathrm{d}b}\frac{1}{B\,v'(c_e)} = \underbrace{\frac{u'(c_{u,t\leq P}) - v'(c_e)}{v'(c_e)}}_{\substack{\text{Social value}\\ \text{of \$1 add. transfer}}} - \underbrace{\left(\eta_{B,b} + \eta_{D,b}\frac{D}{B}\frac{\tau}{b}\right)}_{\substack{\text{Behavioral cost}\\ \text{per \$1 add. transfer}}}, \tag{7}$$

where $\eta_{B,b} = (\mathrm{d}B/\mathrm{d}b)(b/B)$ and $\eta_{D,b} = (\mathrm{d}D/\mathrm{d}b)(b/D)$ are the elasticities of the duration of receiving UI benefits and the unemployment duration with respect to the monthly benefit level, respectively. The first term on the right-hand side represents the social value of increasing the transfer by \$1, which depends on the gap between the marginal utility of benefit recipients relative to the marginal utility of the employed. The second term on the right-hand side represents the behavioral cost of increasing the transfer by \$1 to the government budget.

If we let $\widetilde{u}'(c_{u,t>P}) \equiv \frac{1}{b}\int_{y_u}^{y_u+b} u'(c)\mathrm{d}c$ be the average marginal utility for an individual between consumption levels of y_u and $y_u + b$, then we can write the marginal effect of increasing transfers by \$1 through a PBD extension on welfare as

$$\frac{\mathrm{d}W}{\mathrm{d}P}\frac{1}{S_P b\,v'(c_e)} = \underbrace{\frac{\tilde{u}'(c_{u,t>P}) - v'(c_e)}{v'(c_e)}}_{\substack{\text{Social value}\\ \text{of \$1 add. transfer}}} - \underbrace{\frac{1}{S_P}\left(\int_0^P \frac{\mathrm{d}S_t}{\mathrm{d}P}\mathrm{d}t + \frac{\mathrm{d}D}{\mathrm{d}P}\frac{\tau}{b}\right)}_{\substack{\text{Behavioral cost}\\ \text{per \$1 add. transfer}}}. \tag{8}$$

The structure of this equation follows closely that of Equation 7. The first term on the right-hand side represents the social value of increasing the mechanical transfer by \$1, with a subtle difference being that the gap in marginal utilities now depends on the (average) marginal utility of an exhaustee. Because of the convexity of $u(\cdot)$, we have that $\widetilde{u}'(c_{u,t>P}) > u'(c_{u,t\leq P})$, and the social value term will be larger in Equation 8 than in Equation 7.

The second term represents the behavioral cost, where $\int_0^P \frac{\mathrm{d}S_t}{\mathrm{d}P}\mathrm{d}t$ is the increase in benefit duration B due to the disincentive effect of increasing P, which increases government spending at a rate of b dollars. $\mathrm{d}D/\mathrm{d}P$ captures the increase in nonemployment that reduces tax revenue by τ dollars per time unit. This increase in spending per increase in the PBD P is divided by the additional transfer associated with it, which is equal to $S_P b$ as each exhaustee S_P receives b dollars per additional month of the PBD.

Equation 7 is well known as the Baily-Chetty formula, which has been used in many contexts to describe the trade-offs around the optimal UI generosity level. A version of Equation 8 was first derived by Schmieder et al. (2012a).

An attractive feature of the integrated treatment of benefit levels and durations in Equations 7 and 8 is that the behavioral cost is expressed in the same units and is directly comparable. For example, if $\eta_{B,b} + \eta_{D,b}\frac{D}{B}\frac{\tau}{b} > \frac{1}{S_P}\left(\int_0^P \frac{\mathrm{d}S_t}{\mathrm{d}P}\,\mathrm{d}t + \frac{\mathrm{d}D}{\mathrm{d}P}\frac{\tau}{b}\right)$, this implies that increasing transfers to the unemployed via benefit increases comes at a larger budgetary cost than increasing transfers via a benefit extension. If this inequality holds, this would suggest that extending benefits is preferable to increasing them, as exhaustees are likely to have larger marginal utility of consumption than UI recipients.

The equations also highlight differences in the effects of changes to benefit levels and durations. For example, in the absence of a behavioral response ($\eta_{D,b} = \eta_{B,b} = 0$), Equation 7 would imply that the marginal utility of the employed and unemployed should be equalized, which in a situation where both have the same utility functions would imply that $c_{u,t\leq P} = c_e$. Equation 8 implies that, in the absence of a behavioral effect, UI benefits should be paid indefinitely.

Many papers in the literature have studied the disincentive effects of UI benefits and typically report estimates of the marginal effect, or elasticity, of changes in b or P, on unemployment durations (D) or UI benefit durations (B). However, Equations 7 and 8 show how, given different levels of B or S_P, a given increase in b (or P) may represent a very different increase in transfers. Furthermore, whether behavioral responses are costly to the government depends crucially on the benefit and tax levels. When contrasting estimates of the disincentive effects across studies, it is therefore more informative to compare the disincentive effect rescaled to the behavioral cost per $1 transfer. In Section 4.2, we calculate this rescaled disincentive effect for a range of recent empirical studies of UI parameters on labor supply.[9]

4. LABOR SUPPLY EFFECTS OF UNEMPLOYMENT INSURANCE BENEFITS AND EXTENSIONS OF THE BAILY-CHETTY FORMULA

A long literature in labor economics and public finance has estimated the effect of UI benefit parameters on employment and unemployment outcomes. In this section, we summarize the results from recent studies that have improved the measurement and identification of the labor supply effects of UI (Section 4.1) and how these estimates can be interpreted and made comparable in light of our theoretical framework (Section 4.2). Sections 4.3–4.6 discuss various extensions of this framework in recent papers.

[9]The above model is stylized, but the basic formulas are remarkably robust to altering the baseline assumptions. For example, it is robust to allow for stochastic wage offers with a reservation wage decision, as possible wage effects of the UI benefit path through reservation wages are already internalized by the individual and do not affect the welfare calculation due to the envelope theorem. Similarly, it is conceptually straightforward to allow for endogenous savings, where the unemployed use savings to smooth consumption (see Chetty 2008; Schmieder et al. 2012a). Furthermore, it is straightforward to generalize to a situation with many heterogeneous unemployed with different labor supply responses to UI. If the social planner is not constrained to a single UI benefit path, then the optimal policy would be to set different UI levels for different groups or at different points in time, something we return to in Section 4.3.

4.1. Recent Estimates of Labor Supply Effects of Unemployment Insurance Benefits

Here, we first turn to a brief summary of the approaches to identification in the recent literature. We then provide an overview of the measurement issues and discuss the main findings of this research.

4.1.1. Identification. UI benefits and employment outcomes are frequently jointly related to individual earnings, employment histories, and conditions in the aggregate labor market. As a result, simple ordinary least squares regressions are unlikely to recover the true labor supply effects of UI benefits. To address this identification problem, most studies seek to exploit changes in UI parameters unrelated to labor market conditions and individuals' own characteristics.

In the United States, several studies have analyzed policy-driven variation in both UI benefit levels and UI benefit durations. The most frequent variation in UI benefit durations is at the state level and arises from the Extended Benefit (EB) and the Emergency Unemployment Compensation (EUC) programs (see, e.g., Rothstein 2011). Both programs usually raise UI durations, and sometimes benefit levels, in response to local and national unemployment conditions.[10] To convincingly use this variation, one must sufficiently control for labor market conditions in a state, and most studies attempt to do this. There also have been politically motivated changes in UI benefit durations and levels at the state level, independent of economic conditions, which have provided useful case studies.

Another approach to estimating the effect of UI benefits has been to exploit discontinuities in the benefit schedules or benefit durations that are independent of labor market conditions. In particular, many European UI systems feature discrete changes in the duration of UI benefits by age (e.g., Germany, Austria, Italy, Portugal) or job tenure (e.g., Austria). In the United States and Austria, discontinuities in the marginal benefit schedules have been used to identify the effect of changes in UI benefit levels. These institutional features provide sharp exogenous variation in the duration or level of UI benefits in so far as individuals do not anticipate the policy or manipulate their UI application dates or earnings levels. Papers studying such variation in the context of a regression discontinuity or regression kink design assess this potential bias in detail (e.g., Card et al. 2007a; Schmieder et al. 2012a,b; Landais 2015; Card et al. 2015c). In some cases, exogenous reforms can be used to confirm the finding from the cross-sectional analysis (e.g., Schmieder et al. 2012a).

4.1.2. Measurement. Data are another important challenge when studying the effect of UI benefits. Section 3 highlights that the key outcomes to measure the welfare effects of UI are total nonemployment duration as well as the duration and amounts of UI benefit receipt. In the United States, no large data source measuring nonemployment spells (i.e., the duration between jobs) is currently available. Hence, studies have used either measures of self-reported unemployment duration in the Current Population Survey (CPS) or the duration of UI benefit receipt from administrative records. Because many unemployed individuals exhaust UI benefits before finding

[10]The EB program is based on state-specific triggers and raises UI duration for states whose unemployment rate exceeds certain thresholds. The EB program is entirely managed by the states, and hence states differ in the amount of the increase as well as the trigger thresholds. The EB program has diminished in importance over time (see, e.g., Congr. Budg. Off. 2004, figure 2). The EUC program is a federal program enacted by the US Congress and increases the maximum UI benefit duration for all states. When an EUC program is active, states experience increases in UI durations if their unemployment rates exceed a common threshold value.

a job, the CPS-based measure is in principle preferable. However, the CPS measure is noisy and does not capture worker's total length of nonemployment, which may include periods in which workers do not declare themselves unemployed. Although the administrative data from the UI system have information on quarterly earnings, and hence could be used to study nonemployment durations, this is quite coarse. Some US studies based on administrative data focused on UI benefit duration and the spike at benefit exhaustion as main outcomes. However, although the duration of UI benefits and, in particular, the UI exhaustion rate are indeed key components in the welfare evaluation of UI benefit extensions, neither captures the employment effects of UI parameters, as the majority of workers do not return to work immediately after benefit exhaustion (e.g., Card et al. 2007b, Schmieder et al. 2012a).

Many recent European studies make use of spell-based administrative data, which allow researchers to measure the duration of UI benefit receipt and nonemployment, as well as the incidence of benefit exhaustion. The nature of the data does not allow measuring unemployment as defined in labor force surveys, as information on individuals' job search activity is usually not available. The use of nonemployment instead of unemployment has benefits and disadvantages. It is well known that whether individuals self-declare as unemployed in surveys varies with the institutional and economic environment. Moreover, it is recognized that many of those typically not categorized as unemployed are really partially attached to the labor market. Nonemployment duration has the advantage that it captures all types of nonemployment that might respond to UI benefits. Yet, in some cases, it is meaningful to explicitly distinguish between unemployment and nonparticipation. For example, UI benefits may raise unemployment by increasing participation rather than lowering employment. Rothstein (2011) shows that this can be relevant and that UI extensions helped to prevent labor force exit in the United States in the Great Recession.

4.1.3. Findings on benefit durations. Several classic studies measured the effect of UI benefit parameters during the 1970s and 1980s (e.g., Meyer 1990; Katz & Meyer 1990; Meyer 1995). Because these are covered in surveys by Krueger & Meyer (2002) and Meyer (2002), we focus on more recent work. Several recent studies have evaluated the effect of the increases in UI benefit duration during the Great Recession using survey data and state-time variation in UI benefits (e.g., Rothstein 2011; Valletta 2014; Farber & Valletta 2015; Kroft & Notowidigdo 2016). This work has received substantial attention because of the unprecedented rise in UI durations to a potential maximum of 99 weeks (in contrast, during the 1982 recession, which had similar rates of unemployment as the Great Recession, the maximum PBD increased to 52 weeks). Although the magnitude of the findings is not immediately comparable between studies given differences in methodology, the overall finding of this later round of studies suggested that there was a precisely measured negative but moderate effect of UI benefit increases during the Great Recession on unemployment duration. Compared to earlier studies, the estimated labor supply effects of UI durations in the Great Recession tended to be smaller, raising the question whether labor supply responses to UI benefit had a cyclical component. We return to this in Section 4.3. Based on these findings alone, the conclusion was that UI could not fully explain the rise in unemployment rates or mean unemployment duration (e.g., Aaronson et al. 2010; Rothstein 2011). An important caveat is that by focusing on labor supply responses of the unemployed themselves, these studies do not address potential aggregate effects of UI extensions, something we discuss in Section 4.6.

Despite the care taken in most studies to control for differences in labor market characteristics between treatment and control groups, the fact that the main source of variation in UI benefit duration arises from labor market conditions makes it difficult to fully rule out that these estimates partly capture the effect of weak economic conditions. Hence, studies chiefly relying on this source of variation in UI benefits may overstate the effect of UI durations on reemployment probabilities, as suggested by Card & Levine (2000), who examine a purely politically motivated policy change. They find UI benefit elasticities that are smaller than those estimated based on variation from the US EB and EUC programs used in the earlier studies. More recently, some states have cut UI benefits, partly due to budgetary pressures. Although the financial situation of a state's UI system is not exogenous to recent labor market conditions, these cuts were also partly politically motivated, and hence may provide useful variation (e.g., Johnston & Mas 2015).

Studies from Europe also point to moderate labor supply effects from UI benefit durations. Whereas most recent studies in the United States have analyzed the response in hazard rates, most European studies have focused on nonemployment duration and hence can be easily summarized using duration elasticities. The top half of **Table 1** shows these marginal effects ($\mathrm{d}D/\mathrm{d}P$) and elasticities [$(\mathrm{d}D/\mathrm{d}P)(P/D)$] for a selective set of studies of European studies. The median of the estimated marginal effects is 0.13, implying that for a 1-month increase in UI durations, nonemployment durations rise by approximately 4 days. Excluding two outliers at the top and bottom, respectively, the mean marginal effect is 0.26, with a range from 0.05 to 0.65. Given that both nonemployment durations (D) and PBDs (P) vary substantially across countries, the next column shows the duration elasticity. The median elasticity is 0.40 (after dropping the highest and lowest value, the mean is 0.41 and the range is from 0.1 to 1). Not surprisingly, the range of variation is smaller in the United States for the limited studies for which duration elasticities were available, shown in the bottom half of **Table 1**. There, elasticities ranged from 0.1 (Card & Levine 2000) to 0.40 (Katz & Meyer 1990) but were in the similar ballpark as estimates from Europe.

Despite some expected variation, the labor supply estimates in **Table 1** show a reasonable degree of congruence between countries and studies. Yet, as discussed further in Section 4.2.1, care has to be taken to interpret these estimates. First, as with any uncompensated labor supply elasticity, the total labor supply response to a change in UI benefits combines both a substitution (moral hazard) effect and an income (liquidity) effect. Second, as discussed in Section 3, the full efficiency cost of UI depends on additional parameters that are likely to vary across studies. We discuss this in Section 4.2.

There are several other reasons for caution in directly comparing the estimates in **Table 1**. One issue is that the definition of unemployment duration differs. Whereas most European studies focus on the duration between jobs, most US studies measure the duration of unemployment (if using survey data) or the duration of UI receipt (if using administrative data). Another issue relates to the presence of more generous social insurance support after UI exhaustion. The benefits available after UI exhaustion affect the size of the implied labor supply elasticity.[11] In addition, these estimates pertain to different samples, different nonemployment durations, and different benefit extensions. As it is likely that labor supply responses are heterogeneous along all these dimensions, different estimates capture mean responses for different groups and experiments. Providing a more systematic picture of the effect of UI benefit levels and durations will be a useful avenue for future research.

4.1.4. Findings on benefit levels. To a lesser degree, UI benefit levels have differed between states and varied over the business cycle in the United States, and this variation has been used to estimate their effect on labor supply (e.g., Moffitt 1985; Katz & Meyer 1990; Chetty 2008;

[11] Schmieder et al. (2012a) try to address this issue and report that for a population unlikely to take up second-tier benefits, the implied labor supply effects are comparable in magnitude to those of the United States. Yet we are not aware of a more formal analysis of how the presence of social insurance after UI exhaustion, or of other UI parameters such as benefit levels, modifies the main impact of UI benefits on labor supply.

Table 1 Estimates of the effects of potential benefit durations on unemployment durations and on the fiscal cost of UI transfers

Country/state(s)	Study	Design	Source of variation	$\frac{dD}{dP}$	$\frac{dD}{dP}\frac{P}{D}$	$\frac{dB}{dP}$	$\frac{dB}{dP}\frac{P}{B}$	Behavioral cost per $1 increase in transfer – tax = 3%	Behavioral cost per $1 increase in transfer – tax wedge
Studies from Europe									
Austria	Lalive et al. 2006	DID	Regional variation, PBD from 30 to 39 weeks	0.05	0.10			0.24	0.55
			Regional variation, PBD from 30 to 52 weeks	0.10	0.21			0.58	1.29
Austria	Lalive 2007	RD	Age 50; PBD from 39 to 52 weeks; men	−0.03	−0.09			−0.81	−1.54
			Age 50; PBD from 39 to 52 weeks; women	0.47	0.73			1.17	3.05
			Age 50; PBD from 39 to 209 weeks; men	0.09	0.45			39.54	71.59
			Age 50; PBD from 39 to 209 weeks; women	0.65	0.98			1.52	4.04
Austria	Card et al. 2007a	RD	Cutoff at 36 months UI contributions in previous 5 years; PBD from 20 to 30 weeks	0.10	0.11			0.11	0.37
Austria	Lalive 2008	RD	Border RD; PBD from 30 to 209 weeks; men	0.08	0.37			32.95	59.66
			Border RD; PBD from 30 to 209 weeks; women	0.28	0.56			2.13	4.58
Slovakia	van Ours & Vodopivec 2008	DID	Policy change in 1998; decrease 9 to 6 months	0.43	0.63			0.94	2.36
			Policy change in 1998; decrease 12 to 6 months	0.30	0.43			0.67	1.67
			Policy change in 1998; decrease 18 to 9 months	0.40	0.72			1.54	3.44
Portugal	Centeno & Novo 2009	RD	Age 30/40 discontinuity; PBD from 12 to 18 months	0.22	0.45			1.15	2.16

Germany	Schmieder et al. 2012a	RD	Age 42 discontinuity; PBD from 12 to 18 months	0.13	0.14	0.30	0.58	0.12	0.41
			Age 44 discontinuity; PBD from 18 to 22 months	0.10	0.12	0.26	0.54	0.13	0.38
			Age 49 discontinuity; PBD from 22 to 26 months	0.11	0.13	0.35	0.67	0.14	0.42
France	Le Barbanchon 2016	RD	Threshold in past experience at 8 months; PBD from 7 to 15 months	0.31	0.40			0.52	1.35
Studies from the United States									
CWBH: 13 states	Moffit 1985			0.15	0.34				
CWBH: all states	Katz & Meyer 1990			0.20	0.41	0.23	0.52	1.05	1.89
New Jersey	Card & Levine 2000	DID	EB program; increased benefits by 13 weeks	0.45	0.1	0.08			
Missouri	Johnston & Mas 2015	RD	Benefit cut from 73 to 57 weeks for some cohorts	0.30		0.54		0.36	0.69
CWBH: Louisiana/ Washington	Landais 2015	RKD	Maximum potential duration cap		0.33		1.35		

All calculated behavioral cost terms use the constant hazard approximation described in Section 4.2. The behavioral cost in the last column represents the extra cost (in dollars) to the government budget of increasing the mechanical transfer (that is the transfer in the absence of behavioral responses) to the unemployed by $1. For example, a behavioral cost of $0.55 suggests that to finance a $1 transfer from a benefit extension, one has to raise $1.55 to cover the mechanical cost ($1) and behavioral cost ($0.55). The last two columns differ in whether the budget shortfall is measured using the employee's UI contribution rate (at 3%) or at the full tax wedge.
Abbreviations: CWBH, Continuous Wage and Benefit History data set; DID, difference in differences; EB, Extended Benefits; PBD, potential benefit duration; RD, regression discontinuity; RKD, regression kink design; UI, unemployment insurance.

Kroft & Notowidigdo 2016). Solon (1985) and Meyer & Mok (2007) analyze state-level benefit changes unrelated to business cycle conditions. Moving beyond traditional cross-state, cross-time designs, several recent studies have exploited kinks in the benefit schedules to provide experimental estimates of the UI benefit effect (e.g., Card et al. 2015a, 2015c; Landais 2015). **Table 2** summarizes estimates from 18 studies from five different countries, of which 11 estimates are from the United States. The duration elasticities vary from 0.1 to 2, with a median of 0.53. For the United States alone, the median is 0.38, and the range is from 0.1 to 1.2, with all but two estimates lying below 0.7. Overall, the elasticities with respect to UI benefit levels are somewhat higher than the elasticities with respect to the PBD. This might arise from the fact that the response to benefit changes is more evenly distributed throughout the spell compared to the response to durations, whose effect is mitigated by discounting and which overproportionally affects workers exhausting benefits.

4.2. The Welfare Effects of Changes in Unemployment Insurance Benefits

In this subsection, we show how the sufficient statistics formulas from Section 3 can be used to provide insights into the welfare effects of changing the UI system in different contexts. We first discuss the behavioral costs of UI benefit changes before turning to their social value.

4.2.1. The behavioral cost of unemployment insurance benefit changes. The importance of estimating the labor supply effect goes beyond the traditional analysis of labor supply behavior. As discussed in Section 3, the labor supply responses to changes in UI benefits and durations are key inputs in assessing the efficiency costs of UI benefits. A clear message from the empirical findings discussed in Section 4.1 is that UI induces efficiency costs by reducing labor supply and thus tax revenues. However, as discussed in Section 3, labor supply elasticities alone do not capture the full disincentive effect of UI benefits. In the remainder of this section, we derive more complete and comparable measures of the efficiency costs of UI.

The theory discussed in Section 3 provides expressions of the efficiency costs per additional dollar of UI benefits that can in principle be directly calculated from the data. One difficulty in implementing the formulas in Equations 7 and 8 for existing studies is that most publications do not report estimates of some or most of the required components. To nevertheless be able to infer about the efficiency cost of UI benefits implied by previous research, we derived an approximate welfare formula for the case in which the hazard of exiting the unemployment spell is constant (see Schmieder et al. 2012a for details). If the exit hazard from unemployment s is constant over time (but potentially changing with different levels of P), then we can write $\frac{\mathrm{d}B}{\mathrm{d}b} = \frac{\mathrm{d}D}{\mathrm{d}b}\xi$ and $\int_0^P \frac{\mathrm{d}S_t}{\mathrm{d}P}\,\mathrm{d}t = \frac{\mathrm{d}D}{\mathrm{d}P}\xi$, where $\xi \equiv 1-(1+Ps)e^{-Ps}$.[12] In this case, Equations 7 and 8 simplify to convenient expressions of the efficiency cost that can be calculated based on information available in most studies.

The resulting first-order condition for the marginal welfare effect of a change in the UI benefit level is:

$$\frac{\mathrm{d}W}{\mathrm{d}b}\frac{1}{B\,v'(c_e)} = \underbrace{\frac{u'(c_{u,t\leq P})-v'(c_e)}{v'(c_e)}}_{\substack{\text{Social value}\\ \text{of \$1 add. transfer}}} - \underbrace{\eta_{D,b}\frac{1}{1-S_P}\left(\xi+\frac{\tau}{b}\right)}_{\substack{\text{Behavioral cost}\\ \text{per \$1 add. transfer}}}, \tag{9}$$

[12]The effect of a benefit increase on the duration of receiving UI benefits and on unemployment duration are closely related because $\frac{\mathrm{d}B}{\mathrm{d}b} = \int_0^P \frac{\mathrm{d}S_t}{\mathrm{d}b}\,\mathrm{d}t$ and $\frac{\mathrm{d}D}{\mathrm{d}b} = \int_0^T \frac{\mathrm{d}S_t}{\mathrm{d}b}\,\mathrm{d}t$.

Table 2 Estimates of the effects of benefit increases on unemployment durations and on the fiscal cost of UI transfers

Country/state(s)	Study	Design	Source of variation	$\frac{dD}{db}\frac{b}{D}$	$\frac{dB}{db}\frac{b}{B}$	Behavioral cost per $1 increase in transfer – $\tau = 0.03$	Behavioral cost per $1 increase in transfer – tax wedge
Studies from Europe							
Sweden	Carling et al. 2001	DID	Replacement rate change from 80% to 75%	1.60		0.60	2.36
Norway	Røed & Zhang 2003	Multiple approaches	Timing of UI start; men	0.95		0.87	1.41
			Women	0.35		0.35	0.55
Austria	Lalive et al. 2006	DID	Replacement rate change for target income range from 41% to 47%	0.15		0.06	0.47
Spain	Arranz et al. 2008	Pre–post	Reduction in benefits and duration	0.80		0.29	1.24
Austria	Card et al. 2015c	RKD	Kinks formed by minimum and maximum benefit levels; high income	2.00		0.71	5.56
			Kinks formed by minimum and maximum benefit levels; low income	1.00		0.36	2.79
Studies from the United States							
CWBH: 13 states	Moffitt 1985	Cross-sectional		0.36			
United States: Georgia	Solon 1985	DID	Tax policy change (nontaxable to taxable benefits)	0.10	0.07	0.08	0.14
CWBH: all states	Katz & Meyer 1990	State by year		0.80		0.29	1.74
United States: New York	Meyer & Mok 2007	Pre–post	Increase in maximum weekly benefit level from $180 to $245	0.60	0.30	0.41	0.81
				0.12	0.30	0.08	0.16
				0.23	0.30	0.16	0.31
United States	Chetty 2008	DID	Cross-state maximum benefit level	0.53		0.36	0.71
United States: Idaho, Louisiana, Missouri, New Mexico, Washington	Landais 2015	RKD	Kink at maximum UI benefit level	0.29	0.73	0.14	0.40
United States	Kroft & Notowidigdo 2016	DID	Cross-state maximum benefit level	0.63		0.23	1.43
United States: Missouri	Card et al. 2015a	RKD	Kink at maximum level of UI benefits – during recession – recession	1.21	0.78	0.95	1.68
			Kink at maximum level of UI benefits – prerecession/boom	0.38	0.35	0.38	0.59

All calculated behavioral cost terms use the constant hazard approximation described in Section 4.2. The behavioral cost in the last column represents the extra cost (in dollars) to the government budget of increasing the mechanical transfer (that is, the transfer in the absence of behavioral responses) to the unemployed by $1. For example, a behavioral cost of $0.55 suggests that to finance a $1 transfer from a benefit extension, one has to raise $1.55 to cover the mechanical cost ($1) and behavioral cost ($0.55). The last two columns differ in whether the budget shortfall is measured using the employee's UI contribution rate (at 3%) or at the full tax wedge.
Abbreviations: CWBH, Continuous Wage and Benefit History data; DID, difference in differences; RKD, regression kink design; UI, unemployment.

where $\eta_{D,b} = (\mathrm{d}D/\mathrm{d}b)(b/D)$ is the elasticity of nonemployment duration with respect to benefits, and S_P is the UI exhaustion rate. Similarly, we can derive the marginal effect on welfare of an increase in the PBD (see the **Supplemental Appendix**; follow the **Supplemental Material link** from the Annual Reviews home page at **http://www.annualreviews.org**):

Supplemental Material

$$\frac{\mathrm{d}W}{\mathrm{d}P}\frac{1}{S_P\, b\, v'(c_e)} = \underbrace{\frac{\widetilde{u}'(c_{u,t>P}) - v'(c_e)}{v'(c_e)}}_{\substack{\text{Social value}\\ \text{of \$1 add. transfer}}} - \underbrace{\frac{\mathrm{d}D}{\mathrm{d}P}\frac{1}{S_P}\left(\xi + \frac{\tau}{b}\right)}_{\substack{\text{Behavioral cost}\\ \text{per \$1 add. transfer}}} . \tag{10}$$

As before, these expressions measure the consumption value of the marginal welfare effect in units of the total (mechanical) transfer of UI benefits before the behavioral adjustment (which is B for benefit levels, and $S_P b$ for benefit durations). A key advantage of the two new behavioral cost terms in Equations 9 and 10 is that they can be directly compared to each other.

The marginal welfare effects in the form of Equations 9 and 10 highlight that the most commonly reported parameters—the elasticity of unemployment durations with respect to the benefit level $\eta_{D,b}$ and the marginal effect of increasing the PBD on unemployment durations $\mathrm{d}D/\mathrm{d}P$—are not sufficient to gauge the magnitude of the disincentive effect. It also shows that the elasticity of unemployment durations with respect to the PBD, $\eta_{D,P}$, does not enter the marginal welfare formula without some rescaling.

The final two columns of **Tables 1** and **2** report estimates of the behavioral cost of a marginal increase of UI benefit durations and levels estimated for different studies based on the second term in Equations 9 and 10, respectively. We have to infer the hazard rate s, the term ξ, and the exhaustion rate S_P from statistics on the mean nonemployment and benefit duration reported in the papers. To get a value for τ/b, let $\hat{\tau}$ be the tax rate, so that $\tau = \hat{\tau} w$, and ρ the UI replacement rate, so that $b = \rho w$, as long as pre- and postunemployment wages are approximately equal.[13] We therefore use $\hat{\tau}/\rho = \tau/b$ to calculate the behavioral cost. To obtain a value for ρ, we use the statutory replacement rates for each country (OECD 2015).

Tables 1 and **2** present estimates of the efficiency cost for two values of $\hat{\tau}$ that correspond to two assumptions about the integration of the UI system with the general government budget. The next to last column shows efficiency cost estimates using an average of the worker contribution rate (e.g., payroll taxes) to the UI system across countries. This corresponds to typical applications of the Baily-Chetty formula, which only takes into account the budget shortfall from longer nonemployment durations for the UI system. As noted by Lawson (2014) and Nekoei & Weber (2015), this likely understates the budget shortfall in practice, as workers pay additional taxes on earnings to finance other government expenditures. Therefore, the final column of **Table 1** shows estimates of the efficiency cost using an estimate of the average tax wedge on labor.[14]

Consider first the estimates of the efficiency cost of benefit durations shown in the last two columns in **Table 1**. Using the UI tax rate and excluding three extreme outlier values, we find that the behavioral cost for each additional \$1 transfer of UI benefits varies between \$0.11 and \$2.13, with a median of \$0.60.[15] The median value implies that for every dollar of (mechanical) transfer

[13]Alternatively, one could scale this by the average wage loss after unemployment.

[14]This is captured in the model of Section 3 by adding an additional government expenditure E to the budget constraint in Equation 3. We use a common value for all countries for the UI tax rate that comes from Carter et al. (2013), commissioned by the International Labour Organization. We use country-specific estimates of the tax wedge from the OECD (2015).

[15]The outliers are two values for Austria with efficiency costs above \$50, and the one negative efficiency cost. The Austrian outliers are from a sample of relatively old individuals where the UI expansion seems to have induced many workers to

to existing UI beneficiaries, \$1.60 has to be raised: \$1 to finance the transfer (the mechanical cost) and \$0.60 because of the loss of tax revenue due to the behavioral response (the behavioral cost). As expected, using the tax wedge instead to measure the effect on the government budget raises the efficiency costs. Excluding the same extreme outliers, these now range from \$0.37 to \$4.58, with a median of \$1.78. That is, for each dollar of UI transfer, approximately \$3 has to be raised. Estimates for the efficiency cost of benefit levels are shown in **Table 2** and are generally lower than the effect of benefit durations. The median is \$0.35 (\$0.81) for $\hat{\tau}$ = UI tax ($\hat{\tau}$ = tax wedge). This may be surprising, as the discussion in Section 4.1 (and the evidence in **Tables 1** and **2**) suggests that the labor supply effects of benefit levels are somewhat larger than that for levels. Looking at the formulas, we see that the difference in efficiency costs arises because the labor supply effect is scaled by $1/S_P$ for benefit durations instead of $1/(1 - S_P)$ for benefit levels, whose median values are approximately 5 and 1.25 for the studies in **Table 1**. The intuition is that our formula gives the efficiency cost per unit of mechanical transfer. For example, in the case of UI durations, if there are few exhaustees (i.e., S_P is low), the budget shortfall is distributed over a smaller group of people, and hence the cost per unit of transfer is large.

Overall, **Tables 1** and **2** confirm the implication from labor supply estimates discussed in Section 4.1 that the efficiency costs can be substantial. However, they also imply that labor supply elasticities only imperfectly capture the actual variation in the efficiency costs shown in the tables. Although the marginal effect ($\mathrm{d}D/\mathrm{d}P$) and the behavioral cost are positively correlated, it is clear that the marginal effect does not fully capture the variation in behavioral cost. Excluding again three outliers in **Table 1**, the R^2 of a simple descriptive linear regression of the true efficiency cost of an increase in UI benefit durations on the duration elasticity is 61–68%. The average scaling factor $[(\xi + \tau/b)/S_P]$ across studies as measured by the slope coefficient of regression is -1.85 (-4) when τ = UI tax (τ = tax wedge). Finally, not surprisingly, the behavioral cost exhibits greater variance across studies than the labor supply elasticity, which ranges from -0.1 to -1. Given how we implemented the formulas in Equations 9 and 10, this mainly results from variation in exhaustion rates (S_P) and exit hazards (s).

Overall, the exercise demonstrates that a more complete accounting of the behavioral costs requires not only labor supply estimates, but also information on exhaustion rates, hazard rates, and parameters of the UI system such as benefit levels and tax rates. For a better understanding of the welfare effect of UI, it would be useful if future studies reported a sufficiently extended set of statistics, which should be readily available to the researchers, to allow comparable calculations of the behavioral cost of UI benefits.

4.2.2. The marginal social value of unemployment insurance benefit changes. To use the framework discussed in Section 3 to assess the overall welfare effect of a change in UI benefits—and hence the optimality of UI benefits—one needs estimates of the social value of UI benefit extensions as well. That UI benefits have potentially large welfare benefits is already suggested by estimates of the labor supply effects. Although traditionally the labor supply elasticities of UI have been interpreted as substitution (moral hazard) effects, if individuals are liquidity constrained, these estimates capture both substitution and income effects of UI benefits. Chetty (2008) estimates that more than half of the UI benefit labor supply elasticity in his sample of US workers results from a

effectively drop out of the labor force until early retirement. Another reason for the large computed efficiency cost may be that the constant hazard approximation is particularly poor here, as it implies an exhaustion rate very close to zero, thus blowing up the efficiency cost.

liquidity effect. This implies that a substantial fraction of the population is liquidity constrained, and hence profits from more generous UI benefits.

If one were to use Equations 9 and 10 to calculate the net welfare effect of a marginal change in UI benefits, it would be necessary to recover the gap in marginal utilities. The literature has developed various approaches to this difficult question. Gruber (1997) observes that if the utility function is the same in unemployment and employment $v(\cdot) = u(\cdot)$, then the gap in marginal utilities can be written as $\gamma(\Delta c_1/c_e)$ where γ is the coefficient of relative risk aversion, and $\Delta c_1 = c_e - c_{u,t\leq P}$ is the difference in consumption between the employed and the UI recipients. To obtain a measure of the gap in marginal utilities, Gruber (1997) estimates $(\Delta c_1/c_e)(b) = \alpha + \beta b$ and combines these estimates with typical values for γ from the literature. More recently, Kroft & Notowidigdo (2016) use the same approach to estimate how $(\Delta c_1/c_e)(b)$ (and therefore the gap in marginal utilities) varies by the state of the business cycle. Because assets have been shown to deplete throughout the unemployment spell, the social value of a benefit extension is likely to be higher. No current study estimates the social value for workers exhausting their UI benefits. However, several studies have analyzed the change in household income upon UI exhaustion (e.g., Congr. Budg. Off. 2004; Rothstein & Valletta 2014; Ganong & Noel 2015). Under the assumption that absent UI benefits the decline in consumption is similar to the reduction in household income, one can in principle again use Gruber's (1997) approach to estimate the social value.

A second approach in the literature has been to directly infer the gap in marginal utilities from responses in search effort to changes in incentives. Chetty (2008) shows that in a model with assets and endogenous savings, the gap in marginal utilities can be written as

$$\frac{u'(c_{u,t\leq P}) - v'(c_e)}{v'(c_e)} = \frac{-\partial s/\partial A}{\partial s/\partial A - \partial s/\partial b},$$

where $\partial s/\partial A$ is the marginal effect of a \$1 increase in assets at the beginning of unemployment on search effort, and $\partial s/\partial b$ is the marginal effect of increasing UI benefits by \$1 on search effort. This formulation highlights that the gap in marginal utilities corresponds to the ratio between the liquidity effect and the substitution effect of UI benefits. Furthermore, it has the advantage that it can be estimated using observed responses to changes in assets and UI benefits, which Chetty (2008) does using variation in UI benefits and severance payments.[16]

The top half of **Table 3** displays various estimates of the consumption decline at unemployment. In the United States, these range from 6–15% in expansions to up to 20–27% in recessions. In terms of consumption changes at UI benefit exhaustion, using the Survey of Income and Program Participation, Rothstein & Valletta (2014) report that at exhaustion household income drops to 0.6–0.7 of pre–job loss income. The welfare gain of \$1 of additional UI benefits implied by these numbers depends substantially on the chosen value of relative risk aversion. For a value of $\gamma = 2$, the welfare gain implied by the numbers in **Table 3** would range from \$0.20 in expansions to \$0.40–0.50 in contractions. For a value of $\gamma = 5$, the welfare gains would range from \$0.50 to \$1–1.25.

[16]A third approach to empirically obtain the gap in marginal utilities is developed by Shimer & Werning (2007) in a model with stochastic wage offers in which individuals' job searches are characterized by a reservation wage. Shimer & Werning note that in such a model the reservation wage net of taxes is equal to the value of unemployment. Therefore, the marginal effect on welfare can be expressed as a function of the marginal effect of UI benefits on the reservation wage and of the disincentive effect of UI benefits. Estimates of changes in reservation wages are rare (see, e.g., Feldstein & Poterba 1984, Krueger & Mueller 2016). For a more detailed discussion of this approach, readers are referred to Shimer & Werning (2007) as well as Chetty (2009), who compares the different approaches to estimate the marginal utility gap.

Table 3 Estimates of consumption loss at unemployment and ratio of liquidity to moral hazard effect of unemployment insurance

Study	Range of years	Country	Data source	Consumption loss at unemployment	Implied welfare effect, CRRA coefficient $\gamma = 2$	Implied welfare effect, CRRA coefficient $\gamma = 5$
Consumption loss estimates						
Cochrane 1991	1980–1983	United States	PSID	24–27%	0.51	1.275
Gruber 1997	1968–1987	United States	PSID, food only	6.8%	0.136	0.34
Browning & Crossley 2001	1995	Canada	COEP Canada	14.0%	0.28	0.7
Stephens 2001	1968–1992	United States	PSID	9.0%	0.18	0.45
Chetty & Looney 2006	1980–1993	United States	PSID	10.6%	0.212	0.53
Chetty & Szeidl 2006	1968–1997	United States	PSID	10–15%	0.25	0.625
Rothstein & Valletta 2014	2001 panel	United States	SIPP	10.0%	0.2	0.5
	2008 panel	United States	SIPP	20.0%	0.4	1
Kroft & Notowididgo 2016	1968–1997	United States	PSID	6.9%	0.138	0.345
Ganong & Noel 2015	2012–2015	United States	JPMCI checking account data	6.1%	0.122	0.305
Kolsrud et al. 2015	1999–2007	Sweden	Tax records	19.0%	0.38	0.95
Estimates of liquidity to moral hazard ratio						
				Design to estimate liquidity/ moral hazard effect		**Liquidity to moral hazard ratio**
Card et al. 2007a	1981–2001	Austria	Social security registry	Response to severance pay, RD		1.4
Chetty 2008	1985–2000	United States	SIPP	Response to severance pay, OLS		1.5
Landais 2015	1970s to 1984	United States	CWBH (five states)	Regression kink design		0.88

The implied welfare effect is calculated by multiplying the consumption loss at unemployment by the CRRA coefficient. The midpoint of the interval is taken to calculate the implied welfare effect for studies giving a range of estimates. Abbreviations: COEP, Canadian Out of Employment Panel; CRRA, constant relative risk aversion; CWBH, Continuous Wage and Benefit History data set; JPMCI, JPMorgan Chase Institute; OLS, ordinary least squares; PSID, Panel Study of Income Dynamics; RD, regression discontinuity; SIPP, Survey of Income and Program Participation.

The bottom half of **Table 3** shows three estimates of the welfare gain based on the ratio of moral hazard and liquidity effects. These tend to be larger than the values implied by the consumption-based approach. As Chetty (2008) points out, the reason is in part that the liquidity effects he estimates are only compatible with high levels of risk aversion, such as $\gamma = 5$. The advantage of the sufficient statistics approach is that one need not assume a value for γ, allowing one to implicitly infer the degree of risk aversion from the data. Based on these results, a higher value of γ to scale the consumption estimates in the top half of **Table 3** is likely to be more appropriate.

Overall, it is clear that the welfare gain of a marginal increase in UI benefits is positive and likely to be substantial, especially in recessions. However, the two approaches tend to give somewhat disparate results, with the higher estimates given by the relatively newer studies using liquidity effects. As these require fewer assumptions on risk aversion, generating additional estimates to corroborate existing findings is an important avenue for future research. This is particularly important because for smaller levels of risk aversion the net welfare effect of extensions in UI benefit generosity may as well be negative, especially for larger tax rates.

There are other important additional avenues for future research. Most papers that have implemented the sufficient statistics approach to derive the marginal welfare benefit of UI increases have focused on the effect of changing benefit levels. Therefore, attempts to recover the gap in marginal utilities have been limited to estimating

$$\frac{u'(c_{u,t\leq P}) - v'(c_e)}{v'(c_e)}.$$

However, in principle, it should be straightforward to use very similar approaches to recover the gap in marginal utilities in consumption for the UI exhaustees:

$$\frac{\tilde{u}'(c_{u,t>P}) - v'(c_e)}{v'(c_e)}.$$

Because a large part of the policy debate focuses on the duration of benefits P as opposed to benefit levels, this would be a promising area for future empirical research.

Once one has estimates of the components of Equations 7 or 8, one can calculate the marginal effect of increasing benefits or durations in the current economy. Chetty (2008) and Shimer & Werning (2007), for example, provide calculations that suggest there would be sizable increases in social welfare associated with increasing the level of UI benefits in the United States. In contrast, to determine the optimal level b^* or duration P^* of benefits, one would set the first-order conditions equal to zero: $(\mathrm{d}W/\mathrm{d}b)(b^*) = 0$ and $(\mathrm{d}W/\mathrm{d}P)(P^*) = 0$. Solving the first-order conditions for b^* or P^*, however, requires specifying how the values of the sufficient statistics vary for values of b and P that are different than the ones in the current economy. Solving this problem is an important avenue for future research (see, e.g., Kolsrud et al. 2015).[17]

[17] For example, Gruber (1997) assumes that the consumption gap of the unemployed is linear in b, and that γ and the nonemployment duration elasticity do not vary with b. Although they may be reasonable approximations for levels of b and P that are close to the current economy, they may be quite inaccurate when extrapolating to values further away from the observed values. If exogenous variation over the full range of b and P were available, the sufficient statistics approach could be used to trace out the approximate shape of the marginal welfare function. Because this is rarely available, when the optimal level and duration of UI benefits are far away from the current economy, it may be advantageous to use a structural model to extrapolate behavior and welfare parameters out of sample. Yet, despite a sizable literature that estimates structural models of job search, attempts to use such estimated models to calculate the optimal structure of UI benefits have been relatively rare. One exception is provided by Lentz (2009), who estimates a search model using data from Denmark and then uses the model to solve for the optimal level of UI benefits (with infinite durations). In future work, it would be interesting to combine the structural and sufficient statistics approach to explore the optimality of the UI system.

4.3. Should Unemployment Insurance Vary with Labor Market or Individual Characteristics?

Recurring questions are whether UI durations should be increased in recessions, and by how much; whether they should vary for different demographic groups in the population; or whether they should vary over the unemployment spell. The theory discussed in Section 3 implies that the optimal duration of UI benefits varies over time or in the population if either the insurance benefit or the efficiency cost varies. For example, as shown in Equation 10 for the case of UI benefit durations, two key sources of variation that are easily measured in the data are the UI exhaustion rate and the labor supply elasticity. Several studies have assessed the heterogeneity in these parameters along various dimensions.

For example, Schmieder et al. (2012a) and Kroft & Notowidigdo (2016) assess whether UI durations and benefits, respectively, should vary over the business cycle. Because job search theory does not provide a clear indication as to which direction the labor supply elasticity should change in recessions, the question becomes an empirical one. Schmieder et al. (2012a) find that in Germany, over 30 years, the UI exhaustion rates increased substantially in recessions. In contrast, they show that the labor supply effect as commonly estimated ($\mathrm{d}D/\mathrm{d}P$) is acyclical. They also calculate the adjusted marginal effect per beneficiary $[(dD/dP)(1/S_P)]$, which prominently figures into the true behavioral cost in Equation 10. Because the exhaustion rate is highly cyclical in Germany and in other countries (e.g., Congr. Budg. Off. 2004), the adjusted marginal effect is strongly countercyclical. Absent substantial changes in utility parameters, this implies that the behavioral cost in Equation 10 is countercyclical and that as a result UI benefits should be extended in recessions. Studying the United States, Kroft & Notowidigdo (2016) find that the labor supply effect of UI benefit levels also tends to decline in recessions, whereas the consumption drop upon unemployment weakly increases in recessions, and hence come to a similar conclusion. An important caveat to the interpretation of these findings discussed in Section 4.6 is that changes in the welfare effects over the business cycle should depend on the macro, not the micro, labor supply elasticity.

By similar arguments, if exhaustion rates or labor supply effects of UI (or utility parameters) vary substantially in the population, UI benefit durations or levels should vary. Unfortunately, in many cases, it is difficult to obtain precise estimates for the variation in labor supply effects in the population, either because of sample sizes or because the design itself already targets particular demographic groups. For example, none of the studies analyzing discrete UI extensions occurring at different age cutoffs find substantial variation in UI effects by age (e.g., Schmieder et al. 2012a). Conversely, Michelacci & Ruffo (2015) calibrate a life-cycle model of optimal UI, taking into account human capital formation, and argue that unemployment benefits should be more generous for the young, who have low savings and high incentives to find work. Understanding the heterogeneity of UI benefit effects on labor supply and consumption is an area where additional work would be useful.

A particularly interesting case of potential differences in the effect of UI benefits between local labor markets is discussed by Gerard & Gonzaga (2013). A central concern in developing countries is that the presence of informal labor markets may lower the costs of receiving UI benefits, and hence may raise the efficiency costs of UI. Gerard & Gonzaga (2013) study the effect of discrete increases in UI durations by job tenure in Brazil. Although they confirm that at benefit exhaustion some workers shift from informal to formal work, the effective efficiency cost is minor because reemployment rates in the formal sector are so low. Instead, Gerard & Gonzaga show that the efficiency costs are larger the greater is the share of formal sector employment because a larger fraction of workers reenter formal employment (and hence UI actually reduces formal sector employment and thus tax revenues). Overall, the paper shows that although the efficiency costs of UI in Brazil are smaller than in the United States, a greater fraction of households is likely to be liquidity constrained.

4.4. The Optimal Time Path of Unemployment Insurance

Most recent empirical papers concerned with the optimality of the UI system have used the so-called sufficient statistic approach and focused on the marginal welfare effect of a single change in either benefits or durations from the prevailing level. This is consistent with the observation in Section 2 that the majority of UI systems feature a benefit path with a single step-down in benefits. In contrast, a sizable, mostly theoretical literature has explored the optimal time path of UI benefits.[18] Yet this literature has largely relied on numerically solving calibrated models and has not been tightly linked to the empirical literature. In contrast, in a recent paper, Kolsrud et al. (2015) use a sequence of kinks in the benefit schedule to estimate the labor supply effect of UI and the consumption effect of unemployment at different points over the unemployment spell in Sweden. With a dynamic version of the framework laid out in Section 3, they use these estimates to assess whether the optimal benefit path should increase or decline over the unemployment spell. They find that the consumption drop at unemployment increases over the spell, with little effect of private insurance through savings. In contrast, the behavioral costs derived from the labor supply effects decline over the spell, suggesting that the optimal benefit path should be increasing with unemployment duration. Additional research with similar research designs would be helpful to corroborate these findings.

4.5. Crowd Out of Private Insurance

As with any social insurance program, the presence of UI benefits may crowd out forms of private insurance as well. For example, UI benefits can reduce precautionary savings by workers at risk of layoff (Engen & Gruber 2001) and have been shown to diminish the rise in spousal labor supply in response to a layoff (Cullen & Gruber 2000). Similar crowd-out effects may be present for insurance via family transfers or the take-up of other social insurance programs available to unemployed workers, such as food stamps [Supplemental Nutrition Assistance Program (SNAP)] or employment subsidies such as the Earned Income Tax Credit (EITC). Yet, beyond empirical estimates, the welfare consequences of substituting between different types of insurance mechanisms are not fully understood. For example, some forms of private insurance may entail foregoing investments in favor of short-term consumption commitments. In an extreme case, one may observe no change in consumption at job loss, but reductions in investments in human capital, health, or children. The utilization of costly means of private insurance is a particular concern in developing countries, where income shocks may be larger and the social safety net is weaker. For example, Chetty & Looney (2006) document that although unemployment leads to similar reductions in consumption in the United States and Indonesia, the methods of consumption smoothing are very different. As

[18] In a seminal paper, Shavell & Weiss (1979) show that the optimal time path of UI benefits without savings is declining over time. Hopenhayn & Nicolini (1997) show that allowing for a tax upon reemployment alters the optimal time path to be much flatter. The tax upon reemployment is increasing in the duration of unemployment. However, Pavoni (2007) demonstrates that if the social planner has to maintain a minimum consumption level, the result of an optimal declining benefit path is reestablished, and Pavoni (2009) shows that such a minimum consumption level arises endogenously in a model with skill depreciation. If the unemployed have savings at the beginning of the unemployment spell, the optimal benefit path may be a constant level of benefits paid indefinitely, as suggested by Kocherlakota (2004) and Shimer & Werning (2008).

documented by Dynarski & Gruber (1997), the unemployed in the United States rely chiefly on UI payments (replacing 15 cents for each dollar lost), reductions in tax burden (replacing about 26–35 cents per dollar lost), and reductions in own savings (replacing 35–40 cents per dollar lost). In contrast, in Indonesia, reductions in education spending for children, as well as increases in child labor and labor of other household members, are more frequent. Even in the United States, an increasing amount of research shows that, despite the presence of more generous UI benefits, job loss can have adverse consequences on the health and educational outcomes of children (e.g., von Wachter 2015), possibly because the majority of unemployed have very little savings (e.g., Dickens et al. 2016). Incorporating the costs of alternative forms of insurance into the evaluation of the welfare benefits of UI is a useful avenue for future research.[19]

Another approach to privately reducing the risk of unemployment is to accumulate general human capital. The presence of UI benefits may encourage the accumulation of human capital specific to an occupation or industry whose value is more sensitive to economic conditions. Although the early literature suggested that, by reducing uncertainty, UI may raise human capital accumulation (e.g., Brown & Kaufold 1988), more recent papers (e.g., Mukoyama & Şahin 2006) have suggested that more generous UI favors the accumulation of specific skills and may even reduce the incentives to accumulate general human capital. These ideas have been used to argue that more generous UI benefits in Europe have supported a higher degree of specific skill accumulation than in the United States, which in turn is purported to have low social insurance and higher degrees of general skills (e.g., Wasmer 2002). Whether UI actually leads to a crowd in or crowd out of human capital, and if so of what kind, is an interesting open question.

4.6. Spillover Effects of Unemployment Insurance Extensions

Section 3 presents a partial equilibrium model that assumes that firms do not respond to changes in UI benefit levels by adjusting vacancy creation and that workers' job-finding rates do not depend on the actions of other workers. This assumption may not hold, however. For example, if the unemployed compete for a fixed number of jobs (job rationing), the reduction of search intensity by some will lead to an increased likelihood of a job match by others. However, if the decline in search intensity raises the cost of job creation, the vacancy creation rate may decline in response to more generous UI benefits, augmenting the direct effect of a decline in search intensity on employment.

Landais et al. (2015) develop a search and matching model of the labor market that explicitly allows for such spillover effects. In the model, there are two types of spillover effects, which both act by affecting labor market tightness (the ratio between job seekers and vacancies): (*a*) Firms can respond to UI by increasing or decreasing the number of vacancies they create, and (*b*) there can be spillover effects between job searchers through crowding effects. The model draws a clear distinction between the micro elasticity of UI, $\eta_{D,b}^{\text{micro}}$, which is the effect of benefits on unemployment duration holding tightness constant, and the macro elasticity of UI, $\eta_{D,b}^{\text{macro}}$, which includes the effects of benefits on durations that come from general equilibrium adjustments in tightness. The macro elasticity is given as the sum of the micro elasticity plus a spillover term that depends on the elasticity of tightness with respect to benefits. The standard Baily-Chetty formula does not capture the full welfare effects of UI, because the unemployed individual will ignore the effects of his or her own behavior on labor market tightness, creating a wedge between the individual's first-order condition and the relevant effect of UI on aggregate durations. Landais

[19]Blundell et al. (2016) contrast the role of spousal labor supply with other mechanisms of insurance, but do not pursue a normative analysis of UI benefit provision.

et al. (2015) provide a modified version of the Baily-Chetty formula that includes an elasticity wedge term: $1 - \eta_{D,b}^{\text{macro}}/\eta_{D,b}^{\text{micro}}$. If the wedge term is equal to zero, the formula coincides with the standard Baily-Chetty formula. If the wedge term is positive (i.e., the macro elasticity is smaller than the micro elasticity), then the optimal replacement rate is higher; if it is negative, the optimal replacement rate is lower. Landais et al. (2015) show that the wedge term can be positive or negative, depending on whether increases in UI benefits raise or lower labor market tightness. Because this term can be positive or negative under alternative, plausible search models, estimating the wedge (or the ratio of macro to micro elasticities) is an important empirical question.[20]

Many of the most convincing recent studies on the effects of UI extensions or changes in benefit levels discussed in Section 4.1 come from regression discontinuity and regression kink designs. Although these studies provide clean identification of labor supply effects, the estimates are plausible because they hold many factors constant and, in particular, compare workers within the same labor market and therefore facing the same labor market tightness (e.g., to the left and right of a policy threshold). Thus these estimates all correspond to micro effects and do not provide information about the macro effects. Studies of the macro effects have to allow for adjustments of labor market tightness and therefore have to rely on comparisons across labor markets, which are inherently harder to plausibly identify.

A small but growing literature has tried to assess the potential spillover effects from UI extensions. Using the CPS, Levine (1993) and Valletta (2014) analyze the crowding effect of UI extensions for unemployed workers not eligible for UI. They find support for the notion that UI extensions raise the job-finding rate of unaffected job seekers. Perhaps the best evidence on spillover effects to date is provided by Crépon et al. (2013), who evaluate crowding effects via a randomized social experiment in the context of a large-scale job search assistance (JSA) program in France and find significant evidence for a positive wedge term (macro effects were smaller than micro effects). The strongest evidence on the elasticity wedge of UI estimated consistently within the same setting is offered by Lalive et al. (2015), who evaluate a large-scale regional expansion of UI benefits in the 1980s. They provide strong evidence of significant spillover effects leading to smaller macro than micro effects.

Several papers have tried to assess the effect of UI benefits on unemployment rates through vacancy creation. Marinescu (2015) uses information from a large online job board to directly assess the effect of UI extensions on vacancies and labor market tightness. Although Marinescu (2015) shows that application rates decline in response to UI extensions, she finds little effect on the level or composition of vacancies. She uses the implied effect of UI benefits on labor market tightness to calibrate a macro elasticity, and finds that it is approximately 30% smaller than the micro elasticity. Some evidence consistent with this finding is also provided by Kroft et al. (2015), who show that the macro effects are smaller than micro effects in the United States for a target population of programs such as the EITC or welfare benefits.

In contrast, Hagedorn et al. (2013, 2015) directly study the effect of state-level extensions and contractions in UI benefits on the aggregate unemployment rate. To establish counterfactual unemployment rates, the two papers compare local areas around the borders of states that experienced changes in UI benefits. They find that UI benefit changes can have substantial effects on the aggregate unemployment rate. This result appears to be somewhat sensitive to the exact sample and specification, as Amaral & Ice (2014) argue, and the effects are significantly

[20]The idea that the ratio between micro and macro labor supply effects is informative about labor market spillovers is also developed by Kroft et al. (2015), who show that the ratio between macro and micro labor force participation effects is informative for the optimal shape of the tax and transfer system in a model with general equilibrium adjustments.

smaller under some alternative specifications. Coglianese (2016) also studies the macro responses to UI extensions during the Great Recession, using random measurement error in the CPS relative to the true underlying economic conditions as a source of identification, and finds that UI extensions raise employment growth. Coglianese also argues in some detail that the Hagedorn and Manovskii (Hagedorn et al. 2013) design is likely downward biased. Similarly exploiting measurement error—here identified by later revisions—in the unemployment rates triggering extensions, Chodorow-Reich & Karabarbounis (2016) show that seemingly random variation in UI extensions does not seem to have a significant effect on macroeconomic outcomes. Di Maggio & Kermani (2015) come to similar conclusions using variation in the level of UI benefits across states to argue that the generosity of UI benefits has limited effects on the aggregate unemployment rate. In contrast, Johnston & Mas (2015) study sharp benefit reductions in Missouri. Using a difference-in-differences design, they find a macro effect approximately equal to the implied effect from the micro elasticity (i.e., there are no spillover effects).

Overall, the literature on spillover effects of UI extensions is somewhat mixed, with more evidence pointing toward smaller, or equal, macro than micro effects. More work estimating the spillover effects of UI, for example, under different economic conditions, would be helpful.

Another effect of UI on the aggregate employment rate can arise if the presence of social insurance raises the willingness of firms to fire workers (e.g., Feldstein 1976, 1978). This mechanism was well understood at the conception of the US UI system, and hence firms' UI tax rates rise with the number of new beneficiaries. However, this so-called experience rating is incomplete, so that firms do not fully internalize the externality their layoffs impose on the system (see Krueger & Meyer 2002 for a summary of the evidence). This was a particular concern in the 1970s and 1980s, when temporary layoffs, followed by recall, were a frequent phenomenon, particularly for the US manufacturing sector. Although temporary layoffs have become less frequent, changes in firms' UI tax rates may also influence permanent layoffs. This is a particularly interesting question because after the rise in layoffs during the Great Recession many firms have likely reached their maximum tax rate and hence the minimum cost of a marginal layoff.

5. OTHER FRONTIERS IN RESEARCH ON UNEMPLOYMENT INSURANCE

5.1. The Effect of Unemployment Insurance Extensions on Job Outcomes

A common motivation for providing UI is to allow unemployed workers to search for good job matches. Intuitively, the notion is that job search is more effective when a worker is unemployed, and taking a low-quality, interim job may hurt the prospect of finding a job that fits a worker's skill level. Although there is no heterogeneity in the wage or job type in the basic model sketched in Section 3, this is easily added by introducing reservation wages. In a canonical model in which workers control both job search intensity and reservation wages, an extension in UI benefits leads to an outward shift of the reservation wage at all unemployment durations. This implies that an increase in UI benefits raises the average starting wage for new jobs. A parallel implication holds for other job characteristics and the quality of a job match, which is often measured by the duration of tenure at new jobs. The implication from the basic model can be reversed if unemployment duration itself has a negative effect on wages, for example, if human capital depreciates through the unemployment spell (Schmieder et al. 2016). The presence of negative effects could be rational for forward-looking individuals if the value of leisure is high enough.

A small but growing literature directly evaluates the effect of UI benefits on job outcomes empirically. The overall finding is that UI extensions tend to have small negative effects on wages, but the results are often imprecisely estimated and often include zero or modest positive values in the confidence interval. For example, Schmieder et al. (2016) use a very large sample of individuals to show that an increase in UI durations of 6 months precisely lowers daily wages by less than 1%. Studies with smaller samples have found comparable point estimates with less precision (e.g., Card et al. 2007a and Lalive 2007 in Austria, van Ours & Vodopivec 2008 in Slovenia, Centeno & Novo 2009 in Portugal, and Degen & Lalive 2013 in Switzerland). In contrast, Nekoei & Weber (2015) find a positive relationship between extensions of relatively short baseline UI benefits and reemployment wages in Austria. In line with the literature, they find that nonemployment duration is negatively correlated with wages, and they argue that their findings can be reconciled with those of the rest of literature due to the relatively short UI durations (and hence nonemployment durations) they study. Additional evidence on how the duration of UI benefits affects job outcomes, especially in the United States, would be helpful.[21]

One important implication of these findings is that it appears that unemployment duration indeed has a causal negative effect on wages. It has been difficult to obtain causal estimates of this effect because unemployment duration is not randomly assigned. Yet even if one were able to solve the selection problem, reservation wages also change over the nonemployment spell, making it difficult to isolate the effect of skill depreciation on wages. Schmieder et al. (2016) show that under certain circumstances, one can indeed interpret the negative effect of UI extensions on wages as human capital depreciation or statistical discrimination. They argue that if reservation wages do not bind, by revealed preference the mean reemployment wages at each unemployment duration should be unaffected by UI extensions. They test and find support for this restriction using data from Germany. Lalive et al. (2015) report similar findings for UI extensions in Austria.

Another important question is whether the potential adverse wage effects of UI extensions modify the welfare trade-offs discussed in Sections 3 and 4.2. As discussed in Section 3, if workers receive the entire match surplus, then wage declines are effectively already factored into their optimal response to UI benefits and hence do not alter the welfare calculation. There are three exceptions to this conclusion. First, this equivalence result fails if workers share the surplus with their employers—as would be the case under Nash bargaining, for example. Second, there are budgetary consequences if wage effects are strong enough to reduce other tax revenues. Finally, workers might not be forward looking or might be overoptimistic regarding how their job prospects change over the unemployment spell.

5.2. Long-Term Effects of Unemployment Insurance Extensions

Most theoretical and empirical work focuses on the short-term effects of UI extensions. This is at least in part because empirically it is difficult to analyze longer-term effects with sufficient precision. Yet there are several potential sources of longer-term effects of UI extensions. One effect already mentioned is human capital depreciation or changes in job quality. Studies of effects of other labor market shocks, such as job losses, suggest that changes in wages or job characteristics can be very persistent. Another source of variation arises directly from the underlying labor supply decision—if workers use wealth to self-insure against shocks, a temporary reduction in wealth may raise labor supply after the initial nonemployment spell. Yet another source of persistent effects can arise from habituation or knowledge of the program. It has long been posited in the

[21]The difficulty in the United States is that typically only information on quarterly earnings, not wages, is observed in the data. For example, Johnston & Mas (2015) report that UI reductions in Missouri did not have a noticeable effect on quarterly earnings.

welfare literature that take-up of social assistance programs may be affected by a distaste of, or lack of knowledge of, the program. In that case, initial exposure to the program might yield larger elasticities later on.

The vast majority of the literature analyzes the effect of extensions in UI durations or increases in UI benefits on the duration until a job is found. However, this may either under- or overstate the total cost of UI extensions if these also affect the incidence and duration of future unemployment. Schmieder et al. (2012b) study the long-term effect of UI extensions on nonemployment over a 5-year period after entering UI. They find that longer UI benefit durations raise nonemployment for over 3 years after the initial spell. However, they show that this effect is entirely driven by the initial unemployment spell. The effect of the initial spell on lifetime unemployment is attenuated by future labor supply decisions because workers with UI extensions actually spend less time unemployed after the initial unemployment spell.[22]

In contrast, Lemieux & MacLeod (2000) find evidence that first-time exposure to a new UI regime leads to a higher propensity to collect UI benefits again in the future. This phenomenon, which they term supply-side hysteresis, could be due to information, a decline in stigma, or habituation. However, because they do not have information on actual nonemployment, it is an open question whether labor supply elasticities actually first fell as UI benefits became more generous, and then recovered. Another question is whether learning is always present for first-time UI users. For example, Schmieder et al. (2012a) find that adjustment to a benefit reform in Germany is instantaneous among all UI spells, but they do not differentiate between first-time and previous UI recipients. Another important aspect is that learning about the program could occur for both workers and firms, especially in Canada where firms' UI taxes do not depend on previous UI claims (i.e., there is no experience rating).

5.3. Behavioral Economics and Unemployment Insurance

A rapidly growing literature (see Chetty 2015 for an overview) has documented how insights from behavioral economics can improve public policy making, either by improving the predictive power of economic models or by opening up the possibility of new policy tools. Despite the large influence of behavioral economics in public economics and health, the vast majority of the empirical and theoretical literature on UI has been based on models with standard neoclassical preferences. This is perhaps surprising given that the discussion in Section 3 implies that nonstandard assumptions about risk preferences, discounting, or beliefs are all likely to affect the labor supply and welfare effects of UI benefits. However, a number of recent papers have started to explore how behavioral insights may improve the empirical analysis of job search and shape recommendations for designing UI benefits, and these papers can be classified along these three types of deviations.

[22] Schmieder et al. (2012b) find that the effect of potential UI benefits P on total nonemployment, $\mathrm{d}D/\mathrm{d}P$ (which in their case is measured over the first 5 years of the nonemployment spell), is smaller than the effect of P on the duration of the initial nonemployment spell, $\mathrm{d}D^1/\mathrm{d}P$ (which is the marginal effect typically estimated). That is, the long-term effect of UI on overall nonemployment is smaller. They show that the difference between the two marginal effects consists of three terms: $\mathrm{d}D/\mathrm{d}P - \mathrm{d}D^1/\mathrm{d}P = -(\mathrm{d}D^1/\mathrm{d}P)p_u + (T - D^1)(\mathrm{d}p_u/\mathrm{d}P) - ((\mathrm{dcov}(D^1, p_u))/\mathrm{d}P)$, where p_u is the average probability of being unemployed in a given month after the first nonemployment spell (this is a combination of the probability of being laid off again and the duration of the later unemployment spells). The first term suggests that at a given probability of subsequent unemployment, if the follow-up period is finite, the longer the initial spell, the shorter is the time spent in unemployment afterward. Second, the propensity of spending the remaining time $(T - D^1)$ in unemployment may change. Third, UI benefits may affect the relationship between the initial spell duration and the probability of subsequent unemployment. Schmieder et al. (2012b) show that all three components matter, but that the reduction in the unemployment probability explains more than half the difference.

As a first example of a job search model with nonstandard preferences, DellaVigna & Paserman (2005) explore the implications of relaxing the standard assumption of exponential discounting, allowing for hyperbolic discounting as in Laibson (1997). They show that, although impatience in general leads to lower reservation wages and search intensity, with exponential discounting the former effect dominates (at least for sufficiently patient individuals), and the exit hazard should increase with higher impatience. However, with hyperbolic discounting, the comparative statics are reversed, and the exit hazard falls with impatience. Evidence from the National Longitudinal Survey of Youth and the Panel Study of Income Dynamics appears to be strongly in line with the predictions from the model with hyperbolic discounting. Paserman (2008) builds on this and estimates a structural job search model with hyperbolic discounting. The estimates point to a substantial degree of present bias (β between 0.4 for low-wage workers and 0.89 for high-wage workers), and the model provides a significantly improved fit relative to the model with exponential discounting.

As another form of nonstandard preferences, DellaVigna et al. (2016) allow for reference dependence in the utility function, similar to Kahneman & Tversky's (1979) prospect theory. In this model, individuals evaluate their current consumption level relative to a reference point, which is given as the average income in the recent past. Many papers have documented that the exit hazard from unemployment typically falls early on in the unemployment spell, rises toward the exhaustion point of UI benefits, and then falls again. Reference dependence can rationalize this pattern in a natural way: Early on in the unemployment spell, individuals search hard given that their benefits are low relative to their recent income. Over time, they get used to the lower income, and thus reduce their search effort. As they approach the benefit cut, their search effort rises again, followed by a decline once they get used to the new, even lower, benefit level. To distinguish this model from a standard model with unobserved heterogeneity, DellaVigna et al. (2016) provide evidence from a natural experiment in Hungary that front-loaded the UI benefit path. This reform led to a change in the exit hazard that is difficult to explain with the standard model. The paper goes on to estimate the model structurally to show that the standard model is clearly rejected and that the estimates point to substantial reference dependence with a slowly adjusting reference point.

In the class of nonstandard beliefs, Spinnewijn (2014) analyzes how biased beliefs about the job-finding probability can affect the design of UI benefits. The paper shows that people systematically underestimate the time it takes to find a job, which would lead them to save too little and to not search enough for jobs. It distinguishes between two types of overconfidence: baseline optimism, in which individuals overestimate the level of the job-finding probability, and control optimism, in which individuals overestimate the effect of search effort on the job-finding probability. Spinnewijn (2014) shows that the sufficient statistics approach can be adapted to allow for overconfidence and derives an adjusted Baily-Chetty formula incorporating corrective terms for the biased beliefs. This modified formula shows that the standard unemployment duration elasticity overestimates the cost from reducing search incentives when the unemployed have control-optimistic beliefs. Conversely, the gap in marginal utilities overestimates the welfare gain from providing insurance when job seekers have baseline-optimistic beliefs. This is an interesting example of how the sufficient statistics approach can be used in the context of behavioral economics to provide insights into determining the relevant parameters needed for policy analysis. Although the paper provides estimates for baseline optimism, it is quite difficult to convincingly estimate control optimism, and this should be a fruitful area of future research. Caliendo et al. (2015) have explored a similar idea, in which individuals have different beliefs about the impact of their search effort on the job offer arrival rate. Using the locus-of-control concept from psychology, they show that individuals with an internal locus of control search harder and have higher reservation wages than individuals with an external locus of control.

Finally, a few papers have provided evidence of nonstandard decision making, such as through the role of framing, limited attention, or emotions, though this literature has been less linked to economic modeling and UI design. For example, Altmann et al. (2015) conduct an experiment in which they mailed a letter to a random group of UI entrants. The letter provided some information about benefits of job search and the current economic environment and attempted to frame the period of unemployment in a more positive light. The letter reduced unemployment durations significantly and points toward the importance of at least some of these channels. In a fascinating series of papers, Krueger & Mueller (2010, 2012, 2016) and Krueger et al. (2011) document several stylized facts that may, at least at first glance, seem puzzling from the perspective of the standard job search model. For example, job searchers spend on average very little time searching for a job: only approximately 10 to 20 min per day. Even at this low level, search effort seems to decline throughout the unemployment spell. Furthermore, it is striking that self-reported reservation wages are very close to the pre-unemployment wage for most individuals, yet job seekers often accept jobs that pay below the self-reported reservation wage. Both these facts may point to the importance of nonstandard decision making and are worth exploring further. Perhaps an explanation for the low search effort lies in the fact that self-reported happiness is quite low, in particular while looking for a job, and individuals become increasingly depressed throughout the unemployment spell. But if these emotional states play an important role for determining job search, then the standard model may miss some important aspects, and the typical tools of incentives, sanctions, or search monitoring may have counterintuitive results. Instead, interventions that focus on providing psychological and social support or alternative ways of framing and motivation may be more successful in helping job seekers.

5.4. Interactions with Other Programs

The majority of the literature studies exclusively the effect of UI, independent of other programs. However, clearly the UI program typically does not operate in a policy vacuum. Broadly speaking, there are two types of programs UI can interact with. First, there is typically a range of complementary programs aimed specifically at unemployed job seekers (some of these are available to all job seekers; some are specifically targeted to UI recipients). These include various kinds of JSA, either light or intensive retraining, and sometimes sanctions if suitable jobs are not taken up.

Second, UI also can interact with other social insurance programs, such as welfare programs, food stamps (SNAP), or disability insurance. As discussed in Section 4.1, economists have long understood that UI changes the relative price of insurance for workers, potentially leading to crowd out of self-insurance. In the same fashion, UI may crowd out the utilization of other social insurance programs. If the programs are substitutes, this could generate cost savings that should be taken into account in the optimal benefit calculations. Such savings are limited in so far as most social insurance programs are geared toward those with chronic lower income, not more stable workers who are typically receiving UI. However, especially in the case of large recessions, UI extensions may prevent these stable workers from taking up more expensive programs, such as disability insurance.

There has been a reasonable amount of theoretical and empirical papers addressing the interactions between UI and complementary active labor market programs. There is very little work addressing the interaction between UI and social insurance programs more generally.

Several papers explore the optimal combination of UI-related policies. Because the standard model typically has finite benefit durations, it incorporates a role for the level of second-tier benefits, available in many European countries in the form of a means-tested unemployment assistance program. More sophisticated models incorporate a role for retraining, JSA, or wage subsidy programs, which are all components of a typical UI system. For example, Pavoni & Violante (2007) incorporate these components in a principal-agent model, and derive the optimal policy that arises. They show that an optimal sequence of UI, monitored JSA, and welfare arises endogenously, during which benefits first are constant, then decline, and then are constant again. An important necessary feature in such a front-loaded structure is that there is a negative causal effect of unemployment duration on the job-finding rates, as can arise if workers experience skill depreciation.[23]

There is a large literature analyzing the effect of a range of ALMPs on employment outcomes of the unemployed in general (e.g., Card et al. 2010, 2015b). Typically, these papers focus on the effectiveness of, say, monitoring, sanctions, JSA, or retraining itself, rather than its interaction with parameters of the UI program. Yet, several aspects indicated by the theory are worth further investigation, such as whether the effectiveness of different services varies throughout the UI spell or with economic conditions in the local labor market. For example, Black et al. (2003) find that the threat of reemployment services has a stronger effect on reemployment than the service itself. Yet, this result is established in relatively high-pressure labor markets and may not hold in situations with slack demand. Schmieder & Trenkle (2015) raise the concern that interactions of UI with other job search programs may lead to biased estimates of the disincentive effect of UI. In typical microeconometric studies of the effects of UI extensions, it seems possible that UI caseworkers allocate their resources (e.g., time, vacancies that can be referred, ALMPs) taking UI eligibility into account. If they target these resources either to the unemployed with shorter benefit durations or to those who are most responsive, this could lead to biased estimates of the effects of UI, even in seemingly clean designs such as regression discontinuities or regression kink designs. The paper is reassuring, however, in that it presents evidence that along a variety of measures caseworkers do not seem to target resources differentially to unemployed with different eligibility durations.

A promising avenue for future work is how UI interacts with other social insurance programs, such as welfare, food stamps (SNAP), and disability insurance. For example, Mueller et al. (2016) use haphazard extensions in UI benefits during the 2008 recession in the United States to analyze the effect of UI benefits on the propensity to apply (and receive) Social Security Disability Insurance (SSDI). Given that SSDI is a generous program with a high implicit tax on work and access to costly Medicare benefits, UI extensions could generate substantial cost savings if they helped marginally disabled job losers to remain in the labor force instead of transiting onto SSDI. In contrast to much of the literature suggesting that SSDI may substantially reduce the employment of marginally disabled workers, Mueller et al. do not find that more generous UI benefits lower SSDI application rates. The reason is that the vast majority of workers applying to SSDI actually have very low prior labor force attachment, and hence are unlikely to be eligible for UI.[24]

6. CONCLUSION

Recent years have seen significant progress in our empirical and theoretical understanding of UI. On the one hand, new empirical methods and data sets have greatly improved the plausibility of empirical estimates of the effects of UI. On the other hand, theoretical work has highlighted important dimensions of the trade-offs of more generous UI benefits. Yet, although the body of

[23] Boone et al. (2007) also analyze the optimal amount of monitoring and sanctions in the context of time-limited UI benefits.

[24] See also recent work on the effect of UI receipt on welfare income by Leung & O'Leary (2015).

evidence is slowly building up a consistent picture of some specific aspects of UI—such as the labor supply effects of benefit levels and PBDs on unemployment durations—this work has also drawn the spotlight to many areas where our understanding is quite limited, and where it would be important to have more evidence to provide actual policy recommendations for UI design. Although these areas are numerous, perhaps some stand out in particular: (*a*) The welfare gains from UI have been studied only in very limited contexts and not for benefit exhaustees (the crucial group for understanding the trade-off of extending UI benefit duration); (*b*) despite some creative work, there are still very significant gaps regarding the direction and size of spillover effects and how they may vary over the business cycle; (*c*) the evidence on job outcomes, such as reemployment wages, is limited and somewhat conflicting, in particular given the low power of most studies to detect effects in the relevant range; (*d*) the effects of UI on outcomes such as spousal labor supply, long-term outcomes, and uptake of other social programs are understudied; and (*e*) the analysis of the role of UI in developing economies with large informal sectors is in its infancy, which is particularly important given the sizable interest by many emerging market countries in developing UI systems.

In addition to these open empirical questions, there are some important conceptual questions that have not been fully resolved. One outstanding question is how to combine theory and empirical work to analyze the shape of the welfare function and the optimal UI benefit structure. Another question is what the right framework is in which to model UI effects. Recent papers have moved away from modeling job search in a reservation wage model, at least in part motivated by the lack of evidence for positive effects of UI on reemployment wages. However, models with fixed wages appear at odds with the fact that most labor markets exhibit a large amount of wage dispersion and that workers appear to reject some job offers, in particular if they offer low wages. Related to this, an interesting avenue for future research will be to explore whether job search models can be improved by modeling other features of the search process, for example, as suggested by the recent literature seeking to bring in insights from behavioral economics.

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