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SHORTER ARTICLES

Unemployment Insurance and Full-Cost Experience Rating: The Impact on Seasonal Hiring

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Abstract

This article discusses the effects of a change in the calculation of unemployment insurance tax rates on hiring incentives. In particular, it examines moving from a system with a cap on the unemployment insurance tax rate to a system of full-cost experience rating, creating a direct link between a firm's current hiring decisions and its future unemployment insurance costs. The impact of such a switch on seasonal hiring incentives is found to be asymmetric. The study shows that though layoffs are reduced during downturns, additional hiring remains stable during upturns.

Introduction

The impact that a change in the unemployment insurance tax scheme may have on hiring is examined in this study. In particular, a system of full-cost experience rating to determine the unemployment insurance tax rate charged to firms that chronically vary their employment is suggested. Under full-cost experience rating, as opposed to the current method for determining tax rates, firms will continue to hire workers during upturns and lay off fewer workers during downturns.

A basic premise of the U.S. unemployment insurance tax system is that an employer's future unemployment insurance tax rate, also known as the contribution rate, should be an inverse function of changes in the employer's current labor force. Under existing law, however, the unemployment insurance contribution rate is capped at some maximum amount.[1] Under full-cost experience rating the cap on the unemployment insurance contribution rate is

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[1] For example, in calendar 1986, 68 percent of the firms in Nebraska paid reduced rates because of favorable experience. The remaining 32 percent paid higher rates because of unfavorable experience. Of the total number of firms experience rated, 11.4 percent had negative reserve balances and paid rates ranging from 4.5 to 5.4 percent. Of the total number of firms experience rated, 6.9 percent paid the maximum rate of 5.4 percent (Nebraska Department of Labor, 1988).

removed. The future contribution rate becomes a monotonic function of current hiring.

The Model

Employment decisions are modeled under full-cost experience rating within a three-period framework. At the beginning of the first period, the firm faces a given unemployment insurance (UI) tax rate, and an unexpected demand shock is revealed. The firm responds to the shock by adjusting its labor force. At the beginning of period two, the firm's UI tax rate is adjusted to reflect its hiring decision in period one. In addition, the firm expects period two demand and employment to return to normal. When period three begins, the UI tax rate is again adjusted, this time to reflect employment changes in periods one and two. *A priori* expected demand and employment in period three again will be at their mean values. Within this framework, the firm chooses the optimal employment level in period one to maximize profits over all three periods.

Suppose this firm has a fixed amount of capital and can adjust output only through changes in the amount of labor used. Let the firm be a price taker in both the input and output markets; w denotes wages, benefits and all payroll taxes except unemployment; P denotes output price. The firm faces a stochastic demand for its output in period t described as

$$D_t = D(P_t) + \mu_t \tag{1}$$

with the μ_t independently and identically distributed with a mean of zero and variance σ^2. Furthermore, let μ_t lie within the boundary $(-\mu, \mu)$ with $D(P_t) - \mu > 0$. These conditions insure positive and finite demand in all periods. Expected demand in period t is $D(P_t)$. Assume the marginal product of labor is fixed over the relevant range of production and equal to one. Then expected hiring in period t is $L = D(P_t)$.

An employer's unemployment insurance contribution for each employee is calculated as the employer's contribution rate times the taxable wage base. The reserve ratio, denoted as RR_t, is used in a majority of states to determine the contribution rate.

> The reserve-ratio system is essentially cost accounting . . . [To calculate the reserve ratio,] total benefits paid since the program became effective are subtracted from total employer contributions over that period. The balance is then divided by the employer's taxable payroll, which is usually an average of the last three years (Rejda, 1988, p. 332).

If the contribution rate in period t is denoted as θ_t and the reserve ratio through the end of period t−1 as RR_{t-1}, then under full-cost experience rating

$$\theta_t = \Phi\,(RR_{t-1}), \tag{2a}$$

$$\Phi' < 0,\ \Phi'' \geq 0. \tag{2b}$$

The taxable wage base, W*, is the fraction of the annual salary upon which an employer must base its unemployment insurance contributions. The total unemployment insurance contribution per employee in any period, C_t, is then defined as

$$C_t = \theta_t W^*. \tag{3}$$

An employee's benefit under unemployment insurance is an increasing function of the taxable wage and can be denoted as

$$B_t = \Psi(W^*) \tag{4}$$

with $\Psi' \geq 0$.

Downturns

At the beginning of period one the variable demand parameter is revealed so that period one is a downturn, $\mu_1 < 0$. Let η_1 be the actual number of employees the firm lays off in period one. The choice of η_1 will depend in part on η_1's impact on future unemployment costs.

When making hiring decisions, a firm weighs an employee's marginal resource cost (MRC) against the employee's marginal revenue product (MRP). In the case of a downturn, marginal resource cost and marginal revenue product, respectively, represent the cost saving and revenue loss associated with laying off one additional employee. If the cost saving is greater than the revenue loss (MRC > MRP), the employee will be laid off.

The marginal revenue product of an employee is the revenue forgone due to the loss of production from that employee. In a downturn, however, there may be no demand for that employee's output (assuming the output is non-storable). Hence marginal revenue product effectively may be zero.

Under the current unemployment system, once a firm pays the maximum contribution rate, the contribution rate is generally no longer a function of hiring. Current hiring has no impact on future unemployment insurance costs and therefore on future profits.[2] Hence, marginal resource cost consists solely of current wages, benefits and taxes saved and is always positive. As long as the cost saving from a layoff is greater than the revenue loss ($w + \theta_1 W^* > 0$), the firm will lay off $\eta_1 = \mu_1$ workers.

Suppose that the maximum cap is removed; current hiring always affects future contribution rates. Let total employer contributions up to the beginning of period one equal C_o, and total unemployment benefits equal B_o. If $(L-\eta_1)$ workers are hired in period one, total employer contributions through period one will be $C_o + (L-\eta_1)\theta_1 W^*$. Total benefits paid through period one will be $B_o + \eta_1 \Psi(W^*)$. If L employees were hired in the previous two periods, weighted average taxable payrolls for the last three periods will be $2/3\ LW^* + 1/3\ (L-\eta_1)W^* = W^*(L-\eta_1/3)$. The reserve ratio at the end of period one, therefore, will be

[2] Oi (1962) demonstrates that a rational firm may retain temporarily unneeded workers if it has substantial fixed costs invested in them. The simplifying assumption that there are no such fixed costs is made.

$$RR_1 = [C_o + (L-\eta_1)\theta_1 W^* - B_o - \eta_1 \Psi(W^*)] \ / \ [W^* \ (L - \eta_1 \ / \ 3)], \quad (5)$$

and the period two contribution rate will be $\theta_2 = \Phi(RR_1)$.

The derivative of the period two contribution rate with respect to η_1 is $d\theta_2/d\eta_1 = \Phi' dRR_1/d\eta_1$, with

$$dRR_1 \ /d\eta_1 = [(C_o - B_o) - L(3\Psi(W^*) + 2\theta_1 W^*)] \ / \ [3W^*(L-\eta_1/3)^2] \quad (6)$$

Equation (6) is negative if $(C_o - B_o) < L(3\Psi(W^*) + 2\theta_1 W^*)$. Since Φ' is also negative, θ_2 is increasing in η_1. The period two contribution rate increases as more employees are laid off in period one.

Hiring decisions in period one have an impact on the contribution rate in period three as well. Since the μ_t are independently distributed, even if $\mu_1 < 0$, the firm will expect μ_2 to be zero, and hence expected demand and hiring in period two will be their mean values. But this means the firm expects that the η_1 employees laid off in period one will be rehired in period two. Unemployment insurance contributions will be made for these employees in period two and this will cause the reserve ratio to rise during period two, which will decrease the period three contribution rate.

Algebraically, the period three contributions rate is $\theta_3 = \Phi(RR_2)$, where

$$RR_2 = [(C_o - B_o) + (L-\eta_1) \ \theta_1 W^* - \eta_1 \Psi(W^*) + L\theta_2 W^*] \ / \ [W^*(L - \ \eta_1/3)]. \quad (7)$$

The derivative of the period three contribution rate with respect to η_1 is $d\theta_3/d\eta_1 = \Phi' dRR_2/d\eta_1$, with $dRR_2/d\eta_1 = RR_2'$, or :

$$RR_2' = [L\{W^*(-2\theta_1 + \theta_2 + (3L-\eta_1)\Phi' RR_1') - 3\Psi\} + \{C_o - B_o\}] \ / \ [3W^*(L-\eta_1/3)^2] \quad (8)$$

Examining the firm's profit maximization problem, expected discounted profits over the three periods (with α as the discount rate) can be described as

$$\pi = (D-\mu_1)P - (L-\eta_1)(w+\theta_1 W^*) + \alpha D(P - w - \theta_2 W^*) + \ \alpha^2 D(P - w - \theta_3 W^*). \quad (9)$$

The derivative of expected profits with respect to η_1 provides the following first order condition for profit maximization:

$$0 = w + \theta_1 W^* - \alpha D W^* \Phi'(RR_1' + \alpha RR_2') \quad (10)$$

Marginal revenue product [the left-hand side of (10)] is zero. Marginal resource cost consists of current wages and taxes [the first two terms on the right-hand side of (10)] and the impact of current layoffs on future unemployment insurance costs [the last term in (10)].

The Appendix shows that the last term in (10), $-\alpha D W^* \Phi'(RR_1' + \alpha RR_2')$, is negative and decreasing in η_1. This negative term in (10) can be explained by the dominant negative impact that benefit payments have on reserves. Each period one layoff and its concomitant benefit payment reduces the reserve ratio. Each period two rehire increases the reserve ratio, but not enough to offset the negative impact of period one benefit payments. Therefore, the net effect of laying off and rehiring an employee is to increase the cost of labor to the firm. Equation (10) is decreasing in η_1 because as the period one labor force shrinks, the cost-increasing effect of benefit payments becomes relatively larger.

Since marginal resource cost is a decreasing function of η_1, it is quite plausible that marginal resource cost can be zero while $\eta_1 < \mu_1$. In a slack period, it is less expensive for a firm to retain some unneeded employees than to lay them off and face higher unemployment insurance costs in the following years.[3]

Upturns

Consider the firm's hiring decision when demand in period one is greater than expected, or $\mu_1 > 0$. In an upturn, marginal resource cost (MRC) is the cost of hiring an additional employee. Marginal revenue product (MRP) is the revenue derived from that additional employee. An additional employee will be hired if MRP > MRC. The firm's problem is to choose η_1, the number of extra employees it hires in period one, to maximize profits over three years.

The choicer of η_1 will affect costs in periods two and three. Additional hiring in period one increases contributions and the firm's reserve ratio at the end of period one. This in turn reduces the period two contribution rate. Hence, current extra hiring reduces the next period's unemployment insurance costs. Algebraically, the period two contribution rate is $\theta_2 = \Phi(RR_1)$ with

$$RR_1 = [C_o + (L+\eta_1)\theta_1 W^* - B_o] \;/\; [W^*(L+\eta_1/3)] \tag{11}$$

The derivative with respect to η_1 is $d\theta_2/d\eta_1 = \Phi' dRR_1/d\eta_1$ with

$$dRR_1 \;/\; d\eta_1 = [2L\theta_1 W^* - (C_o - B_o)] \;/\; [3\, W^*(L+\eta_1/3)^2] \tag{12}$$

which is positive if $(C_o - B_o) < 2L\theta_1 W^*$. Since $\Phi' < 0$, $d\theta_2/d\eta_1$ is negative. The period two contribution rate falls as period one employment rises.

Hiring decisions in period one have an impact on the contribution rate in period three as well. Since the μ_t are independently distributed, even if $\mu_1 > 0$, the firm will expect μ_2 to be zero and, hence, expected demand and hiring in period two will be their mean values. But this means the firm expects that the η_1 extra employees hired in period one will be laid off in period two. If these employees collect unemployment benefits in period two, the effect will be to increase benefits accrued against the firm and decrease the firm's reserve ratio in period two. But a lower reserve ratio at the end of period two means a higher contribution rate in period three and hence greater unemployment costs.

The contribution rate in period three can be described as $\theta_3 = \Phi(RR_2)$ with

$$RR_2 = [(C_o - B_o) + (L+\eta_1)\theta_1 W^* + L\theta_2 W^* - \eta_1 \Psi(W^*)] \;/\; [W^*(L+\ \eta_1/3)] \tag{13}$$

[3]This result is consistent with several theoretical and empirical studies. See Baily, 1977; Butler and Sisti, 1978; Feldstein, 1976; Halpin, 1979 and 1980; Saffer, 1980; and Topel, 1984.

The last term in the numerator of (13), $-\eta_1\Psi(W^*)$, reflects the negative impact of period two expected layoffs and benefit payments on the reserve ratio. The derivative of θ_3 with respect to η_1 is $d\theta_3/d\eta_1 = \Phi' RR_2'$, with

$$RR_2' = [L\{W^*(2\theta_1 - \theta_2 + (3L+\eta_1)\Phi' RR_1') - 3\Psi\} - \{C_o - B_o\}] \;/\; [3W^*(L+\eta_1/3)^2] \quad (14)$$

Considering the firm's profit maximization problem over three periods, expected discounted profits can be described as

$$\pi = (D+\eta_1)(P - w - \theta_1 W^*) + \alpha D(P - w - \theta_2 W^*) + \alpha^2 D(P - w - \theta_3 W^*). \quad (15)$$

The derivative of expected profits with respect to η_1 provides the following first order condition for optimal employment:

$$P = w + \theta_1 W^* + \alpha D W^* \Phi'(RR_1' + \alpha RR_2'). \quad (16)$$

The firm should choose η_1 to equate the marginal revenue product of the last worker hired or equivalently, output price [the left-hand side of (16)] to the marginal resource cost which consists of costs in period one [the first two terms on the right hand side of (16)], and costs in periods two and three (the last term).

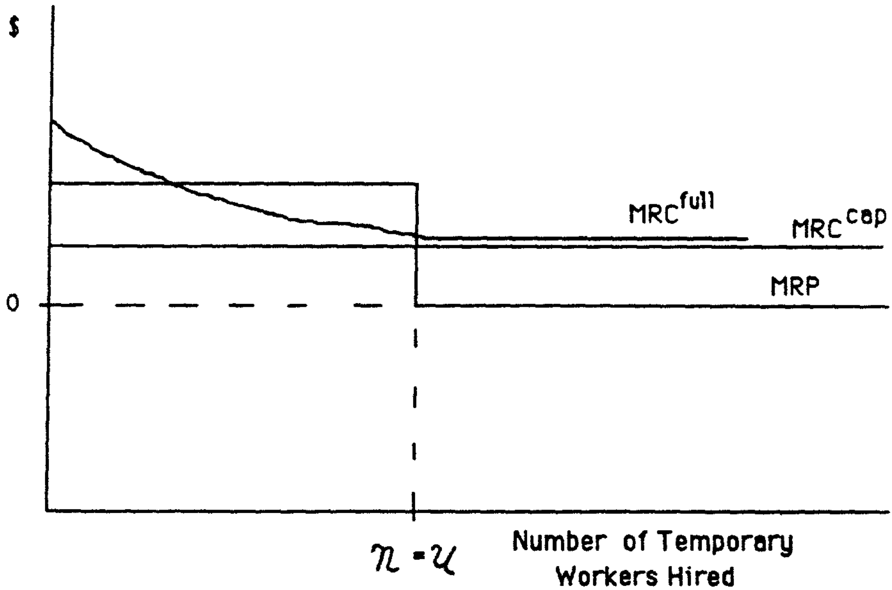
The Appendix shows that, for a variety of parameter values, the last term in (16) is positive and decreasing in η_1. This means that the marginal resource cost of an additional worker is always greater than current wages and taxes $(w+\theta_1 W^*)$, but approaches this value from above (see Figure 1). The last term in (16) is positive because additional hiring in period one decreases the period two contribution rate and, therefore, period two costs. The temporary workers hired in period one will be expected to be laid off in period two and, consequently, collect unemployment insurance benefits. These benefit payments will increase both the contribution rate and costs in period three. Since the effective benefit rate is much greater than the contribution rate, its negative influence dominates, and the net effect of these two impacts is to raise costs. This net effect becomes less pronounced as η_1 increases, however, because growth in the period-one labor force increases the average work force over the three periods and, consequently, dampens the negative impact of benefit payments on the reserve ratio and future taxes.

The marginal revenue product associated with hiring another employee (MRP) and the marginal resource cost under both a capped system (MRC^{cap}) and full-cost experience rating (MRC^{full}) are shown in Figure 1. Marginal revenue product is positive until all demand is met and then falls to zero. Under the capped system, marginal resource cost is constant. In the case of Figure 1, additional hiring will equal μ. Under full-cost experience rating, marginal resource cost asymptotically approaches MRC^{cap} from above. As long as MRC^{full} MRP for the last extra worker hired, a switch to full-cost experience rating will have little impact on hiring in upturns. The firm will still hire $\eta = \mu$ additional workers.

Conclusions

This article contains an examination of the impact that a switch from a capped unemployment insurance contribution rate to full-cost experience

Figure 1
The Marginal Revenue Product and Marginal Resource Cost
of an Additional Hire Alternative Tax Schemes



rating has on costs and employment. The results are quite graphic. A switch to full-cost experience rating affects marginal resource costs. This, in turn, may induce firms to reduce the downward variation in their hiring. From a policy viewpoint full-cost experience rating would help stabilize employment during a downturn without dampening employment during an upturn. The solvency of state trust funds would also be improved. As a result, all other things equal, unemployment insurance would be more effective as an automatic stabilizer.

On the negative side, however, full-cost experience rating would have two undesirable economic effects. First, firms whose contribution rates are sharply increased would have a strong financial incentive to contest and challenge unemployment compensation claims to hold down claim costs. Moreover, labor unions historically have been opposed to experience rating and are likely to rigorously resist any attempt to increase the range of experience rating because of increased contestment of claims by some employers.

Second, financially marginal firms that now pay maximum rates could be forced into bankruptcy because of substantially higher unemployment contribution rates. In addition to seasonal firms, some marginal manufacturing firms in declining industries and construction firms that now pay maximum rates may be unable to absorb the higher tax rates and would go out of business.

Appendix

Layoff Case

Demonstration that $-\alpha DW^*\Phi'(RR_1' + \alpha RR_2') < 0$: Since α, D and W^* are positive and Φ' is negative, the sign of the last term of equation (10) in the text depends upon the sign of $(RR_1' + \alpha RR_2')$. To evaluate this, some simplifications are necessary. First, let the initial reserve ratio be some percentage, Y, of taxable payrolls:

$$Y = -(C_o - B_o)/LW^*. \tag{A.1}$$

Let η_1 be some percentage, k, of expected labor demand:

$$\eta_1 = kL, \text{ with } 0 < k \leq 1. \tag{A.2}$$

Let benefits be some fraction, b, of the taxable wage:

$$\Psi(W^*) = bW^*, \text{ with } 0 < b < 1 \tag{A.3}$$

Let the contribution rate in period one be some percentage, x, of the contribution rate in period two:

$$\theta_2 = x\theta_1, \text{ with } x > 1. \tag{A.4}$$

Substituting (A.1) through (A.4) into text equation (8) provides

$$dRR_2/d\eta_1 = -3[(2-x)\theta_1 - L(3-k)\Phi' RR_1' + 3b + Y] \;/\; [L(3-k)^2] \tag{A.5}$$

Recalling equation (6) in the text, and using (A.1) and (A.2):

$$RR_1' = -3[Y + 3b + 2\theta_1] \;/\; [L(3-k)2] \tag{A.6}$$

Substituting (A.6) into (A.5) provides:

$$\begin{aligned} dRR_2/d\eta_1 = {} & [-3/L(3-k)^2] \\ & [(2-x)\theta_1 + 3\Phi'(Y + 3b + 2\theta_1)/(3-k) + 3b + Y] \end{aligned} \tag{A.7}$$

Using (A.6) and (A.7),

$$\begin{aligned} RR_1' + \alpha RR_2' = {} & [-3/L(3-k)^2] \\ & [Y + 3b + 2\theta_1 + \alpha\{(2-x)\theta_1 + 3\Phi'(Y + 3b + 2\theta_1)/(3-k) + 3b + Y\}] \end{aligned} \tag{A.8}$$

Table A.1 shows some reasonable values for the parameters in the model and a range of values these parameters could conceivably take.

Using a variety of values from the ranges shown in Table A.1 (including the reasonable values) and any value for L, (A.8) is negative. Hence, the last term in equation (10), $-\alpha DW^*\Phi'(RR_1' + \alpha RR_2')$ is negative as well. Computer algorithm shows that its absolute value is increasing in η_1.

Table A.1

Parameters and Their Values Used in the Model

Parameter	Reasonable Value	Range
x	1.08	1.01 to 1.25
θ_1	0.108	0.054 to 0.216
Y	0.30	0.15 to 0.50
Φ'	–0.10	–0.01 to –0.20
k	0.00 - 1.00	0.00 to 1.00
b	0.70	0.45 to 0.85
α	0.90	0.95 to 0.85

For sources see last page of appendix

Hiring Case

Demonstration that $\alpha DW^*\Phi'(RR_1' + \alpha RR_2') > 0$: Since α, D and W* are positive and Φ' is negative, the sign depends on the sign of $(RR_1' + \alpha RR_2')$. Substituting (A.1) through (A.4) (but adjusting (A.4) so that $\theta_2 = X\theta_1$ with $X = 1/x$) into text equations (14) and (12) provides

$$dRR_2/d\eta_1 = 3[(2-X)\theta_1 + L(3+k)\Phi' RR_1' + Y - 3b] \; / \; [L(3+k)^2] \tag{A.9}$$

and

$$dRR_1/d\eta_1 = 3[Y + 2\theta_1] \; / \; [L(3+k)^2]. \tag{A.10}$$

Substituting (A.10) into (A.9) provides

$$dRR_2/d\eta_1 = [3/L(3+k)^2] \, [(2-X)\theta_1 + 3\Phi'(2\theta_1 + Y) \; / \; (3+k) + Y - 3b] \tag{A.11}$$

Using (A.10) and (A.11), and the reasonable parameter values in Table A.1, the sign of $(RR_1' + \alpha RR_2')$ is negative. Therefore, $\alpha DW^*\Phi(RR_1' + \alpha RR_2') > 0$. Computer algorithm shows that it is also decreasing in η_1. To test the robustness of this result, a large number of simulations were run using a variety of parameter combinations from the ranges shown in Table A.1. The results hold for every simulation. The intuition behind the theoretical result is based on the dominant effect of benefit payments. In these simulations, when this effect is lessened, i.e. a low benefit rate (below 45 percent) is imposed, the result no longer holds. Hence the benefit rate does affect the model's outcome as expected.

Sources for Table A.1

x: According to Rejda (1988, pp. 332–3), for the state of Nebraska, the highest unemployment insurance tax bracket is 5.4 percent of covered payrolls. The next highest is 5.0 percent. Moving up brackets, 5.4 percent is equal to 1.08 percent of 5.0 percent.

θ_1: According to Rejda (1988, p. 333), the highest unemployment insurance tax bracket in Nebraska is 5.4 percent. Under full-cost experience rating this cap is removed. A high rate might be double the capped rate, 10.8 percent.

Y: Based on employer records for the state of Nebraska.

Φ': Based on Rejda (1988, pp. 332–3), the maximum reserve ratio allowable for each UI tax bracket in Nebraska was plotted, then lines were drawn between the points to estimate ϕ. Taking the slope of ϕ at the highest brackets, $\phi' = -.10$.

k: Allowed to range from its minimum to maximum value.

b: Committee on Ways and Means (1988, Tables 17, p. 385) and Rejda (1988, p. 346) can be used to calculate that for Nebraska, the ratio of average weekly benefits to average weekly covered wages equals about 85 percent.

α: Allows a nominal discount rate of 10 percent.

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