ISSN 1011-8888

INSTITUTE OF ECONOMIC STUDIES

WORKING PAPER SERIES

W98:12 September 1998

From Unemployment Benefits to Unemployment Support Accounts

J. Michael Orszag and Dennis Snower

Address: J. Michael Orszag
Department of Economics
Birkbeck College
University of London
London W1P 2LL
UK
E-mail: jmo@ricardo.econ.bbk.ac.uk

Please forward all comments to Mr. Orszag.

FROM UNEMPLOYMENT BENEFITS TO UNEMPLOYMENT SUPPORT ACCOUNTS

J. MICHAEL ORSZAG AND DENNIS SNOWER

1. INTRODUCTION

This paper explores the implications of a far-reaching proposal for the reform of labour market policy, namely, to replace the current unemployment benefit systems by unemployment support accounts (USA). Under the USA system, employed people would be required to make ongoing contributions to their unemployment support accounts, and the balances in these accounts would then be available to them during periods of unemployment. The government would be able to undertake balanced-budget redistributions among the USAs, taxing the contributions of the rich and subsidizing those of the poor.

Moving from an unemployment benefit system to a USA system would radically change people's incentives in the labour market. Under an unemployment benefit system, people receive unemployment benefits upon losing their jobs, and lose these benefits when they find jobs again. The unemployment benefits are typically financed through income taxes on employers and employees. These features are absent in the USA system. Aside from the balance-budget redistributions among the unemployment support accounts, people would receive no reward upon losing their jobs and suffer no penalties for finding jobs. People would play a much larger role in financing their own support during periods of unemployment.

The mechanics of the USA system may be summarised as follows. Each employed person would make a fixed mandatory minimum contribution to his or her USA each month. Voluntary contributions above the mandatory minimum levels would be permitted as well. Upon becoming unemployed, an individual would be entitled to withdraw a fixed maximum amount per month from his or her USA. Smaller withdrawals would also be permitted.

When a person's USA balance falls to zero, he or she would become entitled to unemployment assistance, on the same financial terms as under the current unemployment benefit systems. In addition, the government could subsidise the contributions of people's with low incomes. The unemployment assistance and contribution subsidies would be financed through taxes on the contributions of the other USA holders. When people retire, they could use their remaining USA balances to top up their pensions.

The USA system could be run on a pay-as-you-go (PAYG) or fully funded basis. This aspect is important, for a standard criticism of personalized accounts in other areas of the welfare state (such as pensions, health care, or education) is that they are typically viewed as fully funded systems, and in most OECD countries appear to lack the political will to embark on a quick transition to such systems from the current PAYG systems. However, it is easy to conceive of the USA system running on a PAYG basis. People could make their specified maximum withdrawals when they are unemployed, regardless of whether some of their USA balances at any point in time are used to finance the withdrawals of other people.

If the USA system were fully funded, then the contribution rates could be set in an actuarily fair manner so that, for all the USAs of a particular age cohort in the economy, the discounted value of aggregate minimum benefits is equal to the discounted value of aggregate contributions. (This method could ensure that generational accounts are in balance, in the sense of Kotlikoff (1993).) But since some of the USA balances of high-income individuals would be used to subsidize the contributions of low-income individuals, the contribution rates would not be actuarily fair for each individual.

If the USA system were run on a PAYG basis, such cross-subsidization of accounts would also extend across generations. In particular, a part of the USA balances of young people could finance the withdrawals of older people. In this respect, the USA system would be analogous to savings accounts under fractional reserve banking, whereby part of a depositor's balances may fund a borrower's withdrawals.

Since the USA system is compatible with both the PAYG and fully funded schemes, the transition from the former to the latter can proceed at whatever pace political and demographic conditions dictate. The closer the system is to being fully funded, the more discretion people could be given in determining who is to manage their USAs, the government or private ancestor financial institutions. The investment activity of the latter institutions would have to be regulated in order to minimise the risk of bankruptcy and provide adequate insurance.

The case for switching from unemployment benefits to USAs is straightforward. Under the unemployment benefit system, as noted, people are in effect rewarded for being unemployed (through unemployment benefits) and penalised for being employed (through taxes). The unemployment benefit system creates an externality, since the unemployed impose costs on the employed. The unemployed, responding only to their private costs and benefits, do not take the full social costs of their unemployment into account when seeking jobs. In this way, the unemployment benefit system depresses job search and thereby stimulates unemployment. Furthermore, the employed do not receive full compensation for the social benefits from their employment and thus, if the relevant substitution effect dominates the income effect, they will work less hard than they otherwise would have. Thereby, the unemployment benefit system may depress productivity.

The USA system alleviates these externality problems. For when an unemployed person makes withdrawals from his USA, he is thereby diminishing the amount of funds that are available to him later on. Thus, in comparison with the unemployment benefit system, the unemployed internalise more of the social costs of their unemployment and thus have greater incentives to search for jobs. When an employed person makes contributions to his USA, he is thereby increasing the account balance that he can draw on in the future. Thus employed people internalise more the benefit from their USA contributions than from the taxes they pay to finance unemployment benefits, and consequently, the USA system may give them more of an incentive to be productive than the unemployment benefit system.

Naturally, the degree to which the USA system mitigates the above externality problem depends on the government's redistributive goals. The more income the government redistributes from rich to poor, the greater the associated externality problem. Nevertheless, for any given amount of redistribution, the improved incentives under the USA system are likely to lead to higher employment, lower unemployment, and higher productivity than under the corresponding unemployment benefit system.

This paper provides an analytical framework for exploring the implications of the switch from unemployment benefit to USAs. The rest

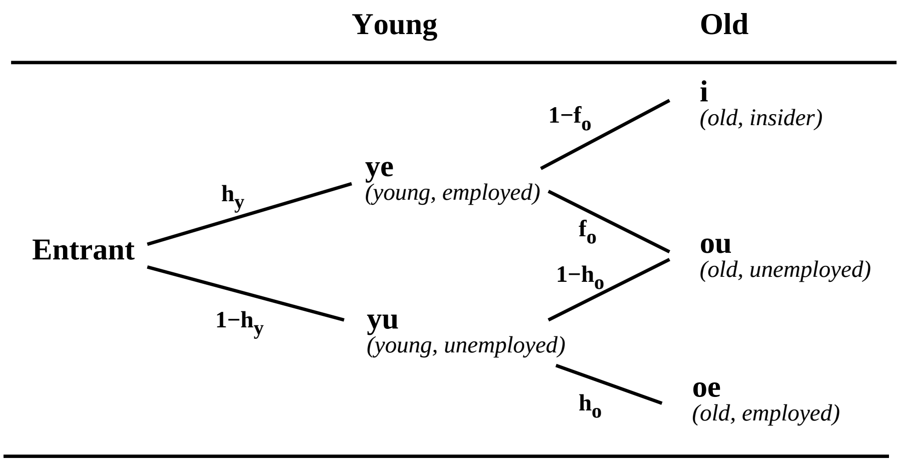

FIGURE 1. The structure of the model.

of the paper is organised as follows. Section 2 presents a basic model of employment and unemployment under the two systems. Section 3 examines the government budget constraint, whereby the two systems finance themselves. Section 4 investigates microfoundations of the hiring and firing rates under the two systems and, on this basis, Section 5 presents a specific analytical example of how the two systems compare. Section 6 concludes.

2. The Model

Workers in our model live for two periods. In the first period of working life the worker is “young”; in the second period he is ”old.” The worker’s possible labor market states are illustrated in Figure (1). Upon entering the workforce, a each young worker faces a predetermined probability h_y of becoming employed and a probability $1 - h_y$ of remaining unemployed. Let $V(y,e)$ and $V(y,u)$ be the discounted lifetime utilities of an employed and unemployed young worker, respectively. Then the discounted lifetime utility of an entrant to the workforce is:

$$V(y) = h_y V(y,e) + (1 - h_y)\, V(y,u) \tag{1}$$

A young, employed worker (y,e) faces a probability f_o of being fired at the beginning of the second period, in which case he turns into an old, unemployed worker (o,u). With probability $1 - f_o$ the young, employed worker is retained in the second period, in which case he turns into an “insider” (i).

Finally, a young, unemployed worker (y, u) faces a probability h_o of being hired at the beginning of the second period, whereupon he becomes an “old, employed worker” (o, e). With probability $1 - h_0$ the young, unemployed worker does not find a job in the second period, so that he becomes an old unemployed worker (o, e).

Workers are assumed to have no access to capital markets, so that young workers are unable to borrow against their future incomes. Unemployed workers divide their time between leisure and job search; employed workers divide their time between leisure and work. The hiring rates in our model depend on job search intensity (i.e., the length of time unemployed workers spent searching), and the firing rates depend on productivity (i.e., the length of time spent working). Workers make their search-leisure and work-leisure choices so as to maximize their discounted lifetime utilities, taking into account the effects of these choices on the hiring and firing rates.[1]

For simplicity, we assume that entrants to the workforce devote all their time to job search, and thus the hiring rate for entrants (h_y) may be taken as an exogenously given constant. The hiring rate h_o for young unemployed workers depends inversely on their leisure (l_{yu}); for the more leisure they consume, the less time they spend on job search and thus the fewer jobs they are likely to find. The microfoundations for this relation is developed in Section 4. The firing rate f_o for young employed workers depends inversely on their leisure (l_{ye}); workers who shirk when young are more likely to be fired by the firm and are also less likely to be productive when old because of “learning by doing.”

Finally, a young, unemployed worker (y, u) faces a probability h_o of being hired at the beginning of the second period, whereupon he becomes an ”old, employed worker” (o, e). With probability $1 - h_0$ the young, unemployed worker does not find a job in the second period, so that he becomes an old unemployed worker (o, e).

2.1. **The Unemployment Benefit System.** Under an unemployment benefit system, let each unemployed worker receives an exogenously given real unemployment benefit b. Furthermore, let unemployment

[1]The model is a simple two-period variant of the labor market model developed by ((Phelps 1994), ch. 15). Our innovations include the incorporation of job search and the analysis of unemployment support accounts in this setting.

benefits be financed through a payroll tax, where τ is the payroll tax rate.

The young unemployed worker receives the unemployment benefit b in the first period, and the corresponding utility is $u(b, l_{yu})$, where l_{yu} is the worker's leisure (unity minus the time spent searching). In the second period, with probability h_o, he gains the utility $V^b(o,e)$ of an old, employed worker, and with probability $1 - h_o$, he gains the utility $V^b(o,u)$ of an old, unemployed worker. Since the leisure of the old workers is fixed, these utilities are fixed as well. (The superscript "b" stands for the benefit system.) Thus, the decision problem of the young unemployed worker may be represented as finding the level of leisure l_{yu} that maximises the following discounted utility:

(2)
$$V^b(y,u) = \max_{l_{yu}} \left[u(b, l_{yu}) + \beta \left(h_o(l_{yu})V^b(o,e) + (1 - h_o(l_{yu}))V^b(o,u)\right)\right]$$

where β is the time discount factor. The first-order condition for this decision problem is:

$$u_{l_{yu}} = -\beta h_o'(l_{yu}) \left[V^b(o,e) - V^b(o,u)\right] \tag{3}$$

In other words, the marginal utility of leisure must be set equal to the discounted marginal hiring propensity ($\beta h_o'$) times the penalty for job loss ($V^b(e,o) - V^b(u,o)$). Since there is diminishing marginal utility of leisure, the optimal level of leisure depends inversely on the penalty for job loss.

Along similar lines, the young employed worker receives the wage $w(1-\tau)$ in the first period; in the second period, with probability f_o, he gains the utility $V^b(o,u)$ of an old, unemployed worker, and with probability $1 - f$, he gains the utility $V^b(o,e)$ of an old, employed worker. (As above, the utilities $V^b(o,u)$ and $V^b(o,e)$ are fixed, since the leisure of the old workers is fixed.) Thus the young employed worker's decision problem is to find the level of leisure l_{ye} that maximises the following discounted utility:

(4)
$$V^b(y,e) = \max_{l_{ye}} \left[u(w(1-\tau), l_{ye}) + \beta \left(f_o(l_{ye})V^b(o,u) + (1 - f_o(l_{ye}))V^b(o,e)\right)\right]$$

The first-order condition for this problem is:

$$u_{l_{ye}} = \beta f_o'(l_{ye}) \left[V^b(o,e) - V^b(o,u)\right]. \tag{5}$$

Here, the marginal utility of leisure must be set equal to the discounted marginal firing propensity ($\beta f_o'$) times the penalty for job loss ($V^b(o,e) - V^b(o,u)$). Once again, diminishing marginal utility of leisure implies that the optimal level of leisure depends inversely on the penalty for job loss.[2]

2.2. **The USA System.** Now consider the workers' choices under the USA system. For comparability, we assume that the interpersonal redistributions among the accounts are such that the unemployed always receive an amount at least as large as the unemployment benefit b. Specifically, if a young worker is unemployed, he receives b, and gains utility $u(b, l_{yu})$. Since he is unemployed, he is unable to accumulate positive USA balances in the second period. With probability h_o, he finds a job in the second period and gains utility $V^a(o,e,0)$, where the superscript "a" stands for "accounts, "o,e" stands for an "old, employed" worker, and "0" stands for the level of that worker's account balances. With probability $1-h_o$, he finds no job in the second period and gains utility $V^a(o,u,0)$. As above, $V^a(o,e,0)$ and $V^a(o,u,0)$ are fixed. Thus the young unemployed worker's decision problem is to maximize

$$V^a(y,u,0) = \max_{l_{yu}} \left[u(b,l_{yu}) + \beta\left(h_o(l_{yu})V^a(o,e,0) + (1-h_o(l_{yu}))V^a(o,u,0)\right)\right] \tag{6}$$

The first-order condition is

$$u_{l_{yu}} = -\beta h'(l_{yu}) \left[V^a(o,e,0) - V^a(o,u,0)\right] \tag{7}$$

If a young worker is employed, she receives the wage w. Denote her optimal level of consumption in period 1 by c^*. Then the contribution to her USA is $(w - c^*)$. Let r be the interest rate and κ be the rate at which her contribution is taxed (both exogenously given to the worker). Then her account balance in the following period will

[2] This is true if leisure and consumption are complements. Otherwise, consumption and leisure must not be strong enough substitutes for the decrease in period one consumption from saving in accounts to a lead to a sufficient increase in the marginal utility of leisure to counterbalance the effect on leisure from the larger penalty for job loss.

be $A = (w - c^*)(1 + r)(1 - \kappa)$. Thus the young employed worker's decision problem is to maximize

(8)
$$V^a(y, e, 0) = \max_{l_{ye}} \left[u(c^*, l_{ye}) + \beta \left(f_o(l_{ye}) V^a(o, u, A) + (1 - f_o(l_{ye})) V^a(o, e, A) \right) \right]$$

and the corresponding first-order condition is

(9) $$u_{l_{ye}} = \beta f'(l_{ye}) \left[V^a(o, e, A) - V^a(o, u, A) \right].$$

Define the replacement ratio as $\nu = \frac{b}{w}$ and the contribution rate under the USA system as $k = \frac{w - c^*}{w}$. In order for the young employed worker's USA contribution to be sufficiently high to yield at least as much as the unemployment benefit, should he become unemployed when old, we require that $A = (w - c^*)(1 + r)(1 - \kappa) > b$, which implies that :

(10) $$k \geq \frac{\nu}{(1 + r)(1 - \kappa)}$$

In what follows, we presuppose that this condition holds. In addition, the tax rate κ must be set so that total tax receipts are sufficient to fund payments of b to each unemployed person with insufficient account balances, i.e. to each young unemployed person and each long-term unemployed person (who is unemployed in both periods). This government budget constraint is examined in Section 3.

	Unemployment Benefit System	
	Employed	**Unemployed**
Period 1 Employed	$w(1 - \tau)$	b
Period 1 Unemployed	$w(1 - \tau)$	b
	Account System	
	Employed	**Unemployed**
Period 1 Employed	$w + (w - c^*)(1 + r)(1 - \kappa)$	$(w - c^*)(1 + r)(1 - \kappa)$
Period 1 Unemployed	w	b

TABLE 1. Period 2 consumption as a function of period 1 and period 2 states.

2.3. **A Preliminary Comparison of the Two Systems.** Observe that the first-order conditions under the two systems are virtually identical. In each case, the crucial variable for determining job search and work effort is the difference between the value of being employed and being unemployed.

Table (1) compares the two systems by describing period-2 consumption as a function of the worker's labor market history.

To understand the incentives generated by the USA system and unemployment benefit system, it is useful to consider what workers stand to lose from being unemployed under the two systems. To make the comparison particularly transparent, suppose that all workers receive the same, exogenously given wage. Then, under the unemployment benefit system, workers receive $w(1-\tau)$ when employed, and b when unemployed; thus they stand to lose $\Lambda = w(1-\tau) - b$ from being unemployed. Under the USA system, however, the incentives are different:

To begin with, consider the old workers who were previously employed. If they are employed, they receive $w + kw(1-\kappa)(1+r)$; and if they are unemployed they receive $kw(1-\kappa)(1+r)$. The difference is w, which is larger than the corresponding difference $\Lambda = w(1-\tau) - b$ under the unemployment benefit system.[3] As for the long-term unemployed (old workers who were also unemployed when young) and the young unemployed, they receive w when employed and b when unemployed. The resulting difference, $w - b$, is also larger than Λ.

In short, under the USA system, workers stand to lose more from being unemployed, since they internalize more of the costs of their unemployment than under the unemployment benefit system. In the first-order conditions (3), (5), (7), (9), we have seen that the workers'

[3]The same holds in utility terms for any concave utility function g:

$$g(w + kw(1-\kappa)(1+r)) - g(kw(1-\kappa)(1+r)) > g(w(1-\tau)) - g(b)$$

We note that by concavity:

$$g(w + kw(1-\kappa)(1+r)) \geq g(w) + g(kw(1-\kappa)(1+r))$$

so that:

$$g(w + kw(1-\kappa)(1+r)) - g(kw(1-\kappa)(1+r)) \geq g(w) > g(w(1-\tau)) - g(b)$$

leisure decisions depend positively on the penalty for job loss. Consequently, the unemployed have the incentive to search harder for jobs (take less leisure while unemployed) and the employed are induced to work harder (take less leisure while employed) under the USA system.

As result, it is straightforward to see that unemployment will be lower under the USA system. Specifically, letting the size of each age cohort be z, the aggregate unemployment level is:

$$U_o = h_y f_o(l_{ye}) + (1 - h_y)\,(1 - h_o(l_{yu})) \tag{11}$$

Since l_{ye} and l_{yu} are both lower under the USA system than under the unemployment benefit system, the firing rate f_o will be lower and the hiring rate h_o will be higher under the former system. Thus the USA system generates less unemployment.

3. The Government Budget Constraint

The government budget constraint under the benefit system is the discounted present value budget constraint that:

$$b((1 - h_y) + \beta U_o) = w\tau\,(h_y + \beta(1 - U_o)) \tag{12}$$

with second period unemployment U_o determined by Eq. (11).

To provide some rough calculations, using Eq. (12), payroll taxes under the benefit system are:

$$\tau = \frac{b}{w}\frac{(1 - h_y) + \beta U_o}{h_y + \beta(1 - U_o)} \tag{13}$$

Using Eq. (13), the payroll tax level is increasing in both the leisure of the employed and unemployed. With the account system, only those who are unemployed in both periods receive unemployment benefits. The unemployment benefits in *both periods* are funded out of taxes on the contributions of the young employed. The amount of expenditure on the period 1 unemployed is:

$$b(1 - h_y) \tag{14}$$

and that on the period 2 unemployed is:

$$\frac{b(1-h_y)(1-h_o(l_{yu}))}{1+r} \tag{15}$$

and the amount of revenue is:

$$\kappa k w h_y. \tag{16}$$

Hence:

$$\kappa = \left[\frac{(1-h_o\left(l_{yu}\right))}{(1+r)} + 1\right]\frac{1-h_y}{h_y k}\nu \tag{17}$$

Suppose that the goal of the system is only to replicate the existing replacement ratio ν so that $k = \frac{\nu}{(1+r)(1-\kappa)}$ then the level of κ necessary to sustain the system is relatively low. For example suppose that $h_y = 0.90$ and the $h_o(l_{yu}) = 0.90$ and $f_o(l_{ye}) = 0.10$, then unemployment in the first period is 10% and 90% of these people find jobs so that only 1% need benefits in the second period. If the discount rate is 10%. The amount of benefits that need to be funded in period 2 units:

$$0.10(1.10) + 0.01 = 0.12b \tag{18}$$

The 90% of people who are employed in period 1 and contributing to the system with an aim of replicating unemployment benefits if unemployed pay a contribution need to pay for this, meaning that the tax rate κ on contributions is about 11.76%.

4. Microfoundations of Hire and Fire Rates

We have assumed that the only way workers perceive they can influence hire and fire is through the choice of leisure. In this section, we provide some microfoundations for such hire and fire rates. There are a variety of models which can produce the same outcomes; here, we only illustrate the simplest possible model.

There are a large number M of firms, each of which has L workers and maximizes its two period profits $F(L,1)$:

$$F(L,1) = \left[\Gamma(0, l_{ye}) - w_y - df_o\right] L - \tau\omega N \frac{U_y}{M} + \beta\pi_2 \tag{19}$$

with:

$$\pi_2 = (\Gamma(\psi, l_{ye}) - w_i)(1 - f_o)L + (\Gamma(0, l_{oe}) - w_o)\omega N \frac{U_y}{M}. \tag{20}$$

Here, β is the discount rate, ψ captures learning by doing in production, Γ is productivity which depends on experience and effort, w_y is the wage in period 1, w_o is the wage of those unemployed in period 1 who become employed in period 2, w_i is the "insider" wage in period 2 for those employed in period 1, d is the cost of firing a worker, f_o is the firing rate, τ is the cost of hiring a worker, l_{oe} is the leisure of the old, N is the number of interviews conducted with each of the U_y period 1 unemployed workers and ω is the hiring rate at each interview.

Since the purpose of this section is to derive the microfoundations of hire and fire rates, we treat the wages w_i, w_o and w_y in the model as predetermined. We introduce these wages as separate parameters here because they separately influence the hire and fire decisions.

The first order condition for hiring is that, if the firm is hiring, the shadow value of a worker λ exceeds the marginal hiring cost:

$$\lambda = \beta \left(\Gamma(0, l_{oe}) - w_o \right) > \tau \tag{21}$$

When a worker comes for interviews at a firm, the firm's hiring decision is based on comparing the estimated shadow values $\lambda - \epsilon$ (where ϵ is a random variable) from hiring additional the employee with marginal training costs τ. At the interview time, the firm does not know how active the worker has been searching for a job so that its estimates of the shadow value are independent of the amount of search of the employee. The hire rate ω then is:

$$\omega = H(\lambda - \tau) \tag{22}$$

where H is the cumulative distribution function of ϵ.

Workers know the hire rate ω and have a time endowment of 1 when unemployed and obtaining an interview takes c units of time. Workers who do one interview are hired with a probability ω; if they are not hired (with probability $1 - \omega$), they may proceed to a second interview and be hired with a probability ω. The total probability of being hired is:

(23)
$$h_o = \omega \sum_{j=0}^{N-1} (1-\omega)^j = 1 - (1-\omega)^N$$

Given that the total endowment of leisure time is 1, then N interviews take cN units of time. Thus, leisure when unemployed is $1 - cN$ so that $N = \frac{1-l_{yu}}{c}$. Hence:

(24)
$$h_o(l_{yu}) = 1 - (1-\omega)^{\frac{1-l_{yu}}{c}}$$

which is decreasing in the leisure when unemployed. A linear approximation to Eq. (24) is:

(25)
$$h_o(l_{yu}) = 1 + \log(1-\omega)\frac{(l_{yu}-1)}{c}$$

which can be rewritten as:

(26)
$$h_o(l_{yu}) = \theta\,(1 - a\,l_{yu})\,.$$

The hire rate function formulation implicitly assumes that workers take the wage as given.

The first order condition of the profit maximization problem Eq. (19) for firing is that a worker will be fired if

(27)
$$\beta(\Gamma(\psi, l_{ye}) - w_i) + d < 0$$

so that a worker is fired when his/her discounted future contribution to profits falls below minus marginal firing costs. Because the worker is working on projects which may take more than one period, his first period effort l_{ye} will influence second period productivity. This effect is captured through the random parameter ψ which measures learning by doing.

Since the learning by doing parameter is random, firing is stochastic and the probability of firing a worker is given by the probability that Eq. (27) is negative. To simplify analysis, we assume that $\Gamma(\psi, l_{ye})$ is linear:

(28)
$$\Gamma(\psi, l_{ye}) = (\varsigma - l_{ye})\psi$$

Hence, the probability of firing the worker is:

$$f = G\left(\frac{\chi}{\varsigma - l_{ye}}\right) \tag{29}$$

where G is the cumulative density function of ψ and $\chi = \frac{\beta w - d}{\beta}$. Here, the fire rate is increasing in the level of leisure on the job l_{ye} as well as increasing in the wage w. The cumulative density function G can take a variety of forms but we can construct a first order approximation in terms of l_{ye} about $l_{ye} = \bar{l}$:

$$f_o(l_{ye}) = \varphi + \phi l_{ye}. \tag{30}$$

Someone who exhibits full effort and does not shirk at all should not be fired which can be achieved by setting $\varphi = 0$. Hence:

$$f_o(l_{ye}) = \phi l_{ye} \tag{31}$$

The parameter ϕ will depend on a number of other parameters including the wage.[4]

5. A Simple Example

In this section, we consider a simple example to illustrate the basic model described in Section 2. We consider the utility function:

$$u(c,l) = \frac{(c^{\alpha} l^{1-\alpha})^{\gamma}}{\gamma} \tag{32}$$

In Sec. 4 above, we derived microfoundations for hiring and firing rates. This section suggests the choice of hire and fire rates of:

$$h_o(l_{yu}) = \theta(1 - a l_{yu}) \tag{33}$$

$$f_o(l_{ye}) = \phi l_{ye} \tag{34}$$

Again, as mentioned in Sec. 4, the parameters ϕ, θ and a, which the worker treats as given, will typically be endogenous and depend on various aspects of the problem of profit maximization by the firm. We focus here only on the effects of funding on the consumer problem or

[4] Another way of justifying this functional form for the firing function is in terms of a shirking model (c.f., (Phelps 1994), Ch. 15 for details).

alternatively assume that the firm treats the worker's supply of effort and leisure as given. Since l_{oe} and l_{ou} are treated as fixed in our model, we normalize their values to 1.

5.1. **Unfunded Benefits.** When unemployed in the first period, the worker's problem is to solve:

(35)
$$V^b(y,u) = \max_{l_{yu}} \left[\frac{\left(b^{\alpha} l_{yu}^{1-\alpha}\right)^{\gamma}}{\gamma} + \frac{\beta}{\gamma} \left(h_o(l_{yu})(w(1-\tau))^{\alpha\gamma} + (1-h_o(l_{yu}))b^{\alpha\gamma}\right) \right]$$

subject to:

$$\max\left[0, \frac{1}{a}\left(1-\frac{1}{\theta}\right)\right] \leq l_{yu} \leq \frac{1}{a} \tag{36}$$

The interior solution for leisure when unemployed is:

$$l_{yu} = \left[\frac{\beta a \theta}{(1-\alpha)\gamma} \left((w(1-\tau))^{\alpha\gamma} - b^{\alpha\gamma}\right) \right]^{\frac{1}{(1-\alpha)\gamma-1}} b^{-\frac{\alpha\gamma}{(1-\alpha)\gamma-1}} \tag{37}$$

When employed in the first period, the worker's problem is to solve:

(38)
$$V^b(y,e) = \max_{l_{ye}} \left[\frac{\left((w(1-\tau))^{\alpha} l_{ye}^{1-\alpha}\right)^{\gamma}}{\gamma} + \frac{\beta}{\gamma} \left((1-f_o(l_{ye}))(w(1-\tau))^{\alpha\gamma} + f_o(l_{ye})b^{\alpha\gamma}\right) \right]$$

subject to:

$$0 \leq l_{ye} \leq \frac{1}{\phi} \tag{39}$$

which, assuming an interior solution, leads to an optimal choice of leisure of:

(40)
$$l_{ye} = \left[\frac{\beta \phi}{(1-\alpha)\gamma} \left((w(1-\tau))^{\alpha\gamma} - b^{\alpha\gamma}\right) \right]^{\frac{1}{(1-\alpha)\gamma-1}} (w(1-\tau))^{-\frac{\alpha\gamma}{(1-\alpha)\gamma-1}}$$

The unemployment rate in the second period is:

$$U_o = (1 - h_y)\theta + \phi l_{ye} + a\theta l_{yu} \tag{41}$$

To determine the balanced budget payroll tax rate τ, we solve the equation:

$$b\left((1 - h_y) + \beta U_o\right) = \tau w \left(h_y + \beta(1 - U_o)\right) \tag{42}$$

for τ. Unfortunately, this equation cannot be solved analytically. However, it is simple to do so numerically.

As a simple example, we set $w = 1.0$, $h_y = 0.90$, $b = 0.20$, $\phi = 1.50$, $r = 0.10$, $a = 0.75$, $\theta = 1.0$, $\alpha = 0.75$, $\beta = \frac{1}{1+r}$, $\gamma = 0.85$. In this case, the equilibrium payroll tax rate is 3.95% and the fire and hire rates are 0.253 and 0.914 respectively. The unemployment in period 2 is 23.7%. In the next section, we will review how to do calculations for an account system. For these same parameter values, unemployment under a balanced account system in period 2 is 11.87% or about half the level of the benefit system because of the effects on incentives.

5.2. **The Account System.** Under the account system, if unemployed in the first period, the workers problem is:

(43)

$$V^a(y, u) = \max_{l_{yu}} \left[\frac{\left(b^\alpha l_{yu}^{1-\alpha}\right)^\gamma}{\gamma} + \frac{\beta}{\gamma}\left(h_o(l_{yu})(w)^{\alpha\gamma} + (1 - h_o(l_{yu}))b^{\alpha\gamma}\right)\right]$$

subject to:

$$\max\left[0, \frac{1}{a}\left(1 - \frac{1}{\theta}\right)\right] \le l_{yu} \le \frac{1}{a} \tag{44}$$

which is the same as that for the benefit system except that there is no payroll tax. In this case:

$$l_{yu} = \left[\frac{\beta a\theta}{(1-\alpha)\gamma}\left(w^{\alpha\gamma} - b^{\alpha\gamma}\right)\right]^{\frac{1}{(1-\alpha)\gamma - 1}} b^{-\frac{\alpha\gamma}{(1-\alpha)\gamma-1}} \tag{45}$$

For the employed in period 1, the problem is:

$$
\begin{aligned}
V^a(y,e) \quad &= \quad \max_{l_{ye},c}[\frac{\left(c^{\alpha}l_{ye}^{1-\alpha}\right)^{\gamma}}{\gamma} + \frac{\beta}{\gamma}((1-f_o(l_{ye}))(w+(c-w)(1+r)(1-\kappa))^{\alpha\gamma} \\
&\quad +f_o(l_{ye})(c-w)(1+r)(1-\kappa)^{\alpha\gamma})]
\end{aligned}
$$

subject to:

(46)
$$0 \leq c \leq w - \frac{b}{(1+r)(1-\kappa)}$$

(47)
$$0 \leq l_{ye} \leq \frac{1}{\phi}$$

For this problem, we obtain:

(48)
$$l_{ye} = \left[\frac{\beta\phi}{(1-\alpha)\gamma}\left((w+(c-w)(1+r)(1-\kappa))^{\alpha\gamma} - ((c-w)(1+r)(1-\kappa))^{\alpha\gamma}\right)\right]^{\frac{1}{(1-\alpha)\gamma-1}} c^{-\frac{\alpha\gamma}{(1-\alpha)\gamma-1}}$$

for an interior solution.

The balanced budget constraint is (c.f., Sec. 3):

(49)
$$\kappa(w-c)h_y = b\left((1-h_y) + \frac{(1-h_y)(1-\theta(1-al_{yu}))}{1+r}\right)$$

The interpretation of Eq. (49) is that the tax on the contributions of employed in period 1 pays for the unemployed benefits of those who cannot afford to pay these benefits out of their accounts. In this simplified model, those without account assets are those who are unemployed in the first period and those who are unemployed in both the first and second periods.

As a simple example, we set $w = 1.0$, $h_y = 0.90$, $b = 0.20$, $\phi = 1.50$, $r = 0.10$, $a = 0.75$, $\theta = 1.0$, $\alpha = 0.75$, $\beta = \frac{1}{1+r}$, $\gamma = 0.85$. In this case, the equilibrium contribution tax rate is 7.72% and the fire and hire rates are 0.123 and 0.918 respectively. The unemployment in period 2 is 11.87% as opposed to 23.66% in the funded case. The maximum consumption wage ratio is 80.3% in period 1 as opposed to

96.05% in the benefit case; however, agents choose to consume only 40.2% of their wage.[5]

5.3. **Comparisons.** We have identified two principal channels whereby accounts reduce unemployment in the two period model:

- **Increased effort** when employed. Because costs are internalized there are larger penalties for job loss so that workers exhibit more effort.
- **Increased search** when unemployed. Internalization of costs leads workers to search more.

We now compare balanced budget behaviour under the account and benefit systems. In Table (2) we report: unemployment under the benefit system in period 2 (U_o^u) and the percentage change in unemployment from moving to a funded system with different values of the replacement ratio $\nu = \frac{b}{w}$, firm monitoring/fire rate ϕ, search cost parameter a, and hiring propensity θ. We fix $h_y = 0.90$, $w = 1$, $r = 0.10$, $\gamma = 0.85$. We find that the incentive effects of a funded system lead to significant employment reductions.

$\frac{b}{w}$	ϕ	a	θ	${U_o}^u$	$\frac{\Delta U_o}{U_o^u}$
0.1	1.5	0.75	1.0	0.182115	-40.07 %
0.2	1.5	0.75	1.0	0.236609	-49.84 %
0.3	1.5	0.75	1.0	0.314233	-58.12 %
0.2	2.0	0.75	1.0	0.219309	-56.54 %
0.2	1.0	0.75	1.0	0.263485	-41.43 %
0.2	0.5	0.75	1.0	0.317194	-36.92 %
0.2	1.5	0.5	1.0	0.237618	-49.64 %
0.2	1.5	0.2	1.0	0.240351	-49.10 %
0.2	1.5	0.75	0.5	0.289315	-40.23 %
0.2	1.5	0.75	0.25	0.317001	-36.47 %

TABLE 2. Funded versus Benefit Unemployment Benefits

These effects can also be seen in Fig. (2) for changes in the unemployment benefit replacement ratio. We note that the incentive effects of funding decrease the dependence of the unemployment rate on the replacement ratio as well as reducing overall unemployment. In Fig.

[5]The intuition for this is that consumption and leisure are complements and agents will have higher leisure in the second period.

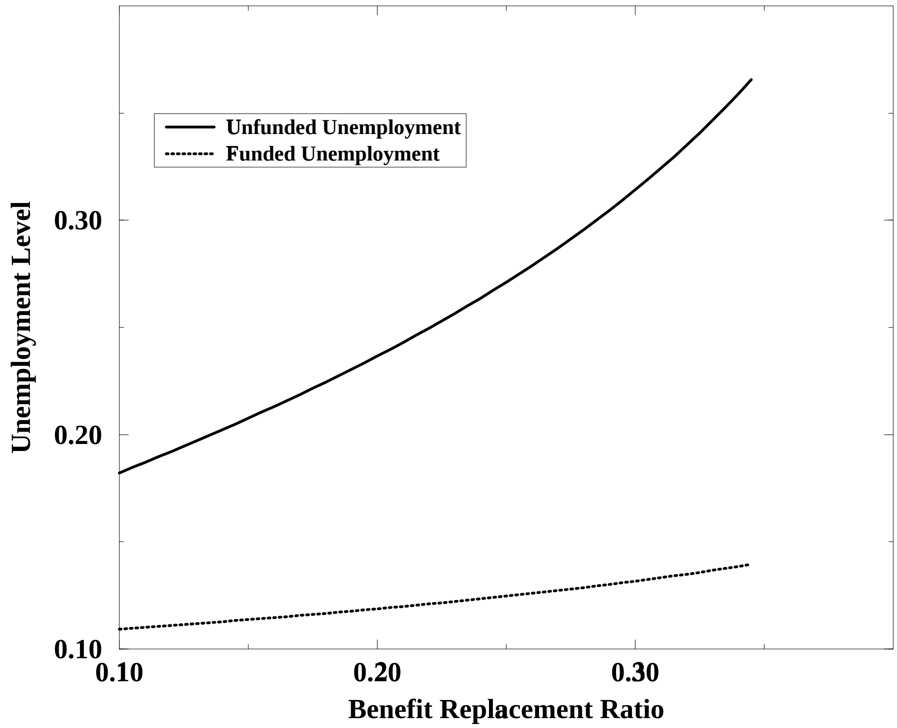

FIGURE 2. The effect of increases on the replacement ratio on unemployment under the benefit and funded systems.

(3), we show the same effects for changes in the parameter ϕ. In Fig. (4), we show the dependence of unemployment under the funded and benefit systems on a. Finally, in Fig. (5), we show the dependence of unemployment under the funded and benefit systems on θ.

6. CONCLUSION

This paper analyzes the implications for unemployment of replacing the prevailing unemployment benefit systems with unemployment support accounts (USAs). This shift involves replacing the current system of payroll taxes and unemployment benefits with a system of mandatory contributions and withdrawal rules. Under our proposal, the government will use a balanced budget redistribution mechanism to provide benefits to those who cannot afford to pay out of their USAs.

Unemployment in our model is equilibrium unemployment in the sense of Phelps (1994) and Lindbeck and Snower (1988) in that there

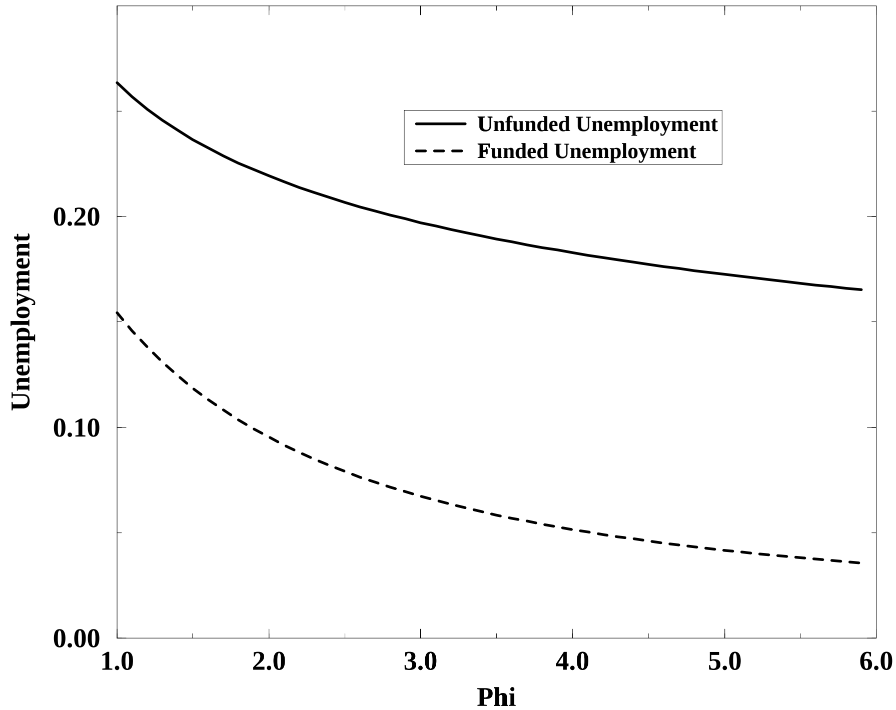

FIGURE 3. The effect of increases on the firm firing propensity ϕ on unemployment under the benefit and funded systems.

are explicit hire and fire costs; while workers choose leisure, their choice of leisure influences their transition probabilities between states rather than the level of hours worked. Workers who cannot afford to pay for unemployment benefits out of their accounts receive unemployment benefits which are funded by contributory taxes on those who contribute to accounts.

Our model shows that unemployment accounts lead to significant decreases in unemployment because the account system leads to substantial increases in the penalties for losing or not finding a job. These stronger penalties lead workers to search and work harder; because hire rates rise and fire rates fall, balanced budget unemployment is lower in the account system relative to the current system of unemployment benefits.

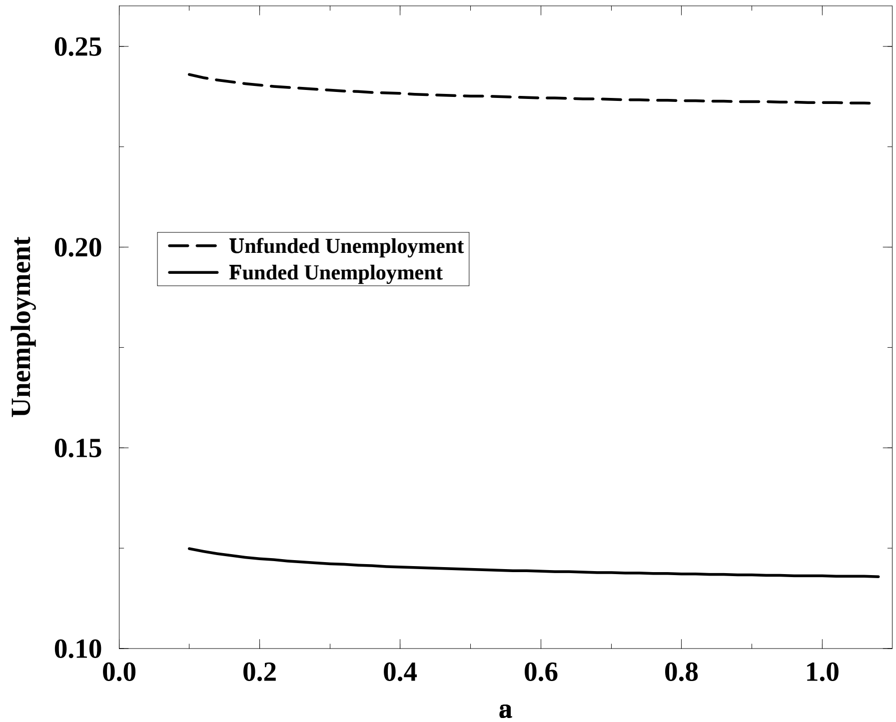

FIGURE 4. The effect of increases on the job search cost parameter a on unemployment under the benefit and funded systems.

REFERENCES

Kotlikoff, Laurence, *Generational Accounting*, Free Press, 1993.

Lindbeck, Assar and Dennis Snower, *The Insider-Outsider Theory of Employment and Unemployment*, MIT, 1988.

Phelps, Edmund, *Structural Slumps: The Modern Equilibrium Theory of Unemployment, Interest and Assets*, Harvard, 1994.

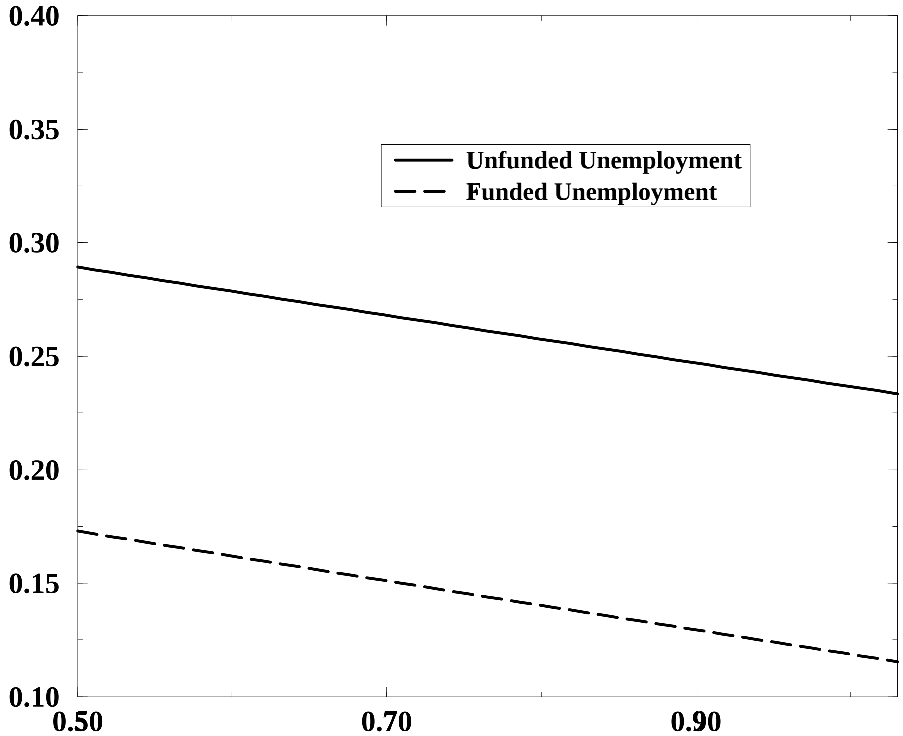

FIGURE 5. The effect of increases on the hiring parameter θ on unemployment under the benefit and funded systems.

INSTITUTE OF ECONOMIC STUDIES WORKING PAPERS 1995-1998
Formerly Iceland Economic Papers Series

Editor Tryggvi Thor Herbertsson

A complete list of IoES Working Papers and Reprints can be accessed on our World Wide Web site at http://www.hag.hi.is/ioes.

W95:08 Thorarinn G. Petursson: Backward and Forward Looking Error Correction Models of Inflation in Iceland

W95:09 Kurt Schuler: The Case Against Central Banking in Devoloping Countries with a Postscript on Iceland

W95:10 Tryggvi Thor Herbertsson and Gudmundur Magnusson: Accounting for Growth in the Five Nordic Countries, 1971-1992

W95:11 Thorarinn G. Petursson: Are Prices Forward Looking? Evidence from Iceland

W96:01 Thorolfur Matthiasson: Why Fishing Fleets Tend to be “Too Big”

W96:02 Birgir Runolfsson and Ragnar Arnason: Iceland’s ITQ System: Evolution and Performance

W96:03 Tryggvi Thor Herbertsson and Sigridur Benediktsdottir: Growth and Environmental Policies in Iceland: A Descriptive Account

W96:04 Fridrik M. Baldursson and Gudmundur Magnusson: Portfolio Fishing

W96:05 Jon Danielsson and Casper G. de Vries: Tail Index and Quantile Estimation with Very High Frequency Data

W96:06 Thorolfur Matthiasson: Cost Sharing and Catch Sharing

W96:07 Thorolfur Matthiasson: Local Governments in the Icelandic ITQ Market. Will they find it rational to sell

W96:08 Tor Einarsson and Milton H. Marquis: Transitional and Steady-state Costs of a Credible Disinflation Policy When Growth is Endogenous

W96:10 Anders Sørensen: Economic Growth: A Survey

W96:11 Ralph E. Townsend: Fisheries Management Implications of Alaskan Community Development Quotas

W96:12 Jon Danielsson: Multivariate Stochastic Volatility Models: Estimation and a Comparison with VGARCH Models

W97:01 Thorvaldur Gylfason: Icelandic Economists: Have They Made a Difference? – A Personal View –

W97:02 Fridrik M. Baldursson: Modelling the Price of Industrial Commodities

W97:03 Edmund S. Phelps and Gylfi Zoega: The Incidence of Increased Unemployment in the Group of Seven, 1970-1994

W97:04 Thorolfur Matthiasson: Fixed Wage or Share: Contingent Contract Renewal and Skipper Motivation

W97:05 Jon Danielsson and Casper G. de Vries: Extreme Returns, Tail Estimation, and Value-at-Risk

W97:06 Tor Einarsson and Milton H. Marquis: Fiscal Policy in an Endogenous Growth Model with Home Production

W97:07 Tor Einarsson and Milton H. Marquis: Formal Training, On-the job Training, and the Allocation of Time

W97:08 Tor Einarsson and Milton H. Marquis: Fiscal Policy Analysis under Alternative Mechanisms of Endogenous Growth

W97:09 Tryggvi Thor Herbertsson and Anders Sørensen: Policy Rules for Exploitation of Renewable Resources: A Macroeconomic Perspective

W97:10 Ragnar Arnason: Developments in Ocean Fisheries Management: Implications for the Volume and Quality of Fish Supply

W97:11 Thorvaldur Gylfason: Prospects for Liberalization of Trade in Agriculture

W97:12 Thorvaldur Gylfason, Tryggvi Thor Herbertsson and Gylfi Zoega: A Mixed Blessing: Natural Resources and Economic Growth

W97:13 J. Michael Orszag, Edmund S. Phelps and Gylfi Zoega: Education and the Natural Rate of Unemployment

W98:01 Leianne A. Clements and Janice B. Breuer: Will Dollar Depreciation Improve the U.S.-Japanese Trade Deficit? A Disaggregated Study

W98:02 Leianne A. Clements: What is Behind the U.S.-Japanese Trade Imbalance? Just the Facts on the Commodity Composition of U.S. Japanese Trade

W98:03 Tryggvi Thor Herbertsson: Accounting for Human Capital Externalities. With an Application to the Nordic Countries

W98:04 Gylfi Magnusson: Internal and External Migration in Iceland 1960-94: A Structural Model, Government Policies, and Welfare Implications

W98:05 Thorvaldur Gylfason, Tryggvi Thor Herbertsson, and Gylfi Zoega: Ownership and Growth

W98:06 Thorarinn G. Petursson: Explaining the Term Stucture: The Expectations Hypothesis and Time Varying Term Premia

W98:07 Thorarinn G. Petursson: The Representative Houshold's Demand for Money in a Cointegrated VAR Model

W98:08 Tryggvi Thor Herbertsson and Gylfi Zoega: Trade Surpluses and Life-cycle Saving Behaviour

W98:09 Thorvaldur Gylfason: Privatization, Efficiency, and Economic Growth

W98:10 Tor Einarsson and Milton Marquis: Uncertain Labor Quality and Asset Pricing

W98:11 J. Michael Orzag: Actuarial Discretion vs. Rules in Regulation of Pension Funds

W98:12 J. Michael Orzag and Dennis Snower: From Unemployment Benefits to Unemployment Support Accounts