Determinants and Characteristics of Unemployment in Sweden: The Role of Labor Market Policy

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1. INTRODUCTION[1]

The rate of unemployment has in the late seventies displayed a substantial increase in a number of western countries, Sweden being one striking exception. Despite a pronounced fall in aggregate demand Swedish unemployment stayed at lower levels 1976-1978 than it did during the more normal recession 1971-72. The rate of unemployment reached a decade high in 1972 - 2.7 percent - but was on average only 2.2 percent in 1978.

This paper is focusing on the relationships between labor market policy and labor market behavior in Sweden. The policies taken account of include traditional programs - such as relief works and manpower training - as well as recent policy innovations such as (i) the employment security legislation, (ii) the inventory subsidy scheme and (iii) the wage subsidy program.

The plan of the paper is as follows: First, in Section 2, a brief description of the institutional setting and the policies undertaken are given. Section 3 contains a rough attempt to establish

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[1] I have benefited from Anders Björklund's constructive comments on an earlier version of this paper.

certain microeconomic effects of two important labor market programs. The basic question is how enrollment in relief works or retraining affects the individual's future unemployment probability. Are trainees rewarded by lower unemployment risks compared to non-participants? This analysis, which applies standard econometric methodology, as a by-product gives microinformation on the determinants and characteristics of unemployment.

Section 4, in turn, approaches the policy issues from a different perspective: How is the probability of leaving unemployment affected by the availability of relief works and training programs? This analysis, therefore, investigates how the contracyclical objectives of these programs are translated into practice. The section includes, moreover, analyses of possible unemployment effects of the employment security legislation. Have the rising firing costs - implicit in this legislation - increased the duration of unemployment via more careful screening practices on part of the firms?

In Section 5 of the paper, finally, we embed a structural unemployment relationship in a macrosimulation model of the labor market.[1] This model - consisting of ten stochastic equations estimated on monthly data - describes the manufacturing sector's decisions on production, vacancies, recruitments, layoffs and hours per worker. The behavior of the household sector is taken account of in quit and unemployment equations. The model is

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[1] The model is described in some detail in Holmlund (1980).

driven as a selfcontained system by exogenous output demand and provides a suitable framework for dealing with the indirect effects and interactions that occur throughout the labor market if one part of it is directly changed. In particular, we present a policy-simulation where the actual development during the seventies is compared to an alternative case, produced by a "passive" labor market policy. Implications for employment, unemployment, labor turnover and labor productivity are revealed by this simulation.

2. THE INSTITUTIONAL SETTING

Swedish post-war labor market policy has to a large extent been fostering mobility and structural change in the labor market. The well-known Rehn-Meidner policy-proposals for selective policy measures had given priority to job security in the entire labor market rather than job security in a particular firm.[1]

A change of the labor market policy appears to have taken place during the seventies. The policies have now to a greater extent emphasized employment protection rather than employment creation.[2] Various layoff-discouraging measures have been undertaken in order to reduce the flow into unemployment whereas less priority has been given efforts aimed at influencing the duration of unem-

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[1] For an overview of the Swedish discussions on stabilization issues during the 40's and the 50's, see Lindbeck (1974).

[2] See Johannesson, this volume, for more details about the Swedish labor market policy.

ployment. These changes are reflected in the expansion of various policy measures, including economic "carrots" as well as legal "sticks". Three of the most important policies are the inventory subsidy schemes 1972 and 1975-77), the employment security legislation (in operation from July 1974) and the employment subsidy program (most actively undertaken during the recession 1977-78).

The inventory subsidies are - roughly speaking - paid to firms conditional upon unchanged volume of employment; the firms under consideration are those where employment reductions are likely in the absence of the policy. The employment subsidies, in turn, are intended to affect temporary and permanent layoffs; firms with high expected layoff probabilities are subsidized, given that they provide their excess labor with a certain degree of training during a specified period of time. The employment security legislation (LAS),[1] finally, is intended to protect employment for tenured workers. The employers' free right to dismiss is replaced by legislation which demand objective cause for dismissal. "Shortage of work" is considered to be one such objective cause. Firms have, furthermore, to give employed workers up to six months advance notice before anyone can be laid off.

The two subsidy programs are temporary contracyclical measures whereas the LAS-scheme represents a permanent institutional change. The employment subsidy scheme will mainly affect unemployment via longer durations of existing jobs. The employment security legislation has employment pre-

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[1] LAS = Lagen om anställningsskydd.

serving aims and strong layoff-discouraging rules and is therefore likely to reduce the flow into unemployment. But the recruitment behavior of firms will, presumably, also be influenced, since the laws make it difficult to revise past hiring decisions based on erroneous information. The result is likely to be longer vacancy durations (falling recruitment probabilities) as well as increasing duration of unemployment. The inventory subsidy program, finally, is - at least for the period 1975-77 - focusing upon net changes in employment as a requirement for subsidies; hence we expect that hiring decisions as well as layoffs will be affected.

Along with these new policies, a continuous expansion of more traditional measures has taken place. Of special importance here are relief works and labor market training programs. Relief works are intended to counteract seasonal and cyclical unemployment as well as unemployment due to personal characteristics (e.g., among elderly or handicapped workers) or adverse characteristics of certain regional labor markets. Relief works can take the form of national, local government or private projects. Labor market training, in turn, is arranged for persons who either are or run the risk of becoming unemployed or who are difficult to place in the labor market. Relief works and labor market training engaged each on average about 50,000 persons in 1978 (slightly above one percent of the labor force for each type of program).

3. UNEMPLOYMENT, PERSONAL CHARACTERISTICS AND POLICY EXPERIENCES

The human capital model views the pecuniary remuneration of labor services as the basic indicator of returns to accumulated investments in knowledge. In empirical human capital studies, therefore, the typical dependent variables are wage rates or earnings.

It is fairly straightforward to pursue the human capital approach beyond these confinements. Acquired skills will not only affect the rewards per hour worked but may also affect the individual's incentives and capacity to find and keep jobs. Consider a simple job search model of the type

$$P = \theta \cdot [1-F(w^*)] \qquad (1)$$

where

P = the probability of leaving unemployment (the transition probability)

θ = the probability of finding a job offer

$[1-F(w^*)]$ = the probability of accepting a job offer (w^* is the reservation wage and $F(\cdot)$ is the distribution of wage offers).

The probability of receiving job offers will, for obvious reasons, be related to the seeker's productivity, as perceived by the employers. Information on the seeker's characteristics in terms of age, education, previous labor market experience, etc. will be useful guides for employers' hiring decisions. This holds true irrespective of whether education is regarded as a productivity augmenting activity or merely as a signalling device.

The job-seeker's stock of human capital will, of course, also affect the reservation wage, in general making the net effect on the transition probability indeterminate a priori.

The probability of job separations will also be affected by the individual's human endowments. In particular, we expect that acquired firm specific knowledge will reduce the likelihood of unemployment inflow via lower quit and layoff probabilities. It is also reasonable to hypothesize that workers with more years of schooling will face lower layoff risks at given length of tenure.

There are well-known difficulties associated with efforts to evaluate labor market programs, such as manpower training. A basic problem is related to the choice of an adequate comparison group.[1] The standard procedure applies multiple regression analysis in order to control for pre-training differences between program-participants and non-participants. There is, however, likely that the standardizing variables are imperfect controls and that left-out variables, affecting both the outcome measures and the program-enrollment probability, will produce biased estimates of the program coefficients. An approach which may reduce such risks utilizes the longitudinal properties of some data sets. If we, e.g., have information on past

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[1] ....."the programs are not usually offered to conform the standards of experimental design; there is not a randomly chosen control and experimental group and more usually those who enroll do so on the basis of some only partially known self-section criteria". (Stafford, 1979, p.10). The ideal design is, however, seldom available in practice, requiring the use of non-random comparison groups.

unemployment experiences (or past wage rates), the effects of leaving out variables affecting current unemployment (current wage levels) will be less serious.[1] This kind of approach will be adhered to in this paper.

Our empirical analysis will focus on one outcome measure, the unemployment probability. In particular, we propose to explain the probability of being unemployed at least once during 1973, conditional upon labor force participation. The micro-economic data source is based on the Level of Living Survey (Levnadsnivåundersökningen), conducted by the Institute for Social Research, Stockholm, in 1968 and 1974.[2] The major fraction of the respondents in 1968 were also interviewed in 1974. Our analysis will focus on individuals that were participating in the labor force in 1967 and in 1973. The criteria for being a participant in 1973 (1967) were that the respondent was unemployed or employed at least once during 1973 (1967).

The functional form adopted is the logistic:

$$Pr(U73) = 1/(1+e^{-X\beta}) \qquad (2)$$

where Pr(U73) is the probability of being unemployed and X is a vector of explanatory variables. The latter includes the following background factors:

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[1] For studies along these lines, see papers by Ashenfelter, Kiefer and Goodfellow, included in Bloch (1979).

[2] See Vuksanovic (1979).

EXP = years of previous labor market experience
S = years of schooling
MAR = dummy for marital status (MAR=1 if the respondent was married, zero elsewhere)
WOM = dummy for female respondents
U67 = dummy for previous unemployment experiences (U67=1 for respondents with at least one spell of unemployment during 1967)
EXCH = dummy for respondents with experiences of employment exchange contacts during 1968-72.

The unemployment equation is a straightforward application of a standard human capital earnings function. The individual's unemployment experiences are related to past labor market experience (reflecting on-the-job training) as well as formal education. In addition, controls are included for marital status, sex and past unemployment and job search.[1]

Uncertainty is associated with the proper specification of the policy variables. We have represented them as follows:[2]

(i) DRT = dummy for retraining at least once during 1968-72

(ii) DRT·U67 = interaction between retraining and previous unemployment

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[1] Regressions were also run with age and age squared included. The results were basically the same; the age-coefficients were insignificant, probably due to strong multicollinearity between age and experience.

[2] The retraining variable also includes those engaged in vocational rehabilitation programs.

(iii) DRW = dummy for enrollment in a relief work program at least once during 1968-72

(iv) DRW•U67 = interaction between relief work enrollment and previous unemployment.

A description of sample characteristics is set out in Table 1. We observe, among other things, that 25 percent of the individuals with unemployment experiences in 1973 also were unemployed some time during 1967; the corresponding 1967-figure for all labor force participants in 1973 is 5 percent.

The results of alternative maximum likelihood estimates are set out in Table 2. The basic human capital approach appears to be consistent with the findings. The variables representing education and labor market experience have the expected signs. The education coefficient implies that one additional year of schooling reduces the unemployment rate for representative individuals by about 0.5 percentage points.[1] The highly autoregressive nature of unemployment is noteworthy; individuals with past unemployment experiences are also facing much higher current unemployment risks. The estimates imply, furthermore, a standardized unemployment rate differential between married and non-married persons of about 3-4 percentage points.

Turning next to the policy variables, the results show that the effects of program enrollment depend

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[1] The derivative

$\frac{\partial P}{\partial S} = -0.11 \cdot P(1-P)$ is calculated at the mean of P where P=Pr(U73).

Note that the unemployment concept used above differs from the conventional measure since one year - rather than one week - is the observation period.

Table 1. Summary of sample characteristics (Means)

Variable	All individuals	Individuals unemployed at least once 1973
U73	0.051	1.00
EXP	22.0	16.8
S	9.6	9.3
MAR	0.776	0.608
WOM	0.381	0.358
EXCH	0.202	0.642
U67	0.052	0.258
DRT6872	0.027	0.083
DRW6872	0.013	0.058
Sample size	2399	123

on whether the individuals had experienced previous unemployment or not (i.e., unemployment in 1967 in these data). Put differently, we may say that the adverse effects of past unemployment on future unemployment tend to be mitigated by participation in labor market programs.

The quantitative effects are displayed in Table 3, showing predicted unemployment probabilities for individuals with different experiences of previous unemployment and labor market training. If persons without previous unemployment and training enrollment are taken as a reference group (row (i)), we observe that previous unemployment is increasing the current unemployment probability by almost 0.10 (row (ii)). However, if those with previous unemployment experiences are affected by labor market training their unemployment probabilities are substantially reduced (row (iv)); in fact, the adverse effects of previous unemployment appear to be completely offset by participation in training programs.

Table 2. Unemployment probabilities and labor market programs. Logit estimates (t-ratios in parentheses).

	(1)	(2)	(3)	(4)
INTCPT	0.905	-1.000	-0.991	-1.003
	(-1.457)	(-1.597)	(-1.587)	(-1.602)
S	-0.119	-0.112	-0.115	-0.113
	(-2.988)	(-2.800)	(-2.879)	(-2.840)
EXP	-0.084	-0.081	-0.082	-0.082
	(-2.672)	(-2.578)	(-2.602)	(-2.618)
EXPSQ	0.001	0.001	0.001	0.001
	(1.669)	(1.590)	(1.561)	(1.625)
MAR	-0.778	-0.818	-0.765	-0.790
	(-3.851)	(-3.919)	(-3.667)	(-3.790)
WOM	-0.151	-0.143	-0.122	-0.141
	(-0.712)	(-0.669)	(-0.568)	(-0.661)
EXCH	1.603	1.529	1.552	1.488
	(7.438)	(6.895)	(7.112)	(6.637)
U67	1.381	1.608	1.457	1.637
	(5.188)	(5.793)	(5.280)	(5.705)
DRT		0.824		
		(1.988)		
DRT•U67		-2.565		
		(-2.214)		
DRW			1.261	
			(2.130)	
DRW•U67			-1.407	
			(-1.505)	
DRTDRW				0.934
				(2.589)
(DRTDRW)•U67				-1.649
				(-2.320)
Log likelihood	-397.8	-394.1	-395.8	-394.0

Note: EXPSQ=EXP^2.
DRTDRW=1 implies participation in retraining programs, relief work programs or both.

Table 3. Predicted unemployment probabilities from Eq.(2)

	Background characteristics	Predicted value
(i)	U67=0,DRT=0	0.027
(ii)	U67=1,DRT=0	0.122
(iii)	U67=0,DRT=1	0.060
(iv)	U67=1,DRT=1	0.024
	Mean	0.051

Note: All variables, except U67 and DRT, are set to their mean values.

The results spelled out for retraining programs are not equally well established as far as relief works are concerned; the coefficient for the interaction term is not significant at conventional levels. However, when the two program categories are lumped together, the basic conclusions remain intact (cf. Eq. (4)).

These exercises should, needless to say, be taken with some care. There are few persons with policy experiences in the sample and it is also likely that the standardizing variables are imperfect controls for differences between those enrolled in the programs and the non-participants. The estimates are, however, significant in most cases and fairly robust with respect to changes in the specifications.[1]

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[1] The Swedish labor market training programs have been evaluated by Dahlberg (1972) and Dahlström (1974). The studies show income increases for the trainees but no significant effects on wage rates. The favorable employment effects revealed by our estimations are consistent with those earlier findings.

To what extent is previous enrollment in labor market programs associated with adverse signalling effects? The positive coefficients for DRT and DRW are at least consistent with a signalling interpretation. The coefficients for these program-dummies are, however, smaller in magnitude than the estimated coefficients for U67, i.e., previous unemployment.[1] (Cf. row (ii) and row (iii) in Table 3). We are inclined to interpret these observations, together with the negative coefficients for the interaction dummies, as indicating that the labor market programs are able to improve the participants' future labor market performance.[2]

4. UNEMPLOYMENT FLOWS AND UNEMPLOYMENT POLICIES

4.1 Unemployment Outflow

The theoretic framework already introduced is a useful point of departure for analyses of the duration of unemployment. The worker's probability of leaving unemployment and finding employment equals the product of two terms, the acceptance probability and the job-offer probability. The job-offer probability, first, depends on (i) the likelihood of encountering a job opening and (ii) the probability of obtaining a wage offer from a located vacancy. The first of these probabilities is related to the number of vacancies available and to the worker's search intensity. An unem-

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[1] Unfortunately, the data include no satisfactory information on unemployment experiences during 1968-72.

[2] Of course, such a conclusion does not necessarily imply that the programs will pass a cost-benefit test.

ployed job searcher has, however, some opportunity to choose between "regular vacancies", and "vacancies" created by the labor market board, i.e., relief works and labor market training. Although no direct measures of these kinds of vacancies are available, some proxies will be tried. The question of interest here is: How have two important elements of the Swedish labor market policy - relief works and retraining - affected the duration of unemployment?

It should be noted that these labor market programs may affect unemployment duration via the job-offer probability as well as the labor force exit probability. An unemployed worker leaving unemployment for training is by definition leaving the labor force. Another circumstance to be kept in mind is that individual unemployment in most cases is a precondition for participation in relief works or retraining. The possibility of induced voluntary unemployment inflow should be recognized; the training programs may be attractive educational alternatives for individuals who not initially are unemployed.

The likelihood of receiving offers from located vacancies will presumably be affected by the searchers' productivities, as perceived by the employers, and by actual firing costs. If past hiring decisions based on erroneous information are costly to revise, this will most likely induce careful screening procedures on part of the firms. The Swedish employment security legislation may be interpreted along these lines; the hypothesis, therefore, is that the introduction of LAS has decreased, ceteris paribus, the probability of

leaving unemployment and increased the duration of unemployment.

The variables used for explaining unemployment outflow are:

(i) VAC_t = the total number of vacancies (unfilled vacancies in the beginning of the month plus the flow of new vacancies during the month).[1]

(ii) DLAS = dummy for the employment security legislation (DLAS=1 from July 1974, zero otherwise).

(iii) "vacancies" associated with relief works and retraining. As proxy-variables we use, first, the number of persons engaged in relief works or training (LMB_t) and, second, the change in this number.[2] Of relevance for an unemployed job searcher is, of course, not the number of relief works or training positions per se but rather the availability of unfilled employment or training opportunities. It is assumed that the latter are closely related to the two variables mentioned above.

Data and Results

The transition probabilities used are calculated by applying a method suggested by Barron (1975).

[1] Adjusted to changes associated with compulsory registering in the late seventies according to investigations undertaken by the National Labor Market Board.

[2] LMB = Labor Market Board.

This method assumes that the transition probability is constant during the whole spell of unemployment. The idea is to compare the number of people in one week who have been unemployed less than, say, five weeks with the number of people four weeks later who have been unemployed five to eight weeks (or five to twelve weeks). The difference consists in principle of people who have left the pool of unemployed.[1] The transition rates obtained include the job-finding probability as well as the labor force exit probability. The expectation is that more training opportunities will increase the exit probability.

Estimation results for three different model specifications are set out in Table 2. The specifications adopted are (i) a linear equation, (ii) a log-linear equation and (iii) a logit-equation; the latter restricts the predicted transition probability to values in the interval between zero and one.

$$P_t = \alpha_0 + \alpha_1 VAC_t + \alpha_2 DLAS + \alpha_3 LMB_t + \alpha_4 \Delta LMB_t \qquad (3)$$

$$\ell nP_t = \beta_0 + \beta_1 \ell nVAC_t + \beta_2 DLAS + \beta_3 \ell nLMB_t + \beta_4 \Delta LMB_t \qquad (4)$$

$$\ell n\left(\frac{P_t}{1-P_t}\right) = \gamma_0 + \gamma_1 VAC_t + \gamma_2 DLAS + \gamma_3 LMB_t + \gamma_4 \Delta LMB_t \qquad (5)$$

Two noteworthy results are displayed in the table. First, the coefficient for DLAS is insignificant

[1] For details, se Barron (1975) or Axelsson and Löfgren (1977). Transition probabilities in this paper have been calculated by using the intervals 1-4 weeks and 5-12 weeks according to the monthly Swedish labor force surveys (AKU).

and has, moreover, an unexpected sign. Thus no adverse effects on unemployment duration are revealed, which is contrary to the basic hypothesis. Second, only transitory effects of relief works and training are found; the coefficient for ΔLMB is significant whereas the stock variable LMB appears to play a negligible role.

The results obtained should be taken with some care. The analysis here is, e.g., focusing on the short-term unemployed, whose behavior may differ from groups with longer spells of unemployment.[1] It may be the case that relief works and labor market training are of special importance for the long-term unemployed, whose reservation wages are likely to be lower. A somewhat speculative story about job-search during unemployment may read as follows: The worker initially contemplates only "regular jobs" and refuses less desirable opportunities such as relief works and retraining. During a period of unsuccesful search, the relative attractiveness of the latter alternatives will increase; the worker's reservation wage - or reservation utility - will fall with the duration of unemployment according to well-known results from search theory.[2]

There is another interpretation to be recognized. The availability of relief works may decrease the probability of transitions from unemployment to the not-in-the-labor force state. It has been shown that these exit rates vary procyclically, at

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[1] Cf. Björklund and Holmlund, this volume.

[2] See, e.g., Gronau (1971).

Table 4. Unemployment outflow and labor market policy. Monthly data 1970.2-1979.5

	$\ell n\ P_t$	$\ell n\ P_t$	$\ell n\ P_t$	$\ell n\ P_t$	P_t	$\ell n(P_t/1-P$
INTCPT	-10.03	-10.32	-11.01	-11.40	-0.002	-2.856
	(-7.887)	(-7.928)	(-8.373)	(-6.211)	(-0.073)	(-10.89)
$\ell nVAC_t$	0.706	0.730	0.785	0.816		
	(6.255)	(6.338)	(6.785)	(5.274)		
VAC_t					0.14E-05	0.10E-(
					(6.390)	(5.882)
DLAS		0.042	0.043	0.042	0.85E-03	0.038
		(1.038)	(1.096)	(1.042)	(0.141)	(0.827)
LMB_t				0.46E-06	0.85E-07	0.35E-(
				(0.302)	(0.390)	(0.209)
ΔLMB_t			0.73E-05	0.75E-05	0.99E-06	0.68E-(
			(2.198)	(2.206)	(1.970)	(1.781)
DW	1.23	1.25	1.30	1.31	1.44	1.40
R^2	0.58	0.58	0.60	0.60	0.59	0.62

Note: $LMB_t = LMB_{t+1} - LMB_{t-1}$. All regressions include eleven seasonal dummies.

least in the U.S.[1] Relief works may, however, affect exit behavior in a way different from regular vacancies. The reason for this possibility is that workers contemplating relief work employment have to be registered at the employment exchange offices, clearly an indicator of active job search according to the labor force surveys.

The absence of significant LAS-effects on unemployment duration may be the result of aggregation phenomena. The groups most likely to be hurt by higher recruitment standards on part of the firms

[1] See Björklund and Holmlund, this volume, for results and a discussion of these findings.

are workers with weak or unstable previous employment experiences or other "undesirable" signalling characteristics. Adverse effects on these groups are perhaps not easily detected by using aggregate data.[1]

Another interesting possibility should, however, also be observed. The advance warning rules included in LAS clearly contribute to on-the-job search among workers threatened by layoffs. This effect implies that the expected number of search periods in unemployment may decrease, even if the total number of search periods increase.

4.2 The Rate of Change of Unemployment

The preceding sections have exclusively been focusing on unemployment outflow whereas the inflow component has been completely disregarded. In this section the relationship for the flow into the unemployment pool will be combined with an outflow equation. The aim is to derive an explicit unemployment equation. The point of departure is the approximation

$$U_t = U_{t-1} + IU_t - P_t U_{t-1} \qquad (6)$$

where IU_t is unemployment inflow and P_t the transition probability, i.e., the probability of leaving the pool of unemployed.[2] Rearranging (6) gives

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[1] Disaggregation by age, however, does not change the basic results. See Holmlund (1978).

[2] (6) is an approximation since those who are entering as well as leaving unemployment within the same month are disregarded.

$$UCHR_t = IU_t/U_{t-1} - P_t, \qquad (7)$$

where $UCHR = (U_t - U_{t-1})/U_{t-1}$ is the relative rate of change in unemployment.

The next step is to specify explicit relationships for the inflow and for the transition probability, thereafter substituting these functions into (7) in order to obtain an equation suitable for estimation purposes. Consider first the inflow relation. As a pure identity, the flow into unemployment consists of quits (Q), layoffs (Y) and labor force entries (E):

$$IU_t = \mu_1 Q_t + \mu_2 Y_t + \mu_3 E_t, \qquad (8)$$

where μ_i (i=1,2,3) is "unemployment propensities" associated with the three flows. Empirical evidence - at least for the U.S. labor market - indicates that μ_1 is substantially below unity; most job changes take place without intervening unemployment spells. We postulate the following relationship for the unemployment inflow:

$$IU_t = \tau_0 + \tau_1 Y_t + \tau_2 DLAS \cdot Y_t + \tau_3 VAC_t \qquad (9)$$

The inflow consists of an autonomous component, τ_0, unaffected by the state of the labor market. Its magnitude is also affected by the number of layoffs. The contributions by firms - via layoffs - to unemployment is, however, assumed to have been decreased by the introduction of LAS. The advance warning rules, giving workers up to six months' notice before layoff, will most likely reduce the "unemployment propensity" associated

with layoffs. The specification takes account of that effect by the slope dummy DLAS • Y.

The unemployment inflow is, finally, affected by quits and labor force entries via the number of vacancies. The hypothesis is that quits into unemployment as well as labor force entries will increase with a tighter labor market.[1]

Consider, next, the transition probability, P_t. The basic search theoretic framework is retained, explaining P_t by variables associated with the likelihood of finding vacancies, receiving wage offers and accepting offers. Recalling the arguments already given and approximating the theoretically preferable multiplicative model with a linear function, the transition probability equation is written as

$$P_t = \tau_4 + \tau_5 \, (VAC_t/U_{t-1}) \tag{10}$$

Substituting (9) and (10) into (7) yields

$$UCHR_t = -\tau_4 + \tau_0\left(\frac{1}{U_{t-1}}\right) + \tau_1\left(\frac{Y_t}{U_{t-1}}\right) + \tau_2\left(\frac{DLAS.Y}{U_{t-1}}\right) + (\tau_3 - \tau_5)\left(\frac{VAC_t}{U_{t-1}}\right) \tag{11}$$

as estimating equation.

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[1] There is theoretical arguments - as well as U.S. empirical evidence - indicating that quits into unemployment will rise with the number of vacancies. See Barron and McCafferty (1977).

The regression equation set out in (11) has been estimated on monthly data with results as follows:[1]

$$UCHR_t = \underset{}{-0.020} + \underset{(3.279)}{3043.63}(1/U_{t-1}) + \underset{(2.505)}{0.743}(Y_t/U_{t-1}) - \tag{12}$$

$$\underset{(-2.027)}{0.686}(DLAS \cdot Y/U_{t-1}) - \underset{(-2.843)}{0.037}(VAC_t/U_{t-1}) + SD$$

Period: 1969.2-1979.5

$R^2=0.62$ DW=1.93

The reported equation is satisfactory in terms of statistical performance and reasonable estimates. The "autonomous" component of the unemployment inflow equals about 3000 workers each month, or about 0.5 % of the number of employed workers. The cyclical part of the inflow is captured by the three remaining terms. The LAS-reform seems to have contributed to a marked decrease in lay-off-associated unemployment inflow via the advance warning rules; the slope dummy coefficient is negative and significant. The final term, VAC_t/U_{t-1}, has an estimated coefficient with negative sign, suggesting that the unemployment reducing effect (via the transition probability) outweighs the unemployment creating effect (via quits and new entrances into unemployment).

The estimated constant term, averaged over all months, is -0.13. Recalling equations (10) and (11) above, we have the transition probability as

$$P_t = 0.13 + 0.037(VAC_t/U_{t-1}) + \tau_3(VAC_t/U_{t-1}) \tag{13}$$

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[1] Data refer in this case to the industrial sector (bluecollar workers). The unemployment rate for workers in manufacturing occupations has been applied to the number of employed workers in industry (according to the establishment statistics). SD is short for eleven seasonal dummies.

By setting $\tau_3 = 0$, thereby completely disregarding voluntary search unemployment due to demand fluctuations, a minimum estimate of the transition probability is obtained for different values of VAC_t/U_{t-1}. If the mean value of the latter ratio is inserted, we obtain P_t (min) = 0.2, which is approximately equivalent to a maximum estimate of the average duration of unemployment of about five months. Available extraneous information suggests that the average duration has been about 14 weeks.[1] The difference between five months (21 weeks) and 14 weeks is due to the cyclical sensitivity of voluntary unemployment inflow.

The estimated unemployment equation may be rewritten as a first order difference equation

$$U_t=0.87U_{t-1}+3043+(0.74-0.69DLAS)\cdot Y_t-0.037VAC_t \quad (14)$$

where the coefficient 0.87 comes from the deseasonalized intercept (0.87=1-0.13). A "quasi-reduced" form of this equation is obtained by fixing DLAS and Y_t and focusing on the unemployment-vacancy relationship. It is easily seen that cyclical variations in VAC will produce clockwise loops in the (U,VAC)-space, thus being consistent with one element in Edmund Phelp's theory of the Phillips curve.[2] We would accordingly, at certain phases of the business cycle, expect to observe simultaneous increases in vacancies and unemployment.

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[1] Björklund (1978).

[2] Phelps (1971).

5. LABOR MARKET POLICY IN A SIMULATION MODEL OF THE LABOR MARKET

5.1 Model Description

The previous analyses have been completely partial, ignoring all possible feed-backs among, e.g., unemployment, vacancies, hirings and layoffs. Clearly, such feed-backs are present in the real world. A high level of unemployment is likely to speed up hirings and reduce the stock of unfilled vacancies via shorter vacancy durations. The layoff-behavior among firms may also be affected by the level of unemployment; firms will presumably be more careful in firing workers if they feel that an eventual unexpected sudden upturn will entail recruitment difficulties due to low unemployment.

In order to deal with some of these interactions, a simulation model of the labor market for industrial workers has been developed and estimated. The system includes the unemployment equation estimated in Section 4 as one relationship. The theoretical framework underlying the model has been described in some detail elsewhere[1] and will not be fully presented here. The model is basically demand-oriented, although both employment and unemployment are partially affected by job search and job acceptance decisions taken by the household sector.[2] The quit and unemployment specifications

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[1] Holmlund (1980).

[2] The driving exogenous variables are sales and unfilled orders. Potential productivity is "explained" by time and estimated on a small number of peak observations.

are focusing on job availability effects rather than inflationary surprises, an approach which has empirical underpinning.[1]

As workers are searching for jobs, employers are searching for employees to fill job vacancies. Employers attempted recruitments are distinguished from their actual hirings, the latter being affected by the state of the labor market.

Changes of employment via hirings or layoffs are likely to be affected by significant adjustment costs. An optimal policy would therefore most likely imply employment smoothing with respect to demand fluctuations. The principal short-run mean of adjusting labor input will be variations in hours per worker. We describe the firms' decisions on men and manhours as being recursive in nature; the basic determinant of hours per worker is the difference between the actual and the desired number of workers on hand.

A condensed description of the model is given in an appendix. We will here give a brief account of how the various policies are taken account of. Inventory subsidies, in the first place, are affecting the system via their effects on firms' production decisions. These, in turn, are dictated by expected demand, represented by sales and unfilled orders. The inventory subsidies are introduced as dummies for the subsidy periods. When planned output increases, so will the size of the desired workforce, thereby indirectly affecting vacancies, hirings, layoffs, which - in turn - influence quits and unemployment, etc.

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[1] Parsons (1973), Barron (1975), Axelsson and Löfgren (1977), Björklund and Holmlund (1981).

The employment subsidy program is directly affecting layoffs, and indirectly therefore unemployment, employment, etc. Technically, the policy is represented by a variable NSUB, the fraction of non-subsidized excess labor.

The third policy taken account of, the employment security legislation (LAS), is transmitted via the equations for hirings, layoffs and unemployment changes. As expected, we find that the higher firing costs - implicit in LAS - have had significant layoff-discouraging effects. Another finding is that these layoff difficulties appear to have produced more careful screening procedures among firms; vacancy durations are significantly higher, ceteris paribus, after the introduction of LAS. A ten percent higher level of unemployment will, furthermore, increase hirings by one percent.

Possible LAS-effects on unemployment duration have already been investigated in Section 4 above. Given the observed effects on layoffs and vacancy durations, it is surprising to note the absence of significant adverse effects on unemployment duration. Possible interpretations of this result have already been discussed in Section 4.

5.2 Simulation Experiments

5.2.1 The Predictive Accuracy of the Model

In order to investigate the tracking ability of the model some historical simulations have been performed. The model takes initial values of exogenous and endogenous variables for the months

preceding 1970.7 and is allowed to run on its own from there and 102 months ahead, ending in December 1978. The exogenous variables are sales, unfilled orders, the policy parameters, season and time. The historical simulations reveal that the model stays roughly on track over time. Actual and simulated values for employment and unemployment are displayed in Figures 1 and 2 (yearly averages). The model ends the 102-months simulation with the simulated unemployment rate equal to the actual rate for the second halfyear of 1978.

The predictive accuracy of the model is summarized in Table 5, where the mean absolute percentage errors between actual and simulated values are set out. One simulation was run with output as exogenous driving variable. A comparison between the two columns in the table reveals that errors in the production equation are of minor importance for the predictive performance of the model as a whole.[1]

The prediction errors are smallest for the stock of employed workers (0.9 percent). This result is unsurprising since the monthly flows are small relative to the stock. The errors are considerably higher (about 23 percent) for the stock of unfilled vacancies, where the monthly flows are of the same magnitude as the size of the stock. Layoffs turn out to be the most difficult variable to predict with precision, a result which partly may be due to relatively large measurement errors in the variable itself.

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[1] The performance of the model turns out to be slightly better with output endogenous, which may be due to large measurement errors in the output data itself.

Figure 1. Employed workers, actual and simulated numbers

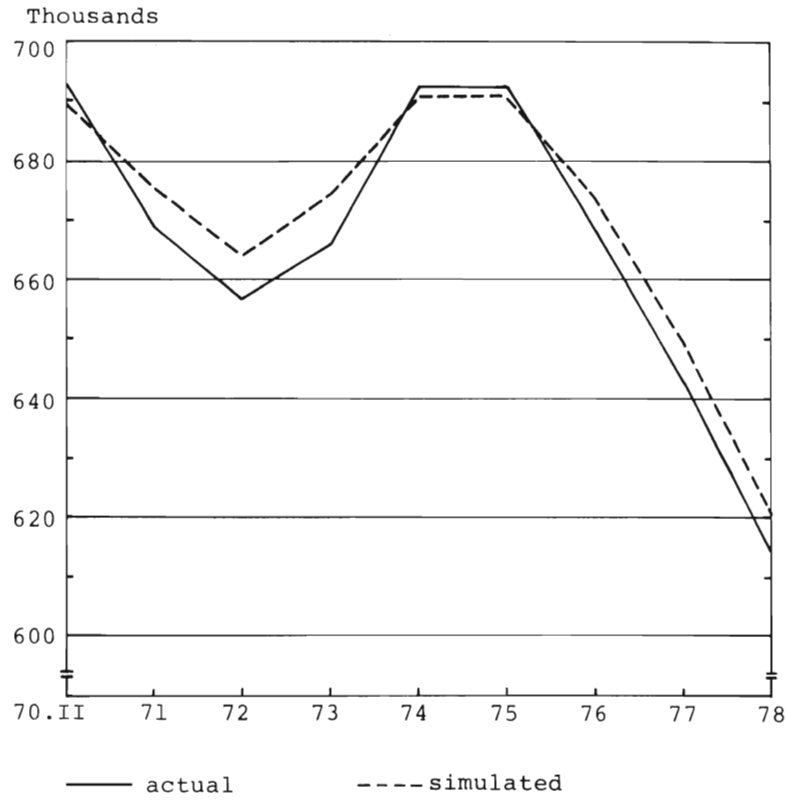

Figure 2. Actual and simulated unemployment rate

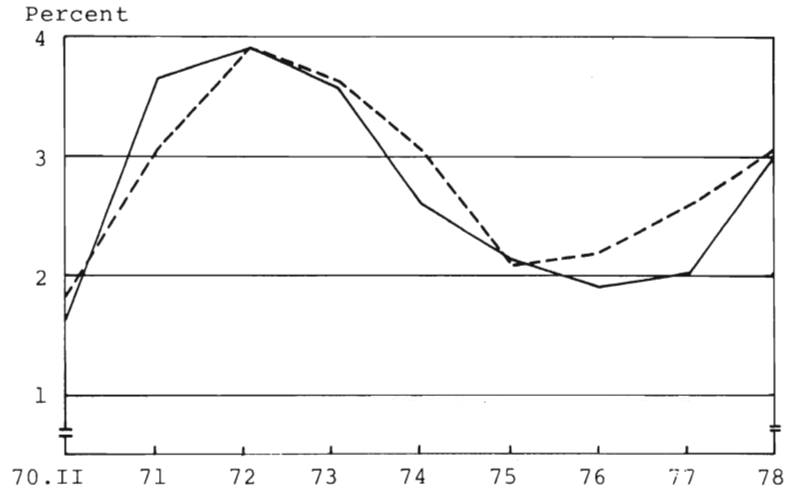

Table 5. Historical simulations - mean absolute errors

	Exogenous sales and orders	Exogenous output
Output	2.2	
New vacancies	13.6	15.8
Unfilled vacancies	22.8	24.8
Hirings	14.7	15.2
Layoffs	34.5	35.1
Quits	15.6	15.5
Hours per worker	4.2	4.1
Total hours	4.2	4.1
Employment	0.9	1.0
Unemployment	15.2	15.5

5.2.2 A policy experiment - Sweden with passive labor market policy

The level of Swedish industrial production fell with about 10 percent between 1974 and 1978. Despite this fairly dramatic fall employment stayed at lower levels than it did during the more normal recession 1971-72. The model developed is a suitable mean for analyzing this development. We will compare the "actual" development, as predicted by a full historical simulation of the model (the reference case), with an alternative case, simulated without employment and inventory subsidies and without the employment security legislation. The alternative case depicts a development produced by a "passive" policy, in contrast to the "active" policy adhered to in practice. Table 6 shows the results as average halfyear differences

Table 6. Sweden's active labor market policy - results of a policy simulation

	N_A/N_R	U_A/U_R	RU_A-RU_R	H_A/H_R	Q_A/Q_R	Y_A/Y_R	HRS_A/HRS_R	$OHRS_A/OHRS_R$
1974.II	0.998	1.169	0.40	1.053	1.020	2.254	0.999	1.001
1975.I	0.992	1.529	1.27	0.942	0.898	2.305	0.991	0.998
1975.II	0.986	1.934	1.66	0.873	0.812	3.165	0.987	1.002
1976.I	0.981	2.012	2.38	0.975	0.819	2.794	0.983	1.006
1976.II	0.981	1.991	2.00	0.980	0.862	2.778	0.983	1.006
1977.I	0.974	1.984	2.68	1.104	0.941	3.052	0.977	1.012
1977.II	0.965	2.012	2.62	1.343	1.029	2.806	0.972	1.028
1978.I	0.954	1.976	3.38	1.775	1.331	2.621	0.964	1.037
1978.II	0.957	1.782	2.34	1.857	1.489	2.567	0.967	1.034

Note: The variables are as follows:
N = The number of employed workers
U = The number of unemployed workers
RU = the rate of unemployment (%)
H = new hires
Q = quits
Y = layoffs
HRS = paid-for hours worked
OHRS = output per paid manhour

for a set of variables. The effects are presented in ratio terms, giving variable values under the alternative development (subscript A) divided by values under the reference case (subscript R). The absolute difference for the unemployment rate (RU) is also set out.

The simulation reveals that the policies undertaken have had important effects on employment, unemployment, labor turnover and labor productivity. The results indicate that employment would have been about five percent lower 1978 with a passive policy, corresponding to nearly 30,000 workers. The level of unemployment would have been approximately twice as high, implying a rise in the unemployment rate of about 2-3 percentage points. The "price" paid by this employment preserving policy is lower productivity - more labor hoarding - as displayed by the last column.

The policy effects on labor turnover are somewhat ambiguous. The most significant change concerns layoff behavior; a passive policy would have more than doubled the number of layoffs and the yearly layoff-rate (in relation to employment) would have been approximately 7 per cent in 1977. The number of quits, on the other hand, have been - due to the policy adhered to - higher in the beginning of the recession, responding to the lower unemployment, the higher vacancy stocks (due to larger vacancy durations) and the higher vacancy flow associated with inventory subsidies. A passive policy, on the other hand, would have induced more quits during the upturn of the business cycle. This, in turn, depends on the larger number of new vacancies and new hires that a less employment preserving policy would have required during the recovery.

6. CONCLUDING REMARKS

The aim of this paper has been to investigate certain unemployment effects of labor market policy programs undertaken in Sweden. This objective has been addressed via different econometric models, intended to elucidate (i) future unemployment experiences for those enrolled in relief works or training programs and (ii) macroeconomic effects of recent policies, in particular the consequences for the rate and duration of unemployment.

The microeconomic results obtained indicate, *inter alia*, a marked autocorrelation in individual unemployment probabilities; workers with unemployment experiences in 1967 are facing substantially higher unemployment risks in 1973 even after controlling for various personal characteristics. However, these adverse effects of previous unemployment appear to be mitigated by participation in labor market programs. The probability of being unemployed in the future shows a marked decline for unemployed workers in training programs.

Ambiguity is revealed to some extent when we explore the contra-cyclical role played by relief works and retraining programs. We are thus only able to establish *transitory* unemployment duration effects of these programs; changes in the (aggregate) magnitude of relief works and retraining are associated with changes in unemployment duration, but no effects from the magnitude *per se* are discernible. The results clearly underline the need for further and more elaborate evaluations of these programs.

Sweden's experiences during the deep recession of the late 70's are fairly remarkable. Despite a dramatic fall in aggregate demand it was possible to avoid rapid increases in unemployment. The policies have caused a marked reduction in layoffs. The employment security legislation may also have reduced turnover into unemployment via a significant "on-the-job-search effect"; the estimated unemployment equation indicates that a given number of layoffs have smaller unemployment effects during the late seventies than during earlier periods. It is notable that the higher firing costs - implicit in the legislative changes - so far appear to have caused no or neglible effects on the duration of unemployment.

DESCRIPTION OF THE SIMULATION MODEL

Variables explained by stochastic equations

FCV_t = filled and canceled vacancies (employment exchange statistics)

H_t = new hires (establishment data)

$HRSN_t$ = paid-for hours per worker

IV_t = the flow of new vacancies

O_t = index of industrial production in real terms

$\widehat{OHRS}_t$ = potential productivity

Q_t = quits

$SHRSN_t$ = standard paid-for hours per worker

$UCHR_t t$ = the relative rate of change of unemployment

Y_t = layoffs

Exogenous variables

B = index of backlog of orders in real terms

DINV1 = dummy for the inventory subsidy scheme 1972

DINV2 = dummy for the inventory subsidy scheme 1975-77

DLAS = dummy for the employment security legislation (DLAS = 1 from 1974.7 on, zero otherwise)

D2, D3... D12 = seasonal dummies

NSUB = the fraction of non-subsidized excess labor

S = index of sales in real terms

T = time

Definitions that close the model

$HRS_t = HRSN_t \cdot N_{t-1}$ (the total number of paid-for hours during month t)

$\widehat{HRS}_t = O_t / \widehat{OHRS}_t$ (the total number of productive hours during month t)

$\widehat{N^*_{t-1}} = \widehat{HRS}_t / SHRSN_t$ (desired employment at the beginning of month t, desired excess labor excluded)

$N_t = N_{t-1} + H_t - O_t - Y_t$ (actual employment at the end of month t)

$U_t = (1+UCHR_t)U_{t-1}$ (the number of unemployed at the end of month t)

$RU_t = 100 \cdot U_t / (U_t + N_t)$ (the unemployment rate at the end of month t)

$VAC_t = V_{t-1} + IV_t$ (the total number of vacancies during month t)

$V_t = V_{t-1}\ IV_t - FCV_t$ (the stock of unfilled vacancies at the end of month t)

$PFCV_t = FCV_t / VAC_t$ (filled and canceled vacancies as a fraction of the total number of vacancies)

Table A1. Estimation results (t-ratios in parentheses)[a]

Potential productivity

$$\widehat{\ell nOHRS}_t = 0.0656 + [0.502E\text{-}02] \cdot T \qquad (5.182)$$

Periods: 1969.1-1969.3, 1970.4-1970.6, 1974.4-1974.6

$R^2 = 0.79$ DW = 3.58

Standard hours[b]

$$\ell nHRSN_t = -1.846 - [0.171E\text{-}02] \cdot T + SD \qquad (-11.289)$$

Period: 1969.1-1978.6

$R^2 = 0.95$ DW = 2.74

Industrial production

$$\ell nO_t = 4.861 + \underset{(4.966)}{0.122}\ \ell nB_{t-1} + \underset{(1.528)}{0.018}DINV1 + \underset{(1.336)}{0.011}DINV2 + 1.325 \sum_{i=0}^{5} w_i \ell nS_{t-i} + SD \qquad (10.64)$$

Period: 1970.8-1978.12

$R^2 = 0.98$ DW = 1.36

New vacancies

$$\ell nIV_t = 6.008 + \underset{(4.868)}{0.453}\ \ell nQ_t + \underset{(3.152)}{2.206}\ \ln(N^*_t \cdot N^*_{t+1} \cdot N^*_{t+2}/3N_{t-1}) + 5.492 \sum_{i=1}^{6} w_i \ell n(N^*_{t-i}/N_{t-i}) + SD \qquad (5.741)$$

Period: 1969.2-1977.10

$R^2 = 0.95$ DW = 2.07

$\rho = 0.60$

[a] Seasonals are not presented but indicated by SD if they appear in an equation. The intercept refers to January.

[b] Note that predicted values from this equation are interpreted as (log) standard hours.

Table A1 (cont.)

Hirings

$$\ell nH_t = 1.380 + \underset{(19.25)}{0.706}\ \ell nVAC_t + \underset{(2.080)}{0.103}\ lnU_{t-1} - \underset{(-2.273)}{0.077}DLAS + \underset{(4.236)}{1.755}\ \ell n(N^*_t \cdot N^*_{t+1} \cdot N^*_{t+2}/3N_{t-1}) + SD$$

Period: 1969.2-1978.12
$R^2 = 0.97$ DW = 1.43

Layoffs

$$\ell nY_t = 4.273 + \underset{(2.252)}{0.261}\ \ell nU_{t-1} - \underset{(-2.683)}{0.452}DLAS + \underset{(2.637)}{1.205}\ \ell nNSUB_t - \underset{(-2.506)}{1.859}\ \ell n(N^*_t \cdot N^*_{t+1} \cdot N^*_{t+2}/3N_{t-1}) - \underset{(5.097)}{6.216}\ \sum_{i=1}^{6} w_i \ell n(N^*_{t-i}/N_{t-i})$$

Period: 1969.2-1978.12
$R^2 = 0.55$ DW = 1.66

Hours per worker

$$\ln(HRSN_t/HRSN_{t-1}) = 0.032 + \underset{(54.97)}{1.058}\ \ln(SHRSN_t/HRSN_{t-1}) + \underset{(3.920)}{0.352}\ \ln(N^*_{t-1}/N_{t-1}) + \underset{(1.647)}{0.043}\ \ln(\widehat{HRS}_{t+1} \cdot \widehat{HRS}_{t+2} \cdot \widehat{HRS}_{t+3}/3\widehat{HRS}_t)$$

Period: 1969.2-1978.12
R^2 0.98 DW = 2.55

Table A1. (cont.)

Quits

$$\ell nQ_t = 2.683 + \underset{(2.369)}{0.291}\ \ell nVAC_{t-1} - \underset{(-1.866)}{0.093}\ \ell nU_{t-2} + \underset{(3.682)}{0.486}\ \sum_{i=0}^{8} w_i \ell nH_{t-i} + SD$$

Period: 1969.2-1977.10

$R^2 = 0.94$ DW = 1.42

Unemployment

$$UCHR_t = -0.020 + \underset{(3.279)}{3043.63}(1/U_{t-1}) + \underset{(2.505)}{0.743}(Y_t/U_{t-1}) - \underset{(-2.027)}{0.686}(DLAS \cdot Y_t/U_{t-1})$$

$$- \underset{(-2.843)}{0.037}(VAC_t/U_{t-1}) + SD$$

Period: 1969.2-1979.5

$R^2 = 0.62$ DW = 1.93

Filled and canceled vacancies

$$\ell n\left(\frac{1-PFCV_t}{PFCV_t}\right) = -6.479 + \underset{(14.16)}{0.774}\ \ell nVAC_t - \underset{(-3.146)}{0.195}\ \ell nU_{t-1} + \underset{(2.924)}{0.178}DLAS +$$

$$+ \underset{(4.521)}{[0.466E-02]} \cdot T + SD$$

Period: 1969.2-1978.12

$R^2 = 0.86$ DW = 1.85

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