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Public Policy, Employment, and Welfare in an Efficiency Wage Model

Ken-ichi Hashimoto
Graduate School of Economic, Kobe University

Taro Kumagai
Graduate School of Economic, Kobe University

Abstract

This paper develops an efficiency wage model to highlight public policy for relieving unemployment. For the purposes of relief, we present unemployment benefits, public employment programs and wage subsidies. The results show that unemployment benefits have a negative effect on the employment rate, while public employment and wage subsidies have a positive effect. The impact of these policies on social welfare is also considered.

Citation: Hashimoto, Ken-ichi and Taro Kumagai, (2006) "Public Policy, Employment, and Welfare in an Efficiency Wage Model." *Economics Bulletin*, Vol. 5, No. 16 pp. 1-11
Submitted: September 26, 2006. **Accepted:** October 26, 2006.
URL: http://economicsbulletin.vanderbilt.edu/2006/volume5/EB-06E60006A.pdf

1 Introduction

Many developed countries, including Japan since 1990, have endured long-run recessions with persistent unemployment, a matter to which policymakers have paid particular attention. In this paper, we theoretically investigate some policies to stimulate the employment rate. To explain high levels of unemployment, various models have been constructed. For the purposes of our analysis, and following Shapiro and Stiglitz (1984), we use an efficiency wage model, the prototype of which has been very widely applied.[1] More recent studies have incorporated the public sector explicitly within this type of model, noteworthy examples being Stiglitz (1999) and Sørensen (1999). However, these studies only analyze the effect of taxation and tax reform on employment, and they do not consider the role of public expenditure policy. Only a few attempts have been made to incorporate and analyze public expenditure policy for relieving unemployment explicitly within an efficiency wage model. Our contribution to the literature is to present a simple formal analysis, incorporating a number of public sector policies aimed towards relieving unemployment in general equilibrium.

In this paper, we present various policies to stimulate labor supply and demand, financed by a nondistortional tax (lump-sum tax). Unemployment benefits and public employment programs are considered for the former, while for the latter we evaluate wage subsidies. The results show that an increase in unemployment benefits and public employment programs decreases the level of employment by firms. This is because these programs weaken workers' incentives to exert effort. Therefore, the firm decreases the level of employment (that is, there is crowding out by the public sector). Consequently, the employment rate is worsened through unemployment benefits. However, a public employment policy improves the employment rate, since the policy increases self-employment. Contrary to these results, wage subsidies have a positive effect on firm sector employment. This is because it increases redistribution from the unemployed to the employed. Thus, policies for relieving unemployment introduce a conflict between workers and the unemployed because of redistribution.

The paper also examines the effects of these policies on social welfare. The findings suggest that policies that decrease (increase) firm sector employment have a negative (positive) effect on social welfare. The reasoning is as follows. To start with, public policy infers redistribution between the employed and the unemployed. Therefore, social welfare does not change in terms of income, *ceteris paribus*. However, if government policy decreases (increases) firm sector employment, there is a decrease (increase) in worker income. This makes social welfare worse off (better off).

[1] See Milgrom and Roberts (1992) and Romer (1995, Ch.10) for further discussion.

The paper itself is organized as follows. In section 2, we construct the model. Section 3 describes the market equilibrium and studies the impact of public policies on the economy. We examine the social welfare effects of the policy in section 4. Finally, section 5 concludes the paper.

2 The Model

We employ a version of the Shapiro and Stiglitz (1984)-type moral hazard or shirking model that explicitly incorporates the public sector. The model describes an economy with three sectors: households, firms, and government. We discuss each sector separately.

First, consider households. All risk-neutral workers are identical and receive utility from wage income $w > 0$ but suffer disutility from effort $e \geq 0$. The instantaneous utility of a worker is $U = w - \tau - e$, where τ is a lump-sum tax. As in Shapiro and Stiglitz (1984), we assume that workers provide either $e = 0$ or a fixed level of effort $e > 0$.

If workers perform at the customary level of effort, that is, they do not shirk, they receive $w - \tau - e$. If workers shirk, they are discovered and fired for neglect of duty with some probability, q, per unit of time. Workers must then choose either to provide effort or to shirk. Regardless of whether or not they shirk, workers are fired without reason for redundancy with some exogenous probability, b, per unit of time. Let us define V_N (V_S) as the expected lifetime utility of an employed nonshirker (shirker). The discounted present value of nonshirkers and shirkers are given by:

$$rV_N = w - \tau - e + b(V_U - V_N), \tag{1}$$

$$rV_S = w - \tau + (b + q)(V_U - V_S), \tag{2}$$

where V_U is the expected lifetime utility of unemployed workers, and r is the discount rate.

A worker will choose not to shirk if, and only if, $V_N \geq V_S$, which is called the nonshirking condition (NSC). $V_N = V_S$ in equilibrium, and the nonshirking condition, using (1) and (2), can be rewritten as:

$$w = \tau + \frac{b + q + r}{q} e + rV_U. \tag{3}$$

We now turn to the determination of the equilibrium wage and employment level, and the expected lifetime utility of unemployed households V_U is the key variable. V_U is given by:

$$rV_U = \overline{w} - \tau + a(V_E - V_U), \tag{4}$$

where $\overline{w}$ is a level of unemployment benefits, a is the job acquisition rate, and V_E is the expected utility of employed households ($V_E = V_N$ in equilibrium). Using (4), we can rewrite the nonshirking condition (3)[2]:

$$w = e + \frac{a+b+r}{q}e + \overline{w}. \tag{5}$$

Now consider the firms, which are assumed to be identical, perfectly competitive firms using labor as their only input. The production function is assumed to satisfy constant returns-to-scale: $F(L) = AL^m$, where A is the constant technology and L^m is the labor level the firm employs. Suppose that the government pays the firm *sw ad valorem* where s is the wage-rate subsidy. Firms decide upon labor demand so as to maximize profits: $(A - (1-s)w)L^m$. Because of the constant return-to-scale technology, firms earn zero profits so long as labor demand has a positive finite value. Thus, the firm sector's demand for labor L^m satisfies $0 < L^m < \infty$ if:

$$(1-s)w = A. \tag{6}$$

We assume that productivity is greater than the level of effort: $A > e$.[3]

Assume the government has three policies available to mitigate the unemployment problem: (i) an unemployment benefits program, (ii) a public employment program, and (iii) wage subsidies. These programs are financed by a lump-sum tax on households. Suppose that the wage of workers employed by the government is equal to the wage of workers employed by the firm. The government pays the wage w to public employment. In equilibrium, we require this system to be balanced in every period, such that the government's budget constraint is given by:

$$\tau N = \overline{w}[N - L^T] + wL^g + swL^m, \tag{7}$$

where $L^T = L^m + L^g$ is the aggregate level of employment, L^g is the public employment, and N is the total labor supply.

3 Market Equilibrium

The rate a can be related to the more fundamental parameters of the model in a steady-state equilibrium. In the steady state, the flow into the unemployment pool bL^m is equal

[2] $V_N \geq V_U$ is called the participation constraint. The participation constraint, using (1) and (4), can be rewritten as $w = \overline{w} + e$, which is not binding in equilibrium. Hereafter, we ignore the participation constraint.

[3] If $A < e$, no one works in equilibrium. This paper does not consider this trivial case.

to the flow out of the employment pool $a(N - L^T)$, that is:

$$a = \frac{bL^m}{N - (L^m + L^g)}. \tag{8}$$

Substituting (7) and (8) into (5), we have the aggregate NSC:

$$w = \Omega + \frac{e}{q}\frac{bL^m}{N - (L^m + L^g)} + \bar{w} \equiv \Phi(L^m), \tag{9}$$

where $\Omega \equiv (b + q + r)e/q$. We define the right-hand side of (9) as $\Phi(L^m)$.

3.1 Equilibrium

To illustrate the properties of this economy, we first consider the no-policy case; *i.e.*, $\overline{w} = 0$, $L^g = 0$, and $s = 0$. From (9), the aggregate NSC is given by:

$$w = \Omega + \frac{e}{q}\frac{bL^m}{N - L^m}. \tag{10}$$

From (6) and (10), the employment level in equilibrium is decided by:

$$L^{m*} = \frac{A - \Omega}{A - \Omega + be/q}N < N.$$

In this case, we obtain the same characters of equilibrium as Shapiro and Stiglitz (1984). The comparative statics of each parameter are as follows. From (10), increasing the quit rate b or decreasing the monitoring intensity q weakens workers' incentive to exert effort. Therefore, the changes require an increase in the wage to induce individuals to work. However, the firm cannot change the wage since A is fixed: $w = A$. This implies that the firm decreases the level of employment. Increasing the technology A leads to a rise in the wage rate, and the employment level increases.

Next, consider the equilibrium in which programs exist. From (6) and (9), the equilibrium for the labor market is given by:

$$\frac{A}{1 - s} = \Omega + \frac{e}{q}\frac{bL^m}{N - (L^m + L^g)} + \bar{w} \equiv \Phi(L^m), \tag{11}$$

where $\Phi(L^m)$ has the following property: $\Phi(0) > 0, \Phi(N - L^g) = \infty$, and $\Phi'(L^m) > 0$. The equilibrium employment with these policies is depicted in Figure 1. This is implies that $L^m + L^g < N$ is satisfied.

3.2 Unemployment Benefits and Public Employment Programs

In this subsection, we show the effect of unemployment benefits $\overline{w}$ and public employment programs L^g on the employment level of the firm L^m. The policy parameters $\overline{w}$ and L^g are related to the right-hand side of (11); $\Phi(L^m; \overline{w}, L^g)$. If $\overline{w}$ rises, RHS of (11) increases; that is, it shifts the RHS curve upwards; $\partial\Phi/\partial\overline{w} > 0$. The increase in L^g has the same effect on RHS (11): $\partial\Phi/\partial L^g > 0$ as the increase of $\overline{w}$ (see Figure 1). Mathematically, with the total differential in (11), we obtain the effects of both programs on firm sector employment:

$$\frac{dL^m}{d\bar{w}} = -\frac{\partial\Phi/\partial\bar{w}}{\partial\Phi/\partial L^m} < 0, \quad \frac{dL^m}{dL^g} = -\frac{\partial\Phi/\partial L^g}{\partial\Phi/\partial L^m} < 0. \tag{12}$$

When $\overline{w}$ or L^g increases, the loss of unemployment decreases. Therefore, the worker's incentive to exert effort weakens. Since the optimal wage w is equal to $A/(1-s)$ from (6), the firm reduces the level of employment L^m. These policies lead to a crowding out of the employment level of the firm.

What effect does such a policy have on the employment rate x? Let us define the employment rate as $x = (L^m + L^g)/N$. From the above, the increase of $\overline{w}$ clearly leads to a decrease in x because L^m falls: $dx/d\overline{w} = (dx/dL^m)(dL^m/d\overline{w}) < 0$. However, the effect of L^g on x is not obvious, since L^g raises employment as its own effect though the rise of L^g decreases L^m. From the definition of x, the effect is given by:

$$\frac{dx}{dL^g} = \frac{1}{N}\left(\frac{dL^m}{dL^g} + 1\right).$$

If $dL^m/dL^g > (<) -1$, the increase in L^g can lead to an increase (decrease) in the employment rate x. From (11), we can explicitly check the effect of L^g on L^m:

$$\frac{dL^m}{dL^g} = -\left(\frac{\partial\Phi}{\partial L^g}\right) \Big/ \left(\frac{\partial\Phi}{\partial L^m}\right) = -L^m/(N - L^g) > -1. \tag{13}$$

Since $dL^m/dL^g > -1$ is satisfied, the public employment L^g has a positive effect on the employment rate x; $dx/dL^g > 0$. Accordingly, a public employment program can improve the employment rate, but only through the crowding out of employment by the firm. This implies that the increase in the level of employment through a public employment program exceeds the decrease in the employment level of the firm.

3.3 Wage Subsidies

In this subsection, we analyze wage-rate subsidies as a policy to stimulate labor demand.[4] Since the equilibrium is given by $A/(1-s) = \Phi(L^m)$, the effect of wage subsidies s on L^m

[4]Production subsidies could also be considered to stimulate labor demand . However, they have a similar effect in equilibrium as a wage subsidy.

is given by:

$$\frac{dL^m}{ds} = \frac{A}{(1-s)^2}\frac{1}{\Phi'(L^m)} > 0. \tag{14}$$

The rise in the subsidy increases employment (and the employment rate; $dx/ds = (dx/dL^m)(dL^m/ds) > 0$) through an upward shift of the labor demand curve. This effect is illustrated in Figure 2.

The increase in wage-rate subsidies is financed by an increase in the lump-sum tax τ. This implies income redistribution from the unemployed to the employed. Since the cost of losing a job increases, workers have a stronger incentive to exert effort. Therefore, the firm increases the level of employment. It is then important for this policy to strengthen the worker's incentive to exert effort, as against the unemployment benefits and public employment programs.

4 Welfare Analysis

We now consider the impact of the various policies on social welfare. As shown, on the one hand, an unemployment benefits program reduces the employment rate. On the other hand, both a public employment program and wage subsidies increase the employment rate. However, the effect of these policies on social welfare is not obvious. Following Shapiro and Stiglitz (1984), we define social welfare U_W as the sum of the employment and the unemployment utility:

$$U_W \equiv (w - \tau - e)L^m + (w - \tau)L^g + (\bar{w} - \tau)[N - (L^m + L^g)].$$

Using the government budget constraint $\tau N = \bar{w}[N - (L^m + L^g)] + wL^g + swL^m$, and the firm's optimal condition $(1-s)w = A$, social welfare is rewritten as:

$$U_W = [A - e]L^m(\bar{w}, L^g, s), \tag{15}$$

where $L^m(\cdot)$ represents the equilibrium value discussed in the previous section. Differentiating (15) with the policy parameter, we obtain the effect of each policy on social welfare. Using the results in the previous section, we obtain:

$$\begin{aligned}
\frac{dU_W}{d\bar{w}} &= [A - e]\frac{dL^m}{d\bar{w}} < 0, \\
\frac{dU_W}{dL^g} &= [A - e]\frac{dL^m}{dL^g} < 0, \\
\frac{dU_W}{ds} &= [A - e]\frac{dL^m}{ds} > 0.
\end{aligned}$$

Intuitively, the results are explained as follows. An increase of $\overline{w}$ and L^g decreases the loss of unemployment, while the rise of s increases the loss of unemployment. It has a negative (positive) effect on the worker's incentive to exert effort, such that the firm decreases (increases) the level of employment. These public policies then imply redistribution of income through lump-sum taxation. However, if public policy crowds out firm sector employment, firm sector employment income falls. Thus, even if a policy to increase the employment rate is undertaken (such as a public employment program), the reduction in firm sector employment reduces social income and worsens social welfare. On the one hand, even though unemployment benefits and public employment programs infer redistribution from the employed to the unemployed, these policies worsen social welfare. On the other hand, despite the fact that a wage subsidy is transferred to the employed from the unemployed, the policy still improves social welfare.

5 Concluding Remarks

This paper constructs an efficiency wage model that explicitly incorporates public policy to relieve unemployment. Several public policies are used to stimulate labor supply and demand, the results demonstrating an effect on firm sector employment and the employment rate. We show that both supply-side programs, namely unemployment benefits and public employment, induce a decrease in firm sector employment. However, unemployment benefits reduce the employment rate, whereas public employment increases it. Demand-side programs in the form of wage subsidies are also found to have a positive effect on the employment rate. Finally, we show that policies that decrease (increase) firm sector employment have a negative (positive) effect on social welfare.

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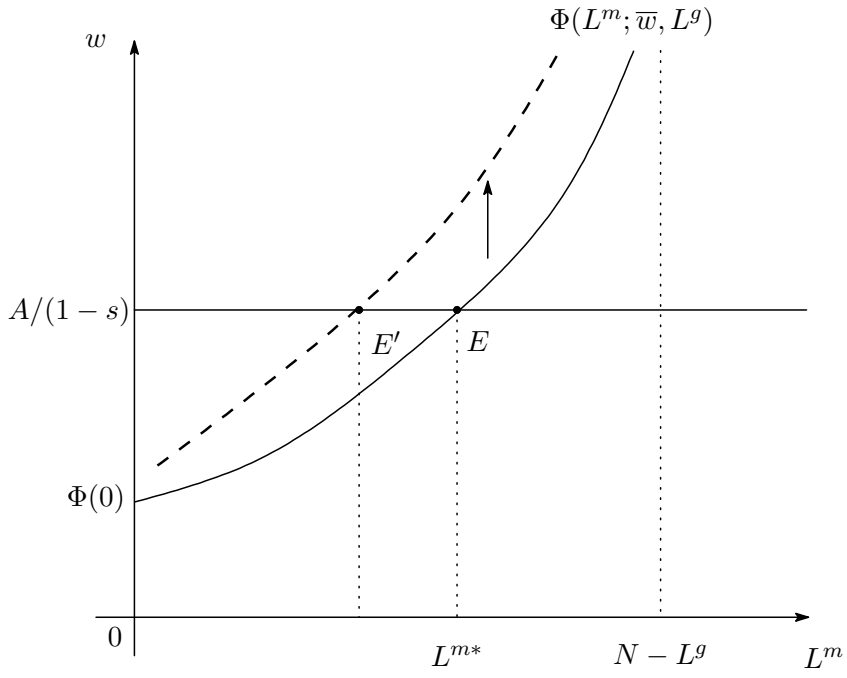

Figure 1: The effect of policy for labor supply ($\overline{w}$, L^g)

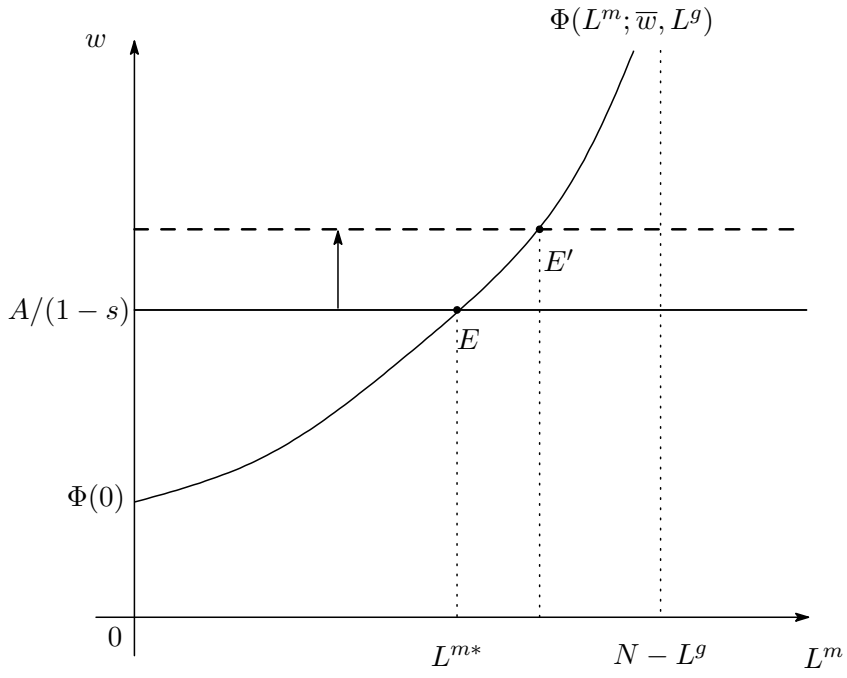

Figure 2: The effect of policy for labor demand (s)