WAITING FOR WORK*

George A. Akerlof, Andrew K. Rose and Janet L. Yellen

University of California at Berkeley

April, 2002

* This paper was prepared for *Imperfect Economics: Essays in Honor of Joseph Stiglitz.* It is adapted from our earlier unpublished paper with the same title, NBER Working Paper No. 3385, May 1990.

I. Introduction

It is more than a pleasure to say “Happy Birthday” to Joseph Stiglitz. To two of the co-authors of this paper, he has been the finest of friends for as long as we can remember. George Akerlof first met Joe when Joe, aged 20, came to MIT as a precocious graduate student. Janet Yellen has known him since 1967, when *she,* aged 21, arrived at Yale for her Ph.D. One of Joe’s first papers, with George, concerned the relation between wages and unemployment; that paper motivated Janet Yellen’s thesis, which Joe advised. The relation between wages and unemployment has been a prime focus of Joe’s research throughout his career (see, for example, Shapiro and Stiglitz (1984) and Greenwald and Stiglitz, (1988) and (1993)). His contributions have been central to the development of efficiency wage theory and the New Keynesian macroeconomics. This paper presents a different perspective on the relation between wages and unemployment and thus is a fitting contribution to celebrate our longstanding collaboration with Joe. Joe’s interest in unemployment is, of course, just one facet of his broader concern with poverty and its cure, both at home and abroad. We admire the passion, intellect and purposefulness with which Joe has pursued this important research and policy agenda as well as his constant good humor, grace, and ever-present smile.

This paper develops a model of “wait unemployment” designed to accord with three well-documented empirical regularities: high-skilled workers suffer more moderate cyclical fluctuations in employment and unemployment than low-skilled workers;[1] low-skilled workers gain substantially improved access to “good jobs” during expansions;[2] and job-changers experience larger procyclical real wage movements than workers who remain in the same job.[3] We do not attempt to model the shocks that cause cyclical fluctuations in job opportunities, treating both the flow of new jobs and the wages associated with them as exogenous. Our focus instead is on the process governing skill patterns of wages, employment and unemployment during a cyclical recovery.

Although our model takes the supply of jobs in the aggregate as “exogenous”, we assume that more skilled workers can, should they choose, bump less skilled workers for available job vacancies since firms prefer to hire the most able workers available. Consistent with the evidence concerning job downgrading and upgrading, such bumping occurs during recessions in our model; but the extent of cyclical downgrading is endogenously limited by the willingness of workers who are laid off in a downturn to rationally wait to accept jobs until business conditions improve. The unemployment experienced by skilled workers in our model during recessions thus reflects their decision to “wait for work”: these workers find it rational to hold out for the “good jobs” which will appear later in an expansion rather than “locking-in” the lower wages paid by the “less good” jobs that are available to them during the initial stages of a recovery.

Our model is motivated in part by the observation that labor is not the only factor of production that experiences periods of idleness. Office buildings sometimes stand unoccupied for extended periods of time and oil reserves sit idly underground. In the case of oil (and other exhaustible natural resources), a well-developed theory (Hotelling 1931) explains why the owners wait to extract their resource. In the equilibrium of the Hotelling model, the owners of oil reserves are compensated for waiting by an increase in the price of oil at the rate of interest.

In contrast to oil, the use of office buildings in one period does not preclude their use in other periods. In this respect, workers more closely resemble office buildings than oil. Yet office-space gluts are fairly common: in Houston during the 1990s, for example, vacancy rates were extraordinarily high in a many completed office buildings. The Hotelling model can be adapted to explain the existence of vacant office buildings provided that a significant fixed cost must be borne when office space is occupied or vacated. If such costs are sufficiently large, there is a "lock-in" effect: a building owner who rents his office space today to one tenant forgoes the possibility of renting the same space in later periods to other tenants. If long-term rental rates increase more rapidly than the rate of interest, it pays the owner of an unoccupied building to leave the space vacant and wait until conditions improve to rent out space[4]. This is true even if there are tenants willing to pay to occupy the space now. In contrast, if the rental rates on long-term leases increase at less than the rate of interest, the building owner maximizes the present value of his income by renting all available space now, since the reward to waiting in the form of higher rents in the future, does not make up for the loss in rentals today. In analogy to the market for oil, in equilibrium, long-term rental rates will rise at precisely the rate of interest with the stock of excess office space being gradually eliminated over time.

The theory of wait unemployment developed in this paper is exactly analogous to Hotelling's model as it would be applied to vacant office space. The cyclical unemployment of workers seeking *long-term (primary-sector) jobs* is analogous to the vacancies in office buildings whose owners seek *long-term tenants.* The "labor supply" function in our model is perfectly elastic; thus the model can rationalize the finding that large variations in employment are accompanied by small procyclic variations in wages concentrated among those workers who change jobs. Our model thus accounts for large aggregate fluctuations in employment without empirically implausible elasticities of substitution between leisure in different time periods. It offers an alternative rationale for a high elasticity of labor supply with respect to transitory wage movements: if the wage were rising more rapidly than the rate of time preference, a rational worker seeking a new, long-term job would optimally wait for work, rather than commit to the best job currently available. This behavior occurs even if workers place no value at all on leisure. Analogously, the supply elasticity with respect to transitory changes in long-term rental rates is infinite in the Hotelling office-space model, even though owners place no value on vacancies per se.

The incidence of wait unemployment (both its distribution across skill groups and its aggregate amount) as well as the paths of wages over time by skill are endogenously determined in our model in much the same way that the path of extraction of oil over time and the length of time that must elapse before the oil is fully depleted and a backstop technology comes into use is endogenously determined in the Hotelling model.

In Section II we present the model. In Section III, we analyze how the amount of wait unemployment and the path of wages vary across individuals as the economy emerges from an exogenously-caused recession and describe simulations of the model for reasonable parameter values. Section IV concludes.

II. Description of the Model

Our model of the labor market focuses on the determination of wages and employment in the "spot" market where newly created jobs are filled. The number of new jobs created at each date and the wage distribution of these new positions are exogenously determined. Workers vary in skill and employers fill new jobs with the best workers available at the offered wage. Workers maximize the present value of lifetime income. Wait unemployment occurs when an individual who could obtain work today decides to hold out for better opportunities in the future. We use the model to characterize the equilibrium paths of wages and wait unemployment by skill type as the economy emerges from a recession and individual workers are reabsorbed into employment.

Specifically, we study how the labor market responds to a “shock” at time 0 which destroys a fraction of existing jobs leaving θ people unemployed. Individuals differ in skill, indexed by x. We assume, for simplicity, that, x is uniformly distributed between 0 and 1 among the θ people unemployed due to the shock. In addition to the workers whose unemployment results from the “shock”, we assume that an ongoing process of job destruction (cum creation), quits, and new entry into the labor force produces a flow of new entrants into the unemployment pool.[5] During a short period of time, dt, new workers arrive into the unemployment pool at the rate α dt. We assume that the skill of these new entrants into the unemployment pool is also uniformly distributed between 0 and 1. Workers who are unemployed receive a benefit that is a proportion b of their ‘steady state wage,’ w_s, the wage that workers of that skill type earn in a long-run equilibrium with full employment.

In deciding whether or not to accept the best currently available job offer in the spot market we assume that unemployed individuals maximize the present discounted value of lifetime income with future income discounted at rate δ. We abstract from uncertainty and assume perfect foresight about future job opportunities.

Our assumptions about labor demand are intended to mirror key findings of internal labor market and efficiency wage theorists concerning the personnel practices of “primary sector” firms offering “good” long-term jobs.[6] In particular, we assume that firms hire workers into “jobs” filling each vacancy with the best worker willing to accept a job offer at the time the vacancy appears. (Our model assumes that firms can observe the skill (x) of applicants and therefore rank them.) Jobs are characterized by the wages they pay with a job of type w paying its incumbent a wage of w. With respect to job creation, we assume that new jobs arrive at the rate λ dt and the distribution of wages of the λ dt jobs created between time t and t+dt is uniform between 0 and $\bar{w}$. Accordingly, there is a uniform distribution (of density $\lambda dt/\bar{w}$) of new jobs paying a wage w between 0 and $\bar{w}$.

We make two further assumptions concerning jobs—both extreme for the sake of analytic simplicity: first, that the wage associated with a given job remains fixed over time; and second, that workers are completely immobile, so that they are indefinitely “locked-in” to any job they accept.

The assumption of a “fixed wage” is intended to capture the empirical finding that “primary sector” jobs shield workers from spot market fluctuations in the labor market so that the wages earned by “job stayers” are relatively insensitive to cyclical fluctuations whereas those received by newly hired workers vary significantly and procyclically, conditioning on worker quality. This assumption mirrors the findings of Rayack (2001), Weinberg (2001) and Baker, Gibbs and Holmstrom (1994b). Baker, Gibbs and Holmstrom find strong “cohort” effects among workers at a large employer whose employment policies they have studied in detail.

Their data provide striking evidence that the “starting wages” of different “new-hire cohorts” fluctuate over time and that starting wages exert a continued influence on the wage paths of the cohort throughout their careers. Our own empirical research (Akerlof, Rose and Yellen, 1990) similarly finds a long-lasting impact of the “intitial conditions” prevailing when a worker starts a job on that worker’s wage path over time. Such “discrimination” among cohorts may partly explain why, contrary to our extreme assumption, quits in the U.S. economy are procyclic (see Akerlof, Rose and Yellen (1988)). In booms, mobile workers leave 'bad' jobs which they acquired in recessions; the less mobile workers, whose behavior we model, remain stuck in these 'bad' jobs.

Our extreme assumption of complete “lock-in” is motivated by the empirical finding of long average job tenures (see, for example, Akerlof and Main, 1981) and an important role in primary-sector jobs for investments in firm-specific human capital and rising rewards to tenure that make mobility costly. (We could amend the model to allow for “short-term” (secondary-sector) job opportunities for unemployed workers with high discount rates, low job-switching costs or liquidity constraints. In our model, these workers would experience unemployment only when their respective "spot" wage falls below the value of their leisure and unemployment benefits. The presence of such workers in our model would *add* to the unemployment of long-term job seekers.)[7]

It should be noted that the evidence concerning the sensitivity of incumbent wages to spot market developments and the extent of “lock-in” are not uniformly supportive of our assumptions. In particular, Beaudry and DiNardo (1991) find strong evidence of “upward flexibility” in wages, suggesting that firms negotiate implicit wage contracts with workers that shield incumbents from losses when spot market wages decline but match “spot market wages” whenever the spot market wage exceeds the initial “contract wage.” Beaudry and DiNardo’s finding suggests, contrary to our model, that job mobility is costless even among workers in long-term jobs. Similarly, the mobility and hiring patterns observed by Baker, Gibbs and Holmstrom suggest that general, rather than firm-specific human capital, is more important in explaining wage and career trajectories.

III. Solution of the Model

A solution to this model consists of a description of the equilibrium paths both for the wage rate of each skill type and the unemployment rate of each skill type at each date during the transition to the steady state as the stock of initially unemployed workers, along with the flow of new entrants, is matched with the flow of new jobs. We denote these w(x,t) and u(x,t). We first describe the steady state of this model, in which there is no unemployment, and then the approach to the steady state.

A. The Steady State

In the steady state unemployment disappears and the flow of new entrants into the labor market is matched with the flow of new jobs. New entrants and new jobs flow into the labor market at the rates α dt and λ dt respectively. We assume that $\alpha < \lambda$. Under this assumption, the flow of new jobs is more than sufficient to provide employment to all new entrants into the labor force. At each time, new entrants queue by skill and "slot" themselves in order of quality into the flow of new jobs becoming available. In a steady state, the wage received by skill type x, denoted $w_s(x)$, is determined by the equilibrium condition that the number of new jobs paying at least $w_s(x)$ should just match the number of incoming workers at least as skilled as x, leading to the following equation

$$(1) \qquad \left[\int_{w_s(x)}^{\bar{w}} \frac{\lambda}{\bar{w}} \, dw \right] dt = \alpha (1 - x) dt$$

The left hand side of (1) is the number of new jobs paying a wage at least as great as $w_s(x)$. The right hand side of (1) is the number of workers at least as skilled as x who are entering the unemployment pool. Solution of (1) yields a specific formula for the steady-state wage $w_s(x)$

(2) $$w_S(x) = \overline{w}\left[1 - \frac{\alpha}{\lambda}\ (1 - x)\right]$$

In the steady state with $\alpha < \lambda$, some newly created jobs are never filled. If, contrary to our assumption, $\alpha > \lambda$, workers of skill type less than $1 - \lambda/\alpha$ are permanently unemployed.

B. Wages and Unemployment Along the Path to the Steady State

Along an equilibrium path to the steady state, all jobs accepted by workers of the same skill type must yield the same intertemporal utility. This follows from the fact that individuals who maximize intertemporal utility will never accept a job at any date t' if they can get higher utility by accepting a job at another date, t". As a result, an initially unemployed worker of type x receives utility U(x) dependent only on his skill type and not on the date of job acceptance. Since firms give preference to more qualified job candidates, workers of higher skill index x will receive jobs with a higher utility.

In order to solve for the path of wages received by a given skill type x along the path to the steady state it is necessary to determine T_x, which is the first date at which workers of type x receive the steady state wage and also the last date at which they have any unemployment. The methodology is similar to that used in a natural resource problem. In a natural resources problem, the price path of a resource is computed conditional on the date of first use of the backstop technology. Then the date of first use of the backstop technology is determined by the condition that the demand for the resource up to that date exactly exhausts the supply of the resource. T_x is analogous to the date of use of the backstop technology. As in the natural resource problem, the equilibrium wage path is computed conditional on T_x. Then T_x is determined by the condition that the demand for labor of type x along the equilibrium wage path between 0 and T_x must match the supply of labor of type x over the same period.

The Wage Path Conditional on T_x. The wage paid to skill type x at the date T_x is the steady state wage, $w_s(x)$, given by (2). Knowing that $w(x, T_x) = w_s(x)$, it is possible to find the wages for type x workers at all preceding dates conditional on T_x, since the present discounted value of the income stream of a worker accepting a job at $t < T_x$ and at T_x must be the same. A job accepted at T_x yields intertemporal utility $U(x)$ which is the sum of two components: the present discounted value of the income $bw_s(x)$ received from unemployment insurance between 0 and T_x plus the present discounted value of the steady state wage, which is received beyond T_x. This utility is

(3) $$U(x) = bw_s(x)\frac{1-e^{-\delta T_x}}{\delta} + \frac{w_s(x)}{\delta}e^{-\delta T_x}$$

The "reservation wage" of type x labor at time t, w(x,t), is then just that wage which yields the same total utility U(x) for an initially unemployed worker who instead accepts a job at date $t < T_x$. The utility from accepting a job paying w(x,t) at t is

(4) $$U(x) = bw_s(x)\frac{1-e^{-\delta t}}{\delta} + \frac{w(x,t)e^{-\delta t}}{\delta}$$

Equating (4) and (3) yields w(x,t).

(5) $$w(x,t) = w_s(x)e^{-\delta(T_x - t)} + bw_s(x)\left(1 - e^{-\delta(T_x - t)}\right)$$

Computation of T_x. To solve for T_x we equate the number of jobs created between 0 and T_x which yield utility at least as great as U(x) with the number of initially unemployed workers and new entrants to the labor force between 0 and T_x with skills at least as great as x. In our example it is possible to show that if type x labor has no unemployment at T_x then no higher grade of labor will be unemployed. In consequence the number of new jobs taken by labor with skill at least as great as x is the sum of two parts: the first component is the stock of workers with skill at least as great as x who were initially unemployed (at T_x they are all employed); the second component is the flow between 0 and T_x of workers who entered the labor force with skill at least as great as x. (All of these workers will also be employed at T_x in jobs which are at least as good as those taken by labor of type x.) There are $(1-x)\theta$ workers who are initially unemployed, with skill at least as great as x who become re-employed by date T_x; and there are $\alpha(1-x)T_x$ workers who enter the labor pool with skill at least as high as x. Consequently $(1-x)\theta + (1-x)\alpha T_x$ jobs are taken between 0 and T_x which are at least as good as the jobs taken by workers of skill level x.

How many jobs preferable to those taken by group x are created between 0 and T_x? At time t the rate of such "superior" job creation is

$$(6) \qquad \int_{w(x,t)}^{\bar{w}} \frac{\lambda}{\bar{w}} \, dw$$

where $w(x,t)$ is the "reservation wage" of labor of type x. Any job paying a higher wage than the reservation wage of type x labor is superior to that paying $w(x,t)$. Between 0 and T_x the total number of such jobs created is

$$(7) \qquad \int_{0}^{T_x} \left[\int_{w(x,t)}^{\bar{w}} \frac{\lambda}{\bar{w}} \, dw \right] dt$$

To solve for T_x, we equate the number of jobs created between 0 and T_x offering utility at least as great as $U(x)$, given by (7), with the number of initially unemployed workers and new entrants to the labor force between 0 and T_x with skills at least as great as x. This results in the equation

(8) $$\int_0^{T_x}\left[\int_{w(x,t)}^{\bar{w}} \frac{\lambda}{\bar{w}}\, dw\right]dt = \theta(1-x)+\alpha(1-x)T_x$$

Substitution of the formula for the wage, given by (5), into (8) yields an implicit equation for T_x:

(9) $$T_x - \frac{1-e^{-\delta T_x}}{\delta} = \frac{\frac{\theta}{\lambda}(1-x)}{(1-b)(1-\frac{\alpha}{\lambda}(1-x))}$$

The Unemployment Path by Skill. The unemployment rate of type x labor at time t, u(x,t), defined as the fraction of the initially unemployed workers of this skill type who are still out of a job at time t, can now be easily obtained. At time T_x there is no unemployment of type x workers or workers with greater skill. Therefore, for any $t < T_x$, the number of unemployed workers at least as skilled as x plus the number of workers who will enter the labor force between t and T_x with skill at least as great as x must equal the number of new jobs which will be created between t and T_x with wages at least as great as w(x,t):

(10) $$\int_x^1 \theta u(\phi,t)d\phi + (1-x)\alpha(T_x-t) = \int_t^{T_x}\left[\int_{w(x,t)}^{\bar{w}} \frac{\lambda}{\bar{w}}\, dw\right] dt$$

The first term on the left hand side of (10) is the total number of unemployed workers with skill at least as great as x; the second term is the number of new entrants to the labor market with skill at least as great as x between t and T_x. The right hand side of (10) is the total number of jobs yielding at least as much utility as U(x) which are created between t and T_x. The unemployment rate of workers of type x at time t, u(x,t), is obtained by total differentiation of (10) with respect to x. Use of (2) and (5) to substitute for w(x,t) and use of (9) to compute dT_x/dx yields the following simple formula for the unemployment rate:

$$(11) \qquad u(x,t) = \frac{1}{1-\frac{\alpha}{\lambda}(1-x)} \frac{1-e^{-\delta(T_x-t)}}{1-e^{-\delta T_x}} - \frac{\alpha(1-b)(T_x-t)}{\theta} + \alpha(1-b)\frac{1-e^{-\delta(T_x-t)}}{\theta\delta}$$

Differentiating (11) with respect to x and making use of the fact that T_x is higher for lower x, it is easy to verify that, at each date, unemployment rates are inversely related to skill; less skilled workers experience higher unemployment throughout the transition to the full-employment steady state. The more skilled experience a more rapid decline in unemployment than the less skilled, who linger longer in the unemployment pool as the economy emerges from recession. Our theory thus rationalizes the fact that the degree of procyclicality in unemployment and employment is inversely correlated with skill. Higher skilled workers have lower unemployment rates but unemployment is not confined solely to the lowest skilled workers in recession. Although more skilled workers can always bump less skilled workers for jobs, and thus there is no "involuntary" unemployment, there are (endogenous) limits to the bumping that occurs. The rate at which skilled workers currently take jobs determines the current wage gradient with respect to skill. Too great a current skill/wage gradient makes it rational for workers to wait rather than to take the jobs that are currently available to them. Unemployment results so that the current skill/wage gradient is not too steep.

The model generates a path for aggregate wages that is slightly procyclic--due to the fact that not all newly created jobs are taken and, as recovery occurs, the wage cut off of those that are taken rises. Q*uality-adjusted* wages vary procyclically as the average skill of new hires into given quality jobs falls in booms. With the more realistic assumption (see, for example, Okun (1973) or Vroman (1977)) that the average quality of new jobs rises in booms, both quality adjusted and aggregate wages would be significantly procyclic.[8]

As should be intuitive, an increase in α or decrease in λ serves to lengthen the amount of time it takes for the unemployment of any group to be absorbed. The unemployment rate of each group at each date is also greater the higher the unemployment benefit, b. These benefits raise an individual's reservation wage path by providing positive income in periods in which waiting occurs. As a consequence, individuals become more patient, in the sense that their wages need to rise at a slower rate to make waiting worthwhile. In the absence of unemployment benefits, wages must rise at the rate δ in order to compensate a worker for waiting. With unemployment benefits, the required rate of increase is approximately $\delta(1-b)$. Interestingly, although not shown in equation 11, the taxation of the marginal unemployment benefits of workers of greater skill will increase the unemployment of lower skill workers because it will induce the higher skill workers to take up the jobs that would otherwise be available to lower skilled workers.

C. Simulations

Figures 1 and 2 illustrate the key properties of this model for reasonably chosen parameter values. The parameters which need to be selected are θ, the percent of the labor force initially unemployed, α, the rate of flow into the labor pool as a fraction of the labor force, λ, the rate at which new jobs are created, b, the fraction of income replaced by unemployment insurance, and δ, the rate of discount. We chose θ = 5 percent; in other words, we examine a recession that starts with 5 percent excess unemployment. The model does not represent the unemployment of persons who are in the secondary labor market or on temporary layoff waiting to be recalled. Nor does it reflect the unemployment of those at the margin between being in and out of the labor force. For this reason we chose α, the flow into the unemployment pool, to be quite low relative to total turnover. Total turnover in manufacturing is approximately 60 percent per year. We chose α to be 5 percent per year. Further, we chose b = .5, and δ = .1. The major reason for choosing such a high rate of discount is to mitigate the extreme assumption in the model that jobs last forever. Workers' leaving their jobs with a constant probability is similar to an addition to the rate of discount in our model. The final parameter chosen was λ, the rate of job creation; λ was chosen so that the length of the recovery would be 36 months, the typical length of recoveries in the United States. That is we chose, T_0, the length of time for the lowest index labor to lose all its unemployment, to be three years. λ was then chosen so that with the values of α, b, and δ already selected, T_0

Figure 1. Fraction of Initial Unemployment Remaining by Skill Percentile by Month from Trough with Benchmark Parameters

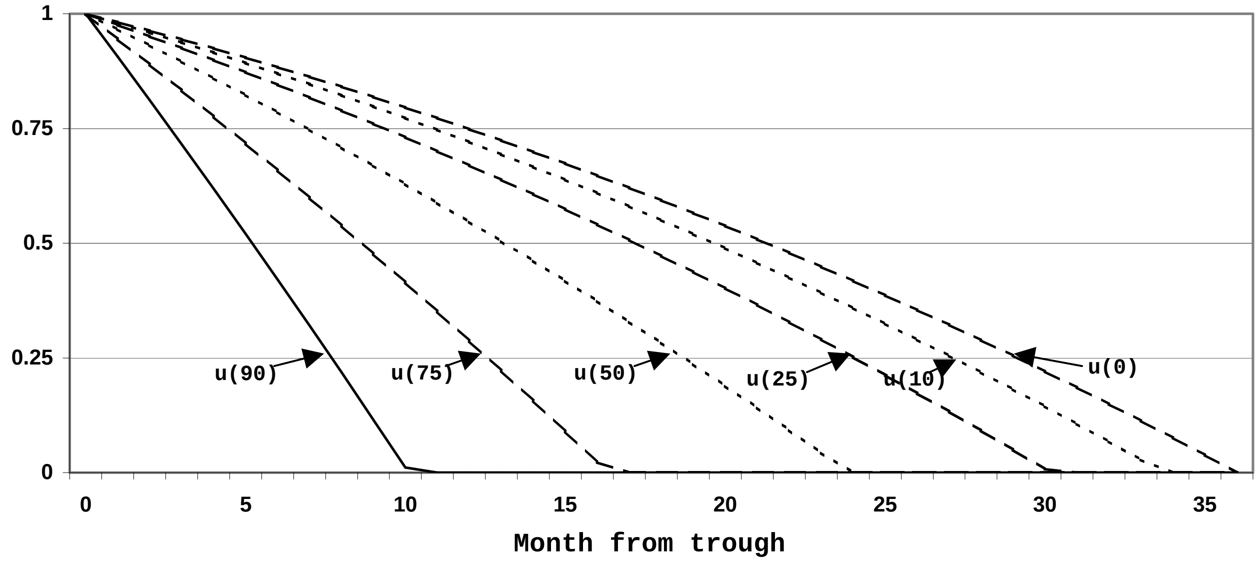
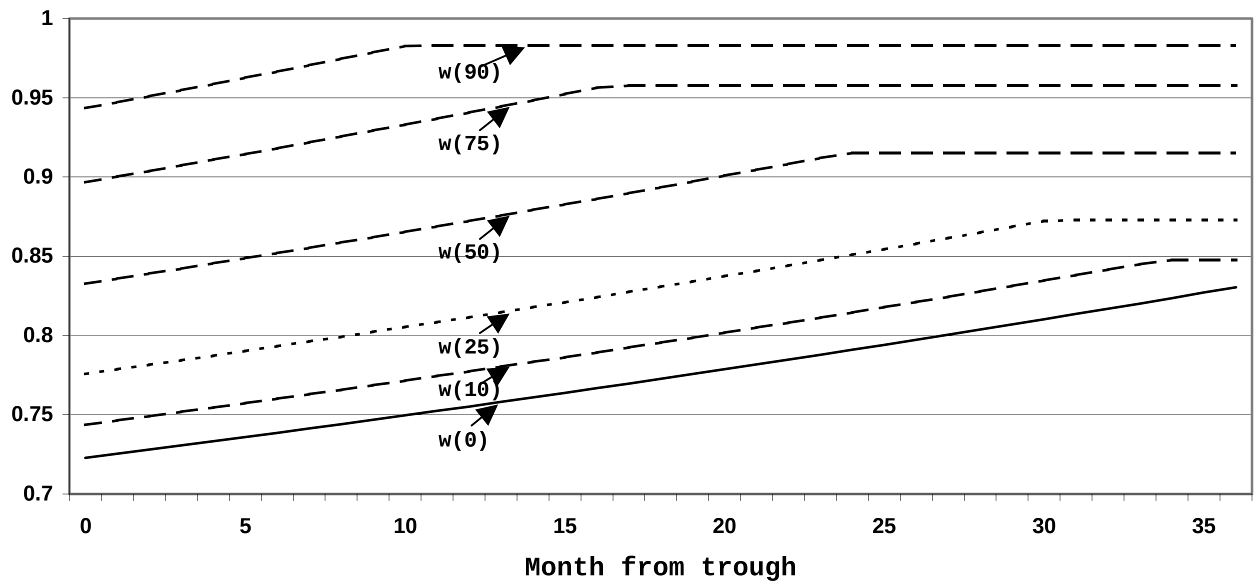


Figure 2. Wages as a Fraction of Maximum Wage by Skill Percentile by Month from Trough with Benchmark Parameters



would be three years (according to formula (9) for T_0). Figures 1 and 2 show simulated paths of unemployment and wages with these benchmark parameters.

It is worth noting how modest the fluctuations in real wages are over this cycle. Our model generates a semi-elasticity of real wages with respect to changes in the aggregate unemployment rate approximately equal to $-\delta(1-b)T_0/\theta$, or –0.03 with our benchmark parameters. This "theoretical prediction" of our model accords closely with actual estimates of the impact of a one percentage point change in the aggregate unemployment rate on the real wages of new job holders. For example, using data from 1979-1986 from the National Longitudinal Survey of Youth we estimate a significant unemployment semi-elasticity with respect to real wages of -.028 for "job changers" and -.039 for school-leavers entering full-time employment for the first time. (see Akerlof, Rose and Yellen (1990) for a detailed description of these empirical results). Similarly, Bils (1985) estimates an unemployment semielasticity of real wages between -.035-.04 for job changers.

IV. Concluding Remarks

This paper has presented a theory of the skill-incidence of unemployment and wages for an economy emerging from a recession. It rationalizes the consistent finding that less skilled workers experience more pronounced procyclical fluctuations in employment and unemployment than those with greater skill. The model provides an equilibrium theory of upward mobility in a high pressure economy as observed by Okun (1973) and others: in booms, less advantaged workers have better odds of escaping from “dead end” jobs and acquiring “primary sector jobs” with steeper returns to tenure. (see, most recently, Hines, Hoynes and Krueger (2002)) In recessions, declining job opportunities induce some workers to “wait for work” rather than lock in to the less desirable jobs that are available. The number of workers unemployed at each skill level is endogenously determined so that the reward to waiting due to the procyclic movement in real wages exactly compensates for income lost due to current unemployment. Simulations of the model suggest that for reasonable parameter values, the model’s theoretical predictions are consistent with existing empirical estimates of the degree of real wage cyclicality.

REFERENCES

Abraham, Katharine G. and John C. Haltiwanger. "Real Wages and the Business Cycle." *Journal of Economic Literature* 33 (1995): 1215-1264.

Akerlof, George A. and Brian G.M. Main. "An Experience-Weighted Measure of Employment and Unemployment Durations." *American Economic Review* 71 (1981): 1003-11.

_______________, Andrew K. Rose and Janet L. Yellen. "Job Switching and Job Satisfaction in the U.S. Labor Market." *Brookings Papers on Economic Activity* (1988): 495-592.

____. "Waiting for Work." National Bureau of Economic Research Working Paper No. 3385,(1990).

Baker, George, Michael Gibbs and Bengt Holmstrom. "The Internal Economics of the Firm: Evidence from Personnel Data." *Quarterly Journal of Economics* 109 (1994): 881-919.

____. "The Wage Policy of a Firm." *Quarterly Journal of Economics* 109 (1994) 921-955.

Barlevy, Gadi. "Why Are the Wages of Job Changers So Procyclical?" *Journal of Labor Economics* 19 (2001): 837-878.

Beaudry, Paul and John DiNardo. "The Effects of Implicit Contracts on the Movement of Wages Over the Business Cycle: Evidence from Micro Data." *Journal of Political Economy 99 (1991): 665-688.*

Bils, Mark J. "Real Wages Over the Business Cycle: Evidence from Panel Data." *Journal of Political Economy* 93 (1985): 666-689.

Davis, Steven J., John C. Haltiwanger and Scott Schuh. *Job Creation and Destruction*. Cambridge and London: MIT Press, 1996.

Greenwald, Bruce C. and Joseph E. Stiglitz. “Examining Alternative Macroeconomic Theories.” *Brookings Papers on Economic Activity* (1988): 207-260.

____. “New and Old Keynesians.” *Journal of Economic Perspectives*. 7 (1993): 12-44.

Hines, James R., Hilary W. Hoynes and Alan B. Krueger, “Another Look at Whether a Rising Tide Lifts All Boats.” In Alan B. Krueger and Robert M. Solow, eds., *The Roaring Nineties: Can Full Employment Be Sustained?* New York: Russell Sage Foundation, 2002.

Hotelling, Harold. "The Economics of Exhaustible Resources." *Journal of Political Economy* 39 (1931): 137-175.

Hoynes, Hilary W. 2000. “The Employment and Earnings of Less Skilled Workers Over the Business Cycle.” in *Finding Jobs: Work and Welfare Reform*, edited by Rebecca Blank and David Card. New York: Russell Sage Foundation.

Krueger, Alan B. and Lawrence H. Summers. “Efficiency Wages and the Inter-Industry Wage Structure.” *Econometrica* 56 (1988): 259-293.

Okun, Arthur M. "Upward Mobility in a High pressure Economy." *Brookings Papers on Economic Activity* (1973): 207-252.

Piore, Michael J. "The Impact of the Labor Market upon the Design and Selection of Productivity Techniques within the Manufacturing Plant." *Quarterly Journal of Economics* 82 (1968): 602-620.

Rayack, Wendy L. “Fixed and Flexible Wages: Evidence from Panel Data.” *Industrial and Labor Relations Review* 44(1991): 288-298.

Reder, Melvin W. "The Theory of Occupational Wage Differentials," *American Economic Review* 45 (1955): 833-52.

Shapiro, Carl and Joseph E. Stiglitz. “Equilibrium Unemployment as a Worker Discipline Device.” *American Economic Review* 74 (1984): 433-444.

Solon, Gary, Robert Barsky and Jonathan A. Parker. “Measuring the Cyclicality of Wages: How Important Is Composition Bias?: *Quarterly Journal of Economics* 109 (1994): 1-25.

Vroman, Wayne. “Worker Upgrading and the Business Cycle.” *Brookings Papers on Economic Activity* 1977(1977):229-250

Weinberg, A. Bruce. “Long-Term Wage Fluctuations with Industry-Specific Human Capital.” *Journal of Labor Economics* 19 (2001)231-264.

ENDNOTES

[1] See, for example, Hoynes (2000) and Hines, Hoynes and Krueger (2002).

[2] The phenomenon by which low-skilled workers move toward "better" jobs in a high pressure economy has been explored by Reder (1955), Okun (1973), Vroman (1977), Bils (1985), Hines, Hoynes and Krueger (2002) and Rayack(2001).

[3] See Akerlof, Rose and Yellen (1990), Barlevy (2001), Beaudry and DiNardo (1991), Bils (1985) and Solon, Barsky and Parker (1994).

[4] This abstracts from the existence of variable costs incurred from renting space and assumes that tenancies last forever.

[5] This assumption is consistent with Davis, Haltiwanger and Schuh's finding of large gross flows in the labor market. In such an environment, it seems highly implausible that skilled workers would be unable to bump less skilled workers for jobs if they want them.

[6] See, for example, Piore (1968) and Katz and Summers (1989).

[7] The presence of such workers at the beginning of a recession typically leads to greater depression of quality-adjusted wages and thus increases the incentive to wait for workers with high switching costs or low rates of time preference.

[8] See Abraham and Haltiwanger (1995) for a survey of the evidence.