THE DETERMINANTS OF SHIRKING:

ANALYSIS AND EVIDENCE ON JOB LOSER UNEMPLOYMENT

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INTRODUCTION

In the efficiency wage model, unemployment is a worker discipline device [Shapiro and Stiglitz 1984]. Firms have an incentive to pay an efficiency wage that yields an unemployment rate above equilibrium. Because there is a real cost to losing one's job and entering the pool of unemployed workers, individuals have an incentive to work on the job rather than to shirk. In the absence of unemployment, there is no market penalty for being fired. When effort is modeled as an all or nothing choice, no one shirks in equilibrium. To remove the all or nothing restriction, Bowles [1985] recognizes the marginal trade-off created by costly monitoring of workers. When the efficiency wage model is extended to permit a continuous level of effort, the individual worker makes a marginal decision as to the extent of shirking appropriate for a given job. The more an individual shirks the greater the risk of being fired. To measure this component of worker behavior empirically, one can turn to the unemployment rate.

The unemployment rate captures the search behavior of job losers, as well as new entrants or reentrants to the labor force. The behavior of these unemployed groups can display significant differences. This paper extends the Shapiro and Stiglitz [1984] model to include an analysis of equilibrium job loss from shirking and empirically tests for the relationship between labor market conditions and job loss. This process identifies empirical differences between job losers and other unemployed members of the labor force.

The equilibrium level of job loser unemployment is shown to fluctuate given the degree to which firms monitor shirking over the business cycle. While this extension does not change the core results of the efficiency wage model, it does provide some additional insights. For example, in equilibrium, everyone shirks some. Consequently, on the job leisure is a form of employee benefit that is regulated by the extent to which the firm monitors, reprimands, and fires shirkers. Across the business cycle

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the firm's shadow price of turnover changes, and hence does the equilibrium level of job losers.

In the first section of the paper the Shapiro and Stiglitz [1984] model of unemployment is extended to include a representation of equilibrium in which workers may choose to shirk. The firm's monitoring problem is modeled with the tolerance of shirking subject to its cost as determined by market forces. The firm therefore views the degree of shirking as a form of compensation like other employee perks. The model presented provides a microfoundation for the job loser portion of unemployment.

The model addresses the following concerns: does equilibrium unemployment for job losers differ from that of other unemployed workers? If indeed there are differences, can they be explained by the theoretical model? In the third section, the empirical implications from the microfoundations are discussed. After the methodology is reviewed, an empirical model is developed to analyze the behavior of job loser unemployment rates at the state level. The state-level data permit an analysis of the correlation of unemployment rate components with productivity and GSP. Then, the state-level data is used to estimate the Phillip's Curve relationship. These estimations are performed using annual data from 1986 through 1994, for a panel of the 48 contiguous states. The final section concludes the analysis.

THE THEORETICAL FRAMEWORK

The equilibrium level of shirking will depend on individual preferences, including risk preferences. Since firms may choose to tolerate shirking as a form of employee compensation, levels of shirking differ among firms. The resulting level of shirking can therefore be viewed either as the consumer equilibrium for the worker facing income constraints associated with potential job loss, or as the firm's employment decision subject to labor supply constraints. Both formulations are developed.[1] Over time, the equilibrium level of shirking within the economy may increase or decrease along with easily measured economic variables, such as unemployment rates and wages.

Microfoundations of Shirking

Consider the individual with a utility function $U(x_t, \gamma_t)$, who, at any time period t, consumes goods x_t with price p_t and a rate of on the job leisure γ_t, where $0 \leq \gamma_t \leq 1$. The individual's consumption decision is subject to a budget constraint, represented by Equation (1):

$$p_t x_t = w_t(1 - \beta_t - \gamma_t q_t) + b_t(\beta_t + \gamma_t q_t) \ . \tag{1}$$

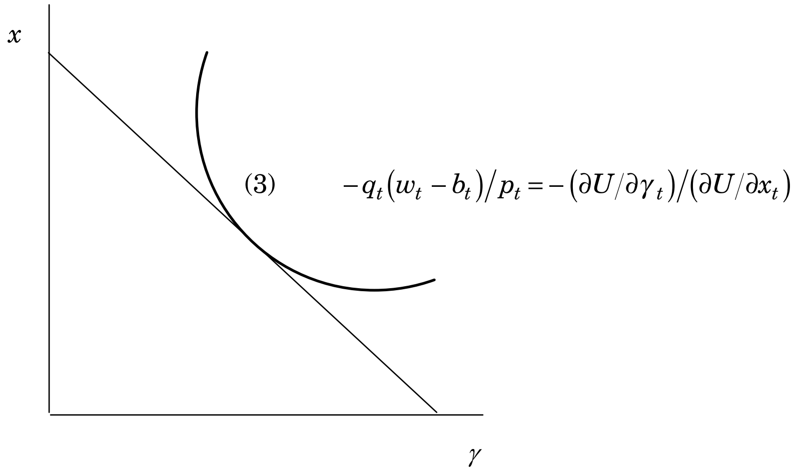
Here wages are represented by w_t. The probability of working is $0 \leq (1 - \beta_t - \gamma_t q_t) \leq 1$. The unemployed individual receives benefits b_t. The probability of unemployment is $0 \leq (\beta_t + \gamma_t q_t) \leq 1$. The probability of being caught shirking is the product of the probability of being monitored, q_t, times the probability that the worker is shirking, γ_t. The probability of losing work for other reasons is captured by β_t. This choice is made and discounted over the individual's lifetime Ω. The individual maximizes lifetime utility, V_1 given by Equation (2), subject to the budget constraint, given by Equation (1).

(2) $$V_1 = \int_0^{\Omega} \{U(x_t, \gamma_t)\} e^{-rt} dt.$$

An interior solution to the optimization problem is assumed. The shadow price on the individual's budget constraint will be represented by λ_{t1}. Finding the usual first-order conditions and solving, in equilibrium:

(3) $$(\partial U/\partial \gamma_t)/(\partial U/\partial x_t) = q_t(w_t - b_t)/p_t.$$

FIGURE 1



The marginal cost of shirking is just the probability of getting caught times the wages lost from a period of unemployment. The consumer equilibrium, as displayed in Figure 1, requires that the ratio of the marginal cost of shirking, $q_t(w_t - b_t)$, relative to the price of the consumption good, p_t, is equal to the ratio of the marginal benefit of shirking relative to the marginal benefit of the consumption good. The utility analysis of the worker implies a demand for on-the-job leisure.

Microfoundations of Firm Monitoring Cost

In equilibrium, the extent to which a worker chooses to consume on-the-job leisure through shirking depends on the probability of being monitored. This raises the question, why might the extent of monitoring workers differ among firms?

Firms that hire workers in a competitive labor market will not face equal turnover costs if they differ in their production processes. If labor is specialized or firm-specific training costs are high, then the firm will adopt strategies to minimize turnover. Pencavel [1972] finds that firms that provide on-the-job training also offer higher wages to reduce voluntary turnover. Parker and Rhine [1991] develop a model in which nonwage compensation is manipulated to attract stable workers and reduce quits. Again, the level of turnover depends not just on the level of total compensation, but also the compensation mix. Dye and Antle [1984] show that workers with heterogeneous preferences do self-select into firms based on the compensation mix offered.

Part of the compensation mix could be viewed as the tolerance of shirking. Following this line of reasoning, a monitoring system that allows some shirking is just a non-monetary benefit that may be used to reduce costly turnover.

Let the firm's production function be represented by $f(N_t^*)$, $f'(N_t^*) > 0$, $f''(N_t^*) < 0$, where N_t^* represents the actual labor effort of the work force. It can be represented by the number of workers reduced by the degree of shirking, $N_t^* = (1-\gamma_t^*)N_t$. Output is sold at price P_t. Thus total revenue is $P_t f(N_t^*)$ and the value of the marginal product of effective labor, N_t^*, is $\partial U/\partial N_t^* = P_t f'(N_t^*)$. The value of the marginal product of another worker, N_t, is $\partial U/\partial N_t = (1-\gamma_t^*)P_t f'(N_t^*)$. The value of the marginal impact on productivity from changing the allowed shirking rate is $\partial U/\partial \gamma_t^* = -N_t P_t f'(N_t^*)$.

Workers will be fired if they are caught shirking more than allowed by the firm. This implies some type of monitoring operation by the firm to identify those workers who exceed the expected level of shirking. Monitoring costs are assumed to be proportional to the size of the labor force, $\theta_t N_t$. The number of people fired for shirking will be a function of the shirking beyond that allowed and the wage paid. The rate of workers fired is then $Q(\gamma_t^*)$, $Q' > 0$. New hires are a function of wages and the working conditions, such as the level of shirking permitted. The functional relation $L(W_t, \gamma_t^*)$ is quasi-concave, with $L_1 > 0$, $L_2 > 0$, $L_{11} < 0$, and $L_{22} < 0$. The change in the workforce, shown in Equation (4), is given by the difference between the number of workers who are hired, $L(W_t, \gamma_t^*)$; who are fired, Q_t; and who lose their job for other reasons, β_t. (The rate of workers losing their jobs for other reasons, β_t, is the same as represented in the worker model of the previous section.)

(4) $$\dot{N} = L\left(W_t, \gamma_t^*\right) - \beta_t N_t - Q_t N_t; \quad L \geq 0.$$

Turnover is costly, particularly when the firm's production process requires specific training. Hiring and training costs are increasing in the number of accessions, $sg(L(W_t, \gamma_t^*))$, $g' > 0$, $g'' < 0$. The coefficient, s, is the ratio of specific to general training and is assumed constant. Turnover costs increase as s increases. Given a wage W_t and monitoring costs of the labor force θ_t, profit is defined as

(5) $$P_t f\left(N_t^*\right) - W_t N_t - \theta_t N_t - sg\left(L\left(W_t, \gamma_t^*\right)\right).$$

The compensation package, W_t and γ_t^*, is selected by the firm to maximize profits, V_2 given in Equation (6), discounted at a rate R, subject to the change in the work force, given by Equation (4), and some initial condition on employment, say, $N(0) = N_0$.

(6) $$V_2 = \int_0^\infty \left\{P_t f\left(N_t^*\right) - W_t N_t - \theta_t N_t - sg\left(L\left(W_t, \gamma_t^*\right)\right)\right\} e^{-Rt} dt.$$

The variable λ_{t2} is used to represent the costate variable that is interpreted as the shadow price associated with labor force adjustments. In addition to the equation of motion and boundary conditions, an interior solution to the optimization problem is assumed, and optimization includes the equations:

(7) $$\lambda_{t2} L_1 = N_t + sg' L_1,$$

$$\lambda_{t2}\,(L_2 - Q'N_t) = N_t P_t \mathrm{f}\,'(N_t^*) + sg'L_2\text{, and} \tag{8}$$

$$(1 - \gamma_t^*)P_t \mathrm{f}\,'(N_t^*) + \lambda'_{t2} = W_t + \theta_t + \lambda_{t2}(\beta_t + Q_t + R)\ , \tag{9}$$

and the transversality condition

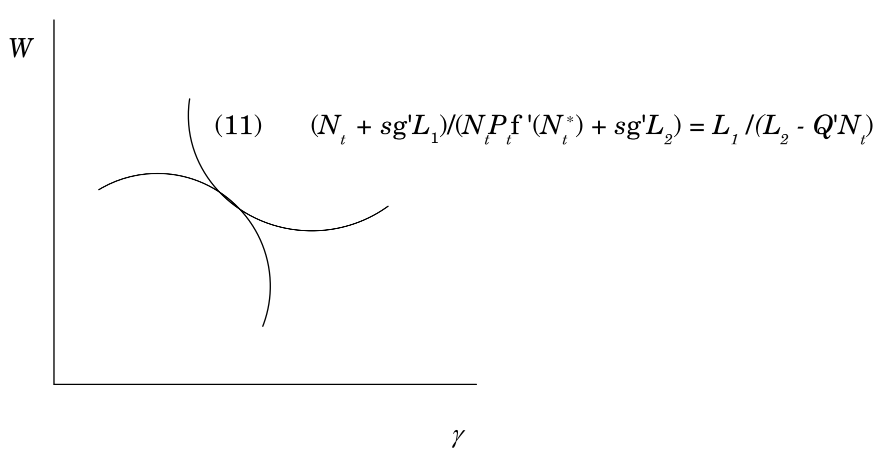
$$\lim_{t\to\infty} \lambda_{t2} e^{-Rt} N_t = 0. \tag{10}$$

Equations (7) and (8) provide an interpretation of the necessary conditions for selecting the optimal values for the control variables. Increasing either type of compensation yields marginal gains through attracting new hires as measured through L_1 and L_2. When the permitted shirking is increased, fewer people are fired and there are marginal gains from the reduced turnover costs, Q'. Equations (7) and (8) each demonstrate that the marginal benefits will equal the marginal cost for each element of the compensation package. Solving Equations (7) and (8), the firm will minimize costs where

$$(N_t + sg'L_1)/(N_t P_t \mathrm{f}\,'(N_t^*) + sg'L_2) = L_1\,/(L_2 - Q'N_t). \tag{11}$$

Equation (9) is the equilibrium condition for the costate variable, λ_{t2}, with the additional condition that the flow equilibrium is equal to zero. The variable λ_{t2} is the shadow price associated with labor force adjustments. The term λ'_{t2} is the derivative of λ_{t2} with respect to N_t. This is interpreted as the rate of change in the shadow price of an additional worker. Equation (9) states that the value of the marginal product of workers, $P_t \mathrm{f}\,'(N_t^*)$, plus the change in the shadow price of an additional worker, λ'_{t2}, will equal total compensation to the worker, W_t, plus the cost of shirking, $\gamma_t^* P_t \mathrm{f}\,'(N_t^*)$; monitoring costs, θ_t; and the turnover costs associated with hiring, firing, and training, $\lambda_{t2}(\beta_t + Q_t + R)$.

FIGURE 2



A graphical representation that illustrates the importance of specific training costs is given in Figure 2, with the slopes as indicated in Equation (11). The distribution of worker preferences will have the convex shape consistent with the microfoundations of diminishing marginal utility with respect to either form of compensation. The firm's training costs provide the concave curve. A firm with training costs such that $(N_t + sg'L_1)/(N_tP_tf'(N_t^*) + sg'L_2) > 1/P_tf'(N_t^*)$ will allow a greater degree of shirking than a firm with no specific training costs.

Workers face the cost-benefit analysis of consuming on-the-job leisure based upon the probability of being caught and fired by their particular employer. The model of firm monitoring costs demonstrates that different firms will choose different strategies for tolerating this shirking behavior based upon firm-specific turnover costs. The firm's compensation structure yields a marginal cost (supply) of permitting shirking within the work environment. The job loser unemployment rate is the aggregate job loss from the various firm-worker interactions across the economy. Job loss beyond that attributed to other economic conditions, β_t, reflects changes in shirking equilibrium or the supply of on-the-job leisure.

EMPIRICAL IMPLICATIONS FROM THE MICROFOUNDATIONS

The implications of this exercise go beyond a demonstration that all workers who value on-the-job leisure shirk some and all firms tolerate some degree of shirking. Now that the microfoundations have been established to allow a continuous level of shirking, the model indicates that the opportunity cost of shirking for both workers and firms is dependent on economic variables. The utility analysis of the worker implies a demand for on-the-job leisure. Similarly, the analysis of the firm's compensation structure yields a marginal cost (supply) of permitting shirking within the work environment. The extent of shirking, therefore, shifts with economic conditions that impact the firm or the worker. The firm's marginal cost of shirking is determined by turnover costs. These costs differ by sector and occupation. The mix of industry employment and education of the work force will reflect these turnover costs. This framework provides the potential to measure and track changes in worker effort.

The objective is to support this model and its implications empirically. Does evidence support the notion that when job loser unemployment rates are low the opportunity cost of shirking is reduced? Does the tolerance of shirking substitute for wage compensation? Does the generosity of unemployment insurance impact the decision to shirk?

These questions are addressed using annual data from 1986 through 1994 for a panel of the 48 contiguous states. A series of simultaneous equations are estimated to address the impact of shirking on state productivity, Gross State Product (GSP) growth, and wage inflation. As a proxy for the probability of job loss (either from economic conditions or from being caught shirking), $\beta_t + \gamma_t q_t$, job loser data from the Department of Labor is used.[2] The number of job losers is divided by the labor force to estimate a "job loser" unemployment rate. Job loss due to shirking will certainly be a component of this rate as well as other factors, such as plant closures and bankruptcies. To the extent that job loss due to firings is a significant source of the dynamics of this rate, then an analysis of its dynamics provides a useful contribution to our understanding of equilibrium shirking. The residual unemployed is categorized as the "adjusted" unemployment rate. Adjusted unemployment acts as an instrument for the probability of being unemployed for other reasons, β_t from Equation (1). Adjusted unemployment includes job leavers, temporary layoffs, reentrants, and new entrants. The sum of "job losers" and "adjusted" unemployment rates is the total unemployment rate.[3]

METHODOLOGY

The first set of estimations considers GSP growth and employment growth. Since productivity is measured by GSP divided by employment, the growth rate of productivity is the growth rate of GSP minus the growth rate of employment. A direct estimation of the impact of shirking on productivity is therefore hampered by the specification of the relationship among productivity growth, GSP growth, and employment growth. Instead, employment growth and GSP growth are estimated. A two-stage least squares estimation is specified to capture the link from job loser unemployment and each of these measures. The econometric approach follows Pantuosco, Parker, and Stone [2001].

The next two pairs of equations estimate the classic Phillips relation as a pair of simultaneous equations using the approach of Hyclak and Johnes [1992]. First, the job loser unemployment rate is estimated in conjunction with wage inflation. In the last estimation, the adjusted unemployment rate is simultaneously estimated with wage inflation. This provides alternate instruments for the impact of the unemployment equation on wage inflation. The pairs of equations were preselected because of their theoretical and empirical endogeneity. The use of a system of simultaneous equations controls for multicollinearity and is a preferred method for testing in the presence of heteroscedasticity. The simultaneous equations technique is estimated using a three-stage least squares estimation with instrumental variables.

Econometric concerns, such as multicollinearity, autocorrelation, and heteroscedasticity, exist when conducting a panel study. Single-equation unadjusted estimation techniques exaggerate these problems. In this paper several steps have been taken to address each issue. Using rates of change mitigates heteroscedasticity and autocorrelation. Incorporating lagged variables is a control for autocorrelation and provides a test for persistence.

PRODUCT MARKET EFFECTS

The following pair of equations addresses the determination of employment growth and GSP growth.

$$EMP = b_0 + b_1{*}JLUR_{-1} + b_2{*}ADJUSTEDUR_{-1} + b_3{*}GSP + b_4{*}\,WAGINF + e\ , \tag{12}$$

$$GSP = a_0 + a_1{*}\,JLUR_{-1} + a_2{*}ADJUSTEDUR_{-1} + a_3{*}GSP_{-1} + a_4{*}CHPOP + a_5{*}EMP + e\ , \tag{13}$$

where *EMP* is the employment growth rate; *GSP* is the growth rate of the GSP; *JLUR* is the unemployment rate of job losers;[4] *ADJUSTEDUR* is the adjusted unemployment rate, which is the residual after job losers are subtracted from the total unemployed; *WAGINF* is wage inflation; and *CHPOP* is the change in population. All data are annual at the state level.

The extended Shapiro-Stiglitz model presented in the previous section communicates the relationship between productivity, employment, and the job loser unemployment rate due to shirking. Companies that closely monitor shirking fire shirkers. When GSP and other economic conditions are controlled for, an aggressive monitoring system is evidenced by an increase in the unemployment rate of job losers. Here the productivity gains are achieved through reduced employment. When the unemployment rate for job losers is high, employment growth is low. The job loser unemployment rate will be negatively correlated with employment growth.

The relationship between employment growth and adjusted unemployment is dependent on the reason for unemployment. For example, reentrants and new entrants may be responding to the same economic signals that permit an employed worker to consume more on-the-job leisure. However, workers who become voluntarily unemployed may be more productive employees who are searching for a better opportunity or greater compensation for their efforts. Workers who shirk may be less likely to leave their jobs. For this reason, there are ambiguous indicators of the relationship between adjusted unemployment and employment growth.

The efficiency wage theory states that employers pay above-market wages to encourage greater productivity and less turnover [Katz, 1986]. Some union literature claims that the above-market wages obtained by unions increase worker productivity [Freeman and Medoff, 1984; and Belman, 1992]. Hirsch [1997] suggests the possibility of a shock effect, in which management in high-paying firms is forced to organize, reducing employment and producing more efficiently to survive. In each framework, the correlation between wage inflation and employment growth is negative.

Consider the relationship between the job loser unemployment rate and GSP growth. Increases in the job loser unemployment rate represent an equilibrium reduction in shirking while decreases in this rate indicate that companies are permitting greater consumption of on-the-job leisure without penalty. If, as indicated in the model, shirking is a form of employee compensation, then decreases in job loser unemployment are an efficient response to labor markets. Consequently, a negative relationship between the job loser unemployment rate and GSP growth would support the claim that permitting shirking is an efficient adjustment of labor market equilibrium.

Search unemployment, new entrants, and reentrants into the labor force tend to rise with the business cycle [Eberts and Stone, 1992], while temporary layoffs are countercyclical. If the coefficient on adjusted unemployment, a_2, is positive, there is evidence to support the claim that the variation in adjusted unemployment stems from cyclical components. A negative coefficient could indicate fluctuations in layoffs.

Columns 1 and 2 of Table 1 show the results from the estimation of the simultaneous Equations (12) and (13). The separation of the unemployment rate into component parts of job losers and adjusted unemployed reveals some statistically significant differences.

The clearest difference is in the GSP equation. The job loser unemployment rate is negatively correlated with GSP, while increases in other types of unemployment are positively correlated with GSP. This dynamic is consistent with the shirking model presented earlier. Reductions in the monitoring of work effort reduce the number of workers fired, and the job loser unemployment rate decreases. Firms engage in this behavior as an efficient form of compensation that serves to enhance economic growth. The adjusted unemployment rate is capturing the cyclical incentives to engage in search. Employment growth has a positive significant impact on GSP while population growth has a positive significant impact on GSP growth.

TABLE 1

	(1) *EMP*	(2) *GSP*
Constant	0.013*	0.034*
	(2.94)	(6.0)
JLUR	–0.265*	–0.694*
	(2.58)	(4.50)
ADJUSTED	0.171	0.119
	(1.35)	(0.64)
EMP		0.339*
		(3.76)
GSP	0.446*	
	(8.9)	
WAGINF	–0.206*	
	(3.43)	
CHPOP		0.448*
		(3.68)
LAGGSP		0.066
		(1.23)

Absolute t-statistics in parentheses.
N = 432.
* Significant at .01.
** Significant at .05.
*** Significant at .10.

The job loser unemployment rate is negatively and significantly correlated with employment growth. Again there are statistically different coefficients for the job loser unemployment rate and the adjusted unemployment rate. As expected, wage inflation is negatively and significantly correlated with employment growth. The coefficient for *GSP* on employment growth is positive and significant. When economic growth occurs, jobs are created.

In summary, the empirical results indicate that the job loser unemployment rate does behave like an efficient form of employee compensation in equilibrium. The job loser unemployment rate is negatively correlated with employment growth and GSP. This is consistent with the argument that efficient reductions in job loser unemployment as shirking is permitted contribute to growth in GSP and employment. Since the coefficient for the GSP equation exceeds that in the employment equation, productivity would also be expected to rise as predicted. Wage inflation is negatively correlated with employment growth, as expected. By comparison, the adjusted unemployment rate is positively correlated with both GSP and employment growth. While the coefficients on adjusted unemployment are not significantly different from zero, they are significantly different from the coefficients on the job loser unemployment rate.

LABOR MARKET EFFECTS

The second pair of simultaneous equations addresses the joint determination of the job loser unemployment rates and wage inflation.

(14) $$JLUR = b_0 + b_1{*}UR_{-1} + b_2{*}BEN_{-1} + b_3{*}PUBUNION + b_4{*}GSP_{-1} + b_5{*}WAGINF + b_6{*}MANEMP + b_7{*}EDUC + e\ ,$$

(15) $$WAGINF = a_0 + a_1{*}JLUR + a_2{*}ADJUSTEDUR + e\ ,$$

where *JLUR* is the job loser unemployment rate; *WAGINF* is the rate of wage inflation; *UR* is the unemployment rate; *PUBUNION* is the percent of public employees who are union members; *GSP* is the GSP growth rate; *BEN* is a measure of unemployment insurance generosity; *MANEMP* is the percentage of employment in the manufacturing sector; *EDUC* is the percentage of college graduates; and *ADJUSTEDUR* is the adjusted unemployment rate.[5] Using the job loser unemployment rate as the dependent variable captures the effects from the unemployment equation as incorporated through job loss.

As the generosity of unemployment insurance increases, the cost of shirking decreases. On the labor supply side, the first-order conditions from Equation (2) indicate that an increase in unemployment insurance benefits received, b, increases shirking. From the firm's perspective, the corporations in states where unemployment insurance is generous must treat this as a form of employee compensation. Therefore, employers are more likely to treat this generosity as a substitute form of compensation and monitor workers in generous states; hence, the rate of workers fired, Q, rises. Since fired employees are not eligible for unemployment insurance it suits firms to monitor workers' behavior.

Allen [1988] claims that public union members are less likely to lose their jobs during economic downturns. Allen [1988] attributes the volatility of employment in the private sector to the less sensitive occupations of public sector employees. Contrary to private unions, public sector unions tend to have positive employment effects. In the presence of shirking, unionized public workers are less likely to be fired than private sector and nonunion employees.

Another factor that influences a state's job loser unemployment rate is GSP growth. The tighter labor market affiliated with GSP growth causes the firm's turnover cost, $(\beta + Q + r)$, to increase. Topel [1986] and Bartik [1991] find a negative relationship between unemployment and GSP growth. As output and demand for labor increase, firms are forced to accept some shirking to mitigate turnover costs.

Wage inflation is added to the unemployment equation as a feedback term and the lagged unemployment rate is inserted as an exogenous indicator of labor market pressure. The coefficient for the unemployment variable in the wage inflation equation captures the Phillips relation [Hyclak and Johnes, 1992; Phillips, 1958]. An increase in the job loser unemployment rate reduces wage pressure on employers. An increase in adjusted unemployment also increases opportunities for employers to fill positions and/or replace workers.

In terms of the theoretical model, shirking is reduced when firms monitor worker performance and provide on-the-job training. Both of these conditions are prevalent in the manufacturing sector. Therefore, shirking is more easily exposed and perhaps less likely in the manufacturing sector. An increase in the percentage of manufacturing employment would result in a reduction in shirking and a lower job loser unemployment rate. Another interpretation of the empirical relationship between manufacturing employment and the job loser unemployment rate is that states that attract manufacturing employment are expected to have lower unemployment and fewer job losers. Likewise, a lower percentage of manufacturing jobs over time increases the likelihood of job loser unemployment [Jacobson, 1987].

The consumer behavior model specifies that wages and benefits are a vital component in the decision to shirk. Since education is linked to human capital and wage increases, the opportunity cost of shirking increases with education [Kim and Kim, 2000; Tremblay, 1986]. Also, educated professionals work independently of their co-workers, but more closely with customers; therefore, formal monitoring is less likely in professional occupations. In essence, the professional worker's desire to maintain or enhance his reputation is what guides him [Mintzberg, 1983]. With these considerations in mind, educational attainment is expected to decrease shirking and the job loser unemployment rate.

The estimations for Equations (14) and (15) are displayed in columns 1 and 2 of Table 2. As shown in the wage inflation equation, column 2, the two component unemployment rates have similar impacts. The negative correlation between unemployment and wage inflation is observed.

TABLE 2

	(1) *JLUR*	(2) *WAGINF*	(3) *ADJUSTED*	(4) *WAGINF*
Constant	–0.075*	0.056*	0.028*	0.069*
	(5.57)	(18.01)	(10.47)	(18.2)
JLUR		–0.275*		0.207**
		(2.48)		(2.14)
ADJUSTED		–0.380*		–1.28*
		(2.94)		(7.89)
FEEDBACK	1.398*		–0.079	
	(5.55)		(1.3)	
LAGGSP	–0.081*		–0.03*	
	(5.47)		(3.13)	
LAGUR	0.881*		0.282*	
	(9.69)		(13.15)	
PUBUN	–0.0001***			
	(1.93)			
LAGBEN	0.00007*		–0.00003*	
	(5.63)		(5.8)	
MANEMP	–0.0012**		–0.015*	
	(2.27)		(2.94)	
EDUCATION	–0.00016*		–0.42*	
	(19.69)		(3.94)	

Absolute t-statistics in parentheses.
N = 432.
* Significant at .01.
** Significant at .05.
*** Significant at .10.

The control variables behave as expected. *LAGGSP* is negatively correlated with the unemployment rate. The public union variable is negatively correlated with job losses, reflecting the heightened job security of public union workers. Benefits are positively correlated with the job loser unemployment rate. This is an alternate form of compensation that substitutes for tolerating shirking. *EDUC* reveals a significant negative correlation with the unemployment rate, reinforcing the concept that the opportunity cost for job loss is greater with a more educated work force. Similarly, *MANEMP* is negatively correlated with job loss. This evidence is consistent with the argument that manufacturing industries carry higher turnover costs and would, in equilibrium, display less job loss from shirking.

The third pair of simultaneous equations addresses the joint determination of the adjusted unemployment rates and wage inflation. Since our underlying analysis of shirking suggests that differences may exist between the unemployment components, the simultaneous estimation is repeated with the remaining unemployment rate as the dependent variable.

$$(16) \qquad ADJUSTEDUR = b_0 + b_1{*}UR_{-1} + b_2{*}GSP_{-1} + b_3{*}BEN_{-1} + b_4{*}WAGINF + b_5{*}MANEMP + b_6{*}EDUC + e\ ,$$

$$(17) \qquad WAGINF = a_0 + a_1{*}JLUR + a_2{*}ADJUSTEDUR + e\ ,$$

where *ADJUSTEDUR* is the adjusted unemployment rate; *WAGINF* is the rate of wage inflation; *UR* is the unemployment rate; *GSP* is the GSP growth rate; *BEN* is a measure of unemployment insurance generosity; *MANEMP* is the percentage of employment in the manufacturing sector; *EDUC* is the percentage of college graduates; and *JLUR* is the job loser unemployment rate.

In Equation (15), *JLUR* and *ADJUSTEDUR* influence wage inflation and the simultaneous effects are captured through the job loser unemployment rate as an instrument, while in Equation (17) these effects are captured through adjusted unemployment rate. If an increase in the job loser unemployment rate captures a decrease in the provision of shirking as a form of on the job compensation, then we would expect a positive correlation between the job loser unemployment rate and wage inflation. However, the remaining unemployment rate would still be expected to reveal the Phillip's relationship.

Unemployment insurance increases the reservation wage of the job seeker and encourages search unemployment [Moomaw, 1998; Meyer, 1990]. In spite of the ineligibility of job leavers, new entrants, and fired workers for collecting unemployment insurance, the increased duration of unemployment causes unemployment rates to be higher in states where benefits are generous [Pantuosco and Parker, 1998].

The estimation of Equations (16) and (17) is shown in columns 3 and 4 of Table 2. When the unemployment rate for job losers is entered as an independent variable in the wage inflation equation, it exhibits a positive correlation that is significantly different from that associated with the adjusted unemployment rate component. This is consistent with the explanation of shirking and wages as substitute forms of compensation. *EDUC* is again negative and significantly correlated with the unemployment rate, as is *MANEMP* capturing the industry mix. For each of these variables the coefficient is of a larger magnitude for the adjusted unemployment rate than for the job loser unemployment rate. While the direction of the dynamics is the same, this suggests a greater sensitivity for the adjusted unemployment rate than the job loser rate to these influences.

The other control variables are consistent with the previous specification, with the exception of benefits. Benefits are negatively correlated with adjusted unemployment rates. If benefits reflect state generosity, then more workers in a less generous state would initiate search unemployment. This illustrates another empirical difference between the performance of the job loser unemployment rate and the adjusted unemployment rate.

In summary, the labor market equations reveal the difference in the performance of the job loser unemployment rate and the adjusted unemployment rate as they relate to the business cycle. The cyclical link between unemployment and GSP is present in the adjusted unemployment rate rather than the job loser rate. These unemployment rates also differ in their relation to wage inflation and unemployment benefits.

CONCLUSION

The extended Shapiro-Stiglitz model suggests that economic factors influence the degree of shirking tolerated by the firm and attempted by the worker. Using the job loser unemployment rate as a proxy for shirkers monitored and dismissed, a number of correlations are revealed between economic conditions and shirking. Firms are more apt to fire shirkers during downturns and tolerate shirking during expansions. Shirking is greater in states where unemployment insurance benefits are generous. Public union employment decreases job loss, regardless of shirking. The adjusted unemployment rate exhibits the classic Phillips relation, while job loser unemployment reveals the substitutability between wage inflation and shirking. Both education and industry mix influence shirking and job loss. The more educated the work force and the greater the employment in manufacturing, the less shirking.

Even though the relationships have spurious components, the empirical analysis of state data justifies expanding the Shapiro-Stiglitz model to allow a continuous level of shirking. This expansion reveals dynamic changes in the tolerance of and willingness to shirk.

APPENDIX

Definitions (All data are at the state level.)

1. *UR*: the annual unemployment rate.
2. *JLUR*: the job loser unemployment rate.
3. *ADJUSTEDUR*: adjusted unemployment rate is the *UR* – *JLUR*.
4. *WAGINF*: the annual percentage change in the wage.
5. *PUBUN*: the percentage of public workers who are in unions.
6. *PROD*: the annual percentage change in the ratio of GSP/employment.
7. *GSP*: the annual percentage change in the gross state product.

8. *CHPOP*: the annual percentage change in the population.
9. *EMP*: the annual percentage change in the number of people employed.
10. *BEN*: the product of the replacement rate and the percent of the unemployed receiving unemployment insurance.
11. All *LAG* variables are one-year lags of the respective variable.
12. *MANEMP*: is the percentage of the employed in the manufacturing sector.
13. *EDUC*: is the percentage of the population over 25 years old with a Bachelor's degree.

Data Sources

1. Data on employment and unemployment are taken from the U.S. Department of Labor, Bureau of Labor Statistics.
2. Gross state product (GSP) data are from the U.S. Department of Commerce, Bureau of Economic Analysis.
3. Union membership data are from the United States Statistical Abstracts and diskettes from Hirsch and McPherson [1993] and Hirsch, McPherson, and DuMond [1997].
4. Wage data are from the U.S. Department of Labor, Employment and Training Administration.
5. Educational attainment data are from U.S. Census Bureau, 1990 Census of Population, CPH-L-96, and Current Population Reports, P20-528.
6. Manufacturing employment data are provided by U.S. Department of Labor, Bureau of Labor Statistics.

NOTES

1. For a formal statement of the necessary conditions for the more general dynamic optimization problem see Intrilligator [1971]. In general, the state variables are continuous function of time, the control variables are piecewise continuous, and the control trajectory is then a piecewise continuous vector value of time. Values for the control variables are constrained such that the control vector belongs to a nonempty, closed, bounded, convex subset of Euclidean space.
2. Specifically, Table 21, Geographic Profiles of the Employed and Unemployed, Bureau of Labor Statistics.
3. A chi-squared test was performed to estimate the difference between the impacts of the job loser unemployment rate and the adjusted unemployment rate on state economic activity.
4. The subscripted –1 indicates that the variable is lagged one year.
5. *BEN* is the product of the replacement rate and the percent of the unemployed collecting unemployment insurance.

REFERENCES

Allen, S. G. Unions and Job Security in the Public Sector, in *When Public Sector Workers Unionize*, edited by R. B. Freeman and C. Ichniowski. *A National Bureau of Economic Research Project Report*. Chicago: The University of Chicago Press, 1988.

Bartik, T. J. *Who Benefits From State and Local Economic Development Policies?* Kalamazoo, Mich.: W. E. Upjohn Institute for Employment Research, 1991.

Belman, D. Unions, the Quality of Labor Relations, and Firm Performance, in *Unions and Economic Competitiveness*, edited by L. Mishel and P. B. Voos. Armonk, N.Y.: M. E. Sharpe, Inc., 1992, 41-107.

Bowles, S. The Production Process in a Competitive Economy: Walrasian, Neo-Hobbesian and Marxian Models. *American Economic Review*, March 1985, 16-36.

Dye, R. A. and Antle, R. Self-Selection via Fringe Benefits. *Journal of Labor Economics*, July 1984, 388-411.

Eberts, R. W. and Stone, J. A. *Wage and Employment Adjustment in Local Labor Markets*. Kalamazoo, Mich.: W.E. Upjohn Institute for Employment Research, 1992

Freeman, R. B. and Medoff, J. L. *What Do Unions Do?* New York: Basic Books, 1984.

Hirsch, B. T. Unionization and Economic Performance, Evidence on Productivity, Profits, Investment, and Growth, in *Unions and Right-to-Work Laws*, edited by F. Mihlar. Vancouver: Fraser Institute, 1997.

Hirsch, B. T. and Macpherson, D. A. Union Membership and Coverage Files From the Current Population Surveys: Note. *Industrial and Labor Relations Review* April 1993, 574-78.

Hirsch, B. T., Macpherson, D. A., and DuMond, J. M. Workers' Compensation Recipiency in Union and Nonunion Workplaces. *Industrial and Labor Relations Review*, January 1997 213-36.

Hyclak T. and Johnes, G. *Wage Flexibility and Unemployment Dynamics in Regional Labor Markets*. Kalamazoo, Mich.: W. E. Upjohn Institute for Employment Research, 1992.

Intrilligator, M. D. *Mathematical Optimization and Economic Theory*. Englewood Cliffs, N.J.: Prentice Hall, 1971.

Jacobson, L. Labor Mobility and Structural Change in Pittsburgh. *Journal of the American Planning Association*, Fall 1987, 438-49.

Katz, L. Efficiency Wage Theories: A Partial Evaluation. *NBER Macroeconomics Annual 1986*, edited by S. Fischer. Cambridge, Mass., 1986.

Kim, S.-J. and Kim, Y. J. Growth Gains from Trade and Education. *Journal of International Economics*, April 2000, 519-46.

Meyer, B. D. Unemployment Insurance and Unemployment Spells. *Econometrica*. July 1990, 757-82.

Mintzberg, H. *Power in and Around Organizations*. Englewood Cliffs, N.J.: Prentice-Hall, 1983.

Moomaw, R. L. Experience Rating and the Generosity of Unemployment Insurance: Effects on County and Metropolitan Unemployment Rates. *Journal of Labor Research*, Summer 1998, 543-60.

Pantuosco, L. J. and Parker, D. Sources of Prevailing Differences in Unemployment Rates. *The Review of Regional Studies*, Fall 1998, 35-46.

Pantuosco, L., Parker, D., and Stone, G. The Effects of Unions on Labor Markets and Economic Growth: An Analysis of State Data. *Journal of Labor Research*, Winter 2001, 195-206.

Parker, D. F. and Rhine, S. Turnover Costs and the Wage-Fringe Mix. *Applied Economics*, April 1991, 617-22.

Pencavel, J. Wages, Specific Training and Labor Turnover in U.S. Manufacturing Industries. *International Economic Review*, February 1972, 53-64.

Phillips, A. W. The Relationship Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957. *Economica* 25, 1958, 283-99.

Shapiro, C. and Stiglitz, J. Equilibrium Unemployment as a Worker Discipline Device. *American Economic Review*, June 1984, 433-44.

Topel, R. H. Local Labor Markets. *Journal of Political Economy*, June 1986, 111-43.

Tremblay, C. H. The Impact of School and College Expenditures on the Wages of Southern and Non-Southern Workers. *Journal of Labor Research*, Spring 1986, 201-12.