Web Appendix

1 Welfare Formula with Longterm Effects

This analysis is closely based on the model in Schmieder, von Wachter, and Bender (2012). We assume that jobs come with a fixed wage (that is the wage is identical for all jobs that an individual can get), but that there is an exogenous probability of job loss q that can vary across jobs. Suppose individuals are offered jobs with a job loss probability from a stochastic offer distribution: $q \sim F(q)$. Assume the offers are i.i.d. across periods and there is no recall of previous offers. Optimal search behavior is described by a reservation job loss probability, since lower q jobs are always strictly preferred to higher q jobs. Job loss probabilities above the reservation probability $q \geq Q_t$ are accepted.

$$V_t(q,A_t) = \max_{A_{t+1} \geqq L} \left(v\left(A_t - A_{t+1} + w_t - \tau\right) + (1-q)V_{t+1}\left(A_{t+1}\right) + qJ_t\left(A_t\right) \right) \tag{1}$$

Unemployed individuals receive UI benefits b_t. Thus the value for a person who does not find a job at the beginning of a period is:

$$U_t(A_t) = \max_{A_{t+1} \geqq L} \left(u\left(A_t - A_{t+1} + b_t\right) + J_{t+1}\left(A_{t+1}\right) \right) \tag{2}$$

At the beginning of a period a unemployed person has to chose a search intensity s_t and a reservation wage R_t. the value at the beginning of a period is:

$$J_t(A_t) = \max_{s_t, Q_t} \left(s_t \mathbb{P}(q \geq Q_t) EV_t(A_t) + (1 - s_t \mathbb{P}(q \geq Q_t)) U_t(A_t) - \psi(s_t) \right), \tag{3}$$

where $\mathbb{P}(q \geq Q_t)$ is the probability that an offer has a job loss probability above the reservation probability and $EV_t(A_t)$ is the expected value of being employed conditional on receiving an acceptable offer.

$$EV_t(A_t) = E\left[V_t(w_t, A_t) | q \geq Q_t\right] = \frac{1}{\mathbb{P}(q \geq Q_t)} \int_{Q_t}^{\infty} V_t(q, A_t)\, dq$$

Using the envelope condition, the marginal welfare gain from increasing P, normalized by the UI benefit level, is given as:

$$\frac{dW_0}{dP} = \frac{dJ_0}{dP} = \frac{\partial J_0}{\partial P} - \left((1 - s_0 \mathbb{P}(q \geq Q_t)) \frac{\partial U_0}{\partial w} + s_0 \mathbb{P}(q \geq Q_t) \frac{\partial EV_0}{\partial w} \right) \frac{d\tau}{dP}$$

The marginal utility of consumption while employed is given as:

$$(T-D)E_{0,T-1}v'(c_t^e) = (1-s_0\mathbb{P}(q \geq Q_t))\frac{\partial U_0}{\partial w} + s_0\mathbb{P}(q \geq Q_t)\frac{\partial EV_0}{\partial w}$$

Let p_t^D the probability of being nonemployed in period t (whether in the initial unemployment spell or after a new job loss). The expected duration of nonemployment is then: $D = \sum_{t=0}^{T-1} p_t^D$. Similarly let $p_t^{d \leq P}$ be the probability that conditional on being unemployed in period t, the individual has not yet exhausted their UI benefits. Then the expected duration of receiving UI benefits is given as: $B = \sum_{t=0}^{T-1} p_t^D \times p_t^{d \leq P}$.

The effect of increasing P on the value function holding labor supply decisions constant ($s_0$and Q in all periods) depends on the probability of being unemployed and actually exhausting UI benefits in every spell.

$$\frac{\partial J_0}{\partial P} = \sum_{t=0}^{T-1} p_t^D \frac{\partial p_t^{d \leq P}}{\partial P} E[u'(c_{t,P}^u)|D, d=P]$$

Suppose the expected marginal utility of exhaustees is roughly constant (that across different unemployment spells), then we can write this as:

$$\frac{\partial J_0}{\partial P} = E[u'(c_{t,P}^u)|D, d=P] \sum_{t=0}^{T-1} p_t^D \frac{\partial p_t^{d \leq P}}{\partial P}$$

Therefore we can write the welfare gain as:

$$\frac{dW_0}{dP} = \left.\frac{dB}{dP}\right|_1 bE[u'(c_{t,P}^u)|D, d=P] - \frac{d\tau}{dP}(T-D)E_{0,T-1}v'(c_t^e)$$

where $\frac{dB}{dP}\big|_1 = \sum_{t=0}^{T-1} p_t^D \frac{\partial p_t^{d \leq P}}{\partial P} = \sum_{t=0}^{T-1} p_t^D p_t^{d=P}$ is the expected number of spells an invidiual is exhausting UI benefits. We can also define the effect of increasing potential UI durations on benefit durations that is purely due to behavioral changes (and not due to the additional coverage): $\frac{dB}{dP}{}_2\big| = \sum_{t=0}^{T-1} p_t^{d \leq P} \frac{\partial p_t^D}{\partial P}$.

The government budget constraint is:

$$\frac{d\tau}{dP} = \frac{b}{T-D}\left(\frac{dB}{dP} + \frac{B}{T-D}\frac{dD}{dP}\right)$$

where we have that $\frac{dD}{dP} = \sum_{t=0}^{T-1} \frac{\partial p_t^D}{\partial P}$ and $\frac{dB}{dP} = \frac{dB}{dP}\big|_1 + \frac{dB}{dP}\big|_2$.

Therefore the marginal welfare gain from an increase in P is given as:

$$\frac{dW_0}{dP} = \left.\frac{dB}{dP}\right|_1 b\left[E_{0,T-1}u'(c^u_{t,P}) - E_{0,T-1}v'(c^e_t)\right] - \left(\left.\frac{dB}{dP}\right|_2 + \frac{B}{T-D}\frac{dD}{dP}\right) bE_{0,T-1}v'(c^e_t) \quad (4)$$

where Compared to the welfare formula in the paper this is identical, except that the survivor function is now determined by the probability of finding a job and the probability of the job loss probability being acceptable.

Alternative formulation for D and B:

Let p^n_s equal the probability that an individual has s nonemployment spells and let p^e_s be the probability that an individual has s employment spells (jobs) after the initial job loss within 5 years of the initial job loss. Furthermore let q_s be the job loss hazard in each month during the s employment spell. p^n_s is a function of the job loss probability in the $s-1$ job since unemployment. We have that $p^n_{s=1}$= 1, $p^n_{s=2} = p^e_1 \times (1-\prod_{t=0}(1-q_1))$, etc.

We then have that: $D = \sum^{\infty}_{s=0} p^n_s E[D_s]$, where the expected duration of nonemployment spell s is given as: $E[D_s] = \sum_{t=0} S^n_s(t)$. Here $S^n_s(t)$ is the average survivor function if staying in nonemployment in the s nonemployment spell in month t of that spell. Therefore: $D = \sum_{s=0} p^n_s \sum_{t=0} S^n_s(t)$, and:

$$\frac{dD}{dP} = \sum_{s=0} \frac{dp^n_s}{dP} \sum_{t=0} S^n_s(t) + \sum_{s=0} p^n_s \sum_{t=0} \frac{dS^n_s(t)}{dP}$$

which illustrates that D increases in response to UI extensions since the probability of future UI spells may change (due to changes in the probability of reemployment and subsequent job stability), and since search behavior in these future jobs may be affected.

Similarly we can write: $B = \sum_{s=0} p^n_s \sum^{P_s}_{t=0} S^n_s(t)$, and taking the derivative we get:

$$\frac{dB}{dP} = \sum_{s=0} \frac{dp^n_s}{dP} \sum^{P_s}_{t=0} S^n_s(t) + \sum_{s=0} p^n_s \sum^{P_s}_{t=0} \frac{dS^n_s(t)}{dP} + \sum_{s=0} p^n_s S^n_s(t)$$

where we can now define: $\left.\frac{dB}{dP}\right|_1 = \sum_{s=0} p^n_s S^n_s(t)$ and $\left.\frac{dB}{dP}\right|_2 = \sum_{s=0} \frac{dp^n_s}{dP} \sum^{P_s}_{t=0} S^n_s(t) + \sum_{s=0} p^n_s \sum^{P_s}_{t=0} \frac{dS^n_s(t)}{dP}$.

2 Comparison with Chetty (2008)

To make the welfare gain from our formula comparable to Chetty, let's rewrite the Formula to represent the marginal effect of 1 extra Euro that is transferred from the employed to the unemployed via UI benefits (call these transfers ω).

For this we can simply divde our welfare formula (the marginal welfare effect for one additional month of potential UI durations) by the additional payments that are caused by this increase in P: $b * \frac{dB}{dP}$)

$$\frac{dW*}{d\omega} = \frac{dW_0}{dP} \Big/ (b\frac{dB}{dP}) = \left(\frac{dB}{dP}\bigg|_1 R - \left[\frac{dB}{dP}\bigg|_2 + \frac{dD}{dP}\frac{B}{T-D} \right] \right) \Big/ \frac{dB}{dP}$$

For the sample average in Germany plugging in the short term estimates for $\frac{dD}{dP}$, $\frac{dB}{dP}|_1$ and $\frac{dB}{dP}|_2$ and using $R = 1.5$ from Chetty yields: $\frac{dW*}{d\omega} = 0.83$. That means each additional Euro of UI benefits increases total welfare by 0.83 Euro. Using the long-term estimates we get: $\frac{dW*}{d\omega} = 0.97$.

If we use our Formula but plug in numbers for the US at the regular potential UI durations of 26 weeks (boom: exhaustion rate $\frac{dB}{dP}|_2 = .35$, $\frac{dD}{dP} = 0.2$, $D = 34$ weeks, $UR = 0.05$) and use our approximate formula to calculate $\frac{dB}{dP}|_2 = \xi\frac{dD}{dP} = 0.18 * .2 = 0.036$, then the Formula above yields: $\frac{dW*}{d\omega} = 1.24$. The number is higher, mainly because of the higher exhaustion rate in the US (due to the shorter potential durations). It is less clear how to modify these numbers to get the equivalent of long term effects.

To get a comparable number from Chetty, note that his formula represents the welfare gain per dollar increase in weekly UI benefits expressed as the value of a permanent wage increase once a person is reemployed. To get a comparable number we first divide his formula by B, since a 1 dollar increase in b increases total UI benefits paid by $B * b$ and multiply his formula by the remaining lifetime after reemployment $T - D$ to express the welfare gain as a one time payment to the employed.

$$\frac{dW*}{d\omega} = \frac{\frac{dW_0}{db}}{B}(T-D) = R - \frac{\varepsilon_{B,b}}{\sigma}$$

Given that Chetty estimates: $R = 1.5$, $\varepsilon_{B,b} = 0.53$, and $\sigma = 0.946$, this yields: $\frac{dW*}{d\omega} = 0.94$

3 Long-term vs. Short-term Effects

Let D_i be the time an individual i spends in nonemployment until retirement at date T. Let $D_{i,1}$ be the duration of the first nonemployment spell. Let $p_{i,u}$ be the fraction of time individual i spends in nonemployment (or the average probability of being unemployed in a given month) after the first unemployment spell (this is a combination of the probability of being laid off again the the duration of the later unemployment spells).

We then have that:

$$D_i = D_{i,1} + (T - D_{i,1})p_{i,u}$$

And:

$$\frac{dD_i}{dP} = \frac{dD_{i,1}}{dP} - \frac{dD_{i,1}}{dP}p_{i,u} + (T - D_{i,1})\frac{dp_{i,u}}{dP}$$

The first term is the QJE effect, the second term $-\frac{dD_{i,1}}{dP}p_{i,u}$ is negative and the third term

$(T-D_{i,1})\frac{dp_{i,u}}{dP}$ could be positive or negative depending on the sign of $\frac{dp_u}{dP}$.

If we aggregate this to the population level (letting the expectation operator E stand for aggregating over individuals, and $D = ED_i$, $D_1 = ED_{i,1}$, and $p_u = Ep_{i,u}$), we get that:

$$\begin{aligned} D &= D_1 + E\left[(T-D_{i,1})p_{i,u}\right] \\ &= D_1 + (T-D_1)p_u - Cov\left(D_{i,1}, p_{i,u}\right) \end{aligned}$$

Taking the derivative with respect to P we get:

$$\frac{dD}{dP} = \frac{dD_1}{dP} - \frac{dD_1}{dP}p_u + (T-D_1)\frac{dp_u}{dP} - \frac{dCov\left(D_{i,1}, p_{i,u}\right)}{dP}$$