Available online at www.sciencedirect.com
SCIENCE @ DIRECT®
ELSEVIER
Journal of Monetary Economics 51 (2004) 1683–1710
Journal of MONETARY ECONOMICS
www.elsevier.com/locate/econbase

Unemployment insurance and capital accumulation ☆

Eric R. Young*

Department of Economics, Florida State University, Tallahassee, FL 32306, USA

Received 11 December 2002; received in revised form 20 February 2004; accepted 5 March 2004

Abstract

In this paper, I examine a model economy with production, search, and unemployment insurance. The introduction of capital into the economy of Wang and Williamson (J. Monetary Econom. 49(7)(2001)1337) generates the result that optimal replacement ratios are always zero. The result arises from the decline in aggregate activity caused by unemployment insurance: both capital and labor inputs to production fall when benefits rise. Unlike most of the literature, I compute explicitly the cost of the transition path; agents are made better off by switching to a steady state with no unemployment insurance, but the welfare gain is approximately cut in half. Only the very poor and unemployed suffer welfare losses along the transition path. I then briefly investigate the implications of negative replacement ratios.

JEL classification: E62; H21

Keywords: Unemployment insurance; Savings; General equilibrium search

☆This paper is a revised version of Chapter 1 of my dissertation submitted to the Graduate School of Industrial Administration, Carnegie Mellon University, and previously circulated under the title "On the Optimality of Zero Unemployment Insurance". I would like to thank Fernando Alvarez, Daniele Coen-Pirani, Robert Couch, Ron Goettler, Finn Kydland, Don Schlagenhauf, Tony Smith, Jorge Soares, Tom Tallarini, Cheng Wang, Stan Zin and an anonymous referee for helpful comments as well as seminar participants at Carnegie Mellon, the Federal Reserve Bank of Atlanta, Florida State, George Washington, Missouri, Texas, and Western Ontario. The financial support of the William Larimer Mellon Foundation and National Science Foundation is gratefully acknowledged. All remaining errors remain my errors.
*Tel.: 850 644 7088; fax: 850 644 4535.
E-mail address: eyoung@garnet.acns.fsu.edu (E.R. Young).

0304-3932/$ - see front matter
doi:10.1016/j.jmoneco.2004.03.001

1. Introduction

The optimal provision of unemployment insurance (UI) in dynamic economies has generated a large body of literature, beginning with Shavell and Weiss (1979). However, much of the literature abstracts from the production side of the economy, instead choosing to ignore private savings entirely or to simply allow savings in the form of stored consumption.[1] In general, it has been (at least implicitly) assumed that the introduction of endogenous interest and wage rates would add little insight into the role of unemployment insurance and would make little quantitative difference, and also therefore that capital accumulation is unimportant. The main purpose of this paper is to examine whether these assumptions are innocuous.

The model economy here extends the model in Wang and Williamson (2001) to include firms, capital, and endogenous prices for labor and capital. Other papers have examined the role played by UI in models with capital markets; these papers include Costain (1997) and Heer (2002). However, those papers introduce other complicating features as well: wage contracting, thin and thick market externalities, and finite horizons with retirement. In those papers, it is not clear where exactly the benefit from unemployment insurance comes from: is it beneficial because it alleviates these labor market frictions or because it overcomes some capital market incompleteness? This paper retains one labor market friction—the costly and unobservable search which leads to moral hazard—but otherwise abstracts from the details of the labor market. The purpose of this abstraction is to isolate attention on the role unemployment insurance can play in mitigating the effects of a missing market.

The literature finds a wide range of optimal replacement ratios (defined variously as that maximizing average welfare or the welfare of a newborn). For example, Hansen and İmrohoroğlu (1992) finds that the optimal permanent replacement ratio ranges from 0.65 in the absence of moral hazard to 0.05 in a case with extreme moral hazard. Sleet (1997), in a model quite similar to this one but without capital, finds an optimal value of 0.4. Wang and Williamson (2001) computes the optimal replacement ratio for benefits that last only two quarters; they obtain a value of 0.47. Davidson and Woodbury (1997) finds an even stronger result: the optimal replacement ratio is 1 if benefits are given for a short duration and around 0.5 if unlimited. Costain (1997) and Heer (2002) instead choose to maximize the utility of a newborn agent—they find that optimal replacement ratios are typically around 0.5 for benefits that are limited in duration. In contrast, the results in this paper point to an optimal replacement ratio of zero independent of the duration. The welfare gain from eliminating the current system is 1.1 percent of aggregate consumption, a number which is somewhat larger than those found in the literature, and 0.59 percent of consumption if the transition is taken into account.

[1]Papers in the first tradition include Wang and Williamson (1996), Andolfatto and Gomme (1996), and Ljungqvist and Sargent (1995, 1998) while those in the second tradition include Hansen and İmrohoroğlu (1992), Sleet (1997), Pallage and Zimmermann (2001), Wang and Williamson (2001), and Abdulkadiroğlu et al. (2002).

The essence of the zero replacement ratio result comes down to UI's effect on the capital and labor inputs. The effect that unemployment insurance has on the labor input has been widely studied. In this model, UI benefits can increase the exit rate from employment (the separation effect) as well as decrease the exit rate from unemployment (the attachment effect). By lowering the cost of unemployment, benefits make it more likely that agents will not exert enough effort to find a job or retain one they already have. All the papers cited above include the second effect; many, however, assume that the separation effect is negligible or even zero.

However, there is more to the story than just the labor input. Aggregate savings in our model will equal the demand for capital in equilibrium. As a result, unemployment insurance can have an impact on the aggregate level of capital. As the labor input falls, so will the marginal product of capital. In addition, increasing unemployment insurance directly reduces the demand for precautionary savings. Consequently, aggregate savings will fall, reducing the capital input. When combined with the decline in the labor input, the result is a relatively large decline in aggregate activity, whether measured by output, consumption, or investment. The potential consumption smoothing benefits of unemployment insurance will be swamped by these effects; it should be noted that UI fails to smooth consumption in this economy—the standard deviation of lifetime consumption rises from 0.0749 to 0.0805 in the presence of the calibrated income support system and the innovation to consumption at the onset of an unemployment spell changes from -0.063 to -0.081. In addition, the tight link between savings and output is critical; without such a link, unemployment insurance has positive welfare effects.

This result is robust to the elimination of the separation effect mentioned above; it holds even when all separations are exogenous. This particular robustness result is important as there appears to be little evidence that the separation effect is very strong. Furthermore, when I examine the transition explicitly, the finding is that almost all agents are made better off; this transition would be implemented in a majority voting environment.[2] However, not all agents gain the same amount from the transition; the relatively-poor but still well-insured have the highest gain, with the poor and the wealthy gaining relatively less. Only the very poor and unemployed lose utility.

Of particular importance for aggregate welfare analysis is the skewness of the wealth distribution; the number of relatively poor agents, and their corresponding high marginal utilities of consumption, is critical in assessing the potential welfare effects of unemployment insurance. In models with storage, where the exogenous interest rate is always below the time rate of preference, agents tend to cluster at the upper end of the distribution—see Fig. 1 in Wang and Williamson (2001). This contrasts with the empirical wealth distribution in the US, where there are far more poor agents than rich agents (see Table 3 in Quadrini and Ríos-Rull (1997)). The

[2]The only paper that considers the transition in the literature is Joseph and Weitzenblum (2003), and their model does not include capital or endogenous prices.

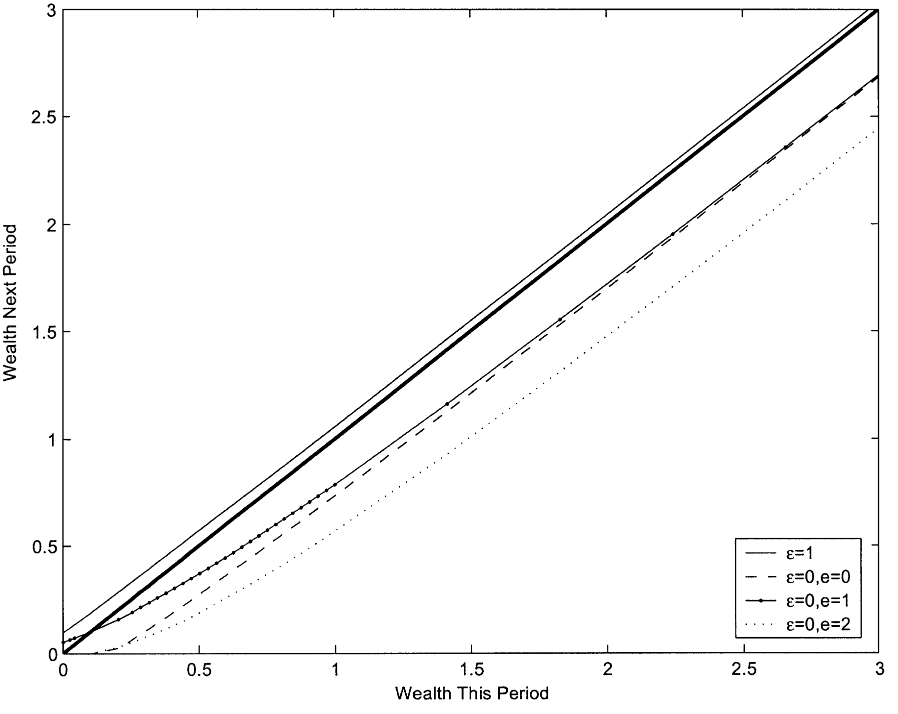

Fig. 1. Savings functions.

model examined here produces a wealth distribution which is a better qualitative match for the empirical US distribution than much of the literature.

It is appropriate here to discuss what the model cannot do. This model has a degenerate wage distribution; consequently, workers do not search to find better jobs. This dimension, which is one first proposed by Albrecht and Axell (1984) and later extended by Acemoglu and Shimer (2000), is completely absent. In those papers, UI can improve efficiency by raising the quality of matches. Whether this effect is quantitatively large enough to counteract the issues raised here is unknown, but is the subject of ongoing work. Very preliminary results suggest that UI has a more positive role to play in economies with permanent differences in productivity and segmented labor markets, however, pointing to the possibility that these results do not generalize in that direction.

The paper is organized as follows. Section 2 presents the model. This section also presents the derivation of the first-best allocation (one in which there is no moral hazard problem). Section 3 calibrates the model to US data and presents results from the benchmark economy and Section 4 presents the welfare results. The transition path to the no-government steady state is computed in Section 5. Section 6 discusses the possibility that the true optimal replacement ratio might be negative. Section 7 concludes.

2. Model

The model economy consists of a unit-measure continuum of households without access to private insurance markets, as in Aiyagari (1994). Preferences are given by

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} - a_t^{\chi} \right], \tag{2.1}$$

where c_t is consumption and a_t is effort. χ, which measures the curvature of the disutility of effort function, is greater or equal to 1, while the coefficient of relative risk aversion, σ, is positive and the discount factor β lies in the interval (0,1).

A household's timeline for the current period proceeds as follows. At the beginning of the period, agents engage in one of two types of effort—if they were employed in the previous period they engage in job-retention effort and if not, they engage in search effort. On-the-job search is precluded, but it would be irrelevant given that all jobs are the same. An agent receives a job opportunity in the current period with probability

$$\Pr(\varepsilon_t = 1 | e_t = j) = 1 - \exp(-\gamma_j a_t), \tag{2.2}$$

where e_t denotes the agent's relevant employment history and ε_t denotes current job status; that is, $\varepsilon_t = 1$ denotes an individual who is currently employed and $\varepsilon_t = 0$ is one who is currently unemployed, and an agent in state $e_t = j$ has had j consecutive periods of unemployment, up to some maximum $\hat{j}$. The flexibility of this construction can allow the probability of employment to fall during an unemployment spell—this feature will be important in matching labor market data. This effort decision does not affect the productivity of workers who obtain a job; this productivity is normalized to 1.

After observing the outcome of their job search, households make a consumption/savings decision. A household can hold assets in the form of capital, the only available tool for consumption smoothing in the face of the above idiosyncratic employment shocks. The budget constraint faced by a household is given by

$$c_t + k_{t+1} = (r_t + 1 - \delta)k_t + \varepsilon_t(1 - \tau_t)w_t + (1 - \varepsilon_t)B_t, \tag{2.3}$$

where k_t is current capital, k_{t+1} is next period's capital, r_t and w_t represent the rental rate and wage rate, τ_t is the payroll tax rate used to fund the unemployment insurance system, and B_t is the benefit level. The depreciation rate δ lies in the closed interval [0,1]. It will be assumed that all households collect their benefits; this decision is optimal in the absence of transactions costs in any case. Taxes are distortionary here; they reduce the value of search by lowering the after-tax wage and thus induce inefficiently low search.

Finally, households face a borrowing constraint:

$$k_{t+1} \geqslant k_{bt}. \tag{2.4}$$

The borrowing constraint for the majority of the paper will be a fixed value; in fact, borrowing will be prohibited. In Section 6, I will examine a borrowing constraint implied by the requirement that consumption be nonnegative.

There also exist a continuum of identical firms in the economy. These firms maximize profit using a Cobb–Douglas production technology in competitive markets, yielding the familiar marginal product conditions

$$r_t = \alpha \bar{k}_t^{\alpha-1}(1-u)_t^{1-\alpha}, \tag{2.5}$$

$$w_t = (1-\alpha)\bar{k}_t^{\alpha}(1-u_t)^{-\alpha}, \tag{2.6}$$

where u_t denotes the unemployment rate, $\bar{k}_t$ the aggregate level of capital, and $\alpha \in [0,1]$ is capital's share of income. With the constant returns to scale assumption combined with free entry and competitive markets, the number of firms can be normalized to one in equilibrium.

The government collects payroll taxes and distributes benefits which cannot be contingent on effort levels, as these are unobservable. It sets a benefit structure $(B_{et})_{e=0}^{\infty}$ and a tax rate τ_t—which is uniform across households—to satisfy the budget constraint

$$\tau_t w_t(1-u_t) = \Sigma_e B_{et} u_{et}, \tag{2.7}$$

where u_{et} is the amount of unemployed in state e and thus receiving benefits B_{et}. For the majority of the paper, I will confine attention to steady-state equilibria in which aggregate variables are constant, but in Section 5 these variables will be allowed to vary along the transition between steady states.

I will also occasionally make reference to the social planning problem (the first-best allocation). In this problem, the government makes the same choices as a social planner and can observe all relevant variables (in particular, effort levels). Given that I will confine myself to steady-state outcomes, this allocation solves the problem

$$\max_{\{a_j\}_{j=0}^{\hat{j}},c,k} \frac{1}{1-\beta}\left\{\frac{c^{1-\sigma}}{1-\sigma} - \sum_{j=0}^{\hat{j}} n_j a_j^{\chi}\right\} \quad \text{(SP)},$$

subject to the resource constraint

$$c + \delta k = k^{\alpha} n_0^{1-\alpha} \tag{2.8}$$

and the Euler equation for investment

$$1 = \beta[\alpha k^{\alpha-1} n_0^{1-\alpha} + 1 - \delta]. \tag{2.9}$$

The Euler equation constraint is needed to pin down the efficient amount of capital in this problem. In the above problem, n_i is the unconditional probability of being in state $e = i$. It is obtained using the Markov transition matrix

$$A = \begin{bmatrix} p_0 & 1-p_0 & \dots & 0 & 0 \\ p_1 & 0 & \dots & 0 & 0 \\ \vdots & \vdots & \ddots & 0 & 0 \\ p_{\hat{j}-1} & 0 & \dots & 0 & 1-p_{\hat{j}-1} \\ p_{\hat{j}} & 0 & \dots & 0 & 1-p_{\hat{j}} \end{bmatrix},$$

where the conditional probability of employment given state $e = i$ is given by

$$p_i = 1 - \exp(-\gamma_i a_i).$$

Note also that, since utility is separable, the planner chooses the same level of consumption for each household independent of past employment status.

The economy admits a recursive representation for the households' problems. Letting $v(k, e)$ denote the value function, $v(k, e)$ must solve the functional equation

$$v(k,e) = \max_{k_1', k_0', a} \left\{ \begin{array}{c} [1 - \exp(-\gamma_e a)] \left[\dfrac{c_1^{1-\sigma}}{1-\sigma} + \beta v(k_1', 0) \right] + \\ \exp(-\gamma_e a) \left[\dfrac{c_0^{1-\sigma}}{1-\sigma} + \beta v(k_0', \min\{e+1, \hat{j}\}) \right] - a^{\chi} \end{array} \right\} \quad \text{(CE)},$$

subject to (2.2)–(2.4), where c_1 denotes consumption if employed and c_0 denotes consumption if unemployed in the current period. The usual arguments establish that the value function exists, is continuous, increasing and concave in k. Note that the problem can be partitioned; since savings decisions are conditioned on the outcome of the job lottery, I can first compute the savings decisions conditional on ε. These decisions define intermediate value functions which can be used to solve for the optimal level of effort.

Equilibria in this economy are elements of the space of distributions over wealth and employment status. Letting $\Gamma(k, e)$ denote a typical element in this space Φ, we then search for a time-invariant distribution Γ^* and an operator $T : \Phi \to \Phi$ such that

1. T is generated by the aggregation of the solutions to the individual households' optimization problems;
2. $T(\Gamma^*) = \Gamma^*$.

Formally, we can define the following object:

Definition 1. A recursive competitive equilibrium for this economy consists of a value function $v : K \times E \to \mathscr{R}$, a savings function $s : K \times E \times \{0, 1\} \to K$, an effort function $a : K \times E \to \mathscr{R}_+$, equilibrium prices $r(\bar{k}, u)$ and $w(\bar{k}, u)$, an unemployment insurance system $(\tau, (B_e)_{e=0}^{\bar{e}})$, and an invariant distribution $\Gamma^* \in \Phi$ such that

(i) v, s, and a solve the households' problems given prices, policy variables, and Γ^*;
(ii) k and u solve the firm's problem given prices;
(iii) the capital market clears: $\int k \, d\Gamma^*(k, e) = \bar{k}$;
(iv) the labor market clears: $\int [1 - \exp(-\gamma_e a)] \, d\Gamma^*(k, e) = 1 - u$;
(v) the government budget constraint holds;
(vi) Γ^* is invariant under T.

This definition only applies to steady-state equilibria. Along the transition path, condition (vi) does not hold, obviously. Instead, it is replaced by the requirement that the distribution in time period $t + 1$ be generated by the decision rules in period t and the distribution in time period t. The solution method is similar to Aiyagari

(1994). First, I guess a value for the tax rate τ and the rental rate r and fix a grid for capital. I then compute the solution to the household problem using Bellman iteration; cubic spline interpolation is used to compute values for the value function between the grid points. Given the decision rules from this computation, I iterate forward to obtain an invariant distribution and compute aggregate statistics; the invariant distribution is a histogram over a finer grid for capital than is used for iteration. Finally, I use nonlinear equation solvers to find the equilibrium (r, τ). In particular, I use Brent's method for r and Newton–Raphson for τ, due to the extreme sensitivity of the economy to changes in r.[3]

3. Calibration and the benchmark

The model economy is calibrated to match certain observations in the US data. I set $\alpha = 0.36$, which is capital's share of income in the post-war US. Letting one period in the model be one quarter in the data, I set $\beta = 0.99$ and $\delta = 0.025$; these parameters imply a wealth-GDP ratio of 11.5 and an investment-GDP ratio of 0.25 respectively, values which are in line with estimates from NIPA data. The search functions are calibrated to replicate the following features of the US distribution of unemployment, estimated from CPS data by Wang and Williamson (2001): total unemployment is 7.4 percent, 69.8 percent of unemployed are in state $e = 0$, and 15.5 percent of unemployed are in state $e = 1$ for the baseline UI system, which is described below.[4] Finally, the borrowing constraint is set initially to zero, $\sigma = 1$ (logarithmic preferences), and $\chi = 2$.

The baseline UI system will match the US system as closely as computationally feasible. In the US, the average replacement ratio is around 50 percent of the last wage earned for UI, which can be collected for at most two quarters, and welfare payments are approximately 17 percent of the average household wage (see Wang and Williamson, 1996). We therefore set $B_0 = B_1 = 0.5w$ and $B_{t \geqslant 2} = 0.17w$. I choose to set $\hat{j} = 2$, the number of distinct UI states measured in the data. The resulting values for γ_e as well as the equilibrium values for r, w, and τ are given in Table 1.[5]

I do not include four features of the US unemployment insurance system. One, UI benefits are considered taxable income in the US. Within this model, this makes little quantitative difference given that the tax rate is relatively low. Second, benefits are tied to past wages. My model, with its degenerate wage distribution, cannot speak to this issue—however, it may be important as the moral hazard problem becomes more severe in the presence of agents with high benefits. This feature, which is

[3]A computational appendix can be found at http://garnet.acns.fsu.edu/~eyoung/papers.html for readers wishing more detailed explanations. Fortran programs can also be found there.

[4]Note that the average unemployment duration cannot be shorter than 13 weeks. Moving to a more realistic number would require changing the period of the model, increasing the computational burden considerably.

[5]This calibration implies there are three different values for γ_e, corresponding to an individual who had a job last period, one who last had a job two periods ago, and one who has not had a job for the previous two periods. Since current employment status is not a state, these three values exhaust all the possibilities.

Table 1
Benchmark parameter values (US Data)

r	w	τ	γ_0	γ_1	γ_2
0.03508	2.3716	0.03609	10.7383	2.9886	1.2664

currently under investigation, seems likely to increase the costs of UI due to this moral hazard problem. The other features abstracted from are experience rating and qualification. Wang and Williamson (2001) find only small aggregate effects from introducing experience rating into their economy; given that it should not impact the mechanism here I choose not to complicate the model with multiple sectors. Furthermore, since tax rates are generally small adding upper and lower bounds due to imperfect experience rating would seem to have little importance. Qualification may have important effects as well, since it would generate complicated entitlement effects, but again it does not seem to be directly relevant for the question at hand. For future reference, I define the replacement ratios for "UI benefits" and "welfare benefits" as

$$\theta \equiv \frac{B_0}{w} = \frac{B_1}{w}$$

and

$$b \equiv \frac{B_2}{w},$$

respectively.

I now present results from the household decision problem. In Fig. 1, households who are experiencing their second consecutive period of unemployment ($\varepsilon = 0$, $e = 1$) save a bit more than those in the first period of unemployment ($\varepsilon = 0$, $e = 0$) if they are sufficiently poor, and their savings functions converge as wealth increases.[6] In Fig. 2, one can also see that consumption functions are decreasing in e for the unemployed; that is, households choose monotonically-decreasing consumption paths if they remain unemployed, which matches with the efficient consumption paths derived by Hopenhayn and Nicolini (1997) in a model without capital accumulation. Fig. 3 draws out this conclusion a bit more clearly by plotting the paths of consumption for individuals who start with different wealth levels and are employed, transit to unemployment, and remain unemployed forever. Note that the poor reach a minimum level of consumption quickly (which corresponds to zero assets) while the wealthy have parallel and nearly-flat consumption paths for a significant portion of their spells.

Fig. 4 presents the probability of a job conditional on the length of the current unemployment spell. The employed from last period ($e = 0$) have a much higher probability of being employed in the current period than do households in states $e = 1$ or $e = 2$, with the latter having a much lower probability than the former. In

[6]The heavy dark line is the 45° line, so it can be seen that employed households save and unemployed generally dissave.

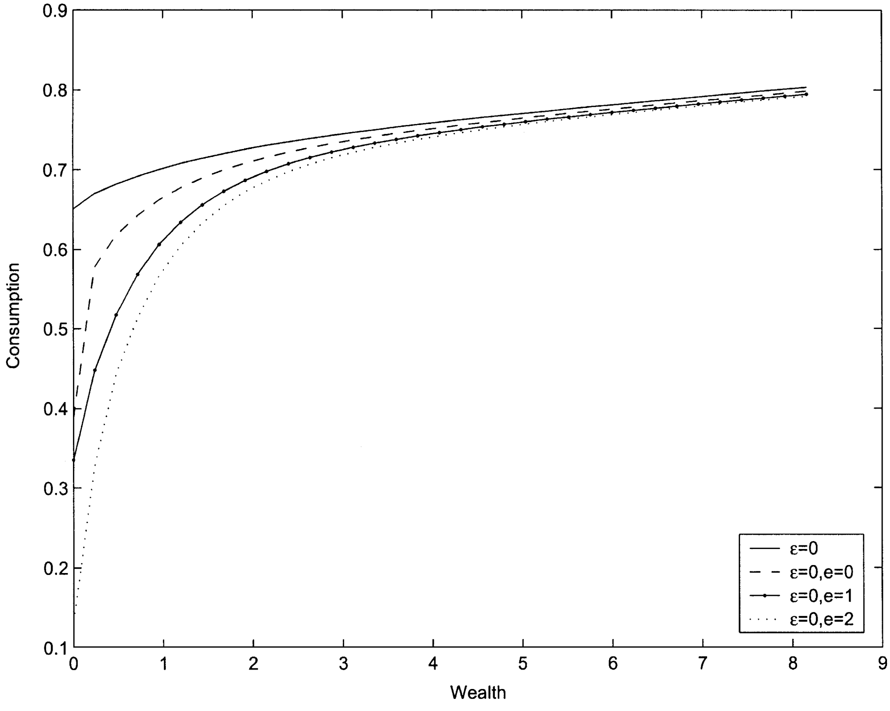

Fig. 2. Consumption functions.

every case, the impact of wealth is to lower the probability of working in the current period through a reduction in effort.

The model's distribution of wealth is plotted in Fig. 5. It has the usual shape; there is a concentration of agents with little or no wealth. However, the Gini coefficient on wealth is too small; in the data this value is 0.78 while the model economy only manages a value of 0.35. Moreover, the contribution of unemployment insurance to the concentration of wealth is limited; the Gini coefficient on wealth only drops to 0.32 if benefits are eliminated. In the working paper version of this paper, I considered variants of the model which explored methods to increase the wealth concentration in the model; these changes had no impact on the issue here and are available upon request. Furthermore, the mean agent is below the median; voting power is concentrated in the hands of the poor and this concentration may have consequence when we examine transition paths.

It is important here to examine how well the model captures certain micro-level facts from the US. For example, Gruber (1997) estimates that the average worker experiences a 7 percent drop in consumption at the onset of an unemployment spell. In the benchmark case, I obtain a negative consumption innovation of 8.1 percent; it should be noted that Gruber (1997) likely underestimated the real impact by using only data on food consumption. This consumption innovation is a rough measure of the potential gain of unemployment insurance—the decline is small, especially

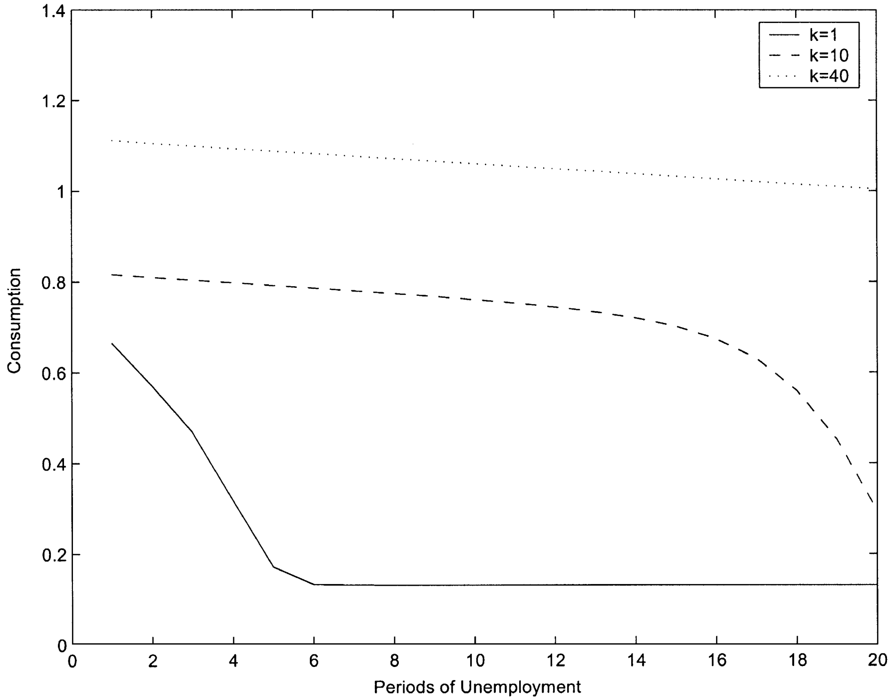

Fig. 3. Consumption path for unemployed.

relative to the drop in income, indicating that there seems to be little aggregate gain possible. Furthermore, Gruber (1999) finds that approximately 75 percent of workers have sufficient assets (including potentially illiquid forms such as housing) to cover their entire income loss from unemployment over a typical spell, but only 40–50 percent can cover their income loss out of liquid assets. In the benchmark model, the average duration of an unemployment spell is 17.9 weeks (it is biased upwards by the assumption that all unemployment spells must last at least 13 weeks). Using this duration, I find that the fraction of agents who can cover their income loss to be 92.6 percent, a number which is clearly too high, even if one is willing to let the capital stock in the model represent producer and consumer capital. The failure of the model to generate an adequate measure of poor agents accounts for the large fraction generated here—but as noted above, variants of the model which produce more poor agents did not overturn the main results.

4. The welfare effects of unemployment insurance

I now consider the effects of changing the generosity of the UI system. We begin first by computing the equilibrium for various combinations of (θ, b) holding fixed the eligibility requirements and all structural parameters. The effects of various

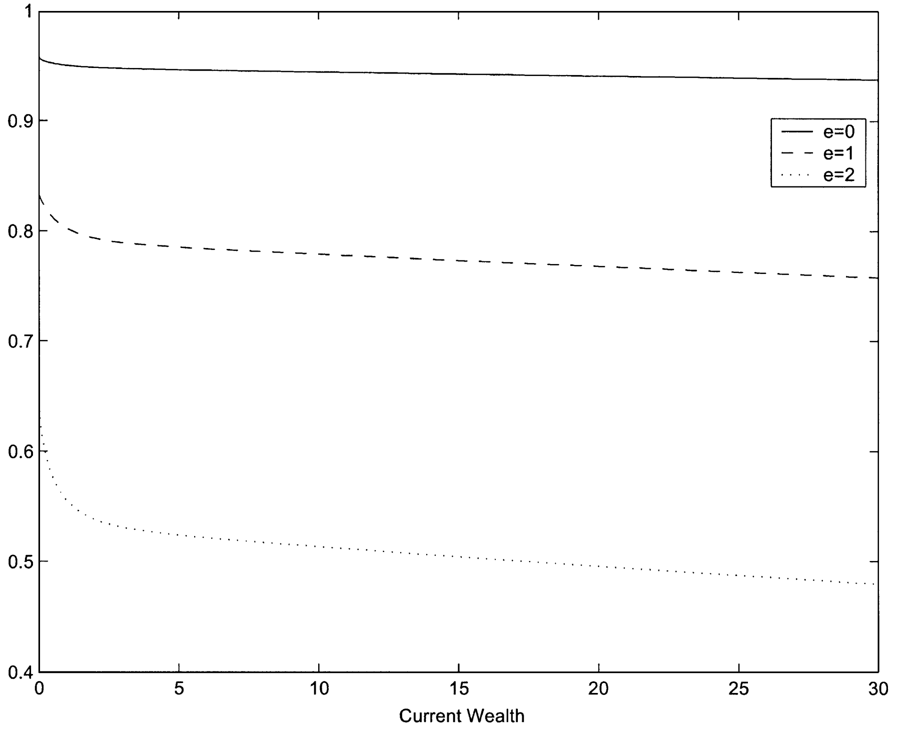

Fig. 4. Probability of employment.

different levels of UI benefits are shown in Table 2. The welfare criterion I choose is the one used in Aiyagari and McGrattan (1998):

$$W = \int v(k,e)\,\mathrm{d}\Gamma(k,e).$$

This criterion is the ex ante lifetime expected utility of a typical agent in the wealth and employment status distribution (it can also be viewed as the utilitarian welfare criterion).[7] I convert these welfare numbers into a percentage of consumption by computing the fraction ϕ that solves the equation

$$W_1 = W_0 + \frac{1}{1-\beta}\log(1+\phi), \tag{4.1}$$

where W_0 is the expected utility in the baseline case and W_1 is expected utility under the policy change; this equation is simply the standard compensated variation measure. It is precisely here that the wealth distribution matters. Value functions are concave; the welfare gradient is larger at low levels of wealth than at higher ones. As a result, average welfare criteria may be sensitive to the nature of the wealth distribution produced by the model.

[7]Aiyagari and McGrattan (1998) provide more motivation for this welfare criterion.

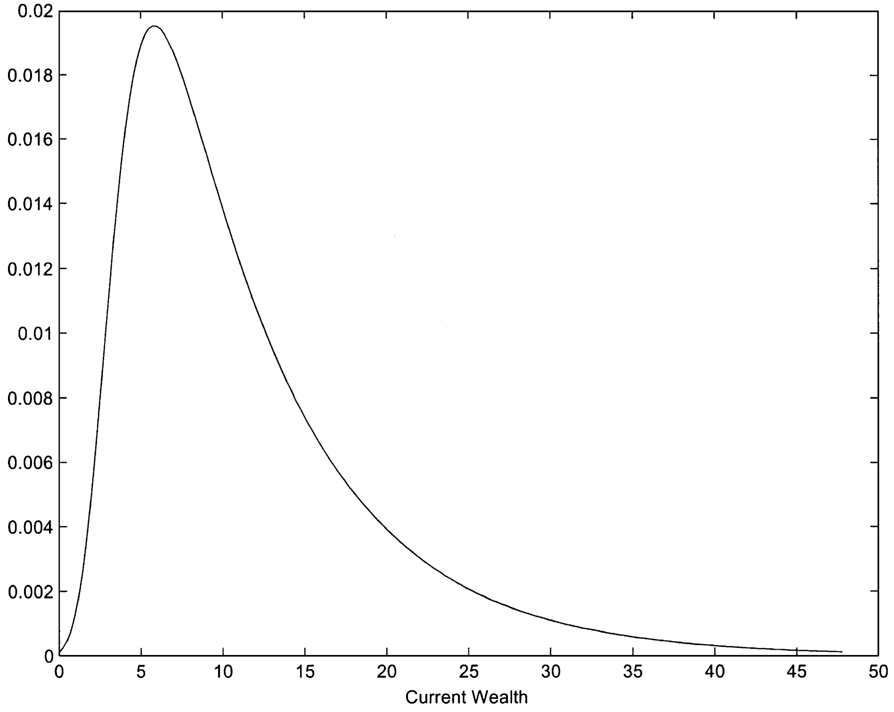

Fig. 5. Distribution of wealth.

Table 2
Aggregate effects of changes in UI rates

(θ, b)	$\bar{k}$	u	r	w	τ	ϕ
(0.0,0.0)	11.8358	0.0488	0.03506	2.3723	0.0000	1.1%*
(0.17,0.17)	11.7407	0.0565	0.03507	2.3720	0.0102	0.8%
(0.5,0.17)	11.5220	0.0740	0.03508	2.3716	0.0361	0.0%
(0.9,0.17)	10.7396	0.1367	0.03508	2.3713	0.1232	−5.2%
(0.17,0.3)	11.7188	0.0589	0.03507	2.3719	0.0119	0.7%
(0.5,0.3)	11.4634	0.0781	0.03508	2.3715	0.0415	−0.4%
(0.9,0.3)	10.4528	0.1592	0.03509	2.3712	0.1480	−7.3%

I next perform a search for the optimal unemployment insurance system by allowing replacement rates to be contingent on e and not restricted to the (θ, b) pattern explored above.[8] When I do so, I find the result in Table 2 to hold without

[8]In practice, I restricted the government to choose 19 different benefit rates and a permanent benefit rate and thus extended the state space to twenty different UI states.

restriction—the efficient unemployment insurance system here is to have none. In addition, I find large welfare effects—the gain is 1.1 percent of consumption.[9] Decomposing this result to determine what drives it is the purpose of the rest of this section.

4.1. Aggregate effects

In this subsection, I detail the effects UI benefit rates have on aggregate activity and welfare. Note that no unemployment insurance generates the highest average level of wealth and the highest level of welfare and that the welfare gain is fairly large (just over 1 percent of consumption).[10]

What is the reason behind the optimality of zero unemployment insurance? Table 2 presents the effect on the capital and labor inputs of changes in the replacement ratios. As benefit rates rise, labor input falls. Essentially, by raising the value of unemployment, the government is reducing the incentive to search. With a lower employment rate, the marginal product of capital falls. As a result, aggregate savings decline. However, it should be noted that the capital–labor ratio does not change much. This small change is related to the size of the frictions in the model. In a complete markets economy, the capital–labor ratio is pinned down by the Euler equation for the representative consumer. Given that this economy is only a small departure from complete markets (as evidenced by the small gap between the time rate of preference and the interest rate net of depreciation), the capital–labor ratio will still be nearly pinned down by this equation and the wage will be fixed by the optimality conditions for the firm. Therefore, prices ultimately change very little, but levels drop considerably as benefits rise.[11] Note that these are general equilibrium effects; without the feedback from labor to capital, wages would rise as the unemployment rate rose. The effect on levels is shown in Table 3—it is easy to see that unemployment insurance is reducing the level of activity in the aggregate economy. Fig. 6 shows the effect of removing unemployment insurance; asset supply A^{S} rises due to increased idiosyncratic risk while capital demand K^{d} rises due to a higher equilibrium employment rate; the net result is only a small change in the equilibrium interest rate and an increase in capital from K^{*} to K^{*}_{C}.

The elimination of unemployment insurance of course has two sides: the elimination of benefits and the elimination of distortionary taxation. To examine the relative size of these two effects, we consider uncontingent transfers financed by distortionary taxation. I keep the level of the tax rate constant at the benchmark case and resolve the model for the endogenous level of uncontingent transfers; that is, all households receive a transfer payment equally. The resulting welfare calculation

[9]This welfare gain is large in comparison to the gain from eliminating business cycles in comparable models. For example, Krusell and Smith (1999) finds a welfare gain of 0.068 percent of consumption from eliminating fluctuations in aggregate production in a model without search.

[10]I do not consider negative benefits for now. Negative benefits (or lump-sum taxation of the unemployed) creates a positive minimum level of assets for households. In that sense, negative benefits are not being considered symmetrically with positive ones. I discuss negative benefit rates in Section 6.

[11]The changes in the prices are very small but are larger than numerical accuracy.

Table 3
Aggregate variables

(θ, b)	Y	C	I
(0.0,0.0)	1.0970	0.8815	0.2155
(0.17,0.17)	1.0916	0.8707	0.2209
(0.5,0.17)	1.0818	0.8474	0.2344
(0.9,0.17)	1.0464	0.7778	0.2685
(0.17,0.3)	1.0896	0.8676	0.2220
(0.5,0.3)	1.0790	0.8414	0.2376
(0.9,0.3)	1.0342	0.7584	0.2758

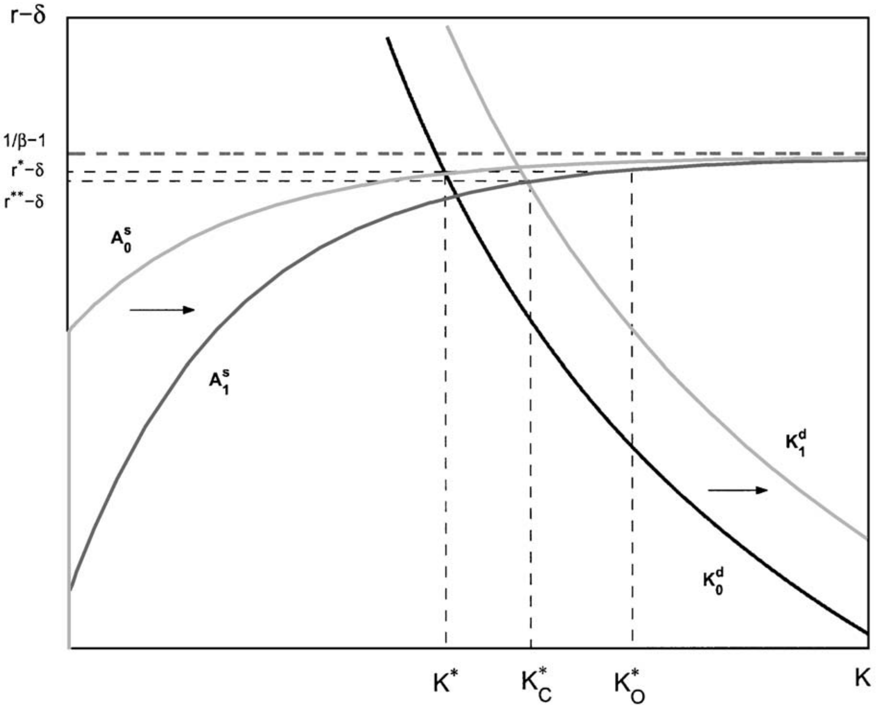

Fig. 6. Capital market equilibrium.

suggests that the welfare gain from eliminating the distortionary taxation would be about 10 percent of the gain from eliminating unemployment insurance, or about 0.1 percent of consumption.

4.2. The importance of capital

This paper stresses the importance of changes in the level of aggregate capital for welfare. To examine how important this aspect is, I examine economies in which the level of wealth is divorced from the level of output. One way to make this consistent with the environment specified above is to let α and δ go to zero; the savings vehicle of the economy is now simply consumption storage, as in Wang and Williamson (2001), and aggregate output is just equal to the exogenous wage times employment. I set the wage to be equal to the wage from the benchmark model and recalibrate β to give the same wealth-GDP ratio as in the benchmark—this results in a value of $\beta = 0.9999825$. Eliminating unemployment insurance is now a net loser for the economy, resulting in a welfare change of $\phi = -0.002$ relative to the benchmark.[12] For comparison, we note that unemployment in this economy goes from 0.0659 to 0.0432, approximately the same response as in the economy with capital. But there is a significant change in the welfare implications, and these implications are only the result of the link between savings and output.[13] Furthermore, the wealth distribution produced by this economy bears little resemblance to the empirical U.S. distribution; it has essentially no upper tail and a tiny Gini coefficient on wealth.

The above result may depend on the exogenously-set rate of return on storage. I explore this dependence by considering other rates of return, leaving α and δ set equal to zero. To ensure that the steady-state distribution of wealth exists, I restrict the return to be below the time rate of preference:

$$r \in \left[0, \frac{1}{\beta} - 1\right).$$

Over this range, I find that the welfare gain from eliminating unemployment insurance is increasing in the net return to savings; it crosses zero at $r = 0.0001$ when $\beta = 0.99$.[14] Only for very low net returns to savings is unemployment insurance a net welfare gain for the economy, and this gain is tiny. The same logic applies to these cases as the benchmark economy, since any storage economy here is formally equivalent to a production economy with additive technology and constant marginal products:

$$y = A\bar{k} + B(1 - u).$$

When A is sufficiently large, the net reduction in aggregate activity is large enough to reduce welfare.

A second way to divorce wealth from capital is to consider a small open economy in which the world interest rate is exogenously set at the level from the benchmark: $r = 0.03507$. The firm's problem determines the wage, and I need only determine the equilibrium tax rate to solve the model, holding all the calibrated parameters constant. The main result from this experiment is that welfare is still maximized at zero unemployment insurance, but that the gain is now 8.5 percent of consumption. The reason that welfare gains are much larger under the small open economy

[12] If $\beta = 0.99$, the wealth level drops very close to zero and the resulting welfare change is decreased to $\phi = -0.004$.

[13] This result suggests that there may be some benefit to UI in an economy in which households endogenously segment themselves in asset markets—the poor save with money and the wealthy with capital.

[14] If $r \geqslant \frac{1}{\beta} - 1$ asset supply is infinite and therefore the wealth distribution never converges.

assumption is that capital increases much more when the interest rate is fixed. In quantitative terms, elimination of UI in the benchmark economy leads to an increase in capital of 3 percent, whereas for the small open economy the increase is a massive 63 percent; this additional savings gets used to purchase foreign assets.

The large outflow of capital generated by the small open economy experiment is due to the extreme sensitivity of the model to the return to savings. As shown in Aiyagari (1994), asset demand goes to infinity as the net return to savings approaches the time rate of preference from below; this can be seen in Fig. 6. As noted above, steady state distributions with returns above this value do not exist. In Fig. 6 the difference between the closed and open economy experiments is that the interest rate cannot fall here; the result is a much larger increase in aggregate capital (the point K_O^*) because this point lies on the elastic portion of the asset supply curve.[15]

These experiments show clearly that a relationship between savings and aggregate output is important for assessing the value of unemployment insurance.

4.3. Distributional effects

The effects of unemployment insurance on the nature of unemployment spells is presented in Table 4. With more generous benefits, the duration of unemployment rises. While the duration in the model is too high—17.9 weeks, a result of the assumption that one period is one quarter—the response of duration to changes in the replacement ratio is not unreasonable. For example, moving from the benchmark case to zero results in a decrease in average duration of 2.57 weeks. Meyer (1990) finds that a 10 percent decrease in the replacement ratio results in a 0.5–1 week decrease in the duration—in the benchmark model a 10 percent decrease in the UI replacement ratio (for the first two periods only) yields a duration of 17.66 weeks, a decrease of around 0.24 weeks. Since my model has too large an average duration, this response is entirely too small. However, small duration effects enhance rather than reduce the welfare results, since they imply a smaller reallocation of the unemployed into low search-efficiency states.

The benefit from UI arises from its insurance value—an increase in UI benefits is intended to decrease the fluctuations in consumption over time. How much an agent values this benefit depends then on the extent to which consumption fluctuates. In the benchmark case, the standard deviation of expected consumption (which is both the cross-sectional dispersion and the standard deviation of one household's expected consumption over time) is 0.0805; this expectation is conditioned on current wealth and the past employment status of the household. Without UI, this standard deviation actually falls to 0.0749. The decrease in the standard deviation of consumption is an interesting result; much of the literature finds the opposite. In the absence of unemployment benefits, households are, for the most part, very well insured (only very poor agents experience significant consumption risk, as can be

[15] The shift in capital demand is different in the small open economy case due to a different response of the equilibrium unemployment rate, but this effect is small and not shown on the graph for ease of presentation.

Table 4
Distributional effects of changes in UI rates

(θ, b)	u_0	u_1	u_2	Duration
(0.0,0.0)	0.7505	0.1358	0.1137	1.309
(0.17,0.17)	0.7207	0.1433	0.1360	1.360
(0.5,0.17)	0.6980	0.1550	0.1470	1.378
(0.9,0.17)	0.6564	0.1762	0.1674	1.484
(0.17,0.3)	0.6998	0.1451	0.1551	1.379
(0.5,0.3)	0.6741	0.1575	0.1684	1.442
(0.9,0.3)	0.6216	0.1816	0.1969	1.574

seen by Fig. 3). Given that aggregate output is high, households have access to enough wealth that they self-insure. With positive benefits, aggregate output is lower; there is less wealth to insulate consumption. As a result, fluctuations in consumption are exacerbated.

Consumption smoothing effects can also be seen through the innovation in consumption at the onset of an unemployment spell. To compute this value, I calculate the average of the ratio of consumption for an unemployed agent in state $e = 0$ to the consumption of an employed agent. As mentioned above, the empirical estimate for this value is 0.93 while in the benchmark allocation we obtain a value of 0.919. When we move to the economy without UI the consumption innovation becomes 0.937, further evidence that UI is not smoothing consumption in the model. This result stands in contrast to the empirical work of Gruber (1997), who finds that unemployment insurance contributes to consumption smoothing, and suggests that I should consider some variants of the model which reduce the effectiveness of the asset market in smoothing consumption.[16]

4.4. The first-best allocation

How does the optimal unemployment insurance system compare to the planner's allocation? In the model a typical household has a welfare gain of $\phi = 0.0263$ by moving to the planning outcome, which has the solution given in Table 5. Note that search is still inefficiently low under the optimal policy of no unemployment insurance (see Table 2); as a result, capital and output are too low as well. It may seem strange that agents are holding too little capital relative to the optimum, especially given that the interest rate is below the rate of time preference in equilibrium. However, as mentioned above, the productivity of capital is related to the unemployment rate; with too much unemployment, capital is less efficient and therefore accumulation is low.

[16]Such considerations did not overturn the results here unless the frictions were very large. For example, with fixed costs for changing asset holdings that were large enough to eliminate trade elimination of UI led to a welfare loss of 0.55 percent of consumption; small transactions costs did not change the results.

Table 5
Optimal allocation

c	a_0	a_1	a_2	n_0	n_1	n_2	k
0.8361	0.3000	0.5521	0.6131	0.9580	0.0332	0.0088	11.9040

I can examine one source of moral hazard by eliminating the separation effect: let all workers lose their job exogenously, as is done in much of the literature. Given that job losers account for the majority of unemployed workers, eliminating the moral hazard problem attached to them could potentially greatly increase the social value of unemployment insurance. I therefore solve a version of the model where the separation rate is held fixed at rate λ, which is chosen with the parameters γ_1 and γ_2 to match the same moments from the distribution of unemployment as before. I find that the result of this experiment is the same as above—agents prefer zero UI to any positive amount. However, I do find that the effect of changing the replacement ratio on the level of unemployment is considerably smaller in this version of the model. For example, changing the benefits from (0.5, 0.17) to (0.0, 0.0) results in a new unemployment rate of 0.0694, which is much higher than the value in the benchmark model of 0.0488. Apparently the separation effect is quite strong in this model; at the same time, though, it is not driving the qualitative results. Therefore, I feel confident in stating that the addition of "involuntary" layoffs would not change the optimal policy setting.[17]

5. The transition path

I have not yet considered the cost of the transition to the zero unemployment insurance policy. In this model, aggregate capital is higher without UI than in the calibrated one. During the transition, capital must therefore increase at the expense of current consumption. Furthermore, search effort must also increase as the unemployment rate must fall. Both of these level effects act to decrease the welfare gain from eliminating unemployment insurance; it is entirely possible that the cost of the transition path would be so large as to wipe out the welfare gain. Furthermore, it is not clear that a majority of agents would prefer the change and implement it in a voting equilibrium.[18] I therefore compute explicitly the cost of the transition path now. Details on the computation of the transition path can be found in a computational appendix available upon request.

The particular experiment I consider is a surprise change in the rate of unemployment benefits; one day, households wake up and find that instead of

[17]The empirical evidence cited in Jurajda (1998) suggests a very small impact of UI on separation rates.

[18]Pallage and Zimmermann (2001) examines voting optima in a model with unemployment insurance. I do not investigate these issues because the unemployment insurance system in the model has more than one dimension and determining decisive voters in such environments is difficult. However, I can, and do, examine whether a majority of voters would implement the change.

collecting benefits at the benchmark rate they will be collecting no benefits at all. Note that this experiment maximizes the potential cost of the transition; if the policy shift is preannounced, agents can smooth variations in consumption and effort more effectively. Furthermore, the government must balance the budget in every period; it cannot smooth tax changes by accumulating debt. Figs. 7–9 show how aggregate capital, the unemployment rate, and the measures of agents in employment states $e = 1$ and 2 change over the transition. Note that unemployment adjusts almost immediately; agents have nearly reached the new steady state level in three periods. Aggregate capital adjusts very slowly, taking 110 periods to converge to within 0.001 of the new steady state value. Furthermore, there is a decline in the duration of unemployment; one can see that from Fig. 10 by noting that the fraction of unemployed who are in state $e = 2$ falls significantly relative to $e = 1$ and 0. The path of prices in the transition is shown in Fig. 10: interest rates jump up as labor input increases, but then eventually fall to below the old steady state value. Wage rates move in the opposite fashion—they fall initially but eventually rise to a new value above the old steady state. Taxes obviously are identically zero during the entire transition, meaning that after-tax wages are also rising.

I examine first the aggregate cost of the transition. An average agent received a welfare gain of $\phi = 1.1$ percent from switching to the steady state with no unemployment insurance. Taking the transition into account, this gain falls to

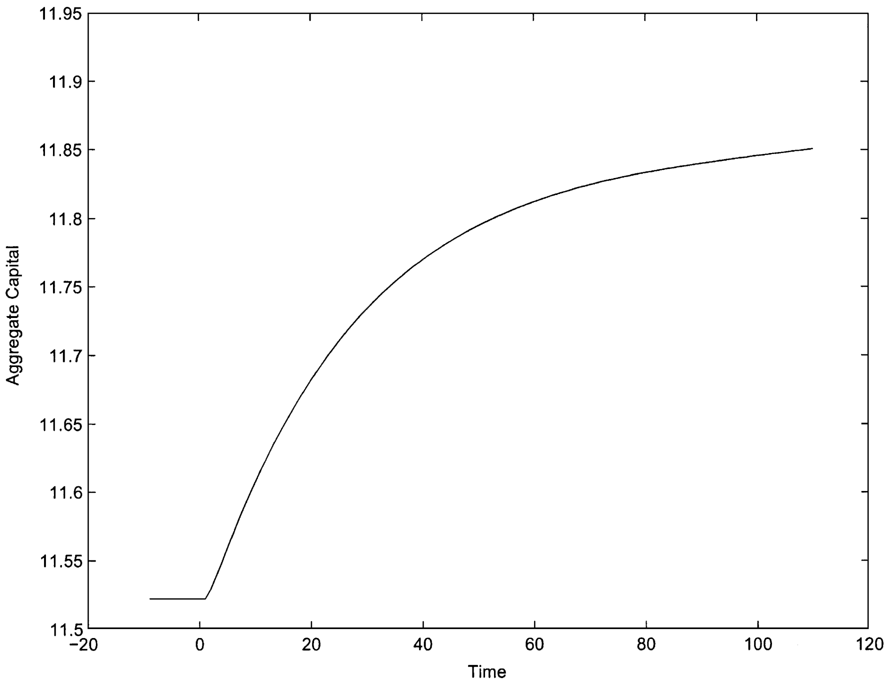

Fig. 7. Transition path for capital.

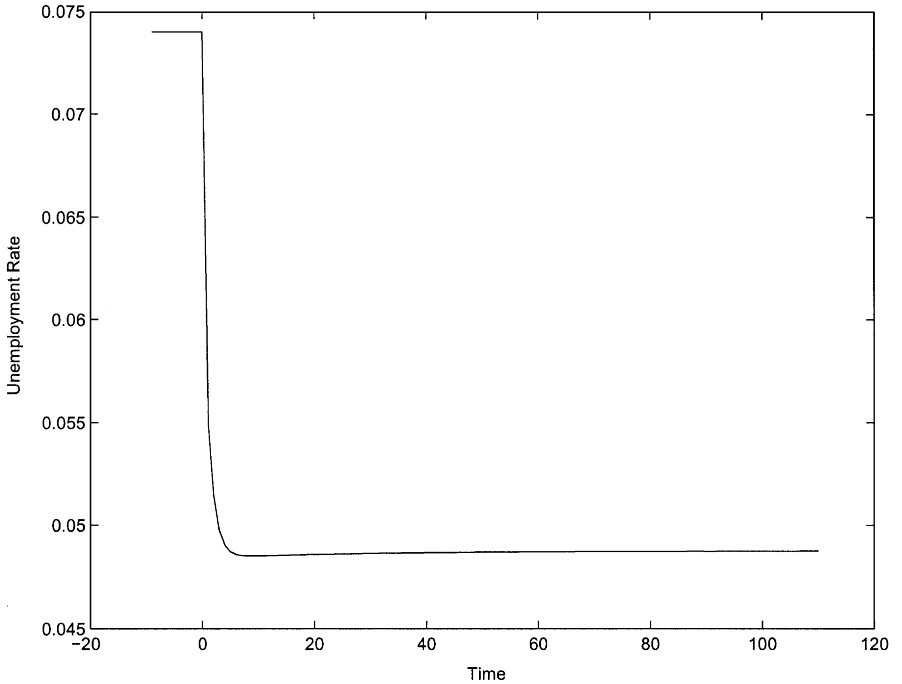

Fig. 8. Transition path for unemployment.

$\phi = 0.59$ percent; essentially, it is cut in half. However, the aggregate number masks potential differences in how various agents view the transition. With this in mind, Fig. 11 presents the welfare gain of agents as a function of their initial state (k, e). The pattern for agents who were employed in the previous period shows that they experience a welfare gain across the board, with the maximum gain experienced by the relatively poor and the minimum gain experienced by very wealthy households who actually do not appear in equilibrium. Although hard to see from the graphs, sufficiently poor unemployed lose from the elimination of benefits, but this loss rapidly disappears as wealth increases.[19] The fraction of agents who lose welfare over the transition is 0.00004, so that majority voting would implement this change.

The welfare gain is hump-shaped in initial wealth; it first rises and then falls and then eventually rises again.[20] Households very close to the borrowing constraint lose

[19]If truly at zero wealth agents would experience a welfare loss of $-\infty$ from the elimination of benefits suddenly. In the calibrated equilibrium, the mass of these agents is less than 0.000002; if we assume that some small, but positive, transfer (less than 0.00001 units of consumption) is given to them by the government in the first period of transition, then this extreme result disappears and the quantitative effects are not affected. Note that this problem would disappear if the policy change is preannounced or implemented in a piecemeal fashion (incremental changes in the replacement ratio), since it would allow households at zero wealth to use some of their current benefits to acquire wealth.

[20]The welfare functions turn upward at wealth levels above $k = 400$.

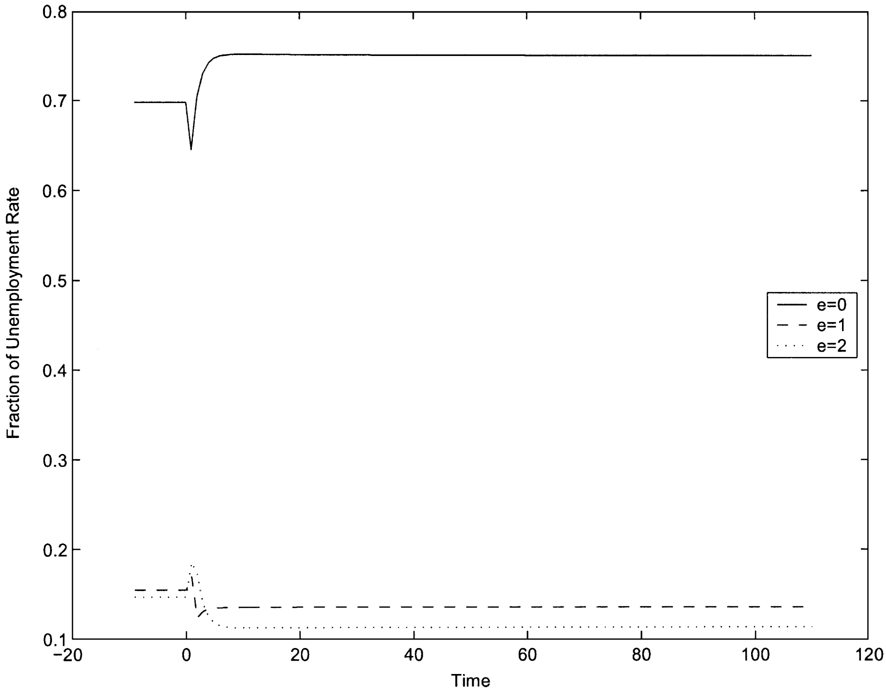

Fig. 9. Transition path for unemployment states.

utility since their income falls significantly if they are unemployed and they lack the assets for self-insurance. Agents a bit further from the borrowing constraint will gain from the elimination of unemployment insurance; on the one hand they benefit from the rise in the after-tax wage $(1-\tau)w$ but on the other hand they lose the income from unemployment insurance that keeps them away from the borrowing constraint. This explains the initial hump in the welfare plots.

Agents with high enough levels of wealth to be well-insured fall into two categories. One category, those with moderate wealth, earn more of their income through labor than capital. As a result, they gain more from the eventual increase in the after-tax wage than they lose from the eventual decline in r. Very rich agents, the second category, have a higher proportion of capital income and therefore gain less from the increase in the wage and lose more from the decrease in the interest rate. These effects are relatively small due to the small changes in the prices.

The welfare gain is larger for households in state $e=0$ than for households who were unemployed last period, but the differences between welfare gains in states $e=1$ and 2 are trivial for all but the extremely poor, who gain more in state $e=1$ because their search technology is more efficient. Since wealth is highly correlated with employment status, this second effect accounts for the decline in welfare gains

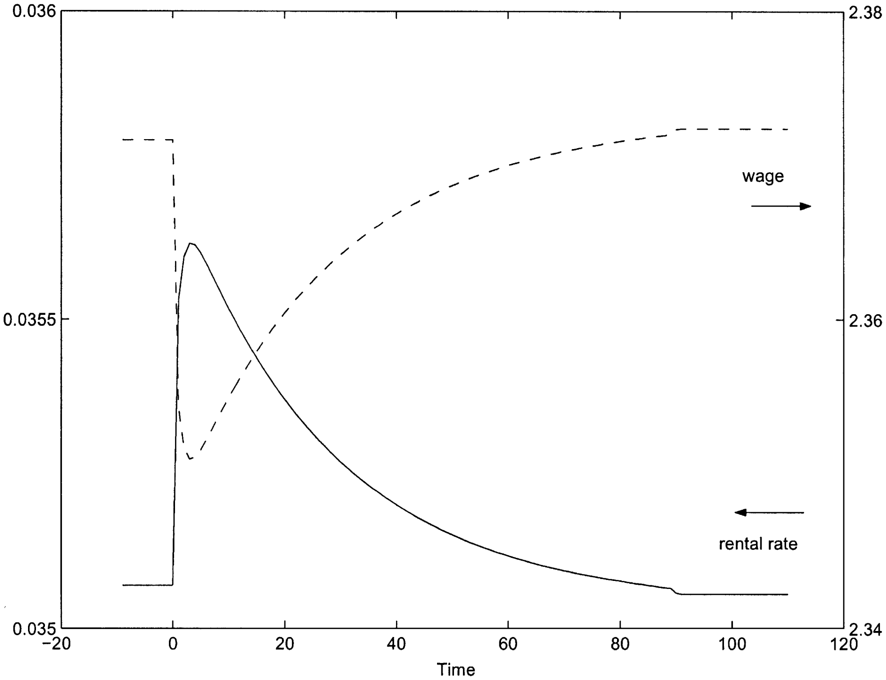

Fig. 10. Transition path for prices.

as a function of wealth, if the household is initially sufficiently wealthy.[21] To pin down the welfare function better, I regress the welfare gain on functions of the initial state, leading to the equation

$$100 * \phi = 0.832 - 0.0932k^{0.5} + 0.003k + 0.0135k^2 - 0.0910e. \tag{5.1}$$

This shows clearly the nonlinear relationship between initial wealth k and welfare gains and the negative impact of e, the employment status.[22]

6. The negative replacement ratio

In the previous sections, I have asserted that the optimal replacement ratio is zero forever. However, this statement is not exactly true; in reality, I should have said that, of all nonnegative replacement ratios, zero is the most preferred. I confined myself to nonnegative replacement ratios for a substantive reason which I will

[21] For comparison, I also computed the transition path for the small open economy variant; computationally, this is easy since there are no prices to iterate over. This transition is very long (over 5000 periods) and results in a net welfare gain of 0.6 percent, less than 10 percent of the steady state gain.

[22] The R^2 value is 0.91 for this regression.

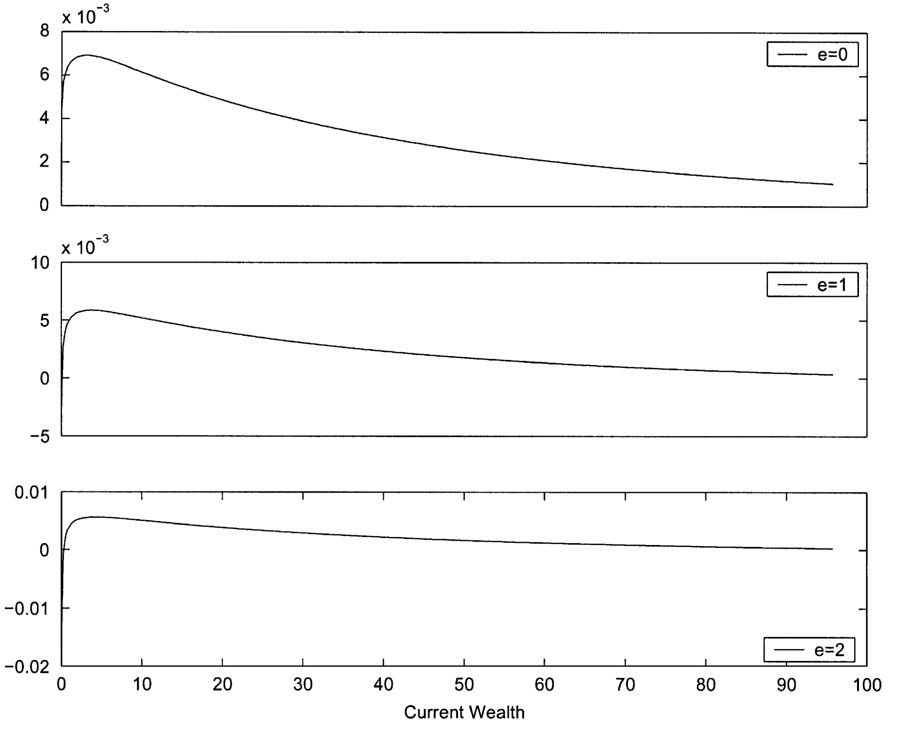

Fig. 11. Welfare gains by state.

discuss here briefly; a more exhaustive investigation would run far afield of the main point here.

I examine borrowing constraints which imply consumption be nonnegative. That is, let the borrowing constraint be given by

$$k_b = \frac{-\min_e(B_e)}{r - \delta},$$

agents with wealth at least this high will be able to consume positive amounts in every state of the world and still repay debt with probability one. Negative benefit rates then imply positive lower bounds on wealth—forced savings—and are therefore potentially more painful to households. However, if I examine the outcome of our model, I find a different result: optimal replacement ratios are actually negative! Computing the true optimum runs afoul of a disturbing feature: for benefits sufficiently low, the equilibrium interest rate fails to exist. By sufficiently low, I do not mean near -1; rather, the equilibrium fails to exist for replacement ratios as high as $(-0.125, 0.0)$. And the benefit rate $(-0.1, 0.0)$ results in a welfare gain of $\phi = 1.63$ percent relative to the benchmark setting in this economy, slightly higher than with no borrowing allowed but still short of the planning outcome.

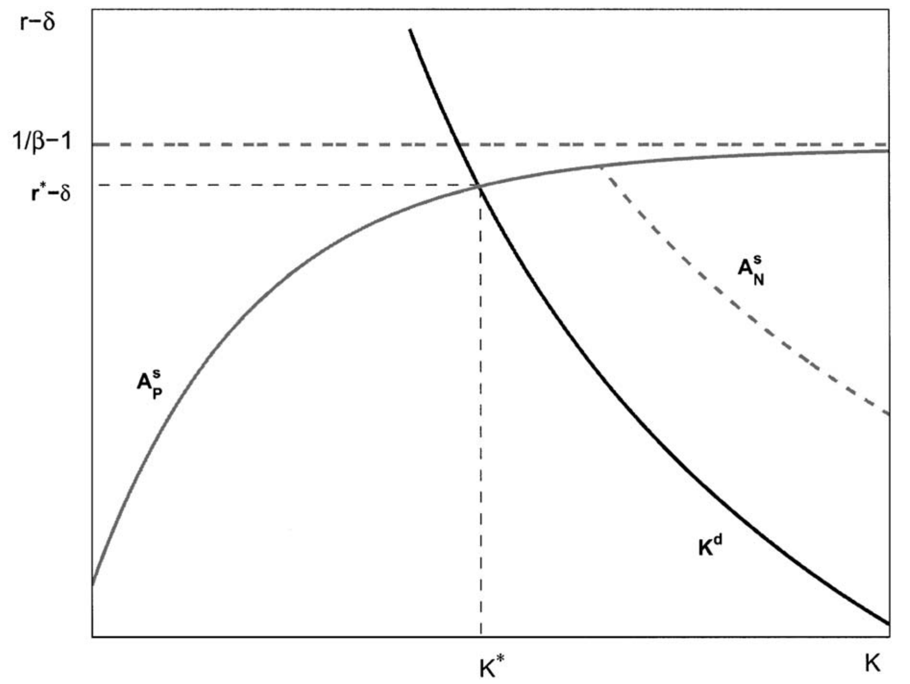

Fig. 12. Nonexistence of equilibrium.

Why does the equilibrium fail to exist? Fig. 12 shows the shape of the asset supply curve for two cases: positive A^s_{P} and negative A^s_{N} replacement ratios. For sufficiently negative benefits, the asset supply curve becomes U-shaped; for some replacement ratios it never intersects the capital demand curve. It is also possible that the model could possess two equilibrium interest rates; I have not examined this possibility as it runs far afield of the zero optimality result I focus on here. A multiplicity result of this nature raises the question of whether both equilibria would be stable—could the economy approach different stationary points from different starting points? Furthermore, how would the transition be affected by changes in the unemployment insurance system? Would it be possible to select stationary states by changing replacement ratios?

The reason for the backward-bending asset supply curve is the relationship between the interest rate and the borrowing constraint. As the interest rate falls, households substitute from consumption in the future to consumption today, decreasing their demand for assets. But the borrowing constraint rises as the interest rate falls; the household must maintain an increasing lower bound on assets. As benefits become negative, this second effect begins to dominate for low enough values of r; thus, the demand for assets curve eventually turns back on itself. It is likely that this result has little empirical content, as borrowing constraints in the US more likely involve some issues related to default and collateral and are therefore unlikely to be this tightly tied to the perpetuity value of permanent noninterest income.

Why is the negative replacement ratio optimal?[23] The major moral hazard problem faced by the government is the search incentive—search is inefficiently low even without unemployment insurance (the optimal unemployment rate is 0.042 which is below the zero-benefit rate of 0.0488). A standard result in the mechanism design literature is that incentives are more effective when marginal utilities are high. Since the incentive the government wishes to implement is one with more search and has access only to pecuniary tools, the correct plan is to punish those with high marginal utilities of consumption: the unemployed. With the government budget constraint not allowing any asset accumulation, the government must return these proceeds to the workers, reinforcing the correct incentives by increasing the gap between the values of employment and unemployment.[24] Note also that the government, by taxing unemployed agents, is reducing their ability to self-insure, thereby making households more easily induced into search.

7. Conclusion

This paper examined the nature of optimal unemployment insurance in a model with production and private savings. Unlike most of the literature, production in this economy takes place at a firm using both capital and labor as inputs, resulting in endogenous interest and wage rates. The resulting optimum rate of benefits is zero for a wide range of economies, even when the cost of the transition is taken into account.

I have conducted extensive sensitivity analysis for my results. In particular, the optimality of zero unemployment insurance is robust to different preference parameters, different tax bases, and transactions costs in the asset market, provided they are not very large. One experiment which is particularly useful to report involves the aggregate stock of capital, which I calibrated to be 11.5 times GDP. If instead I calibrate this to a smaller number that does not include the value of residential housing or consumer durables, I get a number of about 8.35 times GDP. When β and δ are set consistent with this value, the value of eliminating UI rises to 1.7 percent of consumption due to a larger increase in capital.

Of course, my results do not come without some reservations. In particular, I have abstracted from some features of the labor market that apparently have some importance. For example, Costain (1997) introduces "thick" and "thin" market externalities—the number of searchers on each side of the market influences the probability any one agent will find a job. Unemployment insurance can mitigate the

[23] I would like to thank Stan Zin for suggesting this argument.

[24] This system results in something similar in spirit, if not in the details, to the reemployment experiments conducted in Illinois, New Jersey, Pennsylvania, and Washington. In a companion paper I introduce reemployment bonuses into this model economy and find that UI can optimally be positive if the reemployment bonus is chosen optimally as well—see Young (2001) for details.

consequences of these externalities by limiting the number of searchers, particularly from the supply side of the labor market. It would appear that the main benefit from UI is gained through this channel and not through its effect on capital market imperfections.[25]

Furthermore, market wages do not have the degenerate distribution assumed here; there is considerable dispersion in real wages in the US economy. With a nondegenerate wage distribution, UI tends to subsidize the low-income workers (who do not search as hard) at the expense of the high-income workers. However, a complicating feature is that benefits are tied to past wages which, as in Ljungqvist and Sargent (1998), would lead to households with high past wages but poor current prospects not searching enough. Furthermore, there is the possibility that UI affects the accumulation of human capital—since wages tend to decline with unemployment duration and UI tends to extend the duration of unemployment spells, there may be additional effects related to the productivity of the workforce. Finally, with dispersion in wages, workers may also view UI as a financing tool for them to find a better match, as in Acemoglu and Shimer (2000). It is not clear what the ultimate effect of introducing wage dispersion into this model would be, but it clearly seems important. Lastly, segmentation in labor market opportunities could be important; UI could aid the relatively-unskilled by keeping skilled workers out of unskilled jobs, a sort of underemployment insurance.

There may also be important features related to the take-up rate of benefits. As mentioned by Gruber (1999), it is possible that there is a stigma attached to unemployment insurance for some groups of households which could explain why take-up rates in the US are around 67 percent (see Blank and Card, 1991). This stigma would likely apply only to high-wealth households.[26] However, low-wealth households might have to deal with the pecuniary costs of UI take-up, such as the cost of travel—admittedly this constraint seems unlikely to be important now that states have enacted phone and web-enabled UI. Given that the moral hazard of agents with sufficiently high costs of take-up would disappear, it could be the case that positive UI would be optimal in this model.

Finally, unemployment insurance may be an effective tool in combatting aggregate movements in income, rather than idiosyncratic ones. However, extensions to this model which allow for aggregate fluctuations are computationally infeasible, so this question must be postponed. Alternatively, since a large segment of the population saves using fiat money, unemployment insurance might help combat inflation costs; studying such a model would also be computationally demanding.[27]

[25]See Athreya (2003) for a study of bankruptcy and unemployment insurance that suggests capital market imperfections are not necessarily unimportant.

[26]It is also possible that these households do not collect benefits because the effective income tax on such payments would be very high.

[27]Evidence presented in Chambers and Schlagenhauf (2002) show that the young and the very old have a larger fraction of their savings in the form of cash; since the young are also disproportionally unemployed this portfolio choice may have implications for my results.

References

Abdulkadiroğlu, A., Kuruşçu, B., Şahin, A., 2002. Unemployment insurance and the role of self-insurance. Review of Economic Dynamics 5 (3), 1–23.

Acemoglu, D., Shimer, R., 2000. Productivity gains from unemployment insurance. European Economic Review 44 (7), 1195–1224.

Aiyagari, S.R., 1994. Uninsured idiosyncratic risk and aggregate saving. Quarterly Journal of Economics 109 (3), 659–684.

Aiyagari, S.R., McGrattan, E.R., 1998. The optimum quantity of debt. Journal of Monetary Economics 42 (3), 447–469.

Albrecht, J.W., Axell, B., 1984. An equilibrium model of search unemployment. Journal of Political Economy 92 (5), 824–840.

Andolfatto, D., Gomme, P., 1996. Unemployment insurance and labor-market activity in Canada. Carnegie-Rochester Conference Series on Public Policy 44, 47–82.

Athreya, K., 2003. Unemployment insurance and personal bankruptcy. Federal Reserve Bank of Richmond Economic Quarterly 89 (2), 33–53.

Blank, R.M., Card, D.E., 1991. Recent trends in insured and uninsured unemployment: is there an explanation? Quarterly Journal of Economics 106 (4), 1157–1190.

Chambers, M.S., Schlagenhauf, D.E., 2002. Anticipated inflation and portfolio reallocation, Manuscript.

Costain, J.S., 1997. Unemployment insurance with endogenous search intensity and precautionary saving, Manuscript.

Davidson, C., Woodbury, S., 1997. Optimal unemployment insurance. Journal of Public Economics 64 (3), 359–387.

Gruber, J., 1997. The consumption smoothing benefits of unemployment insurance. American Economic Review 87 (1), 192–205.

Gruber, J., 1999. The wealth of the unemployed. Industrial and Labor Relations Review 55 (1), 79–94.

Hansen, G.D., İmrohoroğlu, A., 1992. The role of unemployment insurance in an economy with liquidity constraints and moral hazard. Journal of Political Economy 100 (1), 118–142.

Heer, B., 2002. The German unemployment compensation system: effects on aggregate savings and wealth distribution. Review of Income and Wealth 48 (3), 371–394.

Hopenhayn, H.A., Nicolini, J.P., 1997. Optimal unemployment insurance. Journal of Political Economy 105 (2), 412–438.

Joseph, G., Weitzenblum, T., 2003. Optimal unemployment insurance: transitional dynamics vs. steady state. Review of Economic Dynamics 6 (4), 869–884.

Jurajda, S., 1998. Inflow into unemployment: employment spells and unemployment insurance, Manuscript.

Krusell, P., Smith Jr., A.A., 1999. On the welfare effects of eliminating business cycles. Review of Economic Dynamics 2 (1), 245–272.

Ljungqvist, L., Sargent, T.J., 1995. Welfare states and unemployment. Economic Theory 6, 143–160.

Ljungqvist, L., Sargent, T.J., 1998. The European unemployment dilemma. Journal of Political Economy 106 (3), 514–550.

Meyer, B.D., 1990. Unemployment insurance and unemployment spells. Econometrica 58 (4), 757–782.

Pallage, S., Zimmermann, C., 2001. Voting on unemployment insurance generosity. International Economic Review 42 (4), 903–924.

Quadrini, V., Ríos-Rull, J.-V., 1997. Understanding the U.S. distribution of wealth. Federal Reserve Bank of Minneapolis Quarterly Review 21, 22–36.

Shavell, S., Weiss, L., 1979. The optimal payment of unemployment insurance benefits over time. Journal of Political Economy 87 (6), 1347–1362.

Sleet, C., 1997. Optimal unemployment insurance I, Manuscript.

Wang, C., Williamson, S.D., 1996. Unemployment insurance with moral hazard in a dynamic economy. Carnegie-Rochester Conference Series on Public Policy 44, 1–41.

Wang, C., Williamson, S.D., 2001. Moral hazard, optimal unemployment insurance, and experience rating. Journal of Monetary Economics 49 (7), 1337–1371.