Effect of Unemployment Insurance Tax On Wages and Employment: A Partial Equilibrium Analysis

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Abstract

We develop a partial equilibrium model under a cost minimization problem to derive the effect of an unemployment insurance tax on average wage rates and employment. We assume perfect competition in the product market and perfect factor mobility in the factor market. Our model suggests that a portion of the tax is passed on to employees by means of reduced wages. The model also suggests that a lower level of employment will be realized as a result of the tax.

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Abstract

We develop a partial equilibrium model under a cost minimization problem to derive the effect of an unemployment insurance tax on average wage rates. The model suggests that a portion of the tax is passed on to employees by means of reduced wages.

1. Introduction

The unemployment insurance (UI) tax is a federal tax collected by the U.S. government from employers across the country. Most of the tax revenues is then transferred to the related states in terms of Unemployment Insurance Trust Funds. This fund is then used by the states to pay compensation to unemployed workers actively seeking jobs. The UI tax is "experience rated," which means each employer does not pay the same tax amount for each of its employees. In the product market, however, each employer faces more or less the same price line. This situation gives rise to the belief that employers must have incentive to shift such taxes in order to stay in the market. With diminishing return in production, a downward shift could take place in terms of 1) a lower payment to the worker, 2) a reduction in the employment, or 3) a lower payment to the factor whose supply is less elastic. From a policy perspective, analyzing the ultimate incidence of an unemployment insurance payroll tax and its effect on wages and employment is very useful.

In the past, there have been a few works done on the incidence of UI tax. In his seminal paper, Lester (1962) assumed a competitive equilibrium in both product and factor markets and concluded that the firms themselves bear most of the incidence of a UI tax. Hamermesh (1977) takes this issue to the long run and concludes that the consumers and the workers of a firm share the incidence almost equally. Patricia and Meyer (1997), using data from eight states for the years from 1978 to 1984, analyzed the effect of UI tax on wages and employment. They concluded that individual firms are only able to pass on a small portion of UI tax that, in turn, lead to substantial employment reallocation across firms. They also conclude that experience-rated taxes can be used to reduce a temporary layoff, as the differences in taxes are not easily shifted to workers.

The works done so far on the incidence of UI tax have mostly derived their results from a labor market equilibrium condition. These studies implicitly assume a cost minimizing behavior on the part of the firms. Our paper will explicitly analyze the cost minimizing behavior of the firms in a competitive market and show how a change in UI tax affects the equilibrium wages and employment. Section 2 presents a theoretical model and derives the results. Section 3 concludes the theoretical results.

2. <u>The Model</u>

We assume that the typical firm only employs two factors and produces a single good with a technology represented by the Cobb-Douglas production function as follows:

$$Y = AK^{\alpha}L^{\beta}, \tag{1}$$

where A is a constant factor, K and L are amounts of capital and labor respectively, and α and β are coefficients of capital and labor respectively. The cost function of the firm is assumed to be linear as follows:

$$C = P_L L + IK, \quad (2)$$

where C is the total cost, P_L is the tax-included wage rate, and I is the interest rate facing the firm. Suppose the firm pays unemployment insurance tax to the federal government, which is collected per unit of labor at the rate of T. Therefore, the tax-included wage rate can be expressed as follows:

$$P_L = W + T, \quad (2a)$$

where W is the wage rate. The cost-minimization problem for the firm, given the output constraint and characterized by the Cobb-Douglas production function, can be shown as follows:

$$\Omega = P_L L + IK + \lambda(Y - AK^{\alpha}L^{\beta}) \quad (3)$$

<u>First Order Conditions</u>:

$$\frac{\partial \Omega}{\partial L} = P_L - l\, bAK^{a}L^{b-1} = 0 \quad (4)$$

$$\frac{\partial \Omega}{\partial K} = I - l\, aAK^{a-1}L^{b} = 0 \quad (5)$$

$$\frac{\partial \Omega}{\partial l} = Y - AK^{a}L^{b} = 0 \quad (6)$$

Taking the ratio of equation (4) and (5) yields

$$\frac{P_L}{I} = \frac{bK}{aL}$$

Solving for L yields

$$L = \frac{I}{P_L}.\frac{b}{a}.K \quad (7)$$

Substituting equation (7) into (6) yields

$$Y - A K^{a}\left(\frac{I}{P_L}.\frac{b}{a}.K\right)^{b} = 0$$

Solving the above equation for K yields

$$K = \left(\frac{Y}{A}\right)^{\frac{1}{a+b}}\left(\frac{I}{P_L}.\frac{b}{a}\right)^{\frac{-b}{a+b}} \tag{8}$$

Substituting the value of K into equation (6) yields

$$Y - A\left[\left(\frac{Y}{A}\right)^{\frac{1}{a+b}}\left(\frac{I}{P_L}.\frac{b}{a}\right)^{\frac{-b}{a+b}}\right]^{a} L^{b} = 0$$

$$\Rightarrow Y - A.A^{\frac{-a}{a+b}}Y^{\frac{a}{a+b}}\left(\frac{I}{P_L}.\frac{b}{a}\right)^{\frac{-ab}{a+b}} L^{b} = 0$$

Solving for L^{β} yields

$$L^{\beta} = Y A^{-1} A^{\frac{a}{a+b}} Y^{\frac{-a}{a+b}}\left(\frac{I}{P_L}.\frac{b}{a}\right)^{\frac{ab}{a+b}}$$

Solving for L yields

$$L = \left(\frac{Y}{A}\right)^{\frac{1}{a+b}}\left(\frac{I}{P_L}.\frac{b}{a}\right)^{\frac{a}{a+b}} \tag{9}$$

Substituting equation (8) and (9) into (2) yields

$$C = P_L\left(\frac{Y}{A}\right)^{\frac{1}{a+b}}\left(\frac{I}{P_L}.\frac{b}{a}\right)^{\frac{a}{a+b}} + I\left(\frac{Y}{A}\right)^{\frac{1}{a+b}}\left(\frac{I}{P_L}.\frac{b}{a}\right)^{\frac{-b}{a+b}}$$

$$= \; Y^{\frac{1}{a+b}} A^{\frac{-1}{a+b}} P_L{}^{\frac{b}{a+b}} I^{\frac{a}{a+b}} \left[\left(\frac{b}{a}\right)^{\frac{a}{a+b}} + \left(\frac{b}{a}\right)^{\frac{-b}{a+b}} \right]$$

Denoting α+β by r, the above equation can be rewritten as

$$C \; = \; Y^{\frac{1}{r}} A^{\frac{-1}{r}} P_L{}^{\frac{b}{r}} I^{\frac{a}{r}} \left[b^{\frac{a}{r}} a^{\frac{-a}{r}} + b^{\frac{-b}{r}} a^{\frac{b}{r}} \right]$$

$$= \; r \left[A a^{a} b^{b} \right]^{\frac{-1}{r}} Y^{\frac{1}{r}} I^{\frac{a}{r}} P_L{}^{\frac{b}{r}}$$

Denoting $\left[A a^{a} b^{b} \right]^{\frac{-1}{r}}$ by s, the above expression can be rewritten as

$$C \; = \; s.Y^{\frac{1}{r}} I^{\frac{a}{r}} P_L{}^{\frac{b}{r}}$$

Suppose, the firm’s revenue function is Cobb-Douglas type as follows:

$$R \; = \; B P_L^{d} I^{q},$$

where B is a constant, P_L is the price of labor, and I is the price of capital. We assume that there is perfect competition, so that the firm makes no economic profit, and its total revenue (R) is equal to its total cost (C). As such, we have the following equilibrium condition:

$$B P_L^{d} I^{q} \; = \; s.Y^{\frac{1}{r}} I^{\frac{a}{r}} P_L{}^{\frac{b}{r}}$$

Rearranging the terms in the above equation yields

$$P_L{}^{\frac{d-b}{r}} = \frac{s}{B} Y^{\frac{1}{r}} I^{\frac{a}{r}-q}$$

Solving the above equation for P_L yields

$$P_L = (\frac{s}{b})^{\frac{r}{gd-b}} Y^{\frac{1}{gd-b}} I^{\frac{a-gq}{gd-b}}$$

Since P_L = W + T as shown earlier, decomposing it yields

$$W + T \;=\; (\frac{s}{b})^{\frac{r}{gd-b}} Y^{\frac{1}{gd-b}} I^{\frac{a-gq}{gd-b}} \tag{10}$$

Suppose the unemployment insurance tax is a constant function of the wage rate such that T = tW. Then, equation (10) can be rewritten as

$$W + tW \;=\; (\frac{s}{b})^{\frac{r}{gd-b}} Y^{\frac{1}{gd-b}} I^{\frac{a-gq}{gd-b}}$$

Rearranging the terms in the above equation yields

$$W \;=\; \frac{1}{1+t} (\frac{s}{b})^{\frac{r}{gd-b}} Y^{\frac{1}{gd-b}} I^{\frac{a-gq}{gd-b}}$$

$$= (1+t)^{-1} (\frac{s}{b})^{\frac{r}{gd-b}} Y^{\frac{1}{gd-b}} I^{\frac{a-qg}{gd-b}} \tag{11}$$

Taking log of both sides yields

$$\text{LnW} \;=\; \ln\left[(\frac{s}{b})^{\frac{r}{gd+b}} \right] - \ln(1+t) + (\frac{1}{gd-b})\ln Y + (\frac{a-gq}{gd-b})\ln I$$

$$= b_0 - b_1 \ln D + b_2 \ln Y + b_3 \ln I \tag{12}$$

where $b_0 = \ln\left[\left(\frac{s}{b}\right)^{\frac{r}{gd+b}}\right]$, $b_1 = 1$, D = 1 + t, $b_2 = \left(\frac{1}{gd-b}\right)$, and $b_3 = \left(\frac{a-gq}{gd-b}\right)$.

Since D = 1+ t = 1 + $\frac{T}{W}$ by assumption, estimating equation (12) with restriction that

β_1 =1 and testing if β_1 is negative will show if unemployment insurance tax (t) negatively affects the wage rate. In other words, a negative β_1 indicates that the employer is able to shift at least some of the burden of unemployment insurance tax to the employee by offering reduced wages.

Effect of Unemployment Insurance Tax on Wages

Differentiating equation (11) with respect to t yields

$$\frac{dW}{dt} = -(1+t)^{-2}\left(\frac{S}{B}\right)^{\frac{r}{gd+b}} Y^{\frac{1}{gd+b}} I^{\frac{a-gq}{gd-b}}$$

Since t, S, B, Y, and I are all positive, $\frac{dW}{dt} < 0$. This implies that an increase in tax rate causes the wage rate to decrease. The result suggests that the employer passes a part of the unemployment insurance tax on to the employees by offering reduced wages. With other factors remaining the same, this implies that the equilibrium levels of wages decrease with the increase in unemployment insurance tax.

Effect of Unemployment Insurance Tax on Employment

The equilibrium level of labor demand is given by the equation (9), which can be rewritten as

$$L = (\frac{Y}{A})^{\frac{1}{a+b}} (\frac{I}{W+tW} . \frac{b}{a})^{\frac{a}{a+b}},$$

where price of labor, P_L, is equal to the average wage rate, W, and the unemployment insurance tax, T, which is t^{th} fraction of the wage rate. The above equation can be rearranged as follows:

$$L = (\frac{Y}{A})^{\frac{1}{a+b}} (\frac{Ib}{Wa})^{\frac{a}{a+b}} (1+t)^{\frac{-a}{a+b}} \qquad (13)$$

Differentiating equation (13) with respect to t yields

$$\frac{dL}{dt} = -\frac{a}{a+b} (\frac{Y}{A})^{\frac{1}{a+b}} (\frac{Ib}{Wa})^{\frac{a}{a+b}} (1+t)^{\frac{-2a-b}{a+b}}$$

Since Y, A, I, W, β, α, and t are all positive, $\frac{dL}{dt} < 0$. This means that an increase in the tax rate reduces the equilibrium level of labor demand. With other factors remaining the same, this implies that the whole labor demand curve shifts downward following the introduction of the tax. Therefore, the equilibrium level of employment decreases with the increase in unemployment insurance tax.

3. Conclusion

Our paper theoretically examines the incidence of unemployment insurance (UI) tax on equilibrium levels of wages and employment. Past researches on the incidence of UI tax are mainly based on labor market equilibrium condition and implicitly assume a cost minimizing behavior on the part of the firms. In our paper, we explicitly analyze the cost minimizing behavior of the firms in a competitive market and show how a change in UI taxes affects the equilibrium wages and employment. Our results suggest that the UI tax negatively affects the equilibrium levels of wages and employment.

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