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ARE ADJUSTMENT COSTS FOR LABOR ASYMMETRIC?

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ABSTRACT

In this paper we analyze the structure of adjustment costs for labor. In particular the question whether hiring and firing costs are asymmetric is addressed. We maintain the standard assumption of quadratic adjustment costs, but allow the multiplicative coefficient to differ for the firing and hiring regime. The Euler equations for this problem can be combined into a general model that nests the one with symmetric adjustment costs. The model can be conveniently estimated and the parameter restrictions implied by symmetry easily tested. We also extend the model to allow for adjustment coefficients that depend upon macroeconomic conditions and proxies of union strength. In the empirical applications we use a panel data collected by CERIS on fifty two large Italian firms for the period 1958-1988. The general conclusion from the econometric testing is that the hypothesis of symmetric adjustment costs is rejected by the data. There is also evidence suggesting that the adjustment costs parameters are not constant over time.

Introduction

In the empirical modelling of labor demand, it is usually assumed that adjustment costs are symmetric and convex, and can be represented by a quadratic function. Although this is an analytically convenient device, there is no reason why hiring and firing workers should be equally costly, and moreover, there may be considerable lumpiness in changing employment (Nickell, 1986).

Recent econometric evidence has suggested that it may be fruitful to abandon the standard formulation of adjustment costs. Hamermesh (1989) and (1991) has addressed the issue of the existence of fixed components in adjustment costs[1]. Econometric estimates of reduced form labor demand models for seven individual US plants and for seven US airlines suggest that there is empirical support for a departure from standard formulations of adjustment costs. Moreover, using aggregate data , Smith (1984), Burgess (1988), Burgess and Dolado (1989) and Lucas and Fallon (1991) provide evidence that the speed of adjustment varies with labor market tightness, with changes in labor market legislation and with trade union power[2]. Pfann and Verspagen (1989), instead, propose an alternative flexible adjustment cost function that allows for asymmetry between hiring and firing costs. This function is then estimated for Dutch firms using balance sheet information on reorganization costs. The same functional form is also used in Pfann and Palm (1990) in estimating Euler equations for labor for aggregate Dutch and UK manufacturing. Chang and Stefanou (1988) estimate a multi variate flexible accelerator model for Pennsylvania dairy operators, derived from dynamic duality under the assumption of static expectations, and allow the parameters to differ between expansions and contractions. The results obtained in all these studies suggest that there is evidence against the symmetric form of adjustment costs.

In this paper we will also focus on the issue of asymmetry. We maintain the assumption of quadratic adjustment costs, but we allow the multiplicative coefficient to vary for the hiring and firing regime. We abandon the static expectation hypothesis, maintained in Chang and Stefanou (1988), and assume that expectations are formed rationally. The main implication is that, rougly speaking, a firm must consider not only the regime (hiring or firing) it is in today, but also the regime it expects to occur in the future. We suggest how the Euler equation for this problem can be formulated for the purpose of estimation. Our general model nests the one with symmetric adjustment costs, and the parameter restrictions implied by symmetry can be easily tested. The specification is then extended to allow the adjustment cost parameters that characterize each regime to depend upon the general state of the labor market and the strenght of trade unions.

In the empirical aplication a panel of fiftytwo large italian firms over the period 1958-1988 collected by Ceris will be used. The availability of panel data is essential in the investigation of asymmetries because it allows one to avoid the fundamentally insoluble problem of aggregating over firms in different regimes. Italy is moreover a very interesting case to study, because labor market legislation and other institutional constraints suggest that it may be quite costly to adjust employment (Emerson (1988), Bentolilla and Bertola (1990)).

The structure of the paper is as follows. In section 1 we develop the dynamic model of employment that will be the basis of our empirical work. In section 2 we discuss briefly the labor market legislation and other institutional features that affects the cost of adjusting employment in Italy. In section 3 we describe the data set that will be used and we present the econometric estimates of various versions of the model. Section 4 concludes the paper.

1. The Model

For illustrative purposes we will start from a model of a perfectly competitive firm with a quadratic production technology that depends only upon labor, L_t. The firm faces quadratic adjustment costs $C(X_t)$, that are a function of the gross addition to the numbers of workers, X_t. These costs are asymmetric so that we can write

$$C(X_t) = \begin{cases} \frac{\phi^h}{2} X_t^2 & \text{if } X_t \geq 0 \\ \frac{\phi^f}{2} X_t^2 & \text{if } X_t \leq 0 \end{cases} \qquad (1)$$

where, denoting with $1-\theta$ the exogenous quit rate:

$$L_t = X_t + \theta L_{t-1} \qquad (2)$$

The objective function for the firm can therefore be written as:

$$\max_{L_t} V_t = E_t \sum_j \beta^j [(f_0 + e_{t+j})L_{t+j} - \frac{f_1}{2} L^2_{t+j} - w_{t+j} L_{t+j} - C(X_{t+j})] \qquad (3)$$

e_t denotes a zero mean, serially uncorrelated stochastic shock to the production function, w_t is the real wage and ß the real discount factor, assumed to be constant purely for expositional simplicity. If gross hiring occur ($X_t > 0$), the Euler equation for employment can be rewritten as:

$$f_0 + e_t - f_1 L_t - \phi^h X_t - w_t + \beta\theta E_t[C'(X_{t+1})] = 0 \qquad (4)$$

Combaining (4) and (2) it is easy to show that for (4) to be the relevant Euler condition:

$$e_t > - f_0 + \theta f_1 L_{t-1} + w_t - \beta\theta E_t[C'(X_{t+1})] = b_t \qquad (5)$$

If firings occur ($X_t < 0$) the relevant Euler equation is as in (4) with ϕ^h replaced by ϕ^f.

$$f_0 + e_t - f_1 L_t - \phi^f X_t - w_t + \beta\theta E_t[C'(X_{t+1})] = 0 \qquad (6)$$

Equation (6) is the relevant Euler equation if $e_t < b_t$.

In order to estimate (4) and (6) we must discuss how to treat the term $E_t[C'(X_{t+1})]$. Define a random variable B_t such that:

$$B_t = \phi^h D_t X_t + \phi^f (1-D_t) X_t \qquad (7)$$

where the dummy variable D_t is such that, for all t's:

$$D_t = \begin{cases} 1 \text{ if } X_t > 0 \\ 0 \text{ otherwise} \end{cases} \qquad (8)$$

Note that $E_t[C'(X_{t+1})] = E_t(B_{t+1})$. The expectation of B_{t+1} can then be replaced by its actual value. A forecast error v_{t+1} is therefore introduced and an instrumental variable should be used for estimation. Moreover, since the error term in each Euler equation is truncated, a simple estimation strategy is to combine (4) and (6) in a single equation. The instrumental variable method can also deal with the endogeneity of the dummy variable D_t (See Heckman (1978)). Multiply (4) by D_t and (6) by $1-D_t$ and add the resulting equations together. Use (7) and (8) in the resulting equation. After some rearrangement we obtain:

$$L_t = \pi_0 + \pi_1 w_t + \pi_2(X_t - \beta\theta X_{t+1}) + \pi_3(D_t X_t - \beta\theta D_{t+1} X_{t+1}) + u_t \qquad (9)$$

$$\text{where } \pi_0 = \frac{f_0}{f_1};\ \pi_1 = -\frac{1}{f_1};\ \pi_2 = -\frac{\phi^f}{f_1};\ \pi_3 = \frac{\phi^f - \phi^h}{f_1}; \qquad (10)$$

$u_t = e_t + v_{t+1}$, where the expectational error v_{t+1} is uncorrelated with the elements of the information set. However, given the presence of e_t, the composite error u_t may have an MA(1) structure, and only lagged values of the endogenous variables should be used as instruments. The formulation of equation (9) allows us to test very easily for the importance of asymmetries in adjustment costs. If adjustment costs are symmetric, than $\phi^h = \phi^f$. It follows from (9) that $\pi_3 = 0$, so that we return to the standard Euler equation for labor with symmetric adjustment cost (Sargent (1979), ch. IX). In the formulation and estimation of (9) we assume that the quit rate, θ, is known and constant, and we will experiment with different values for it. This is imposed on us by data limitations since firm by firm or aggregate information on quit rates is not available. In the empirical application, instead, we allow for a variable discount factor, β_t.

The basic model of equation (9) can be easily extended to allow for monopolistic competition in the product market. If the demand function is, for instance, linear with an additive shift factor, the linearized version of the Euler equation will be identical to the one presented above with the exception of an additional regressor, representing the shift parameter in the output demand function. The inclusion of capital can also be handled, provided one mantains the assumption of additively separable adjustment costs. If we continue to use a quadratic approximation to the production function, this introduces the capital stock linearly on the right hand side in the various equations. Its coefficient should be positive if capital and labor are cooperant factors and negative otherwise. Another simple extension to the production technology is to assume that the production function is Cobb-Douglas[3]. In this case, denoting with α the elasticity of output with respect to the labor input, the Euler condition is:

$$\frac{Y_t}{L_t} = \pi_0 + \pi_1 w_t + \pi_2(X_t - \beta\theta X_{t+1}) + \pi_3(D_t X_t - \beta\theta D_{t+1} X_{t+1}) + u_t \qquad (11)$$

$$\text{where } \pi_0 = -\frac{f_0}{\alpha}; \; \pi_1 = \frac{1}{\alpha}; \; \pi_2 = \frac{\phi^f}{\alpha}; \; \pi_3 = -\frac{\phi^f - \phi^h}{\alpha}; \qquad (12)$$

Finally, we could allow a more complex specification for the adjustment cost parameters. It is reasonable to assume that both ϕ^h on ϕ^f are not constant but depend, with separate coefficients, on a set of variables describing the general conditions of the labor market and the strength of trade unions[4]. For instance, a higher aggregate level of vacancies and lower unemployment is likely to increase hiring costs. The unemployment rate and union strength will also influence the cost of dismissing a worker. Finally, both hiring and firing costs will be affected by labor market legislations. Let us assume that the adjustment cost parameters are related to their determinants in a linear fashion so that:

$$\phi^j_t = \phi^j_0 + \phi^j_1 Z^j_t \qquad j = h,f \qquad (13)$$

where Z^j_t is a column vector of explanatory variables for the j^h regime and ϕ^j_1 a column vector of their respective coefficents. The Euler condition can now be combined to yield:

$$L_t = \pi_0 + \pi_1 w_t + \pi_2(X_t - \beta\theta X_{t+1}) + \pi_3(D_t X_t - \beta\theta D_{t+1} X_{t+1}) +$$
$$+ \pi^1_4 [Z^f_t X_t(1-D_t) - \beta\theta Z^f_{t+1} X_{t+1}(1-D_{t+1})] + \pi^1_5 [Z^h_t X_t D_t - \beta\theta Z^h_{t+1} X_{t+1} D_{t+1}] + u_t \qquad (14)$$

where:

$$\pi_0 = \frac{f_0}{f_1}; \quad \pi_1 = -\frac{1}{f_1}; \quad \pi_2 = -\frac{\phi^f_0}{f_1}; \quad \pi_3 = \frac{\phi^f_0 - \phi^h_0}{f_1}; \quad \pi_4 = -\frac{1}{f_1}\phi^f_1; \quad \pi_5 = -\frac{1}{f_1}\phi^h_1 \qquad (15)$$

Equation (14) differs from (9) because of the inclusion of an additional set of regressors (see the last line) that capture the change over time in the adjustment costs.

In the next section we will provide a summary view of the institutional features of the Italian labor market, that are likely to affect the cost of adjusting employment.

2. Hiring and Firing Costs and the Institutional Setting

Hiring costs are basically expenditure on advertising, screening and training people. They depend upon the production technology and the skill requirements that it implies and are also affected by the legislation on recruitment. Restrictions on who can be hired can add significantly to hiring costs. In this respect Italy is the only OECD country where employment legislation requires companies to follow the rank ordering of canditates determined by the public employment agency according to social criteria[5]. Moreover, in Italy private temporary work agencies are prohibited, direct employment on the basis of non permanent contracts is severly restricted, and part time work has been traditionally discouraged. However dispensations from the rule requiring hiring according to the official ranking are available for special skilled jobs and for up to 10% of new hires by large firms. Relaxation of the rules are available for small firms. Finally, the introduction in 1985 of fixed term apprenticeship contracts, allowing to choose workers individually for up to 50% of new hires, is likely to reduce hiring costs. (see Emerson (1988), Barca and Magnani (1989), Bentolilla and Bertola (1990) and references therein).

Firing costs are also affected by rules regulating the labor market and in particular by employment security legislation concering dismissals. The impact of this legislation can be strengthened or weakened by additional employment arrangements, such as those regulating lay-offs, short time working and part time contracts. In comparative terms, Italy appears to be the most restrictive nation in terms of the ability of a firm to fire an employee, particularly after the introduction of Workers Charter (Statuto dei Lavoratori) in 1970. Apart from criminal acts and gross misconduct, firing an individual worker is very difficult and the courts have been prone to put more weight on social and family consideration than on the suitability of the worker for the job. However, the regulations concerning firing do not apply to small firms with less then thirty five workers. As far as permanent lay-offs are concerned, they were practically impossible during the late 60's and most of the 70's, because of strong opposition by the unions, and because of the general political climate. The use of temporary lay-offs was more frequent, although it was also being met by stiff trade union resistance. The provisions regulating lay-offs (Cassa Integrazione Guadagni, CIG) stipulate that workers receive 80% of previous earning for up to 40 hours per week, ordinarily up to two years but in practise indefinitely in the case of reorganization of large firms. The financing of the scheme rests mainly on the government, who must approve the lay-offs, and there is not a system of experience rating, whereby the portion financed by the firm increases with the frequency and size of previous lay-offs. During the 80's a general weakness of the labor movement has led to a greater degree of labor market flexibility. Moreover such flexibility has been enhanced by the way in which CIG was actually applied. The governement, in fact, allowed CIG to be used more frequently to finance permanent lay-offs, in order to facilitate large firm reorganizations. Finally, during this period the governement also helped in financing early retirement schemes.

3. The Data and Econometric Estimation

The data set that will be used in estimating the model is a panel of fiftytwo large companies over the period 1958-1988 provided by CERIS. The main advantage of this panel is that it covers a long time period during which significant changes in labor market legislation and practises have occurred. In table 1 we provide some descriptive statistics for this sample, over the entire period and in different sub periods. On average, employment falls by 1.1% over 1963-88 period as result of an increase in the 1969-1980 period followed by a sharp decline in the eighties. The average rate of growth figures, however, hide a difference in behaviour for individual firms within each period. In the whole sample employment is found to fall in 55.5% of the observations and to be stable or to increase in the remaining 44.5%. In the 1963-80 subsample the figures are 47.0% and 53.0% respectively. Finally in the 1981-88 subsample decreases in employment (75,3) are much more frequent than increases (24.7).

We now turn to the econometric estimation of the combined Euler equation (9). In all the estimated equations, the error term for firm i in period t, u_{it}, is modelled as the sum of a firm specific effect λ_i, a time specific effect η_t, and an idiosyncratic shock ε_{it}. In order to eliminate the firm specific effect, we take first differences and in order to allow for the endogeneity of the regressors, estimation is carried out by the Generalized Method of Moments, using appropriately lagged variables as instruments. Tests on the serial correlation properties of the residuals (m_1 and m_2) as well as the

Sargan test on the correlation of the instruments with the error term are also reported[6]. In all the equations we also include in addition to the time dummies industry dummies. The inclusion of time dummies can be thought of as capturing shifts in output demand when the firm is a monopolistic supplier.

In table 2 we present in column (a) the estimates for equation (9) . After experimenting with different values of θ, a 5% quit rate per year was chosen for all the equations[7]. We also allow the real discount rate to be variable and compute it adding a 5% risk premium to the real rate of interest[8]. Looking at the results for the asymmetric model, the coefficients are fairly well determined and the Sargan test is not suggestive of mispecification[9]. π_1 and π_2 have the sign one would expect from the theoretical model. The coefficient for firing costs, ϕ^f, is positive even if the asymptotic t statistic suggests that its estimate is not very precise (t=1.36). The significance of π_3 at conventional levels implies that the hypothesis of symmetric adjustment costs is rejected by the data. However, solving for the value of ϕ^h one obtains the unacceptable result that hiring costs are negative. Perhaps this can be interpreted as evidence against the hypothesis that hiring costs increase at the margin. Although the asyntonic t statistic for ϕ^h (t=1.30) does not allow to reject the hypothesis that $\phi^h=0$, imposition of this restriction on the model yields negative estimated values for ϕ^f. In column (b) we report, as a comparison, the estimates for the symmetric model ($\phi^h=\phi^f=\phi$), which is rejected against the asymmetric one. While the wage rate coefficient enters with the expected sign and is significant, the adjustment cost parameter has the wrong sign. In column (c) we include as an additional regressor the capital stock. Its coefficient, π_4, is positive and significant indicating that capital and labor are cooperant factors. The estimates of the remaining coefficients (π_1, through π_3) still imply a rejection of the symmetric model. The coefficient for firing costs, ϕ^f, is positive and significant (t=2.60). The numerical value of ϕ^f implies that marginal adjustment costs are

3 per cent of the annual wage per worker, when gross firings represent 6 per cent of the work force (this is the sample average of the observations for which X is negative). Since marginal firing costs are linear in X, they would be 6 per cent and 12 per cent of the wage, when gross firings represent, respectively, 12 per cent and 24 per cent of the work force. The estimated magnitude of firing cost is, perhaps, not as large as would have expected, given that our panel includes only large firms that are more likely to face trade union resistance to reductions in employment. However what our estimate seems to suggest is that the generous lay-off provisions were succesful in enhancing labor market flexibility[10]. The problem of the negative value of ϕ^h (t=2.02) remains also in this specification. As a further extension, we have added industry demand as a regressor to capture shifts in demand facing an imperfectly competitive firm. However its coefficient was insignificant probably because the time and industry dummies that are included in all the equations alredy capture the demand effects. Finally, replacing the quadratic approximation to the production function with a Cobb Douglas technology (see (11)) does not yield a more satisfactory empirical model, since all the coefficients are poorly determinated. For reason of space, we do not report these two sets of results.

The overall conclusion up to this point is that, while the estimate of the firing cost coefficient is well determined and reasonable, the same cannot be said for the hiring cost coefficient. Our results should be compared with those in Pfann and Verspagen (1989) and Pfann and Palm (1990) who find that hiring costs are more important than firing costs.

In table 3 we present the estimates for equation (14) in which the adjustment cost parameters in each regime are allowed to be variable. Since no vacancies data are available for Italy, we have used unemployment as a proxy for the degree of labor market tightness, which may influence both ϕ^h and ϕ^f. A measure of trade union strenght and militancy for each individual firm is also not available, and we have used as a proxy union density and the number of hours lost in strike at the industry level. After some experimentation we have converged to the specification reported in Table 3. The coefficients π_4 and π_5 are associated respectively with industry union density and the unemployment rate respectively. They suggest that there is a significant and negative relationship between hiring cost and the unemployment rate, since there is a greater pool of applicants the firm can choose from (although with the restrictions discussed in section 2). The association between firing costs and union density is, instead , positive and significant, since stronger unions are more likely to organize a costly resistance (for the firm) to cuts in employment. When other variables are included as a determinant for the adjustment cost parameters (for instance unemployment for ϕ^f and union density for ϕ^h) they do not play a significant role. We have also allowed the constant components (ϕ^f_0 and ϕ^h_0) to differ between sub periods. One can argue for instance that the 70's should be treated separately from the rest of the period because they represented the years in which labor market legislation was tighter. A test of parameter constancy for ϕ^h_0 and ϕ^f_0 however does not suggest a structural break (the Wald test equals 1.75 with two degrees of freedom). What is happening here is that the union and unemployment variables act as proxies also for changes in legislation and for the effectiveness which it has been enforced. The variability of the adjustment speed is an interesting result from an economic point of view. Unfortunately even this more general specification does not solve the problem of the sign of the hiring cost coefficient.

4. Conclusions

The microeconometric evidence from our panel of italian firms suggests that the hypothesis of symmetric adjustment costs is rejected by the data. In the model that allows for asymmetries, firing costs are correctly signed, but the sign of hiring costs is not theory consistent. Our results also provide empirical support for considering the adjustment cost coefficients as variable. In particular, firing costs are significantly affected by trade union strength, while hiring costs are a function of the general degree of tightness in the labor market. Summing up, while it is necessary to abandon the standard specification of adjustment costs, allowing for asymmetries and variable coefficients represent useful steps forward, but not sufficient ones to obtain a satisfactory model of employment. Further progress will require better data and better models. In particular, it would be useful to have direct information on gross hirings and firings or, which is the same, on quits. Alternatively, it may be fruitful to make the quit rate a function of aggregate economic conditions, although this makes estimation considerably more complex because increases the number of coefficients to be estimated and raises the degree of non linearity in the model. Another extension worth exploring is the introduction of linear (or fixed) components in the adjustment cost function in addition to the strictly increasing component. This is a research agenda we intend to pursue in the future.

FOOTNOTES

1) See also the theoretical contributions by Nickell (1978), Kelsey (1986), and Bentolilla and Bertola (1990) based on models with linear adjustment costs associated to changes in employment. The linear adjustment cost assumption yields the same fundamental conclusions of the fixed adjustment costs assumption, in the sense that period of inactivity are followed by burst of hiring and firing. Note that this characterization is particularly appropriate when one analyzes high frequency data. For other recent work on adjustment costs see also Prucha and Nadiri (1986), Morrison (1988), and Bernstein and Nadiri (1989).

2) Smith (1984) uses aggregate data for eight OECD countries, Burgess (1988) and Burgess and Dolado (1989) uses aggregate data for the UK, and Lucas and Fallon (1991) use aggregate data for India and Zimbabwe.

3) This is the formulation used by Burda (1991), under the assumption of symmetric adjustment costs.

4) This can be seen as a generalization of Smith (1984), Burgess (1988), Burgess and Dolado (1989), and Lucas and Fallon (1991) who allow for a variable adjustment speed but not for asymmetry.

5) The so called "numerical system" ranks unemployed workers according to a set of criteria, including the lenght of unemployment spells and family size.

6) The DPD programme developed by Arellano and Bond (1988) is used for estimation. See also Arellano and Bond (1990).

7) For different values of θ between 0 and .12 the results remain sustantially identical, althoug the coefficient estimates are somewhat less significant.

8) The average cost on short term loans is used as a proxy for the nominal rate.

9) The value of M(2) points to the absence of second order serial correlation. This legitimates the use of variables dated t-2 as instruments.

10) Note from table 1 that reductions in employment occur more frequently during the 81-88 period, when the Government allowed firms to make use of CIG provisions more often.

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TABLE 1

CERIS PANEL
Descriptive Statistics

	1963-88	1963-80	1981-88
N. of firms	**52**	**52**	**52**
N. of observations	1336	936	400
Employment growth rate			
Mean	-0.011	0.006	-0.050
Standard deviation	0.087	0.070	0.107
N. of observations with			
Net hiring $(L_t - L_{t-1}) \geq 0$	595	496	99
% of total	44.5	53.0	24.7
Net firing $(L_t - L_{t-1}) < 0$	741	440	301
% of total	55.5	47.0	75.3

TABLE 2

ESTIMATES OF EQUATION (9)
(Sample period 1963-87)

	(a)	(b)	(c)
π_1	-.301 (2.80)	-.193 (2.22)	-.306 (2.77)
π_2	-1.755 (1.86)	.744 (2.21)	-2.211 (2.72)
π_3	3.296 (2.02)		4.896 (3.67)
π_4			.006 (2.63)
W(1)	26.76 [3]	12.12 [2]	116.93 [4]
W(2)	175.57 [25]	150.88 [25]	142.09 [25]
W(3)	38.92 [8]	49.19 [8]	41.09 [8]
M(1)	-1.47 [52]	-.50 [52]	-2.05 [52]
M(2)	.83 [52]	.67 [52]	.74 [52]
Sargan	5.29 [6]	7.59 [7]	9.10 [5]

Instruments: X_{t-2}, D_{t-2}, X_{t-3}-$\beta_{t-2}\theta X_{t-2}$, $D_{t-3}X_{t-3}$-$\beta_{t-2}\theta D_{t-2}X_{t-2}$,$w_{t-2}$, Y_{t-2}, K_{t-2}, I_{t-2},β_{t-2}

W(1) Wald test of joint significance of the reported regressors.
W(2) Wald test of joint significance of time dummies.
W(3) Wald test of joint significance of industry dummies.
M(1) Test for first order serial correlation in the residuals.
M(2) Test for second order serial correlation in the residuals.

[..] Degrees of freedom.

(*) Employment figures refer to effective workers. Employees in temporary lay-off (CIG) are excluded.

TABLE 3

ESTIMATES OF EQUATION (14)
(Sample period 1963-87)

π_1	-.237 (1.56)
π_2	70.480 (6.12)
π_3	-79.280 (5.78)
π_4	-1.417 (6.27)
π_5	1.075 (3.33)
W(1)	84.09 [5]
W(2)	278.36 [25]
W(3)	52.14 [8]
M(1)	-4.03 [52]
M(2)	1.18 [52]
Sargan	6.60 [6]

Instruments: X_{t-2}, D_{t-2}, $X_{t-3}-\beta_{t-2}\theta X_{t-2}$, $D_{t-3}X_{t-3}-\beta_{t-2}\theta D_{t-2}X_{t-2}$,

$[Z^f_{t-3}X_{t-3}(1-D_{t-3}) - \beta_{t-2}\theta Z^f_{t-2}X_{t-2}(1-D_{t-2})]$,$[Z^h_{t-3}X_{t-3}D_{t-3}-\beta_{t-2}\theta Z^h_{t-2}X_{t-2}D_{t-2}]$,

w_{t-2}, Y_{t-2}, K_{t-2}, I_{t-2}, β_{t-2}

W(1) Wald test of joint significance of the reported regressors.
W(2) Wald test of joint significance of time dummies.
W(3) Wald test of joint significance of industry dummies.
M(1) Test for first order serial correlation in the residuals.
M(2) Test for second order serial correlation in the residuals.

[..] Degrees of freedom.

(*) Employment figures refer to effective workers. Employees in temporary lay-off (CIG) are excluded.