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UNEMPLOYMENT INSURANCE TAXES AND THE CYCLICAL AND SEASONAL PROPERTIES OF UNEMPLOYMENT

David Card

Phillip B. Levine

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ABSTRACT

We combine Current Population Survey microdata for 1979-1987 with a newly assembled database of tax rates for the Unemployment Insurance system to measure the effects of imperfect experience-rating on temporary layoffs and other types of unemployment. We find a strong negative association between the degree of experience-rating and the rate of temporary layoff unemployment, with the largest effect in recessionary years and the smallest effect in expansionary years. Increases in the degree of experience-rating are also associated with dampened seasonal fluctuations in temporary layoffs, particularly in construction and durable manufacturing. The correlation between the degree of experience-rating and the unemployment rate of permanent job losers is smaller but also negative, whereas the correlation with the unemployment rate of job quitters and re-entrants is negligible. Attempts to control for the endogeneity of unemployment insurance taxes are consistent with a causal interpretation of our findings.

David Card
Department of Economics
Princeton University
Princeton, NJ 08544
and NBER

Phillip B. Levine
Department of Economics
Wellesley College
Wellesley, MA 02181

Unemployment Insurance Taxes and the
Cyclical and Seasonal Properties of Unemployment

A unique feature of the U.S. unemployment insurance system is its experience-rated tax structure. Firms whose previous employees have collected more unemployment insurance (UI) benefits are charged higher payroll taxes. Nevertheless, employers in most states are only partially experience-rated: the tax increases generated by an additional UI claim cover only a fraction of the benefits paid. Because of the implicit subsidy on UI benefits, it is argued that firms have an incentive to hold an excess inventory of workers and cycle them through spells of temporary unemployment.[1] Indeed, estimates presented by Feldstein (1978) and Topel (1983) suggest that up to one-half of all temporary layoff unemployment in the US can be attributed to imperfect experience-rating.

While the effects of imperfect experience-rating are easily identified in a stationary environment, in a cyclical or seasonal environment the effects vary with the state of demand. Experience-rated UI taxes introduce a layoff or firing cost into the firm's intertemporal optimization decision. Increases in the degree of experience-rating raise this adjustment cost, creating an incentive for firms to lay off fewer workers in a recession and hire fewer workers in a boom. Imperfect experience-rating therefore generates more temporary layoffs and greater unemployment in a trough, but higher employment (and possibly lower unemployment) at the peak of the cycle.

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[1]This point is developed formally in models by Feldstein (1976), Baily (1977) and Brechling (1977).

In this paper we use a newly assembled database of experience-rating factors for individual states and industries to measure the effects of imperfect experience-rating at different points in the demand cycle. Using Current Population Survey microdata from 1979 to 1987, we estimate the effect of experience-rating on temporary layoff unemployment rates during the cyclical downturn in the early 1980s, and in the expansionary periods before and after. We also examine the effects in different months of the year. As an informal check on the results, we estimate similar models for the unemployment rates of permanent job-losers and non-job-losers (job-quitters and labor force re-entrants). We find a strong negative correlation between the degree of experience-rating and the rate of temporary layoff unemployment in recessionary years, but smaller and unsystematic correlations in expansionary years. Likewise, temporary layoff rates in high-unemployment months are strongly negatively correlated with the degree of experience rating. By comparison, there is no relation between experience-rating and the unemployment rate of quitters and labor force re-entrants.

A major difficulty in the empirical analysis is the potential endogeneity of UI tax rates. Since each state's UI system has a maximum tax rate, industries with the highest unemployment rates may not be experience-rated at all. We present instrumental variables estimates that use only the features of the state tax system (and not the actual unemployment experience of firms in the state) to identify the experience-rating effect. We also examine the effects of experience rating within industries, and find negative effects in services and trade, where few firms are at the maximum of the tax schedule.

On balance, we believe the evidence is broadly consistent with a causal link between experience rating and the use of temporary layoffs.

I. EMPLOYMENT AND TEMPORARY LAYOFFS IN A CYCLICAL ENVIRONMENT

This section presents a simple model of employment determination in the presence of cyclical demand shifts. To capture the effects of experience-rating in the UI tax system we model the pool of recently laid-off workers "attached" to each firm. Temporarily laid-off workers have a value to the firm, since they can be re-employed in an upturn without incurring any training or recruiting costs. They also have a cost, since the UI benefits drawn by these workers are charged back to the firm at a rate that depends on the degree of experience-rating. In a model with a simple alternating demand cycle we show how changes in the degree of experience rating affect the firm's employment and unemployment decisions at the peak and trough of the demand cycle.

In any period t a firm is assumed to have a pool P_t of attached workers, consisting of N_t employed workers and U_t temporarily unemployed workers. The firm pays a wage rate w to its employed workers, which we take as exogenous.[2] Its laid-off workers receive an average unemployment benefit of \$B per worker.[3] It is convenient to express B as a fraction of the average wage: $B = R \cdot w$, where R is the net replacement ratio.

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[2]In contrast, Feldstein (1976) and Baily (1977) take the utility level of workers as exogenous and treat the wage as endogenous.

[3]Only a fraction of laid-off workers receive any unemployment benefits. Thus B represents the product of the fraction receiving benefits and the average benefit per worker, conditional on receiving benefits. See below.

The cost to the firm of the unemployment benefits received by its laid-off workers is (1-s) of the total, where s is the implicit subsidy generated by incomplete experience-rating of the UI tax system. For simplicity, we treat s as fixed and exogenous, although long-run differences in the firm's layoff policy can obviously affect the value of s. We defer discussion of this point to the next section.

Assume that a fraction δ of workers who are employed in period t quit during the period and that a fraction $\delta+\Delta$ of workers on temporary lay-off move to other jobs. If laid-off workers have a higher attrition rate than those with jobs, then $\Delta > 0$. The available pool of workers in period t depends on the size of the pool in the previous period and on the number of new-hires (A_t):

$$P_t = (1-\delta)P_{t-1} - \Delta u_{t-1}P_{t-1} + A_t, \tag{1}$$

here $u_t \equiv U_t/P_t$ is the fraction of workers on lay-off. We assume that $A_t \geq 0$, which implies that the firm cannot freely dispose of workers. Rather, excess workers are released into the pool of attached unemployed workers. We also assume that new-hires are costly and denote the per-worker recruiting and training cost by ρw. Finally, we assume that the revenues of the firm in period t have the simple form $\theta_t f(N_t)$, where f( ) is an increasing and strictly concave production function and θ_t denotes a relative demand shock in period t. With this set-up, the net profits of the firm in period t are

$$\pi_t = \theta_t f(\, P_t(1-u_t)\,) - w(1-u_t)P_t - (1-s)wRu_tP_t - \rho wA_t. \tag{2}$$

The firm is assumed to maximize $\Sigma_t \beta^t \pi_t$, subject to $0 \leq u_t \leq 1$ and $A_t \geq 0$, where β is a discount factor.[4]

Let S_t denote the shadow value of an attached worker in period t. The first order conditions for profit maximization include

$$\theta_t f'(N_t) - w(1 - (1-s)R) + \Delta\beta S_{t+1} \geq 0, \text{ with equality when } u_t > 0, \tag{3}$$

$$S_t \leq \rho w, \text{ with equality when } A_t > 0, \tag{4}$$

and

$$(1-u_t)\theta_t f'(N_t) - w(1-u_t) - wu_t(1-s)R - S_t + \beta(1-\delta)S_{t+1} - \beta\Delta u_t S_{t+1} = 0.$$

Using equations (2) and (4) the shadow value of an attached worker can be written as

$$S_t = \theta_t f'(N_t) - w + \beta(1-\delta)S_{t+1}, \quad \text{if } u_t = 0 \tag{5a}$$

and

$$S_t = -w(1-s)R + \beta(1-\delta-\Delta)S_{t+1}, \quad \text{if } u_t > 0. \tag{5b}$$

These conditions describe the evolution of S_t in states of full-employment and unemployment. When attached workers are fully employed the shadow value of a worker is his or her marginal product, minus the cost of wages, plus the expected future shadow value (discounted by $\beta(1-\delta)$ to reflect the quit rate δ). If some attached workers are unemployed, however, the shadow value is the expected future shadow value (discounted by $\beta(1-\delta-\Delta)$ to reflect the attrition rate $\delta+\Delta$) minus the firm's UI costs.

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[4]This formulation ignores UI taxes that do not depend on the number of layoffs generated by the firm. While such taxes are important, their inclusion does not directly affect the layoff decision of the firm, and we ignore them.

For a given sequence of θ_t (t=1...T) the first order conditions can be solved for a sequence of shadow values S_t, unemployment rates u_t, and employment levels N_t. The solution of these equations is particularly simple when θ_t follows a deterministic cycle. For our purposes it is sufficient to consider a case where θ_t alternates between a high value θ_h and a low value θ_l. In this case, if we assume a stationary solution and that there are temporary layoffs in the low-demand state, then equations (5a) and (5b) lead to

$$S_h = \theta_h f'(P_h) - w + \beta(1-\delta)S_l = \rho w,$$

and

$$S_l = \beta(1-\delta-\Delta)S_h - w(1-s)R,$$

where $P_h = N_h$ is the size of the attached pool in the high-demand state. If we assume that the production function $f(\cdot)$ has a constant elasticity form with a conventional labor demand elasticity of $-\eta$ ($\eta > 0$) then we can solve explicitly for peak employment N_h and trough unemployment u_l as[5]

$$\log N_h = \eta \log(\theta_h/w) - \eta\rho\{1 - \beta^2(1-\delta)(1-\delta-\Delta)\} - \eta\beta(1-\delta)(1-s)R$$

and

$$u_l = \eta\log(\theta_h/\theta_l) - \eta\rho\{\Delta\beta + 1 - \beta^2(1-\delta)(1-\delta-\Delta)\}$$
$$- \eta(1-s)R(1 + \beta(1-\delta)) - \delta.$$

[5]These expressions ignore constants and make (liberal) use of the approximation log $(1+r) = r$.

These expressions indicate that peak employment is decreasing in the firm's marginal UI tax cost (1-s), as is the rate of temporary unemployment in the trough. Indeed, the derivatives

$$\frac{\partial \log N_h}{\partial(1-s)} = -\eta\, R\, \beta(1-\delta),$$

and

$$\frac{\partial u_l}{\partial(1-s)} = -\,\eta\, R\,(1 + \beta(1-\delta)),$$

are proportional to the product of the conventional labor-demand elasticity η and the average UI replacement rate R. Using the fact that the level of trough employment is $N_l = (1-u_l)(1-\delta)P_h$, the proportional gap between peak and trough employment can be written as:

$$\log(N_h/N_l) = \eta\log(\theta_h/\theta_l) - \eta\rho\{\lambda\beta + 1 - \beta^2(1-\delta)(1-\delta-\Delta)\}$$
$$-\,\eta(1-s)R(1 + \beta(1-\delta)),$$

which is also decreasing in the firm's marginal UI cost.

In this model an increase in the marginal tax cost of a layoff has two important effects. First, holding constant the size of the attached pool, it leads to a decrease in the temporary layoff rate in low-demand periods. Second, it leads to a decrease in the cyclical amplitude of employment fluctuations, since firms with higher UI costs have lower employment at the peak of the demand cycle and higher employment at the trough.

The magnitudes of these effects depend on the size of the demand elasticity (η), the replacement rate (R), the discount rate (β), and the quit rate of employed workers (δ). To fix ideas suppose that time is measured in 6-month intervals and that a complete cycle lasts 1 year (as is the case for a seasonal cycle). Suppose that $\eta = 0.3$, $\beta = 0.9$, and $\delta = 0.1$. Suppose in addition that one-half of layoffs generate a UI claim[6], that UI payments are received for an average of 12 weeks by those who start a claim, and that the average ratio of UI benefits to wages among UI recipients is 0.5. Then a 0.1 increase in the marginal tax cost of a layoff is predicted to lower the temporary layoff unemployment rate by .003 (0.3 percent). Since the temporary layoff unemployment rate in a trough averages 1.8 - 2.0 percent (see below), this is a relatively large effect. On the other hand, the same change in the UI subsidy rate is predicted to raise peak-level employment by about 0.14 percent -- a small effect.

The implications of this simple deterministic model can be generalized by considering a model with stochastic transitions between high- and low-demand states, as in Bertola (1990). If demand follows a first-order Markov process, the firm's optimal policy specifies a peak employment level (in the high-demand state), a trough employment level (in the low demand state), and a temporary unemployment rate (in low-demand states) that reflects the gap between the size of the attached pool and the optimal employment level. As in a deterministic model, increases in the marginal tax cost of a layoff lower

[6]Anderson (1991b) uses individual and firm-level UI records to measure the ratio of UI claims to total separations for a broad sample industries and states. She reports an average of 0.15 claims per separation (among separations that last one quarter or more).

the level of employment in the high-demand state, raise the level of employment in the trough, and reduce the layoff unemployment rate in low-demand states.

II. EXPERIENCE-RATING IN THE UI TAX SYSTEM

These theoretical results highlight the importance of the degree of experience-rating in determining the layoff and employment decisions of employers. In this section we describe the UI tax systems used in a majority of states and outline our procedures for estimating the degree of experience-rating for a representative firm in a particular state and industry.

a. Typical UI Tax Systems

The UI program is financed by a payroll tax on the earnings of covered employees. Although the federal government sets guidelines for the program, each state has its own method for determining the tax rate for individual employers. Most state systems are minor variants of two basic plans -- the "benefit-ratio" system, used in 6 states, and the "reserve-ratio" system, used in 32 others.[7] States using these systems accounted for 77 percent of workers covered by the UI program in 1987. The tax systems in the other 12

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[7]More sophisticated versions of these systems, which compute the relevant ratio for each firm and then charge a tax based on the firm's relative ranking among all firms, exist in six states (reserve ratio: Idaho, Kansas, Montana, and Vermont. Benefit ratio: Iowa and Oregon). We omit these states in our analysis.

Becker (1972) and Topel (1990) provide more detailed descriptions of the UI tax system. Our derivation of the marginal tax cost of a layoff is similar to Topel (1983, 1984, 1985, 1990).

states do not permit simple calculations of the marginal tax cost of a layoff, and we have therefore excluded these states from our empirical analysis.

The benefit-ratio system ties a firm's UI tax rate to the ratio of the benefits drawn by the firm's employees over the past 3 years to the size of its taxable payroll during those years.[8] Let C_t represent the average weekly number of UI recipients originating from a given firm in year t. If the firm's average employment level is N_t, then the firm's insured unemployment rate is defined as $\mu_t = C_t/N_t$. Assuming that the average UI benefit in year t is B_t and that a fraction α of claims originating from former employees of the firm are actually charged to the firm, the benefits charged to the firm in year t are $\alpha B_t C_t = \alpha B_t \mu_t N_t$.[9] The firm's benefit-ratio in year t (BR_t) is then:

[8]In one state that uses a benefit-ratio system (Minnesota) the average is taken over the previous 5 years.

[9]Approximately 15 percent of all UI benefits paid in the US are uncharged. There are a wide variety of circumstances leading to uncharged benefits. For example, South Carolina does not charge employers for benefits drawn by recipients with fewer than 8 weeks of claims (leading to 40 percent of benefits being uncharged) --see U.S. Department of Labor Employment and Training Administration (1991, page 2-37). Similarly, dependent's allowances are not charged in some states; while only a fraction of UI benefits drawn by seasonal employees are charged in other states.

$$BR_t = \frac{\sum_{i=1}^{3} \alpha B_{t-i} \mu_{t-i} N_{t-i}}{\sum_{j=1}^{3} W_{t-j} N_{t-j}} \tag{6}$$

where W_t is the firm's taxable wage base in the state in year t.[10] The UI tax rate is a function of the benefit-ratio, subject to a minimum and maximum rate. Specifically, between the minimum and maximum rates, τ_{min} and τ_{max}, the firm is charged a tax rate $\tau_t = \psi_t + \lambda_t BR_t$ where the parameters ψ_t and λ_t vary by state and year.

From equation (6) it is clear that a firm's benefit-ratio is a function of its past insured unemployment rates. A firm with a constant insured unemployment rate μ^s will face rising or falling tax rates until the annual benefits charged to the firm equal the taxes paid in. This equality defines a "steady-state" tax rate $\tau^s = \alpha(W/B)^* \mu^s$, assuming that the ratio of the taxable wage base W to the average UI benefit B is constant. If

$\tau^s > \tau_{max}$ or

$\tau^s < \tau_{min}$ then the firm's benefit-ratio grows or declines continuously and its MTC is zero. Otherwise, in steady-state the firm is located on the sloped portion of the tax schedule with a positive MTC.

Suppose that an extra dollar of UI benefits is charged to a firm with $\tau_{min} < \tau^s < \tau_{max}$. If employment and the taxable wage base are constant, this will increase the benefit ratio

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[10]The UI payroll tax is only applied on the first W_t dollars of an employee's annual earnings. At present, the taxable wage base varies across states from $7,000 to over $20,000, with most states in the $7,000-$14,000 range.

by $1/(3 \cdot W \cdot N)$ in each of the next three years.[11] The resulting increase in the tax rate, applied to the taxable payroll, will increase tax payments by $\lambda/3$ in each year. In the absence of discounting, a value of $\lambda = 1$ therefore implies a marginal tax cost of 1 (i.e., perfect experience rating). With a positive discount rate the marginal tax cost is lower since the tax payments are made 1, 2, and 3 years in the future. On the other hand, if the taxable wage is growing over time or employment is trending upward, the MTC will be higher since the higher tax rate will be applied to a growing taxable payroll. In Appendix 1 we show that:

$$MTC = \frac{\alpha\lambda(1+\pi)^2(1+g)^2}{3}\left[\frac{1 - (1+i)^{-3}}{i}\right] \qquad (7)$$

where i is the (real) interest rate, π is the growth rate of the taxable wage base, and g is the growth rate of employment. For example, if $g = 0.02$, $\pi = 0.01$, and $i = 0.10$, then $MTC = 0.88\ \alpha\ \lambda$.

Under a reserve-ratio financing system, a "bank account" is established for each firm, with tax payments added to the account and UI benefits drawn from it. The reserve ratio (r_t) is the ratio of the reserves in the firm's account (RES_t) to a three-year rolling average of its taxable payroll:

[11]If the benefit-ratio is defined over the previous 5 years, the calculation is similar.

$$r_t = \frac{RES_t}{\left[\sum_{i=0}^{2} W_{t-i}N_{t-i}\right]/3} \tag{8}$$

A firm's UI tax rate is a decreasing function of its reserve-ratio, subject to a minimum and a maximum rate. A typical schedule specifies a series of steps with variable step-sizes at different reserve ratios. We use a linear spline function to approximate the segments of the tax schedule, as illustrated in Figure 1.

The calculation of the firm's MTC under a reserve-ratio system is similar to the calculation under a benefit-ratio system. A steady state tax rate, τ^s, is calculated by setting UI tax payments equal to UI benefits charged at some steady-state insured unemployment rate. If $\tau^s > \tau_{max}$ or $\tau^s < \tau_{min}$, the MTC is zero and the firm's reserve ratio tends to infinity or 0. If $\tau_{min} < \tau^s < \tau_{max}$, the firm's MTC is positive. However, calculation of the MTC in most states is complicated by the existence of several segments in the tax schedule. Define τ_{low} and τ_{hi} as end points of a particular segment with $\tau_{low} < \tau^s < \tau_{hi}$. The relevant slope of the tax schedule is then the slope between τ_{low} and τ_{hi}, which we denote by ξ (see Figure 1).

If employment and taxable wages are constant then the existence of a steady-state tax rate implies that the firm's reserves are constant. It follows that the undiscounted tax liabilities generated by an additional dollar of UI benefits must be equal to \$1, independent of the value of ξ (although the dollar will be paid back more quickly for higher values of ξ). However, the discounted tax liabilities generated by an additional dollar of UI benefits are less than 1; a reserve-ratio finance system necessarily offers a subsidy to the UI costs of a firm with constant employment that is larger in states with smaller values of ξ. This may be offset if the taxable wage base is rising over time, or if the firm's employment is growing over time. In Appendix 1 we show that an approximate formula for the MTC in a reserve-ratio state is:

$$MTC = \frac{\alpha(1+g)^2(1+\pi)^2\xi}{i + (1+g)^2(1+\pi)^2\xi} \tag{9}$$

where g represents the growth rate of employment, π represents the growth rate of the taxable wage base, and i is the discount rate.

b. Marginal Tax Costs By State and Industry

Two pieces of information are needed to calculate the steady-state MTC facing a particular firm: its long-run average insured unemployment rate, and the relevant state tax schedule. Unfortunately, firm-specific data on average insured unemployment rates are unavailable. Instead, we use industry average insured unemployment rates by state to calculate the marginal tax cost for a "representative firm" whose insured unemployment rate equals the overall state average.[12] Industry level data are available for five broad industry groups: construction, durable manufacturing, nondurable manufacturing, services, and trade. We estimate the steady state insured unemployment

[12]One difficulty with this procedure is that it ignores the variation in MTCs across firms within a state and industry. Thus, if insured unemployment rates in a state and industry are high enough, that state and industry is assigned a MTC of 0, even though some firms may still face a positive MTC. Topel (1985) addresses this issue by modelling a distribution of MTCs within state and industry cells. Anderson (1991a) uses firm-specific tax rates and employment data, which are available for a small set of states.

rate in an industry and state by the average rate during 1978-1987.[13] We also estimate the long-run growth rate of employment (g) by the average growth rate of covered employment in the state and industry over the period.

We have collected annual tax schedules for 1978-1987 for each of the states that use either a benefit-ratio or reserve-ratio tax system. The schedules were obtained from a variety of sources, including Unemployment Insurance Reporter and the individual states' Departments of Employment Security. In benefit-ratio states, the slope of the tax schedule in any year (the parameter λ) is reported explicitly. For reserve-ratio states we approximate the steps in the tax schedule with a series of linear splines and estimate the slope of the schedule for each reserve ratio.[14] In total, we have tax schedules for 35 states and the District of Columbia for each of the years 1978-87.[15]

Examination of the actual tax schedules indicates two problems in implementing the MTC measures specified in equations (7) and (9). The first is that tax rates vary systematically over the business cycle. Typically, minimum and maximum tax rates and the slope of the tax schedule shift up during recessions and down during expansions

[13]Average annual insured unemployment rates by state and industry are taken from Unemployment Insurance Statistics for 1978 and 1979. Rates for 1980 through 1987 were obtained from unpublished reports of the Department of Employment Security, United States Department of Labor (we thank Cindy Ambler and Philip Blue for their assistance in acquiring these data). Rates for some industries in smaller states are not reported in some years. Because of missing data we omit from our analysis nondurable manufacturing in the District of Columbia, New Mexico, Arizona, Nevada, and Hawaii, durable manufacturing in the District of Columbia and Hawaii, and construction in Wyoming. The same data sources provide information on covered employment by state and industry.

[14]These approximate schedules are available upon request from the authors.

[15]We have excluded 2 states (Utah and Virginia) that switched tax systems between 1978 and 1987.

(usually after a 1 or 2 year lag for the state's UI Trust Fund to show a surplus or deficit).[16] Thus, the tax schedule in a particular year is not always a good estimate of the tax schedule that will prevail in the near future.

A second problem arises because UI benefits have increased over time at about the rate of inflation while the taxable wage base has risen much more slowly. From the steady-state relationship, $\tau^s = (B/W)^* \mu^s$, it is apparent that the tax rate must rise over time if state UI reserves are to be maintained in the face of a declining real taxable wage base.[17] As shown in Figure 2, this has been the case. Among reserve-ratio states the average tax rate for firms with negative reserve ratios rose by 35-50 percent over the 1980s. Ideally, one needs information on the expected rate of growth of B/W to calculate the steady-state MTC. In practice, however, it is difficult to disentangle the secular growth in tax rates necessitated by the declining real value of the taxable wage base from the effects of the business cycle. Part of the increase in UI tax rates over the 1980s was driven by the unusually severe 1982-83 downturn, and the subsequent efforts of the states to replenish their Trust Funds.

Given these difficulties we have elected to use the average tax schedule over the 1978-87 period as a proxy for a states's steady state schedule. This strategy solves the problem of determining the MTC based on tax rates assigned during a recession or

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[16]In fact, Brown (1986) uses this variation to show that the marginal tax cost is counter-cyclical. However, her evidence and our own simulations suggest that cyclical changes in the MTC are relatively small for reasonable discount rates.

[17]With a fixed nominal wage base and fully indexed benefits the tax rate must grow at the rate of inflation in steady state.

boom. The other parameters required to evaluate the MTC are estimated by their average values over the ten year period from 1978 to 1987. The taxable wage base by state and year is taken from Comparison of State Unemployment Insurance Laws. Average weekly benefits in a state and year are taken from Statistical Abstract of the United States. Finally, the percentage of benefits charged to firms in a given state and year was obtained from unpublished records of the Department of Employment Security, United States Department of Labor.[18]

The distribution of marginal tax costs across the 36 states and 5 industries in our data set is illustrated in Figure 3. As previous researchers have noted, the MTC in the construction industry is zero for all but a handful of states. For other industries, MTCs cluster around 0.8: only a few state systems impose MTCs greater than one. In general, states with higher MTCs in one industry tend to have higher costs in all industries. For example, the benefit-ratio systems in Florida, Texas, and Minnesota set MTCs close to 1 for all industries. At the other extreme, Washington had no experience-rating in its tax system during our sample period. A complete listing of MTCs by state and industry is presented in Appendix Table A1.

III. EFFECTS OF EXPERIENCE RATING ON UNEMPLOYMENT RATES

To measure the effects of experience-rating on the incidence of temporary layoffs and other types of unemployment we have assembled microdata from the 1979-87

[18]We thank Mike Miller of the Unemployment Insurance Service for his assistance in acquiring these data.

Current Population Survey (CPS) merged outgoing-rotation-group files.[19] Information on state-of-residence and current or previous industry allows us to match individual unemployment outcomes with industry- and state-specific measures of the marginal tax cost of layoffs. This data set has a number of important advantages for studying the effects of experience rating. First, the sample period encompasses a full cycle of economic activity -- from a peak in 1979 to a trough in 1982-83 to a peak in 1987. Second, the merged outgoing-rotation-group files are drawn from all 12 months of the year, allowing us to compare the effects of incomplete experience rating at different points in the seasonal cycle. Finally, the sample size is large: a 50 percent sample of the available observations yields over 180,000 individuals in 36 states and 5 industries over 9 years.

Descriptive statistics for the sample are reported in Table 1. We include individuals in the labor force age 16 and older who report their current or previous industry as construction, manufacturing (either durable or nondurable), trade, or services. Public-sector employees, labor force non-participants, and unemployed individuals who report no previous industry or occupation are excluded.[20] The latter restriction eliminates new entrants to the labor force and others who have not worked in the past 5 years. The sample is roughly one-half female and about 13 percent non-white. Average education

[19]These files combine the responses for 1/4 of individuals in every month of the survey.

[20]State and local employees are covered by the UI system. However, state and local governments (and many non-profit institutions) self-insure their UI costs. We have estimated many of our models with samples that include state and local workers (with a MTC of 1) and obtained similar results to those reported here.

and experience are approximately the same as the averages for all labor force participants.

The demographic characteristics of the sample vary across industries. For example, service industries employ relatively more women and college graduates, whereas retail and wholesale trade employ a relatively high fraction of young workers. The industry shares in the overall sample are reported in the bottom row of the table. Trade and services each account for about 30 percent of the sample, while durable and nondurable manufacturing and construction are a smaller fraction of the total.

Unemployed individuals are divided into 3 categories: those on temporary layoff (individuals who report that they have a job from which they are on temporary or indefinite layoff); permanent job losers (unemployed individuals who do not report themselves as on lay-off and who report that they began looking for work as a result of a job loss); and others. The "other" group includes job seekers who quit their previous job as well as labor force re-entrants -- for this reason we refer to this group as "non-job-losers." In the overall sample about 18 percent of the unemployed are on temporary layoff, with the remainder divided between permanent job losers and non-job-losers. The relative importance of temporary layoffs varies across industries, being highest (close to one-third) in durable manufacturing and lowest (less than 10%) in trade and services.

As shown in Figure 4, the probability of unemployment and its composition also vary over the years of the sample. The overall unemployment rate in the sample tracks the aggregate rate fairly closely, with a peak in 1982 and relative troughs in 1979 and 1987.

Temporary layoffs also peak in 1982, although their fraction of total unemployment is similar in 1980 (23%), 1981 (20%), and 1982 (21%).

According to the model in Section I, increases in the degree of experience rating should lower the layoff unemployment rate in a low-demand state, but should have no effect at a cyclical or seasonal peak. These predictions are based on the behavior of a single firm. In applying the model to aggregate data it must be recognized that individual firms face idiosyncratic as well as macroeconomic shocks.[21] At any point in time some firms are experiencing a relative peak in demand while others are experiencing a relative trough. Nevertheless, the fraction of firms facing a peak will vary systematically over the business cycle or the seasonal cycle. We therefore expect to see a larger negative effect of experience-rating on temporary layoff unemployment rates in a recession or a seasonal trough, although not necessarily a zero effect at a cyclical or seasonal peak.

By comparison, changes in the degree of experience rating should not effect the incidence of unemployment among non-job-losers, since few non-job-losers are covered by UI. Job quitters are denied benefits in all but a handful of states. Likewise, most labor force re-entrants are ineligible for benefits. An analysis of the effects of the MTC of layoffs on the unemployment rate of non-job-losers thus provides a simple check on our results: a finding of a significant effect signals a spurious correlation between overall labor market conditions and the measured degree of experience-rating.

[21]Indeed, the results of Davis and Haltiwanger (1989) suggest that the idiosyncratic demand components are substantially bigger than the aggregate components.

The predicted effect of experience rating on the fraction of permanent job losers is somewhere between the predicted effect on temporary layoffs and non-job losers. Increased experience rating imposes a higher cost on both temporary and permanent layoffs. Thus we expect to see some effect of higher MTC's on the incidence of permanent job loss.[22] Nevertheless, many permanent separations arise for idiosyncratic reasons (such as a bad "job match") or as a result of plant-closings or a permanent reduction in force. In such cases the marginal effect of a firing cost is likely to be smaller than its effect on short-run cyclical adjustments.

a. Effects of Experience Rating Over the Business Cycle

Our empirical strategy is to fit models for the probability of unemployment to the microdata sample described in Table 1, and to include as an explanatory variable the MTC of the individual's current or most recent employer. We fit separate models for the incidence of unemployment as a result of a temporary layoff, a permanent job loss, or some other reason. Despite the discrete nature of the dependent variables we fit linear probability models by ordinary least squares. These models are computationally feasible (some of our models have over 180,000 observations and over 500 explanatory

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[22]The distinction between temporary layoffs and permanent job-losses is far from clear-cut. Workers may begin a spell of unemployment thinking that they have some probability of recall and only later recognize the situation as a "permanent" job loss.

variables) and can easily accommodate the potential endogeneity of the measured MTC for a state and industry (see below).[23]

Table 2 presents coefficient estimates for models fit to the overall sample (pooling 5 industries, 8 years, and 36 states). The models include a set of person-specific covariates, as well as dummy variables for the individual's occupation and industry and the year of the observation. The 3 sets of models in the table differ by whether they include unrestricted state effects, unrestricted state*year and industry*year interaction effects, or neither.

The results in columns 1, 4, and 7 suggest that increases in MTC are associated with significantly lower temporary layoff unemployment rates. The estimated effect is bigger (more negative) when state effects are included (compare columns 4 and 1) but is very similar whether or not the state and industry effects are allowed to vary by year (compare columns 4 and 7). The estimated coefficient in column 1 implies that a change from an average MTC of 0.68 (the sample average) to full experience rating (MTC = 1.0) would reduce the average layoff unemployment rate by 0.28 percentage points, or about 20 percent. The estimated coefficients in columns 4 and 7 imply an effect about twice this big. The latter magnitude is consistent with the estimates presented by Topel

[23]Angrist (1991) presents an informative analysis of conditions under which an instrumental variables - linear probability model recovers the "average" effect of an endogenous regressor.

(1983, 1985), and suggests that close to one-half of all temporary layoffs are attributable to incomplete experience rating.[24]

The estimated effect of UI tax costs on the unemployment rate of permanent job losers is relatively large when state effects are excluded from the model, but falls substantially when these are included (compare columns 2 and 5). The estimates in columns 5 and 8 are only marginally significant and suggest that incomplete experience rating can account for at most 5 percent (0.15 percentage points) of the unemployment of permanent job losers. The differing implications of models with and without state effects for temporary and permanent layoffs indicates an important advantage of our UI database, which measures experience rating factors by state and industry. Judging by the estimates in Table 2, fixed interstate differences in temporary and permanent layoff unemployment rates have very different correlations with measured MTC's, and it may be inappropriate to ignore these effects.

Regardless of whether state effects are included or excluded, there is no evidence of any correlation between MTC's and the unemployment rate of non-job-losers (columns 3, 6, and 9). Since quitters and re-entrants are mainly uninsured, this finding suggests that there is no inherent correlation between measured MTC's and the underlying labor market conditions in different states and industries.

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[24]Topel (1985) estimates the effect of UI experience rating on the unemployment of full-time full-year adult men, and uses a slightly different estimate of the MTC that ignores uncharged benefits and growth rates in employment and the taxable wage base (see the formulas in Section II). The MTC coefficient in a model similar to the one in column 4, Table 2 but using Topel's MTC measure is -1.49 (with a standard error of 0.15). The sample average value of the simpler MTC is 0.71, so the implications of the estimate for the share of layoffs attributable to incomplete experience rating is the same.

Table 3 presents linear probability models in which the MTC coefficients are allowed to vary across years. (For simplicity we only present models with state or state*year effects). The MTC coefficients in columns 1 and 4 show a systematic cyclical pattern, with the largest (negative) effects in the recessionary 1980-82 period and relatively small effects in the peak 1979 and 1986-87 years. This is precisely the pattern predicted by an adjustment cost model of temporary layoffs. According to such a model, changes in the MTC of layoffs alter the proportion of a firm's labor force laid off in a demand slump. In a business cycle downturn we therefore expect to see an increase in the interstate dispersion in layoff rates generated by differential tax subsidies on UI benefits. Indeed, the estimated coefficients in the 1980-82 period are surprisingly close to the -3.0 value predicted by the theoretical model presented in Section I, assuming plausible values for the demand elasticity and the net replacement rate.

The MTC coefficients in models for the probability of permanent layoff unemployment also show a slight cyclical pattern, although the coefficients are estimated relatively imprecisely and vary substantially from year-to-year. In the model with state*year and industry*year effects (column 5) the largest negative coefficients are estimated for 1984 and 1985, rather than for the peak-unemployment years. The pattern of the MTC coefficients in models for non-job-losers (columns 3 and 6) is even more unsystematic. Again, we interpret the systematic cyclical pattern of the MTC coefficients for temporary layoffs and the <u>absence</u> of such a pattern for the unemployment rate of non-job-losers as a useful check on our interpretation of the former.

Despite the relatively favorable evidence in Tables 2 and 3, the nature of the UI experience-rating system in most states suggests that caution is required in drawing causal inferences from the correlation of MTC's and unemployment rates. Each state's UI financing system sets a maximum payroll tax that is applied to firms with the lowest reserve or benefit ratios. Firms with the highest insured unemployment rates therefore face a MTC of 0. The implication of this institutional feature is revealed by the inter-industry pattern of temporary layoffs and MTC's. As shown in Table 1, construction and durable manufacturing have the highest temporary layoff unemployment rates and the lowest MTC's. This correlation is driven by the large number of states in which construction and durable manufacturing are at the maximum tax rate.[25] Even within the 5 industry groups in our analysis it is conceivable that sub-industries with different propensities to use temporary layoffs are concentrated in certain states, leading to a spurious negative correlation between MTC's and measured unemployment rates.

One way to overcome this mechanical connection between measured MTC's and the historical pattern of unemployment in a state is to use national average insured unemployment rates for the industry to calculate the MTC for each state. This alternative MTC is independent of the actual unemployment history of firms in the state, and relies instead on the characteristics of the state tax schedule in combination with the average characteristics of the industry to assign tax rates.

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[25]Of course not every firm is at the same point in the state tax schedule. Our calculations only apply to a firm whose insured unemployment rates mimic the average rates for all firms in the same state and industry.

Table 4 presents models that use this alternative MTC measure as an instrument for the actual degree of experience-rating in each state and industry.[26] The first 3 columns give models that are directly comparable to models in columns 4-6 of Table 2. The instrumental variables (IV) estimates show the same general pattern as the OLS coefficient estimates, although the estimated effects on temporary and permanent layoffs are both more negative, while the estimated effect on non-job-losers is more positive. In no case are the IV estimates statistically different than the OLS estimates, although this is largely a reflection of the imprecision of the IV estimates.

The models in columns 4-6 of Table 4 are directly comparable to models in columns 1-3 of Table 3. Again the IV estimates are relatively imprecise, making it difficult to draw strong conclusions. There is certainly no evidence that OLS estimates of the effect of experience-rating on layoff unemployment are negatively biased (as a reverse-causation argument would imply). On the other hand, the IV coefficients in column 4 of Table 4 show no strong cyclical pattern, which could be taken as evidence against our adjustment-cost interpretation. On balance, however, we believe the IV estimates, taken together with the other evidence in Tables 2 and 3, provide support for a causal interpretation of the MTC effects.

The models in Tables 2-4 assume that increases in the MTC of layoffs have the same effect on employment decisions in different industries. This is a relatively strong assumption, especially in light of the heterogeneous group of industries in our sample. A

[26]In calculating the alternative MTC using national average insured unemployment rates we also ignore the effects of employment growth and non-charged benefits in the state.

simple way to incorporate heterogeneity is to allow the MTC coefficient to vary by industry. The results of this exercise (for specifications similar to columns 4-6 in Table 2) are presented in row 1 of Table 5. As might be expected, construction and durable manufacturing show the largest effects of imperfect experience rating on temporary layoffs, although in all 5 industries the coefficients are negative and significant. The MTC coefficients for permanent layoff unemployment are quite variable and (with the exception of construction) insignificantly different from 0, while the coefficients for non-job-losers are positive but uniformly insignificant. These coefficients suggest that a move to complete experience-rating (MTC=1) would lower temporary layoff unemployment rates by 1.7 points (or 45 percent) in construction, 0.6 points (or 23 percent) in durable manufacturing, 0.4 points (or 22 percent) in nondurable manufacturing, 0.3 points (or 43 percent) in trade, and 0.3 points (or 50 percent) in services.

The evidence of a systematic negative effect of experience-rating on temporary layoffs in trade and services is reassuring, since these industries are far from the maximum tax rate in all states (indeed they are at the minimum rate in some states). As a result, MTC's will tend to be higher for trade and service industries in those states that had above-average insured unemployment rates in the 1980s. This implies a positive simultaneity bias in our estimate of the effect of UI experience-rating on temporary layoff unemployment rates in trade and services, rather than the negative bias implied by the effect of the maximum tax rate. Despite this potential bias, the estimated coefficients are significantly negative, providing confirmation of a causal effect from higher MTC's to lower temporary layoff rates.

Further evidence on inter-industry differences in the effects of experience rating is presented in rows 2 and 3 of Table 5. Row 2 presents estimates of the MTC coefficient from models that are fit by industry. Row 3 presents similar coefficients from an IV estimation scheme, using the MTC calculated with national average insured unemployment rates as an instrument for each state's MTC. Since MTC is constant for each state and industry, we cannot include unrestricted state effects in the industry-specific models. For construction and durable manufacturing, the differences between rows 1 and 2 are relatively small. For the other three industries the pooled specification with state effects implies a larger (more negative) MTC effect on temporary layoff unemployment then the alternative specification, while the industry-specific model without state effects implies a larger (more negative) MTC effect on the permanent layoff unemployment rate. This is similar to the pattern in Table 2 for the pooled models with and without state effects, and may reflect the correlation between unmeasured state differences and measured MTC's.

With the exception of the results for the construction industry, the IV estimation results are roughly consistent with the OLS results. The IV estimate of the MTC effect on temporary layoff unemployment in durable manufacturing is smaller (in absolute value) than the OLS estimate, while the reverse is true for nondurables, trade, and services. For the construction industry the IV estimation scheme leads to large and clearly erroneous coefficients. This is caused by the very weak correlation between actual MTC's and the estimated MTC using national average insured unemployment rates.[27]

Finally, Table 6 presents estimation results from models that allow separate MTC coefficients by year and industry. The specifications include unrestricted state*year and industry*year effects. For all 5 industries the tax coefficients in the temporary layoff equation show a systematic cyclical pattern. These patterns are illustrated in Figure 5, where we have graphed the MTC coefficients from columns 1, 4, 7, 10, and 13 of Table 6. Construction and durable manufacturing show the strongest cyclical variation, although in every industry the largest tax cost effects are estimated for the 1980-82 period, while the effects for 1979 and 1986-87 are close to 0.

By comparison the patterns of the annual coefficients in the permanent layoff and non-job-loser equations are unsystematic. There is some tendency for more negative coefficients in the permanent layoff equation in 1980-81, although the coefficients for 1982 and 1983 vary in sign. The coefficients in the model for non-job-losers also vary in sign, and few are significantly different from zero.

[27]The difficulty is created by the fact that 2 states (Florida and Texas) have very high MTC's for construction, but would have 0 MTC's if these states had national-average insured unemployment rates in construction. Because of the influence of these states, the correlation of the two MTC measures is close to 0.

b. Effects of Experience Rating Over the Seasonal Cycle

The implications of an adjustment-cost model for the effects of experience-rated UI taxes apply to seasonal as well as cyclical demand shocks. Indeed, the simple deterministic model presented in Section I is probably more appropriate for describing regular seasonal demand fluctuations than stochastic macroeconomic fluctuations. In this section we therefore compare the effects of experience-rating in different months of the calendar year. To preview the results, we find that estimated MTC coefficients have a systematic seasonal pattern in models for the probability of temporary layoffs, with larger (more negative) effects in low-demand months. By comparison, the monthly coefficients from models for the unemployment of permanent job losers and non-job-losers show little seasonal pattern.

A very simple example of the effect of UI taxes on the seasonal characteristics of unemployment is provided in Figure 6. Here we present quarterly unemployment rates for construction workers in 3 groups of Southeastern states: states with very high MTCs in the construction industry (Florida and Texas); states with moderately high MTCs (Georgia, North Carolina and Tennessee); and the remaining Southeastern states in our data set (Arkansas, Kentucky, Louisiana, Maryland, Mississippi, and South Carolina), all of which have 0 MTC in construction. The upper panel of the Figure shows that temporary layoff unemployment rates have the greatest seasonal variation in the "0 MTC" states, and the lowest seasonal amplitude in the high-cost states. As a check on the comparability of the groups the lower panel shows quarterly unemployment rates for non-job-losers, which are very similar across the 3 groups. Assuming that the seasonal patterns of temporary layoffs would be the same in the absence of different UI taxes, the data in the upper panel suggest that a move from a MTC of 0 to a cost of 1 would lower the temporary layoff unemployment rate in January-March by 3-3.5 percentage points. This is comparable in magnitude to the estimates in Table 6 for the construction industry in the highest-unemployment years, and also to the magnitude implied by our theoretical calculations, assuming a demand elasticity of -0.3, a benefit replacement rate of 0.5, and that workers laid off in the first quarter receive an average of 12 weeks of UI benefits.

Although employment and unemployment in construction follow a clear seasonal cycle, in other industries the monthly pattern of temporary layoffs is more complex. Figure 7 shows average monthly temporary layoff unemployment rates in durable and nondurable manufacturing (the upper panel) and trade and services (the lower panel). These data suggest that durable manufacturing has two seasonal peaks in temporary layoffs: one in December-January; the other in July-August (corresponding to the traditional "summer shutdown" in auto assembly and other industries). Trade and services also have at least 2 seasonal peaks in temporary layoffs. Nondurable manufacturing, on the other hand, shows little systematic seasonal pattern in temporary layoffs.

In light of these differing monthly patterns across industries it is impossible to identify a particular month as either a "high" or "low" demand month. Rather, within each industry we have ranked the months by the average rate of temporary layoff unemployment over the 1979-87 period. An individual observation in the CPS sample is then assigned a "month" (from 1 to 12) based on the rank of the month for the individual's industry. Table 7 reports estimated models for the probability of unemployment that include interactions of MTC with the rank of the month in which the individual is observed. The models in columns 1, 3, and 5 include state, industry, and month dummies, while the models in columns 2, 4, and 6 include state*month and industry*month interactions.

The pattern of the MTC coefficients in the temporary layoff equations is consistent with an adjustment-cost model of UI tax effects. In the lowest-demand (highest rank) months, a move from 0 MTC to full experience-rating is predicted to reduce the temporary layoff unemployment rate by 2.5-3.0 percentage points. In highest demand (lowest rank) months, the effect is smaller, although still negative and significant. By comparison, the MTC coefficients show much less of a seasonal pattern in the permanent layoff equations, and no systematic pattern at all in the non-job-loser equations. We interpret these estimates as confirming our conclusions based on an analysis over the business cycle: both the pattern of the MTC coefficients and their relative magnitudes are consistent with the evidence in Table 3.

Given the very different seasonal patterns in the 5 different industries in our data set, we have also analyzed the monthly patterns of temporary layoffs by industry. Estimation results for industry-specific models are presented in Table 8. In these specifications the 12 months are grouped into "quarters" on the basis of the (industry-specific) average temporary layoff rate. We then interact the MTC variable with indicators for whether the monthly observation is drawn from the 3 highest layoff months; the 4th-6th highest layoff months; the 7th-9th highest layoff months; or the 3 lowest layoff months. Since the models are fit by industry, we cannot include state effects and the full set of 4 quarterly MTC interactions.[28] Two possible alternatives are presented in the table. In the models in columns 1, 3, 5, 7, and 9, we exclude the state effects and present MTC coefficient estimates for 4 separate quarters. In the models in columns 2, 4, 6, 8, and 10 we exclude the MTC*"lowest layoff months" interaction, and include state effects. These specifications then estimate the additional MTC effect in each quarter relative to the MTC effect in the lowest-layoff months.

For construction and durable manufacturing the results by either scheme are consistent with a strong seasonal pattern in MTC effects. Excluding state effects we estimate a MTC effect of about -1.0 in both industries in the lowest layoff (highest demand) quarter, and MTC effects in the highest layoff quarter of -4.0 (construction) and -3.3 (durable manufacturing). When state effects are included we estimate an excess MTC effect for the highest layoff quarter of -3.2 in construction and -2.1 in durable manufacturing.

For nondurable manufacturing the models without state effects suggest a negative MTC effect that is roughly constant in different months. The models with state dummies show no excess MTC effect in the higher-layoff months. As shown in Figure 7, however, there is little seasonal variation in layoff rates in durable manufacturing. Given this fact, the results for nondurables are expected.

For trade and service industries the models without state effects show only limited seasonality in the MTC coefficients. The models with state dummies show excess MTC

[28]Recall that MTC is constant for each industry*state cell.

effects in the highest layoff months for both industries, but the excess effects for the intermediate months follow a mixed pattern. The estimates for these two industries are consistent with seasonal variation in the MTC effect, but the patterns are weak relative to construction and durable manufacturing.

V. Conclusions

The experience-rating provisions of the UI tax system require employers to repay some fraction of the UI benefits drawn by their former employees. Unemployment insurance taxes therefore create a firing cost that varies across states depending on the degree of experience-rating in the state's tax system. We use a simple partial-adjustment model to study the effects of this firing cost, concentrating on differences over the demand cycle. An increase in experience-rating is predicted to reduce the fraction of workers who are laid off in a downturn and reduce the total number of workers who are hired in an expansion. The combination of these two effects implies that an increase in experience-rating will dampen observed employment and unemployment responses to cyclical or seasonal demand shocks.

To test these implications we have developed a new database of UI tax costs for firms in 5 major industries and 36 states during the 1980s. We use this information together with individual microdata from the 1979-1987 Current Population Survey to measure the effects of imperfect experience rating on the probability of temporary layoffs at different stages of the business cycle and in different months of the year. Our empirical results suggest that the degree of experience-rating has a substantial effect on the probability of layoffs in a downturn or a seasonal trough, but relatively smaller effects in a cyclical expansion or a seasonal peak. We estimate that a move to complete experience-rating would reduce the temporary layoff unemployment rate by about 1.0 percentage point (or roughly 50 percent) in the trough of a recession, and would reduce temporary layoff unemployment in the lowest demand months of the year by about the same amount. This magnitude is consistent with plausible values for the labor demand elasticity in our theoretical model.

We have presented a variety of additional evidence that supports a causal interpretation of the correlation between UI experience-rating and temporary layoff unemployment. First, we estimate similar models for the unemployment rates of job quitters and labor-force re-entrants. Since most of these individuals are uncovered by UI benefits, the unemployment rate of non-job-losers should be unaffected by changes in experience-rating provisions. On the other hand, general economic conditions in a state and industry will be reflected in the unemployment rates of non-job-losers. Since we find no relation between experience-rating and unemployment rate of quitters and re-entrants, we think it is unlikely that our findings for temporary layoffs are driven by a spurious correlation between tax rates and overall job market conditions.

Second, we have presented instrumental variables estimates that purge the measured degree of experience-rating for a state and industry from the effects of the particular unemployment history of firms in that state and industry. Although the instrumental variables estimates are imprecise, they give no indication of a bias created by the presence of maximum tax rates for high-unemployment employers. Finally, we have analyzed industry-specific results, paying special attention to trade and services. Layoff rates in these industries are relatively low and very few trade and service employers are affected by maximum tax rate provisions. For these industries we find a similar pattern of results as for other industries and for the sample as a whole. On balance, we believe the evidence provides a strong case that increases in the degree of experience-rating reduce the utilization of temporary layoffs in cyclical and seasonal slumps.

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APPENDIX 1: CALCULATING THE MARGINAL TAX COST

The steady state MTC for a representative firm is determined in two steps. First, the firm is placed at the appropriate point on the state tax schedule. Second, given the slope at that point on the schedule and some other relevant information, the MTC can be calculated. This appendix will describe in detail the procedures and data used to accomplish these two steps. For states using the benefit ratio method, placing the firm on the tax schedule is straightforward. The steady state relationship requires that benefits paid out equal taxes paid in: $\mu^s B = \tau^s W$. This $\tau^s = (W/B)^* \mu^s$, where μ^s is the steady state unemployment rate, τ^s is the steady state tax rate, and W is the taxable wage base. If τ^s is greater than the maximum tax rate τ_{max} or less than the minimum tax rate τ_{min}, then the MTC is 0. Otherwise, the slope of the tax schedule is a known constant.

Using the notation defined in the paper the benefit ratio is defined by:

$$BR_t = \frac{\sum_{i=1}^{T} \alpha B_t \, \mu_{t-i} \, N_{t-i}}{\sum_{j=1}^{T} W_{t-j} \, Nt-j} \tag{A1}$$

Consider the most common case where T = 3 years. Assuming that taxable wages and employment grow exponentially so that $W_{t+1} = (1+\pi)W_t$ and $N_{t+1} = (1+g)N_t$, (A1) can be approximated by:

$$BR_t = \frac{\sum_{i=1}^{3} \alpha B_t \mu_{t-i} N_{t-i}}{3W_{t-2} N_{t-2}} \tag{A2}$$

assuming that π and g are relatively small.

Taxes in a benefit ratio system are set such that $\tau_t = \psi + \lambda BR_t$, or applying equation (A2) and manipulating:

$$W_t N_t \tau_t = \psi W_t N_t + \alpha\lambda(1+\pi)^2(1+g)^2 \frac{\sum_{i=1}^{3} B_t \mu_{t-i} N_{t-i}}{3} \tag{A3}$$

Notice that the left side of equation (A3) is the total tax payment made by a firm in year t. The discounted change in taxes over time given a change in benefit payments due to additional layoffs ($N_t B_t \mu_t$) is given by:

$$NPV(tax\ change) = \frac{\alpha\lambda(1+\pi)^2(1+g)^2}{3(1+i)}\left[1 + \frac{1}{1+i} + \frac{1}{1+i^2}\right]$$

$$= \frac{\alpha\lambda(1+\pi)^2(1+g)^2}{3}\left[\frac{1 - (1+i)^{-3}}{i}\right] \tag{A4}$$

Equation (A4) represents the MTC in a benefit ratio system for firms between the minimum and maximum tax rates. When T = 5 years, we can similarly derive the MTC:

$$MTC = \frac{\alpha\lambda(1+\pi)^3(1+g)^3}{5}\left[\frac{1 - (1+i)^{-5}}{i}\right]$$

Under a reserve ratio system the steps are similar. The value of the steady state tax rate is calculated as above. If $\tau^s > \tau_{max}$ or $\tau^s < \tau_{min}$ then the MTC is zero. If neither of these conditions is true then define the equation of the relevant segment of the tax schedule as $\tau_t = \theta + \xi r_t$, where r_t is the reserve ratio in period t.

The reserve ratio is the ratio of the firm's reserves (RES_t) to its average taxable payroll averaged over the last three years:

$$r_t = \frac{RES_t}{\left[\sum_{i=0}^{2} W_{t-i}N_{t-i}\right]/3} \approx \frac{RES_t}{W_{t-1}N_{t-1}} = \frac{(1+\pi)(1+g)RES_t}{W_t N_t} \qquad \text{(A5)}$$

for π and g small. A firm's reserves in a given period equals its reserves from the last period plus receipts less payments:

$$RES_t = RES_{t-1} + \tau_t W_t N_t - \alpha \mu_t B_t N_t \qquad \text{(A6)}$$

Multiplying both sides by $(1+\pi)(1+g)W_tN_t$ and manipulating yields:

$$r_t \approx \frac{r_{t-1}}{(1+\pi)(1+g)} + (1+\pi)(1+g)\tau_t - \alpha(1+\pi)(1+g)\frac{B_t}{W_t}\mu_t \qquad \text{(A7)}$$

Using the equation of the tax schedule:

$$\tau_{t+1} = \theta - \xi r_t \rightarrow r_t = \frac{\theta - \tau_{t+1}}{\xi} \qquad \text{(A8)}$$

Substituting (A8) into (A7):

$$\frac{\theta-\tau_{t+1}}{\xi} \approx \frac{\theta-\tau_t}{\xi(1+\pi)(1+g)} + (1+\pi)(1+g)\tau_t - \alpha(1+\pi)(1+g)\frac{B_t}{W_t}\mu_t \tag{A9}$$

Multiplying both sides of (A9) by $(1+\pi)(1+g)N_tW_t\eta_1$ and rearranging yields:

$$N_{t+1}W_{t+1}\tau_{t+1} = N_tW_t\theta\ [(1+\pi)(1+g)-1] + \left[1-(1+\pi)^2(1+g)^2\xi\right] N_tW_t\tau_t + \alpha(1+\pi)^2(1+g)^2\ \xi N_tB_t|$$

Note that the left hand side of this expression equals the total tax payments made by the firm. Taking the derivative in all future periods with respect to an increase in UI benefit payments in period t gives the marginal tax cost:

$$MTC = \frac{\alpha(1+\pi)^2(1+g)^2\xi}{1+i} + \frac{\alpha(1+\pi)^2(1+g)^2\ \xi\ (1-(1+\pi)^2(1+g)^2\xi)}{(1+i)^2}$$

$$+\frac{\alpha(1+\pi)^2(1+g)^2\xi(1-(1+\pi)^2(1+g)^2\xi)^2}{(1+i)^3} + \ldots$$

$$= \frac{\alpha(1+\pi)^2(1+g)^2\xi}{i+(1+\pi)^2(1+g)^2\xi} \tag{A11}$$

Table A1:
Marginal Tax Cost by State and Industry

Construction State	Construction Cost	Durable Manufacturing State	Durable Manufacturing Cost
Arizona	0.000	Louisiana	0.000
Arkansas	0.000	Nevada	0.000
California	0.000	Ohio	0.000
Colorado	0.000	Washington	0.000
Connecticut	0.000	West Virginia	0.000
Dist. Columbia	0.000	Wyoming	0.000
Indiana	0.000	South Carolina	0.327
Kentucky	0.000	Maine	0.413
Louisiana	0.000	Colorado	0.491
Maine	0.000	Rhode Island	0.504
Maryland	0.000	New Hampshire	0.540
Massachusetts	0.000	Arizona	0.609
Minnesota	0.000	Massachusetts	0.613
Mississippi	0.000	California	0.616
Missouri	0.000	Missouri	0.641
Nebraska	0.000	Georgia	0.649
Nevada	0.000	New Mexico	0.650
New Jersey	0.000	Tennessee	0.663
New Mexico	0.000	Connecticut	0.678
New York	0.000	Maryland	0.681
North Dakota	0.000	Arkansas	0.691
Ohio	0.000	Mississippi	0.696
Rhode Island	0.000	Nebraska	0.712
South Carolina	0.000	Wisconsin	0.753
South Dakota	0.000	New Jersey	0.765
Washington	0.000	North Carolina	0.772
West Virginia	0.000	New York	0.781
Wisconsin	0.000	Indiana	0.799
New Hampshire	0.264	South Dakota	0.803
Hawaii	0.272	North Dakota	0.869
Tennessee	0.574	Kentucky	0.893
Georgia	0.650	Texas	1.019
North Carolina	0.750	Minnesota	1.065
Texas	1.052	Florida	1.501
Florida	1.468		

Nondurable Manufacturing	
State	Cost
California	0.000
New York	0.000
Washington	0.000
South Carolina	0.315
Maine	0.410
Louisiana	0.474
Colorado	0.487
Rhode Island	0.505
West Virginia	0.575
Massachusetts	0.595
Missouri	0.638
Georgia	0.643
Connecticut	0.650
Tennessee	0.655
Arkansas	0.670
Maryland	0.681
Mississippi	0.684
North Dakota	0.706
Ohio	0.719
Nebraska	0.766
New Hampshire	0.769
North Carolina	0.770
South Dakota	0.803
Wisconsin	0.815
New Jersey	0.819
Wyoming	0.826
Kentucky	0.893
Indiana	0.909
Texas	0.979
Minnesota	1.046
Florida	1.394

Services	
State	Cost
Hawaii	0.000
Maine	0.000
Massachusetts	0.000
Rhode Island	0.000
Washington	0.000
Louisiana	0.507
Tennessee	0.522
Nevada	0.544
Missouri	0.588
California	0.605
West Virginia	0.607
Arizona	0.620
New Mexico	0.657
Georgia	0.658
Arkansas	0.661
South Carolina	0.667
North Dakota	0.718
New Hampshire	0.718
Colorado	0.742
Ohio	0.749
Mississippi	0.755
Kentucky	0.759
Nebraska	0.767
North Carolina	0.779
New Jersey	0.792
New York	0.796
South Dakota	0.803
Maryland	0.821
Connecticut	0.826
Wisconsin	0.827
Dist. Columbia	0.843
Indiana	0.848
Wyoming	0.911
Texas	1.128
Minnesota	1.219
Florida	1.606

State	Trade Cost
Hawaii	0.000
Maine	0.000
Rhode Island	0.000
Washington	0.000
Tennessee	0.522
Massachusetts	0.540
Nevada	0.543
Missouri	0.578
California	0.589
West Virginia	0.596
Arizona	0.609
New Mexico	0.652
Georgia	0.652
Arkansas	0.656
South Carolina	0.661
North Dakota	0.707
New Hampshire	0.716
Mississippi	0.730
Colorado	0.735
Ohio	0.737
Maryland	0.746
Connecticut	0.757
Nebraska	0.764
North Carolina	0.776
New Jersey	0.784
Kentucky	0.788
New York	0.793
South Dakota	0.801
Louisiana	0.827
Dist. Columbia	0.830
Wisconsin	0.839
Indiana	0.841
Wyoming	0.873
Texas	1.083
Minnesota	1.092
Florida	1.497

Figure 1: Typical Tax Schedule

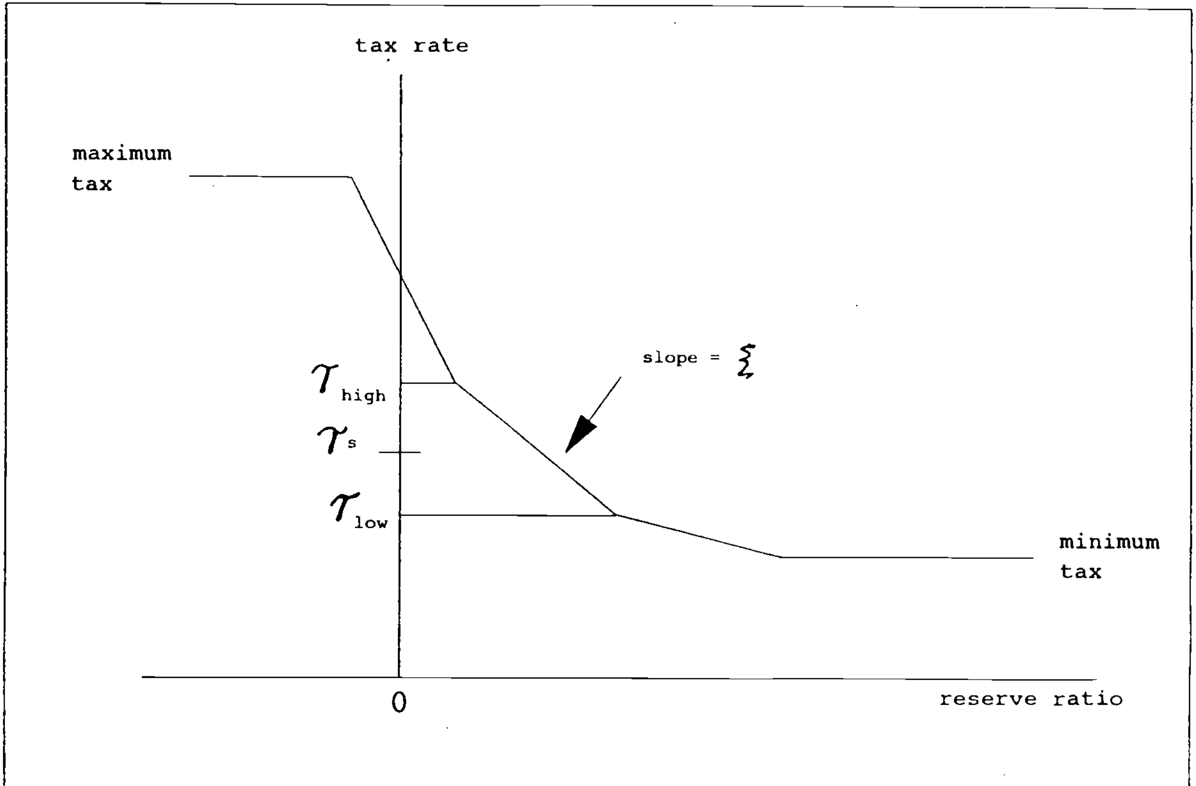


Figure 2: Tax Schedules Averaged over all Reserve Ratio States (selected years)

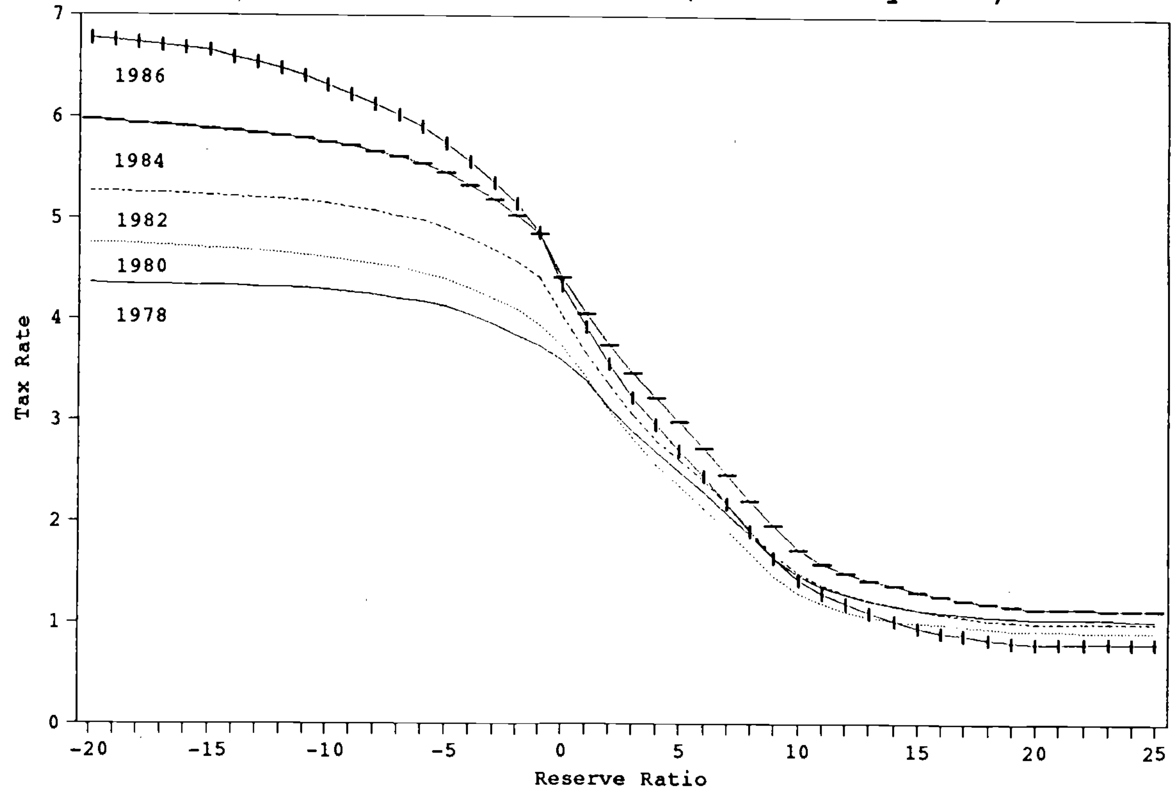


Figure 3: Distribution of UI Tax Cost
for 36 States and 5 Industries

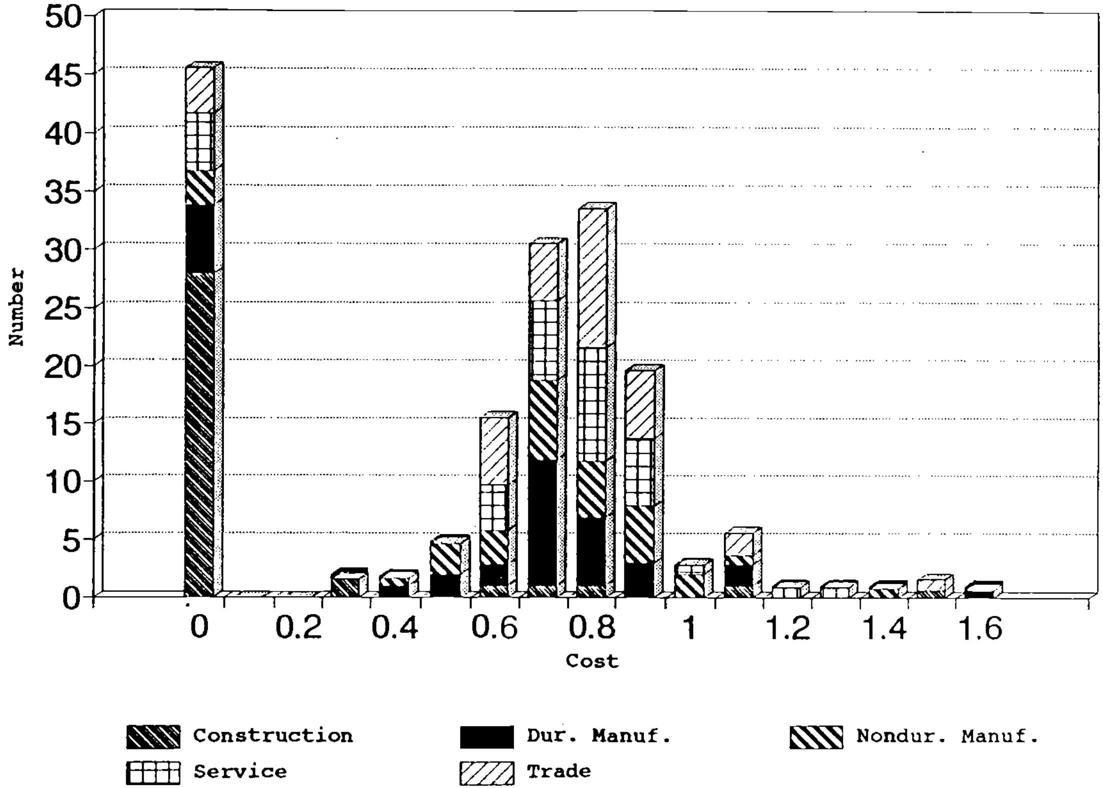


Figure 4

Components of Unemployment
Individuals in 5 Industries, 1979-87

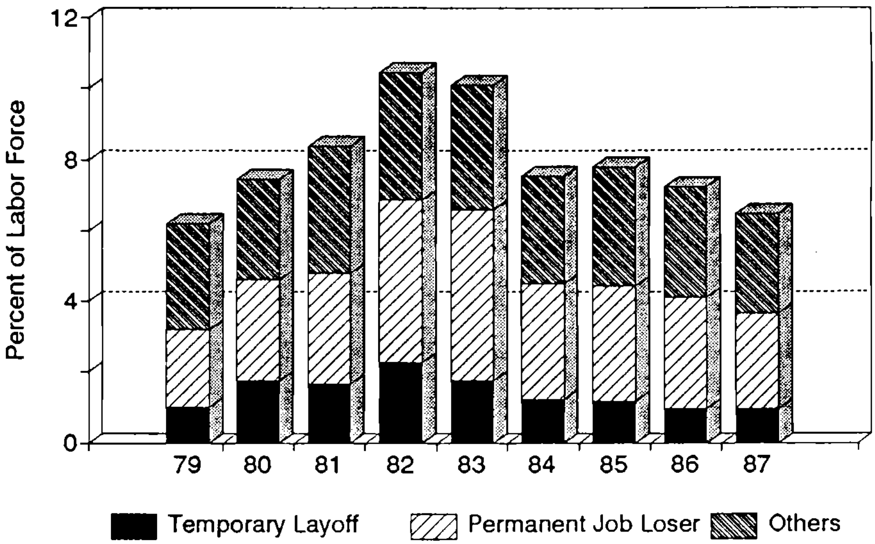


Figure 5

MTC Coefficients - Temporary Layoffs
By Industry and Year

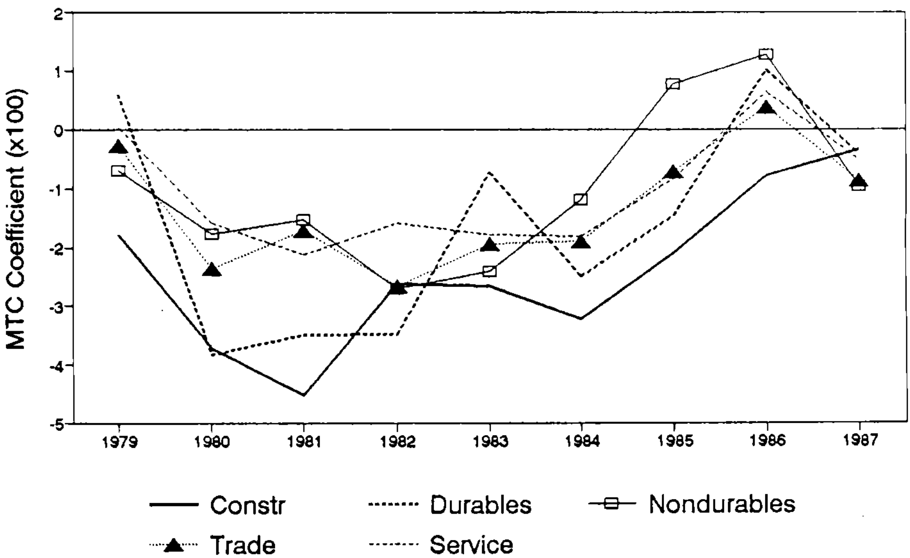
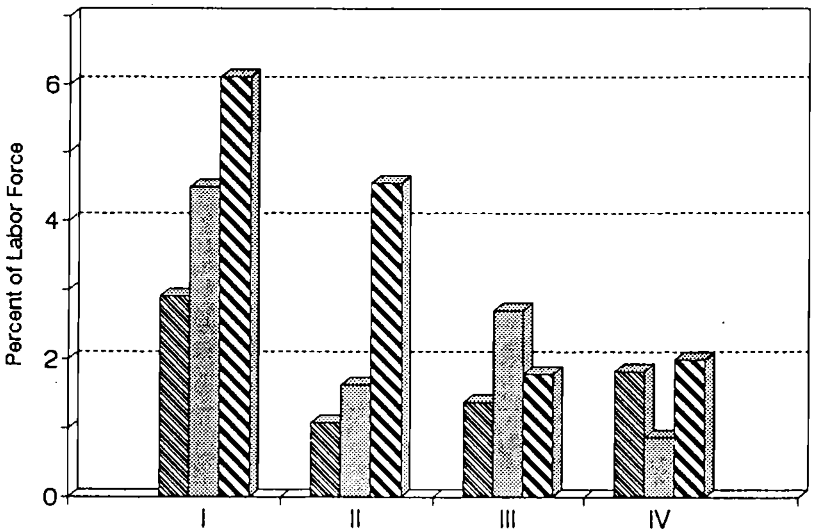


Figure 6

Quarterly Unemployment Rates
Southeast States Construction Industry

Temporary Layoffs



Non-Job-Losers

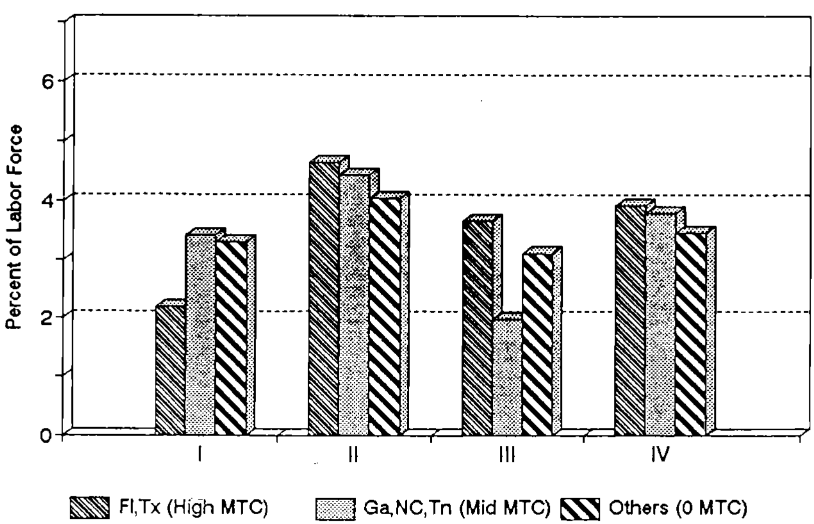
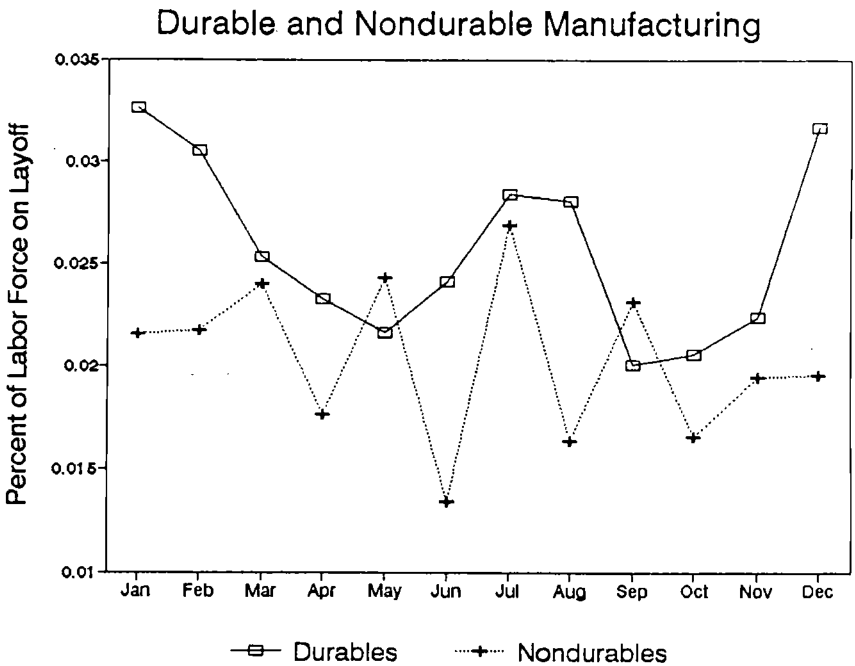


Figure 7
Temporary Layoff Unemployment Rates



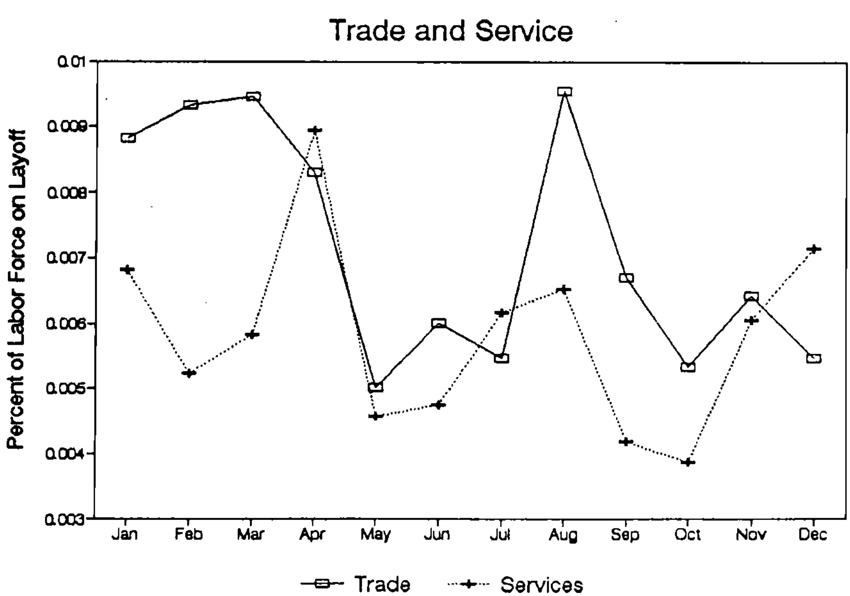


Table 1
Descriptive Characteristics of Sample

Industry:	All	Constr	Durable Mfg	Nondurable Mfg	Trade	Services
1. Average MTC	0.68	0.31	0.65	0.58	0.77	0.75
2. Avg Experience	15.5	15.4	18.1	18.3	13.0	15.4
3. Percent Age 16-24	29.3	31.5	21.1	22.1	39.6	26.0
4. Avg Education	12.3	11.6	12.2	11.7	12.2	12.9
5. Percent Female	47.9	9.9	31.8	46.0	50.9	64.5
6. Percent Nonwhite	12.7	10.6	12.0	14.5	11.0	14.5
Unemployment Rates:						
7. Temporary Layoff	1.40	3.77	2.58	2.03	0.72	0.58
8. Permanent Job Loss	3.36	7.21	3.34	3.62	3.10	2.59
9. Other	3.24	3.32	1.80	2.67	4.28	3.22
10. Number of States	36	35	34	31	36	36
11. Sample Size	187,598	14,103	31,752	23,392	58,590	59,761
12. Percent of Total	100.0	7.5	16.9	12.5	31.2	31.9

Note: Sample consists of individuals in the labor force (employed or unemployed) in the 12 monthly outgoing rotation group files of the Current Population Survey for each year from 1979 to 1987. Only individuals who report their current or previous industry as construction, manufacturing, trade, or services are included. Individuals from 15 states for which the UI tax costs are not available are also excluded. The sample is a random 1/2 sample of the total available observations.

Table 2

Linear Probability Models for the Likelihood of Unemployment
(standard errors in parentheses)

Cause of Unemployment:	Temp Layoff (1)	Perm Layoff (2)	Other (3)	Temp Layoff (4)	Perm Layoff (5)	Other (6)	Temp Layoff (7)	Perm Layoff (8)	Other (9)
1. MTC (x100)	-0.88	-0.93	0.12	-1.59	-0.42	0.34	-1.61	-0.46	0.32
	(0.08)	(0.12)	(0.12)	(0.16)	(0.24)	(0.24)	(0.16)	(0.24)	(0.24)
2. Experience (x1000)	0.25	1.51	-1.04	0.24	1.49	-1.02	0.22	1.48	-1.03
	(0.08)	(0.12)	(0.12)	(0.08)	(0.13)	(0.12)	(0.08)	(0.13)	(0.12)
3. Exp-Squared (x100,000)	-0.54	-3.52	0.89	-0.54	-3.48	0.89	-0.51	-3.46	0.90
	(0.16)	(0.25)	(0.24)	(0.16)	(0.25)	(0.24)	(0.16)	(0.25)	(0.24)
4. Youth (x100)	0.19	1.64	1.24	0.19	1.61	1.24	0.18	1.61	1.23
	(0.09)	(0.14)	(0.14)	(0.09)	(0.14)	(0.14)	(0.09)	(0.14)	(0.14)
5. Yrs Educ (x100)	-0.07	-0.30	-0.15	-0.08	-0.30	-0.15	-0.08	-0.30	-0.15
	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
6. Female (x100)	0.20	-1.19	1.60	0.19	-1.16	1.58	0.20	-1.16	1.58
	(0.06)	(0.10)	(0.09)	(0.08)	(0.10)	(0.10)	(0.06)	(0.10)	(0.10)
7. Nonwhite (x100)	0.08	3.25	1.95	0.28	3.23	2.00	0.28	3.24	2.00
	(0.08)	(0.13)	(0.12)	(0.09)	(0.13)	(0.13)	(0.09)	(0.13)	(0.13)
Other Control Variables:									
8. State Effects (35 states)	No	No	--	Yes	Yes	--	Yes	Yes	--
9. State*Year and Ind*Year Effects	No	No	Yes	No	No	Yes	No	No	Yes
10. R-squared	0.016	0.018	0.016	0.019	0.020	0.017	0.023	0.023	0.019

Notes: Sample consists of individuals in the labor force (employed or unemployed) who report their current or previous industry as either construction, manufacturing, trade, or services. See Table 1 for source of data. The dependent variables are indicators for unemployment status as a result of temporary layoff, permanent job loss, or other reason. All models include 9 occupation dummies, 4 industry dummies, and 8 year effects in addition to the control variables listed.

Table 3

Marginal Tax Cost Coefficients in Models
for the Probability of Unemployment
(standard errors in parentheses)

Cause of Unemployment:	Temp Layoff (1)	Perm Layoff (2)	Other (3)	Temp Layoff (4)	Perm Layoff (5)	Other (6)
MTC (x100) Interacted with Year:						
1. 1979	-1.03	0.41	0.41	-0.54	0.80	0.71
	(0.26)	(0.39)	(0.39)	(0.44)	(0.68)	(0.67)
2. 1980	-2.28	-0.25	-0.04	-2.74	-0.15	0.00
	(0.25)	(0.39)	(0.38)	(0.44)	(0.68)	(0.67)
3. 1981	-2.20	-0.04	0.42	-2.96	0.21	1.00
	(0.25)	(0.39)	(0.38)	(0.45)	(0.68)	(0.67)
4. 1982	-2.73	-2.25	1.01	-2.60	-0.98	0.95
	(0.27)	(0.41)	(0.40)	(0.49)	(0.75)	(0.74)
5. 1983	-1.60	-0.77	0.02	-2.01	-0.21	-0.48
	(0.26)	(0.40)	(0.39)	(0.48)	(0.73)	(0.72)
6. 1984	-1.59	-1.06	-0.51	-2.23	-1.92	-1.70
	(0.26)	(0.40)	(0.40)	(0.48)	(0.74)	(0.73)
7. 1985	-1.33	-0.58	0.69	-0.91	-2.09	1.01
	(0.26)	(0.41)	(0.40)	(0.49)	(0.75)	(0.74)
8. 1986	-0.38	-0.19	0.88	0.50	-0.06	0.96
	(0.27)	(0.41)	(0.40)	(0.50)	(0.76)	(0.75)
9. 1987	-1.09	0.70	0.31	-0.55	1.48	0.42
	(0.26)	(0.40)	(0.39)	(0.49)	(0.76)	(0.75)
10. State Effects	Yes	Yes	Yes	--	--	--
11. State*Year, Ind*Year Effects	No	No	No	Yes	Yes	Yes

Notes: See note to Table 2. All models include 9 occupation dummies, 4 industry dummies, 8 year effects and the covariates listed in rows 2-7 of Table 2.

Table 4

Instrumental Variables Estimates of
Marginal Tax Cost Coefficients in Models
for the Probability of Unemployment
(standard errors in parentheses)

Cause of Unemployment:	Temp Layoff (1)	Perm Layoff (2)	Other (3)	Temp Layoff (4)	Perm Layoff (5)	Other (6)
1. MTC (x100)	-2.81	-1.52	0.90	--	--	--
	(1.82)	(2.79)	(2.74)			
<u>MTC (x100) Interacted with Year:</u>						
2. 1979	--	--	--	-3.10	-1.62	0.78
				(1.86)	(2.84)	(2.79)
3. 1980	--	--	--	-3.01	-1.70	0.59
				(1.86)	(2.86)	(2.81)
4. 1981	--	--	--	-3.07	-1.49	0.26
				(1.86)	(2.85)	(2.81)
5. 1982	--	--	--	-2.47	-3.78	1.66
				(1.86)	(2.85)	(2.81)
6. 1983	--	--	--	-2.62	-1.55	0.91
				(1.86)	(2.85)	(2.80)
7. 1984	--	--	--	-2.98	-2.22	0.44
				(1.87)	(2.86)	(2.82)
8. 1985	--	--	--	-2.65	-1.60	1.21
				(1.87)	(2.87)	(2.82)
9. 1986	--	--	--	-1.96	0.06	1.45
				(1.84)	(2.83)	(2.78)
10. 1987	--	--	--	-2.90	0.49	1.47
				(1.84)	(2.83)	(2.78)

Notes: See note to Table 2. All models include 9 occupation dummies, 4 industry dummies, 8 year effects, state dummies, and the covariates listed in rows 2-7 of Table 2. Models are estimated by instrumental variables, using as an instrument for MTC (in columns 1-3) an estimate of MTC for the state and industry using national insured unmeployment rates, and using as instruments for the interactions of MTC and year dummies (columns 4-6) the interactions of the alternative MTC with year dummies. See text.

Table 5

Linear Probability Models for the Likelihood of Unemployment, By Industry
(standard errors in parenthesis)

Cause of Unemp't:	Construction			Durable Mfg			Nondurable Mfg			Trade			Services		
	Temp Layoff (1)	Perm Layoff (2)	Other (3)	Temp Layoff (4)	Perm Layoff (5)	Other (6)	Temp Layoff (7)	Perm Layoff (8)	Other (9)	Temp Layoff (10)	Perm Layoff (11)	Other (12)	Temp Layoff (13)	Perm Layoff (14)	Other (15)
<u>Coefficients from Pooled Model:</u>															
1. MTC	-2.45	-1.28	0.10	-1.68	0.69	0.73	-1.05	-0.64	0.51	-1.35	-0.71	0.34	-1.09	-0.03	0.06
(x100)	(0.23)	(0.35)	(0.34)	(0.25)	(0.38)	(0.37)	(0.23)	(0.35)	(0.35)	(0.28)	(0.42)	(0.42)	(0.23)	(0.35)	(0.34)
<u>Coefficients from Industry-Specific Models:</u>															
Estimated by OLS															
2. MTC	-2.30	-1.96	0.14	-1.56	-0.34	0.26	-0.45	-1.52	0.29	-0.46	-1.25	0.10	-0.23	-0.29	0.00
(x100)	(0.32)	(0.43)	(0.30)	(0.27)	(0.31)	(0.23)	(0.25)	(0.33)	(0.28)	(0.12)	(0.24)	(0.28)	(0.09)	(0.19)	(0.21)
Estimated by Instrumental Variables															
3. MTC	-26.83	23.23	3.92	-0.27	-0.90	0.29	-1.28	-1.40	0.39	-1.17	-1.56	0.59	-0.52	-0.61	0.27
(x100)	(8.86)	(11.20)	(7.05)	(0.44)	(0.50)	(0.37)	(0.38)	(0.50)	(0.43)	(0.18)	(0.38)	(0.44)	(0.44)	(0.27)	(0.31)

Note: See notes to Table 2. Models in row 1 are fit to all 5 industries simultaneously, with an interaction of industry and MTC. These models include unrestricted state effects. Models in rows 2 and 3 are fit by industry, and exclude state effects. Instrumental variables estimates use MTC calculated with national average insured unemployment rate as an instrument for the MTC (see text). Sample sizes and means of dependent variables are given in Table 1.

Table 6

Marginal Tax Cost Coefficients in Models for the Probability of Unemployment

(standard errors in parenthesis)

	Construction			Durable Mfg			Nondurable Mfg			Trade			Services		
Cause of Unemp't:	Temp Layoff (1)	Perm Layoff (2)	Other (3)	Temp Layoff (4)	Perm Layoff (5)	Other (6)	Temp Layoff (7)	Perm Layoff (8)	Other (9)	Temp Layoff (10)	Perm Layoff (11)	Other (12)	Temp Layoff (13)	Perm Layoff (14)	Other (15)
MTC (x100) Interacted with Year and Industry:															
1979	-1.78	1.90	1.83	0.60	1.85	1.65	-0.69	-0.94	0.06	-0.26	0.12	0.83	0.04	0.84	-0.66
	(0.87)	(1.03)	(1.01)	(0.69)	(1.08)	(1.04)	(0.65)	(0.99)	(1.00)	(0.81)	(1.20)	(1.24)	(0.87)	(1.01)	(1.00)
1980	-3.72	-1.88	-0.05	-3.83	-1.38	1.42	-1.78	-2.05	-1.12	-2.36	-1.11	0.40	-1.57	0.07	0.21
	(0.87)	(1.02)	(1.00)	(0.68)	(1.04)	(1.02)	(0.65)	(1.00)	(0.97)	(0.81)	(1.25)	(1.21)	(0.66)	(1.00)	(1.00)
1981	-4.53	-1.44	0.48	-3.50	1.66	2.31	-1.53	-0.27	0.07	-1.72	0.42	0.39	-2.12	1.51	1.46
	(0.86)	(1.01)	(0.98)	(0.68)	(1.04)	(1.02)	(0.66)	(1.00)	(1.00)	(0.79)	(1.20)	(1.18)	(0.65)	(1.00)	(0.99)
1982	-2.62	-0.34	-0.29	-3.47	0.09	1.08	-2.69	-0.68	2.50	-2.86	-0.86	1.93	-1.57	0.55	0.33
	(0.72)	(0.11)	(1.00)	(0.76)	(1.13)	(1.14)	(0.72)	(1.11)	(1.08)	(0.85)	(1.30)	(1.29)	(0.89)	(1.06)	(1.04)
1983	-2.66	0.76	0.49	-0.72	-0.90	-1.15	-2.41	0.29	-0.71	-1.94	-3.68	0.21	-1.79	-2.10	-0.66
	(0.69)	(1.05)	(1.04)	(0.75)	(1.15)	(1.13)	(0.69)	(1.07)	(1.03)	(0.82)	(1.25)	(1.24)	(0.68)	(1.04)	(1.01)
1984	-3.23	-2.93	-1.18	-2.49	-0.51	-1.76	-1.18	-2.21	-1.71	-1.90	-3.08	-2.16	-1.81	-1.71	-2.56
	(0.67)	(1.03)	(1.01)	(0.76)	(1.16)	(1.14)	(0.72)	(1.11)	(1.08)	(0.85)	(1.29)	(1.28)	(0.89)	(1.08)	(1.04)
1985	-2.09	-3.80	-0.35	-1.45	-0.07	0.04	0.78	-1.65	2.70	-0.71	-0.76	-0.78	-0.84	-1.62	1.29
	(0.87)	(1.02)	(1.00)	(0.78)	(1.17)	(1.00)	(0.74)	(1.12)	(1.10)	(0.86)	(1.29)	(1.30)	(0.70)	(1.08)	(1.06)
1986	-0.78	-2.08	0.28	1.02	0.49	-0.08	1.28	1.41	2.62	0.38	0.48	1.85	0.63	0.25	1.21
	(0.72)	(1.09)	(1.06)	(0.79)	(1.20)	(0.12)	(0.74)	(1.13)	(1.10)	(0.86)	(1.31)	(1.29)	(0.70)	(1.09)	(1.05)
1987	-0.33	0.78	-0.38	-0.40	4.47	2.48	-0.96	0.23	0.86	-0.87	1.50	0.08	-0.50	1.57	-0.90
	(0.69)	(1.04)	(1.03)	(0.80)	(1.21)	(1.19)	(0.73)	(1.10)	(1.10)	(0.84)	(1.31)	(1.33)	(0.69)	(1.07)	(1.05)

Note: Table reports estimated coefficients of MTC variable in linear probability model for the likelihood of unemployment among individuals in the labor force. Models are fit to all 5 industries simultaneously, and include state*year and industry*year effects in addition to the control variables listed in Table 2.

Table 7
Marginal Tax Cost Coefficients in Models for Probability of Unemployment
By Month and Reason for Unemployment
(standard errors in parentheses)

	Temporary Layoffs		Permanent Layoffs		Other	
	(1)	(2)	(3)	(4)	(5)	(6)
Marginal Tax Cost * Month:						
1. Month 1	-3.01	-2.30	-0.82	-0.48	0.20	0.34
	(0.29)	(0.35)	(0.44)	(0.53)	(0.43)	(0.53)
2. Month 2	-3.22	-2.52	-0.94	-0.12	0.04	0.43
	(0.29)	(0.34)	(0.44)	(0.52)	(0.43)	(0.51)
3. Month 3	-2.28	-2.19	-0.23	0.41	0.26	0.14
	(0.29)	(0.34)	(0.44)	(0.53)	(0.44)	(0.52)
4. Month 4	-1.18	-1.00	-0.47	-0.32	-0.10	-0.20
	(0.29)	(0.34)	(0.45)	(0.52)	(0.44)	(0.51)
5. Month 5	-1.92	-1.83	-0.82	-0.34	0.28	0.04
	(0.29)	(0.35)	(0.45)	(0.53)	(0.44)	(0.52)
6. Month 6	-1.03	-1.10	-0.13	-0.09	-0.21	0.08
	(0.29)	(0.36)	(0.45)	(0.55)	(0.44)	(0.54)
7. Month 7	-1.36	-1.56	-0.16	-0.61	0.97	0.54
	(0.29)	(0.34)	(0.44)	(0.52)	(0.43)	(0.52)
8. Month 8	-0.75	-0.86	-0.02	0.27	1.60	1.76
	(0.29)	(0.33)	(0.44)	(0.51)	(0.43)	(0.50)
9. Month 9	-1.38	-1.73	0.02	-0.08	0.42	0.10
	(0.29)	(0.33)	(0.44)	(0.51)	(0.44)	(0.50)
10. Month 10	-1.07	-1.34	-0.86	-1.22	0.17	0.12
	(0.29)	(0.34)	(0.44)	(0.52)	(0.44)	(0.51)
11. Month 11	-0.86	-1.11	-0.14	-0.91	-0.10	-0.33
	(0.29)	(0.35)	(0.45)	(0.54)	(0.44)	(0.53)
12. Month 12	-0.97	-1.47	-0.34	-1.62	0.47	0.77
	(0.29)	(0.36)	(0.44)	(0.56)	(0.44)	(0.55)
13. State, Ind Effects:	Yes	--	Yes	--	Yes	--
14. State*Month Ind*Month Effects:	No	Yes	No	Yes	No	Yes

Notes: See Table 1 and notes to Table 2 for definitions of dependent variables, means and standard deviations of dependent variables, and list of other control variables. Months are ranked by industry on the basis of average monthly temporary layoff unemployment rate over the 1979-87 period.

Table 8

Marginal Tax Cost Coefficients in Models for the Probability of Temporary Layoff
By Industry and Month

(standard errors in parentheses)

	Construction		Durable Mfg		Nondurable Mfg		Trade		Services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MTC (x100) Interacted By Month:										
3 Highest Layoff Months	-4.05	-3.20	-3.31	-2.13	-0.39	-0.07	-0.90	-0.15	-0.52	-0.50
	(0.64)	(0.90)	(0.54)	(0.77)	(0.50)	(0.70)	(0.24)	(0.34)	(0.18)	(0.25)
Next 3 Months	-2.51	-1.58	-0.75	0.48	-0.72	-0.39	-0.32	0.41	0.00	0.02
	(0.63)	(0.90)	(0.55)	(0.78)	(0.49)	(0.70)	(0.24)	(0.34)	(0.18)	(0.26)
Next 3 Months	-1.63	-0.66	-1.05	0.12	-0.32	0.03	0.09	0.81	-0.35	-0.34
	(0.63)	(0.89)	(0.53)	(0.76)	(0.50)	(0.70)	(0.24)	(0.34)	(0.18)	(0.26)
3 Lowest Layoff Months	-0.93	0	-1.11	0	-0.37	0	-0.73	0	-0.02	0
	(0.64)		(0.55)		(0.50)		(0.24)		(0.18)	
State Effects:	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Table reports estimated coefficients of MTC variable in linear probability model for the likelihood of a temporary layoff among individuals in the labor force of the appropriate industry. See Table 4 for sample sizes, means of the dependent variables, and list of other included covariates. In columns 2, 4, 6, 8, and 10 the MTC*(3 Lowest Layoff Months) coefficient is normalized to 0. Months are ranked by industry on the basis of average monthly temporary layoff unemployment rates over the 1979-87 period.