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UNIONS, WAGES AND EMPLOYMENT IN FINLAND

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CONTENTS

ABSTRACT

Reduced form wage and employment equations stemming from a bargaining framework are estimated with two-step method proposed by Engle and Granger (1987). Quarterly data for manufacturing and aggregate private sector is used. Step response functions due to various shocks were calculated by dynamic simulation. Adjustment was rather fast in general. If the actual real wage-employment combination is considered as inappropriate, it is not due to labour market rigidities. It rather implies that the equilibrium is inappropriate. Out-sample short-run forecasts were also simulated. In addition to standard variables several tax variables as also a proxy for union power was included. The positive effect found for union strength on both wages and employment in manufacturing industry is not evaluated as an evidence for efficient contract model.

TIIVISTELMÄ

Tässä keskustelualoitteessa analysoidaan palkkojen ja työllisyyden määräytymistä Suomen järjestäytyneillä työmarkkinoilla. Ammattiliittojen ja yritysten välinen neuvotteluasetelma määrittää tarkastelukehikon. Empiiriset yhtälöt estimoidaan Grangerin ja Englen (1987) esittämällä kaksivaiheisella menetelmällä, jonka etuna on pitkän aikavälin vaikutuskertoimien ja lyhyen ajan dynamiikan "luotettava" yhdistäminen. Tulosten mukaan sekä reaalipalkat että työllisyys sopeutuvat varsin nopeasti tasapainotasoonsa. Kyseessä ei kuitenkaan ole tasapaino täystyöllisyyden mielessä, vaan lähinnä eräänlainen neuvottelutasapaino. Se syntyy prosessissa, jossa neuvotteluosapuolet etsivät omalta kannaltaan optimaalista ratkaisua. Jos siis toteutunutta työllisyyskehitystä ei pidetä tyydyttävänä, syynä on epätyydyttävä palkkojen ja työllisyyden "tasapainokombinaatio". Tähän tasapainoon voidaan vaikuttaa sen määräävien tekijöiden kautta. Sen sijaan palkkajäykkyyden merkitys on toissijainen. Tulosten mukaan väitteet ammattiliittojen vahvistumisen aiheuttamasta työttömyyden lisääntymisestä eivät saa tukea varsinkaan teollisuudessa. Myös tuontipanosten kallistumisen vaikutus osoittautuu marginaaliseksi. Sen sijaan verotustekijöiden negatiivinen työllisyysvaikutus on suuri. Silti vahvan kysynnän rooli keskeisimpänä työllisyyttä ylläpitävänä tekijänä piirtyy selkeänä myös tämän tutkimuksen tuloksissa.

1 INTRODUCTION*

In the middle of the 1960s only one in every three Finnish workers belonged to a union. At present, the unionization rate is 70 - 80 per cent in the private sector and even higher in the economy as a whole. So, the degree of unionization in Finland is high by international standards. Finland has one large central organization of unions primarily concisting of manufacturing workers. In addition, there are three confederations of unions representing mainly white collar workers. The wage settlement procedure is highly centralized and synchronized. The period 1964 - 1988 saw only three years when settlements were concluded at industry level.

Given this background, it seems only natural to analyse the Finnish labour market within a bargaining framework, in which the role of unions is taken into account. Of the standard union models, the "right-to-manage" one looks like most closely to resemble our view of the real world. Despite its shortcomings, it was chosen as the starting point for specification of empirical equations.

In the literature, there are two prevailing ways of selecting empirical equations.[1] One makes explicit assumptions concerning the utility functions of unions, production functions etc. and estimates various structural parameters. This is the method applied by, inter alia, Pencavel (1985), Forslund (1986) and Holmlund & Pencavel (1987). A problem with this method is that the functional forms often become complicated and require sophisticated estimation methods. In addition, a great number of (perhaps too many) restrictive assumptions are arrived at. A competing method seeks merely to specify the relevant variables and to search for functional forms more or less on an ad hoc basis. The latter approach is followed by, inter alia, Newell & Symons (1985), Bean & Layard & Nickell (1986), Holmlund (1987) and Calmfors & Forslund (1988).

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[1]See e.g. Calmfors & Forslund (1989).

*I would like to thank Steve Nickell, Richard Jackman, Andrew Oswald and George Alogoskoufis for helpfull comments and suggestions.

Tyrväinen (1988a) applies a strategy which lies somewhere between the two methods described above. It is less restrictive than the former method, but less ad hoc than the latter. In specifying the equations, several assumptions concerning the utility functions, the role of competition in the goods market etc. were made.[2] Thanks to these specifications, not only the variables incorporated in the equations but also their signs were obtained from the theoretical considerations. The parameter restrictions, which become very tricky, are not tested. This should be appropriate also due to drawbacks in using aggregate data. Long run homogeneity between prices and wages is assumed to hold. In its most general form, the basic model for equilibrium real wages and employment is of the following form:

$$(1) \qquad N^* = N(\underset{-}{\tau_1}, \underset{-}{\tau_2}, \underset{-}{\frac{P_c}{P}}, \underset{?}{\beta}, \underset{-}{\frac{P_m}{P}}, \underset{+}{Q}, \underset{-}{B}, \underset{-}{S}, \underset{?}{K}, \underset{?}{t})$$

$$(2) \qquad \left(\frac{W}{P_c}\right)^* = W(\underset{-}{\tau_1}, \underset{+}{\tau_2}, \underset{+}{\frac{P_c}{P}}, \underset{+}{\beta}, \underset{-}{\frac{P_m}{P}}, \underset{+}{Q}, \underset{+}{B}, \underset{+}{S}, \underset{+}{K}, \underset{+}{t})$$

The variables are: N = employment, W = (consumption) wages, τ_1 = employers' social security contributions, τ_2 = income taxes, τ_3 = indirect taxes, β = union power, P = producer prices, P_m = prices of raw materials (incl. energy), Q = gross output, B = unemployment benefits, S = strike allowances, K = capital stock (predetermined), t = technical progress.

It should be noted that the equations above can be interpreted as a certain

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[2]Tyrväinen (1988a) contains the detailed analysis of the model and, thus, only a rough listing of its underlying characteristics is given here. The game between a utilitarian union and a firm is specified as a standard Nash solution of a cooperative game in line with Binmore et al. (1986). There are n identical firms in the economy, each of which produces with a simple three factor Cobb-Douglas technology, where technical progress is of the Harrod neutral (labour augmenting) type. In each period, the firm's capital stock is that with which it begins the period: any investment undertaken during the period only influences the capital stock for the next period. In the production function, inputs (raw materials in particular) are separable from capital and labour. Imperfect competition was assumed to prevail in the goods market, so that the firm faces a downward-sloping demand curve. The firm maximizes its profits, which are defined as the difference between sales revenue and production costs. Instantaneous adjustment is assumed to take place in the goods market: supply is therefore always equal to demand.

kind of reduced forms[3]. Wages are not explained by employment nor vice versa.[4] The reasoning behind the expressions chosen could be as follows:

> "What does it mean to say that high unemployment is caused by high real wages? Are not real wage rates and unemployment both endogenous variables in any reasonable picture of a modern capitalist economy?... We have to adopt the right procedure, which is to look for the true exogenous variables." Robert Solow (1986, pp. 24-25)

Our aim is not to question the relevancy of a negative impact of real wages on employment, that is, to evaluate the existence of a labour demand curve. Our exercise is designed with a different purpose. Over-looking the structural relationship materialized in the labour demand schedule is a key element of our strategy. We wish to see whether the data approves that in the longer run both wages and employment - and basically the combination of the two - adjust towards an equilibrium determined by the exogenous factors of the model.[5] So, the resulting equations should have reasonable properties in the long-run as well as in the short-run. They should be stable over subperiods. In additon, the short-run out-sample forecasting properties should not be too bad.

An equilibrium is a position to which a system will return after a disturbance. This is not necessarily a position of market clearing. In fact, in this paper we are dealing with a "bargaining equilibrium". Working with reduced forms when long run relationships are discussed underlines the heuristic vision that all adjustment necessary has fully taken place.

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[3]After having finished this exercise I have discovered that Carruth, Oswald & Findlay (1986) follow similar ideas when studying wages and employment in British coal and steel industries.

[4]Exclusion of unemployment variable from the wage equation has raised questions in several occations. It could have been introduced as a factor influencing bargaining power of unions, e.g. It was, however, considered as inconvenient to have unemployment variable in an equation explaining employment. Artificial explanatory power could have emerged. As we wanted to work with identical reduced forms for both wages and employment, unemployment was left out from both equations.

[5]In more general systems most of the variables listed here can of course be considered as endogenous. For our econometric exercise it is, however, sufficient that no Granger-causality emerges. This will be tested below.

2 EMPIRICAL EQUATIONS

Series of the Bank of Finland Quarterly Model of the Finnish Economy, BOF4, were mainly used in estimation. The estimations were carried out with quarterly data for two sectors: 1) private sector excl. agriculture and forestry, and 2) manufacturing.[6]

The equations above were assumed to determine the target levels implied by error correction models. The estimations were carried out using the two-stage procedure presented by Granger & Engle (1987). The estimation period is 1965Q1 - 1984Q4.

At this phase problems connected to endogeneity deserve our attention. - The object of the theoretical examination was a firm. In conditions of imperfect competition, its pricing decisions are influenced by the producer price of competitors which is exogenous. In aggregation over identical firms, the counter part of competitors' producer price is the aggregate producer price. Now, the assumption of exogeneity is uncomfortable _a priori_, although this kind of situation is rather typically connected with aggregation.

In addition, output of an individual firm has been treated as endogenous. The aggregate production in the final equations is a proxy for the exogenous demand shift parameter stemming from a downward sloping demand curve in product markets.[7] An alternative choice would have been household disposable income, which Holmlund & Pencavel (1987) use as a demand shift parameter. However, this neither is a solution without problems. Household disposable income actually have a direct link on wages on the one hand, on employment on the other hand, that is, on the dependent variables of the two equations. Moreover, the third essential component of disposable income, the tax ratio, is already among the right hand side variables. The endogeneity problem

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[6]In 1984, the share of manufacturing in the production of the private aggregate sector was 50 per cent and of the total number of employed persons 34 per cent.

[7]Inventories were abstracted away.

appears to be even more serious here than with the output variable. Even if the latter variable would neither be an ideal choice for a demand shift parameter, it has been arrived at.[8] Still, in further examinations the treatment of both production, pricing and the capital stock should be reconsidered.

As the endogeneity problem arosed concern, we tried to clarify its gravity. The aim was to test Granger-causality. The short-term interaction between five variables (wages, employment, consumer prices, output, capital stock) was examined. First, for each variable a level regression was run with other variables on the right hand side. Then, an error correction equation was run for the differencies of each variable. In this equation explanatory variables included lagged changes in the endogenous variables and changes in other variables with four different lags, and the lagged residual of the level-form regression. The F-test did not refute the null hypothesis, according to which the coefficients of the differences of employment and wages are all zero in the equations tracing the dynamics of production, capital stock and consumer prices. Thus, it might not be a doomed attempt (in the technical sence) to estimate error correction equations in which the capital stock, the price level and production are considered as exogenous with respect to our dependent variables.[9]

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[8]Holmlund (1987) emphasizes problems concerning the appropriate choice of the demand shift variable. There are lots of open questions, here. In this study, the following alternatives were experimented in instrumenting the output: 1) public demand, 2) budget deficit, 3) share of budget deficit in GDP, 4) deviation of GDP from trend, 5) terms of trade in Finnish foreign trade, 6) Finnish exports, 7) imports of countries important for Finnish exports. Output was instrumented also by different combinations of these variables. As far as employment was regarded, the results were fine. The consequences on statistical and/or analytical properties of wage equations created however concern. Holmlund & Pencavel (p. 12) experimented with foreign demand in their employment equations. However, neither the terms-of-trade nor the disposable income in the OECD area obtained a significant role.

[9]Holmlund & Pencavel (1987) test, with Swedish data, the exogeneity of producer prices in a wage-employment system. The test does not imply that prices should be treated as endogenous. Also consumer prices and household disposable income are assumed to be determined exogenously. The solutions correspond to those carried out in this study. For Denmark Andersen & Risager (1988) report test results, according to which no sign of simultaneity problems were found with their equations that have a set of key variables rather similar to that of ours.

The assumption of long-run homogeneity between prices and wages does a little violence to the free estimations. In these, the coefficient of the price variable is generally very close to one, and does not differ significantly from one in any equation (see Tyrväinen (1988a)). In error correction equations tracing short-run dynamics of the nominal wages the coefficients of price variables are allowed to be determined freely.

The strike allowances were considered as exogenous in our theoretical examination. In reality, strike allowances are paid by the union itself, and it collects the funds from its members in the connection of membership fees. Furthermore, the size of allowance is stated on a case-by-case basis in Finland. There are no established income ratios etc. When a strike is on, the daily amount of assistance is determined "for the time being". In case the strike lengthens and strike funds dry up, the assistance may be changed. Thus it is not possible to construct a uniform time series for strike allowances. The set up becomes even more confused when the so-called "sliced strikes" that have become common in recent years are considered. In these, only a part of union members are on strike and the working members support the strikers from their current income. - As the endogeneity of strike allowances is obvious and the conceptual and statistical problems appear unsolvable, it is omitted in estimations.

The proxy chosen for the union power is the unionization rate, UNION. Tyrväinen (1988b) makes a reference to certain alternative specifications. In Finland, the picture given by the unionization rate closely corresponds to the qualitative conception of changes in union strength. The social position of trade unions fundamentally strengthened during their explosive growth from the mid 1960s to the latter half of the 1970s.[10] Since then major shifts in their position and influence appear to have been over. Also the rise in the unionization rate has come to a halt. Temporally, fundamental changes in bargaining power and in the unionization rate thus seem to fit each

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[10] Borg (1980) confirms this statement.

other quite well, although the latter is undoubtedly only a rough measure for the former. It is, nevertheless, regarded to be the best alternative available here. The choice is also supported by its simplicity. As the normal working hours have been remarkably cut due by acts and agreements, we also try to find out whether it is possible to distinguish the effects of shifts in this factor, H_N, on variables relevant for the study.

In Finland, the wage settlement procedure is highly centralized and synchronized. As most of agreements are concluded more or less simultaneously, there are clear peaks in the wage series in the contract quarters. This institutional feature is to be accounted for in estimation. It could even be thought that the size of the annual contract pay increase is agreed upon first, and only later is concluded how the increases will be timed, whether they will be paid in one or more instalments etc. The case is solved with a multiplicative dummy, DCONT.

So, we are finally ready to write the empirical counterparts of the theoretical wage and employment equations. This will follow the Granger & Engle procedure and we will use entirely logarithmic expressions and thus, for instance, N_t corresponds $\log(N_t)$ in ordinary writing. The empirical estimating equations have the following forms.

<u>STAGE ONE/COINTEGRATING EQUATIONS (IN LOG LEVELS):</u>

<u>Wages</u>

$$W_t = a_1 P_{c,t} + a_2\left(\frac{P_c}{P}\right)_t + a_3\left(\frac{P_m}{P}\right)_t + a_4 Q_t + a_5(1+\tau_{1,t}) + a_6(1-\tau_{2,t})$$

$$+ a_7 UNION_t + a_8 B + a_9 H_N + a_{10}(K\&TIME) + \text{constant} + z_{W,t},$$

where $z_{W,t}$ is the residual of the equation and $a_1 = 1$, if the first order homogeneity between prices and wages hold,
$a_2 < 0,\ a_3 < 0,\ a_4 > 0,\ a_5 < 0,\ a_6 < 0,\ a_7 > 0,\ a_8 > 0,\ a_9 < 0,\ a_{10} > 0.$

Employment

$$N_t = b_1(\frac{P_c}{P})_t + b_2(\frac{P_m}{P})_t + b_3Q_t + b_4(1+\tau_{1,t}) + b_5(1-\tau_{2,t})$$

$$+ b_6UNION_t + b_7B + b_8H_N + b_9(K\&TIME) + constant + z_{N,t},$$

where $z_{N,t}$ is the residual of the equation and $b_1 < 0$, $b_2 < 0$, $b_3 > 0$, $b_4 < 0$, $b_5 > 0$, $b_6 \gtreqless 0$, $b_7 < 0$ ja $b_8 < 0$, when the dependent variable is the number of employed persons, but $b_8 > 0$, if dependent variable is hours worked. The sign of b_9 depends on the price elasticity of product demand (see Tyrväinen (1988a)).

STAGE TWO/ERROR CORRECTION EQUATIONS (IN LOG DIFFERENCES):

Wages

$$c_0(L)\Delta W_t = c_1(L)\Delta P_{c,t} + c_2(L)\Delta(\frac{P_c}{P})_t + c_3(L)\Delta(\frac{P_m}{P})_t + c_4(L)\Delta Q_t +$$

$$c_5(L)\Delta(1+\tau_{1,t}) + c_6(L)\Delta(1-\tau_{2,t}) + c_7(L)\Delta UNION_t + c_8(L)\Delta B_t +$$

$$a_9(L)\Delta H_{N,t} + c_{10}(L)\Delta(K\&TIME)_{t-1} + c_{11}DCONT + c_{12}z_{W,t-1},$$

where $z_{W,t-1}$ is the lagged residual of the level equation on wages, $c_{12} < 0$.

Employment

$$d_0(L)\Delta N_t = d_1(L)\Delta(\frac{P_c}{P})_t + d_2(L)\Delta(\frac{P_m}{P})_t + d_3(L)\Delta Q_t + d_4(L)\Delta(1+\tau_{1,t}) +$$

$$d_5(L)\Delta(1-\tau_{2,t}) + d_6(L)\Delta UNION_t + d_7(L)\Delta B_t + d_8(L)\Delta H_{N,t} +$$

$$d_9(L)\Delta(K\&TIME)_{t-1} + d_{10}z_{N,t-1},$$

where $z_{N,t-1}$ is the lagged residual of the level equation on employment, $d_{10} < 0$.

The dynamics in error correction equations is determined freely. Four lags of all relevant variables are included.

3 ESTIMATIONS

The two-stage procedure of Granger & Engle stems from the notion that a set of time series can form a stationary system as a linear combination, although the time series separately are not stationary. How about the time series of this study? Can they be made stationary, and if so, how many times must each series be differentiated in order to achieve stationarity? - Table 1 presents the results of an ADF-test for relevant time series and their transformations used in the regressions. Each one of them appears to follow either the I(1) or the I(2) process.

TABLE 1. TESTS FOR THE ORDER OF INTEGRATION

Results of an Augmented Dickey-Fuller (ADF)-test

	I(0)	I(1)	I(2)
W private sector	1.31	-0.86	-19.87**
manufacturing	1.37	-0.99	-10.81**
N private sector	0.96	-3.69**	-
manufacturing	1.10	-4.22**	-
H private sector	0.14	-16.46**	-
manufacturing	0.07	-4.50**	-
H_c manufacturing	0.24	-6.85**	-
P_c	1.80	-0.96	-12.22**
P_m	2.66	-4.46**	-
P private sector	2.01	-1.29	-6.10**
manufacturing	1.86	-1.40	-7.57**
P_c/P private sector	-1.74	-5.78**	-
manufacturing	-2.09	-5.57**	-
P_m/P private sector	-1.15	-10.17**	-
manufacturing	-1.64	-6.66**	-
PCD private sector	0.47	-10.47**	-
manufacturing	-0.20	-6.12**	-
$1+\tau_1$ private sector	1.01	-2.81	-7.93**
manufacturing	1.12	-2.60	-13.68**
$1-\tau_2$	0.97	-8.80**	-
$1+\tau_3$	0.40	-3.02*	-
Q private sector	2.82	-2.78	-6.92**
manufacturing	3.08	-2.29	-7.83**
K private sector	1.14	-0.89	-12.96**
manufacturing	1.67	-1.22	-6.60**
K&TIME private sector	1.19	-0.55	-12.96**
manufacturing	1.70	-0.62	-6.60**
UNI private sector	1.00	-1.44	-4.49**

* The test statistic exceeds the critical level on 5 per cent significance level.
** The test statistic exceeds the critical level on 1 per cent significance level.

3.1 Cointegrating regressions

3.1.1 Wages

The first stage of the Granger & Engle procedure, level-form equations, is reported in Tables 2 - 4. The first of them contains wage equations, the others report demand for labour equations. The original estimation period of all the equations was 1965Q1 - 1984Q4. In the wage equations, the effects of the stabilization policy in 1968 - 1970 were captured with a dummy variable. This, nevertheless, appeared to be an insufficient method to handle the dynamic effects of this policy action. When the estimation period was shortened, the statistical properties of the error correction equations for wages improved. On the other hand, the coefficients of the level-form equation hardly changed (cf. equations (2) and (3)). So, the preferred wage equations have been estimated from the period 1971Q1 - 1984Q4.

For evaluating the effects of the above solution, a parrallel procedure was carried out for a couple of representative wage equations and for other interest for employment equations. The regressions were carried out for 1965 - 1984 so, that the more recent observations were given more weight than those located in the more distant past. The newer data could be in some - not precisely defined - sence "better" than old data. When all the time series were multiplied by the unionization rate, it was thought that our approach would be the more applicable the higher the unionization rate in the economy is. The results differed only slightly from those reported here for both wages, employment and hours worked (see Tyrväinen (1988a)). As unionization rate has risen from 33 per cent in 1965 to 86 per cent in 1984, the results are a strong evidence for the stability of the equations. The tables 2 - 4 also introduce the non-transformed operational counterparts of the equations derived from theory. The final equations can be compared to them. The preferred ones are marked by a star,*.

In the level-form regressions of wages, the signs of the coefficients of all key variables correspond to our <u>a priori</u> expectations. Also the t-values are high, with the exception of the proxy for the demand shift parameter of the goods market, the output of the sector in

TABLE 2. COINTEGRATING EQUATIONS: WAGES

Estimation period: 1965Q1/71Q1 - 1984Q4
Estimation method: OLS

Indepen-dent variables	Dependent variable W = consumption wages in nominal terms: Private sector, 1965Q1 - 1984Q4 (1)	(2)	1971Q1 - 1984Q4 (3)	(4)	(5) *	Manufacturing industry, 1965Q1 - 1984Q4 (6)	(7)	1971Q1 - 1984Q4 (8)	(9) *	(10) *
P_c[1]	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
P_m/P	-.149	-.091	-.068	-.105	-.080	-.156	-.119	-.090	-.072	-.124
P_c/P	-.683	-.496	-.491	-	-	-.369	-.305	-.346	-	-
PCD[2]	-	-	-	-.078	-.102	-	-	-	-	-.162
$(1+\tau_3)$	-	-	-	-1.543	-1.000[4]	-	-	-	-	-1.000[4]
$(1-\tau_2)$	-.515	-.614	-.607	-.354	-.482	-.129	-.252	-.214	-.534	-.163
$(1+\tau_1)$	-1.785	-2.219	-2.585	-1.192	-1.000[4]	-.093	-.983	-1.564	-1.000[4]	-1.000[4]
Q	.043	.054	.012	.041	.105	.016	.024	-.094	.060	-
UNION	.285	.340	.403	.175	.138	.239	.346	.351	.256	.319
(K&TIME)[3]	.680	.549	.558	.753	.637	.594	.486	.599	.381	.560
B	-.028	-.043	-.021	-	-	.066	.033	.064	.032	.033
H_N	-.060	-.253	-.563	-	-	.011	-.164	-.806	-1.000[4]	-.263
DSTAB	-	-.043	-	-	-	-	-.045	-	-	-
Constant	-4.007	-2.469	-.551	-4.464	-4.746	-3.190	-1.817	1.923	1.904	-1.278
R^2	.992	.994	.970	.973	.980	.993	.995	.980	.973	.988
R^2C	.991	.994	.964	.968	.978	.992	.994	.976	.969	.986
CRDW	1.462	2.006	2.096	2.263	2.111	.990	1.356	1.850	1.389	2.075
ADF	5.54	7.43	5.91	6.23	5.87	6.25	7.03	6.23	5.30	6.47
SE	.022	.019	.020	.019	.019	.021	.018	.016	.019	.015

P_c = consumer prices, P = producer prices, P_m = import prices of raw-materials and semi-products (incl. energy), τ_1 = employers' social security contributions, τ_2 = marginal rate of income taxes, τ_3 = indirect taxes on consumption, Q = output of the sector in concern, UNION = unionization rate, K = capital stock, B = replacement ratio, H_N = normal annual working time, DSTAB is a stabilization policy dummy which receives value of one in 1968Q2 - 1970Q4, and is 0 elsewhere

1 The coefficient of P_c is restricted to take value of one (for reasoning, see the text).
2 PCD = $P_c/P(1+\tau_3)$ and it incorporates that part of changes in relation of consumer prices to producer prices that is due to other factors than changes in indirect taxation.
3 This variable measuring the contribution on productivity of capital stock and technical progress is in private aggregate sector (K**0.42124)*EXP(0.00576*TIME). In manufacturing it is (K**0.36956)*EXP(0.00836*TIME).
4 The value of the coefficient is restricted to one.

concern. The coefficient of the output variable is rather small throughout and the t-value low. There appears to be such correlation between the time series for production (Q) and the producer price (P) that the simultaneous inclusion of Q and (P_c/P) within explanatory variables is not without problems.

In the first equations reported, we have P_c/P as an explanatory variable. Here, the coeficient of indirect taxes has been imposed to equal the coefficient of other factors influencing this relative price ratio. Later on P_c/P was disaggregated into two components, the effect of indirect taxation $(1 + \tau_3)$ and other factors. The last-mentioned is obtained as residual PCD = $P_c/P(1 + \tau_3)$). Regressions with disaggregated components of P_c/P often worked better in wage equations. According to equations (3) and (8), about 1/3 - 1/2 of the increase in the ratio between consumer prices and producer prices lowers the equilibrium real wage. In equations (5) and (10), this effect is disaggregated into two components. The transmission of the changes in indirect taxes (due to governement - that is, "internal" - decisions) appears to be more straightforward than that of changes in price ratios resulting from other (that is, "external") factors. The tax effects even tended to be overestimated. As the coefficients in concern did not significantly differ from one, this restriction was imposed in the final wage equations.

A ten per cent increase in relative import prices of raw materials reduces the equilibrium real wage by just over one per cent in manufacturing. In the total private sector, the effect is slightly smaller.

Tightening of income taxation adds to wage pressures. However, the coefficients vary considerably. In the preferred equations (9) and (10) for manufacturing industry, an increase of one percentage point in the marginal tax rate raises the equilibrium real wage by 0.2 - 0.5 percentage point. In the private sector equation (5) the effect is 0.5 percentage point.

The wage equations imply that a rise in employers' social security contributions will reduce nominal wage pressures.[11] In free estimation, the coefficient often even exceeded (minus) one. As the deviation was not significant in the relevant equations (4) and (8), the coefficient was imposed to equal (minus) unity in the final versions. Holmlund (1987) presents a theoretical rationale for this. - The trade union takes into account the fact that the payroll tax (or at least a part of it) will be returned to union members as pensions. If the union is "large", it cannot regard the refunds as exogenous from its point of view. Here a rise in employers' social security contribution does not affect the employment level preferred by the union. Total backward shifting the labour tax makes well sense in this framework.

The three per cent annual growth in the capital stock and technological development, which is close to the trend of productivity, seems to raise the long-term equilibrium real wage by 1 - 2 percentage points per annum. Shortening of the normal annual working time will, <u>ceteris paribus</u>, reduce annual earnings fully. According to the wage equations, a rise in (hourly) wages appears to have compensated for this effect. However, the dispersion of the coefficient estimates is fairly large.

The proxy for union power, the unionization rate, is of special interest for us. Its coefficient is positive in all wage equations, in the range 0.2 - 0.4 and the t-values are high. The actual strengthening of the social position of the trade union movement thus appears to have pushed up the equilibrium real wage. However, similarly as a certain unemployment rate may be connected to different degrees of tightness in the labour market at different points of time, a certain unionization rate appears also to be linked to varying degrees of

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[11]OECD (1986) refers to a fairly similar estimation result for Finland. Ingberg (1984) estimates that social security contributions influence wages with a weight of about one quarter. Ingberg applies the approach used by Holmlund (1983). The latter obtains a result for Sweden according to which about one half of an increase in social security contributions is transmitted to wages within year's time. This concerns the short-run effect. Holmlund points out that in the longer term employees will probably bear the burden in full (op. cit. p. 13). Also Ingberg's results should be interpreted as short-run effects. A long-run coefficient of -0.7 can be solved from his various equations.

militancy in different times. This could be even more so in economies where full unionization has been nearly reached. The fact that in Finland the largest unions have sometimes been compared with the state machinery refers to an increase in corporatistic features in union behaviour. This in turn implies fading militancy for a given membership.

The CRDW and ADF test statistics[12] of all the relevant wage equations[13] exceed the critical levels known at the 1 per cent significance level (see Engle & Granger (1987), Hall (1986) and Engle & Yoo (1987)). As regards the wage equations, the cointegration hypothesis can be accepted without problems.

3.1.2 Demand for Labour

The demand of labour can be measured by two different concepts, the number of employed persons and the amount of working hours performed. The latter is closer to the concept relevant for the production function, the profit function and household income. On the other hand, from the point of view of economic policy, the number of employed persons is the key variable. Equations have been estimated for both heads and hours. Table 3 reports the regressions explaining the number of employed persons. Table 4 presents the results for the working hours performed. In equations (24) - (26), hours worked are adjusted for quarterly variations in the number of working days.

Employment: Heads

We now move on to examine Table 3 and the level-form equations for the number of employed persons. - A fall in the relative producer prices

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[12]The weakness of these tests is well known (see Oxford Bulletin of Economics and Statistics, Vol. 48, No. 3, Special issue on cointegrated variables). In addition, the test-statistics have been generated in simulations with smaller sets of independent variables than we have in our equations. Despite all this, we have used the critical levels available as we do not have a better choice. Problems stemming from the complexity of our equations should, however, not be overlooked.

[13]ADF test statistics were calculated from parsimonious specifications of the regressed equations by including only those lagged terms that significantly differed from zero.

TABLE 3. COINTEGRATING EQUATIONS: DEMAND FOR LABOUR

Estimation period: 1965Q1 - 1984Q4
Estimation method: OLS

Indepen-dent variables	Dependent variable N = employment (number of employed persons)						
	Private sector				Manufacturing industry		
	(11)	(12)	(13) *	(14)	(15)	(16) *	(17)
P_m/P	-.027	-.039	-.040	-.042	-.030	-.049	-.026
P_c/P	-.193	-.417	-.412	-	-.359	-.464	-
PCD	-	-	-	-.184	-	-	-.291
$(1+\tau_3)$	-	-	-	-.622	-	-	-1.308
$(1-\tau_2)$	-.300	-	-	-	-.269	-	-
$(1+\tau_1)$	-.181	-.305	-.293	-.056	.171	-	-
Q	.346	.257	.256	.263	.331	.246	.244
UNION	.031	.057	.055	.043	.172	.224	.203
(K&TIME)[1]	-.239	-.109	-.099	-.082	-.344	-.229	-.213
B	-.038	-.003	-	-	-.019	-	-
H_N	-.087	-.047	-	-	-.119	-.122	-.217
DN^2	.029	.015	.016	.024	-	-	-
Constant	5.094	5.354	5.100	4.957	4.885	5.433	5.976
R^2	.982	.973	.973	.978	.978	.975	.982
R^2C	.979	.969	.970	.975	.975	.973	.980
CRDW	1.068	.824	.824	.766	.775	.626	.943
ADF	5.06	4.20	4.17	4.03	4.61	4.12	5.53
SE	.007	.009	.009	.008	.015	.015	.013

1 This variable measuring the contribution on productivity of capital stock and technical progress is in private aggregate sector (K**0.42124)*EXP(0.00576*TIME). In manufacturing it is (K**0.36956)*EXP(0.00836*TIME).

2 DN is a dummy referring to a change in statistics and is 1 in 1965Q1 - 1975Q4, and 0 elsewhere.

weakens the demand for labour with a coefficient of about 0.4. However, the effect stemming from an increase in the turnover tax could be even stronger. The coefficient of the relative import prices of raw materials is negative in the employment equations, although small.[13]

The income tax variable was dropped from the preferred regressions on account of a priori "wrong" sign. The same was made for employers' social security contributions in the employment equation for manufacturing.[14] In the aggregate private sector, the payroll tax obtained a negative but small coefficient. These results might be clarified by recalling that according to the wage equations, an increase in the payroll tax was transmitted fully to lower real wages. Thus, little - if any - adjustment is left to employment. This could be the factual explanation reflecting actual behaviour, for not finding a significant effect of the payroll tax in employment equations.

The growth of the capital stock and improving technology appear to have reduced the need for labour. The coefficient of (K & TIME) variable is about (minus) 0.1 - 0.2. In manufacturing, the effect appears to be a little larger than in the entire private sector. This is no surprise as the role of the - traditionally measured - capital stock incorporated in the national accounts ought to be greater in manufacturing than in the more service-intensive aggregate sector.

The linkage between employment and output is clearcut. Coefficients of the output variable are, nevertheless, fairly low in comparison with

[13]Also Bean, Layard & Nickell (1986) and McCallum (1986) arrive, from different starting points and with differing methods, in their studies covering 12 OECD countries to the conclusion that the effect of import prices or the terms of trade on the development of employment has been modest in Finland.

[14]In Holmlund (1987) there is an example of a case in which a positive coefficient in equation (15) would be sensible. If the sum of the measure for the degree of relative risk aversion (δ) and the wage elasticity of the demand for labour (ε) is less than one, an increase in the payroll tax reduces wages and raises employment. The assumption that $\delta + \varepsilon < 1$, does not, however, correspond to our preconseption of the size of δ and ε.

conventional results. An exogenous ten per cent increase in product demand - or here, in the output - increases the number of employed persons by just under 3 per cent in the long term.[16] When evaluating the result one must keep in mind that we are dealing with a reduced-form equation in which employment is not explained by wages. If an exogenous increase in product demand raises wages, the adjustment required for employment is smaller than in the conventional structural form equations.

The coefficient of normal working hours was in accordance with expectations negative in all employment equations. However, the effect is marginal in the aggregate private sector. Instead, conditional support is obtained to the hypothesis that the shortening of normal working time in manufacturing would have been reflected - albeit modestly - in a higher number of employed persons.[17]

Let us now examine the union power. A rise in the unionization appears to have increased employment in manufacturing industry.[18] This contrasts the widely spread thinking that unionization - if unions are succesful in pushing up wages - will lead to lower employment. It is, however, common from literature that theoretically a strengthening of

[16]For instance Santamäki (1980) obtained the value of 0.53 - 0.58 for the long-run output elasticity for employment. Peisa & Solttila (1986) arrived at the long-term production elasticity of employment amounting to 0.8 in level-form regression whereas to 0.5 in difference models. Peisa & Solttila (1987) obtained the same coefficient as above in an level-form estimation with instrumental variables. In contrast, the long-run output elasticity in their instrumented difference equation is 0.3, which corresponds to the results obtained in the present study. In all exercises of Peisa & Solttila, the real wage is an independent variable in employment equations.

[17]Wadhwani (1987) finds a similar although somewhat stronger effect for the UK.

[18]Alogoskoufis & Manning (1987) find a similar effect for the UK. In their structural form employment equation the coefficient of union density was +0.16 with t-value of 4.83.

unions either increases[19] or decreases employment, or then it does not affect it in any way. It all depends on the model and behavioural hypothesis chosen.

When reviewing the entire private sector, our empirical results are less controversial. Union power obtained a positive coefficient close to zero. When putting this together with figures for manufacturing, it is obvious that outside the manufacturing industries the union effect on employment has been definitely negative.

Let us, however, explore further the positive impact found for Finnish manufacturing. This kind of employment effect is conventionally linked to the efficient contract model. As no bargaining over employment can be traced in actual negotiation process in Finland, we do not wish to make such a straightforward conclusion. There are several ways to solve the puzzle. The first refers to Manning (1987). We may be dealing with a case where the positive effect of growing union power in employment determination (α) has dominated the negative effect stemming from higher wages (β), that is, $N_\alpha > N_\beta$ in absolute values. The steeper the labour demand schedule is, the more likely this is.[20] An other - although related - interpretation has to do with time-series

[19]Fehr (1988) introduces a model in which the "union" maximizes a generalized utilitarian objective function $U = (w - w_a)^\gamma N^\tau$, $\gamma > 0$, $\tau \geq 0$. This is inserted in a standard asymmetric Nash-solution. According to the comparative statistics, the sign of the employment effect of an increase in union power is generally ambigous. However, if $\tau > 0$ and sufficiently large, that is, if employment has high positive weight in the utility function above, a positive employment effect of an increase in the bargaining power is induced.

[20]According to Nickell & Wadhwani (1988) using micro-data for the UK, the actual labour demand curve could be considerably steeper than most aggregate studies would indicate. Consequently, the elasticity of employment with respect to the real wage would not be very large. As the elasticity of real wage with respect to union power is not very large either, a shift in direct union influence on employment need not to be tremendous to dominate and, thus, to generate the kind of results achieved by us.

properties and the speed of adjustment.[21] The slower the adjustment is, the more observations we have with employment higher than optimal as far as negative shocks are concerned. If these target errors are related to the union strength, time-series regressions are probable to show a positive union effect on employment. Both of these interpretations are valid though the representative firm would operate on the labour demand curve in "normal" conditions.

The third, and the most comprehensive way to look at the matter stems from the - now commonly accepted - notion that unions in different positions and circumstances are supposed to behave differently. Jackman, Layard & Nickell (1988) incorporates an extensive discussion on the theme. As the centralization of bargaining becomes high enough, the external effects of higher wages will be internalized. That is, the individual unions can no more disregard the consequences of their actions on aggregate prices or aggregate unemployment. The costs implied will be paid by union members, in form of higher prices or higher taxes to finance the increased outlays for unemployment benefits. In these circumstances a rational union tends to take an economy-wide view when choosing its strategies (see Calmfors & Driffill (1988)). This in turn, as Jackman (1989) shows, leads to a tendency towards lower unemployment,

[21]Nickell (1987) analyses labour demand in a dynamic context. In his model with convex adjustment costs, "if initial employment is too high ... the firm will gradually lay of employees ... reducing employment towards N*" (p. 483). If unions are able to create additional costs to lay-offs, this adjustment becomes even slower. On the other hand, according to Nickell & Wadhwani (1988) there is a striking difference between firms with different degrees of unionization. The employment in unionized firms displays much greater persistance. So, there is some evidence for the view that unions increase the adjustment costs associated with changes in employment. Nickell & Wadhwani conclude: "Our results based on comparing firms with varying levels of union density suggest that unions make the adjustment more sluggish, although the evidence on whether there is bargaining over the level of employment (albeit with $\alpha < \beta$), is less conclusive (p. 30)." So, in Finland the positive union effect on employment may also have taken place in form of preventing part of the lay-offs induced by other factors, negative demand shocks, e.g. This kind of job protection could be part of the positive union effect on employment. Thus, our result is not necessary pervert even though the representative firm would tend to operate on labour demand curve.

that is, higher employment.[22] According to our view, both data on the size of the unions and casual evidence on union response in certain critical episodes, approve that the themes discussed above are not irrelevant in Finland. In fact, if one wishes to verify the favourable effects of increasing "corporatism" in empirical context, Finland should be an obvious candidate for this kind of exercise. It is hard to find an industrialized economy where the labour market characteristics would have changed so much in such a short time. In other Nordic countries (as also in Austria) the shifts in union density and the degree of centralization in wage bargaining have been much more smooth.

All in all, none of the above models is hardly sufficient as such. The actual data generating process is probably a mixture of all these mechanisms. They have played different roles in different circumstances in different occations within 25 years of the recent economic history of Finland. However, to discover a positive union effect on employment we do not need a world with efficient bargaining over both wages and employment.

The CRDW test statistics of the employment equations pass the critical values at the one per cent significance level. The results of the ADF test, however, vary. The time series in equation (17) should be cointegrated at the one per cent significance level, in the equations (11) and (15) at the five per cent level. In other equations, the test variables do not quite reach the five per cent critical level, although they are close to it. The equations (13) and (16) were chosen to be moved over to the ECM stage of the Granger & Engle procedure. The ADF test leaves this open to question,[23] but in defence we refer to the inverse correspondence shown by Granger (1986, p. 217): "Data generated by an error correction model ... must be cointegrated". The

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[22]Jackman et al. (1988) underline two actual facts related to the discussion on union effects on unemployment. First, in the 1980s, European unions have lost significant legal rights. But unemployment has not fallen. Second, in the countries with highest unionization in the Western world the unemployment is lowest.

[23]It has also been shown, that the ADF test leads to rejection of stationarity in many cases where it is present. On the other hand, if this test is passed, a rather stringent test has been passed.

justification for the choice above is sought in a way ex post, in evaluating the success in trying to capture a data generating process in line with error correction behaviour from the data.

Hours worked

If the number of working hours per individual worker were constant, heads and hours would move hand in hand. In reality, the difference is large. It results, in addition to variations in overtime work, also from the effect of shortened work weeks. Gradual reduction in normal hours should also be seen.

The equations for hours worked are in Table 4. Their explanatory power remains clearly weaker than that of the wage and employment equations. Figure 7 shows how strong the quarterly fluctuation in hours is, although the series have been adjusted for seasonal variation. Neither does the adjustment for the number of working days reduce this fluctuation much, it rather influences its timing. The cointegrating equation for the aggregate private sector is weaker than that of manufacturing. One reason for this may lie in the less reliable calculation methods of the series for working hours in the service sector. In most equations, the CRDW and the ADF tests are passed at the one per cent level.

In the equations for hours, the coefficients are in general close to those obtained for employment. Here they are, however, perhaps even more stable from one transformation to another. An exogenous increase in output increases working hours with a weight of just over one-third in the long term. To the low value of the coefficient we may attach the same comment concerning the reduced-form specification as in the case of the employment equations above. Productivity gains brought about by the capital stock and technology reduce the need for labour input with a weight of roughly one half in manufacturing and about one quarter in the entire private sector.

An increase in the relative consumer price (= fall in the producer price) reduces the use of labour input with a weight of just over

TABLE 4. COINTEGRATING EQUATIONS: DEMAND FOR LABOUR

Estimation period: 1965Q1 - 1984Q4
Estimation method: OLS

	Dependent variable								
	H = Hours worked						H^C = Hours worked, working days adjusted		
Independent variables	Private sector			Manufacturing industry			Manufacturing industry		
	(18)	(19) *	(20)	(21)	(22) *	(23)	(24)	(25) *	(26)
P_m/P	-.026	-.023	-.020	-.039	-.035	-.026	-.154	-.159	-.157
P_c/P	-.414	-.458	-	-.321	-.400	-	-.289	-.348	-
PCD	-	-	-.211	-	-	-.141	-	-	-.316
$(1+\tau_3)$	-	-	-.814	-	-	-1.000[3]	-	-	-.431
$(1-\tau_2)$	-.094	-	-	-.167	-	-	-.203	-	-
$(1+\tau_1)$	-.100	-.042	-	.142	-	-	-.408	-.366	-.364
Q	.388	.353	.354	.401	.328	.338	.478	.420	.420
UNION	-.057	-.065	-.073	.106	.120	.115	.239	.250	.248
(K&TIME)[1]	-.326	-.252	-.240	-.504	-.395	-.386	-.620	-.515	-.511
B	-.027	-	-	-.037	-	-	-.127	-.089	-.087
H_N	.096	.164	.045	.046	-	-	-.161	-	-
DL^2	-	-	-	-.012	-.018	-.021	-.126	-.130	-.130
Constant	1.582	1.283	1.836	2.415	3.022	3.025	3.252	2.728	2.728
R^2	.607	.603	.630	.878	.872	.865	.805	.801	.801
R^2C	.556	.564	.594	.860	.861	.853	.777	.778	.775
CRDW	1.853	1.854	1.959	.951	.886	1.198	1.663	1.673	1.681
ADF	7.16	7.15	8.08	4.89	4.70	5.49	7.17	7.22	7.25
SE	.020	.020	.019	.018	.018	.015	.029	.029	.029

1 This variable measuring the contribution on productivity of capital stock and technical progress is in private aggregate sector (K**0.42124)*EXP(0.00576*TIME). In manufacturing it is (K**0.36956)*EXP(0.00836*TIME).

2 DL is a dummy referring to a strike in metal and engineering industry and is 1 in 1971Q1, and 0 elsewhere.

3 The value of the coefficient is restricted to one.

one-third in manufacturing. In the aggregate private sector the effect is slightly larger, close to one-half. The effect of indirect taxation again appears to be more straightforward than that stemming from other factors. The role of relative raw material prices is marginal when estimated with series not adjusted for the number of working days. According to the estimations with adjusted series for manufacturing, an increase of ten percentage points in relative import prices of commodities and semiproducts reduces the demand for hours by over one percentage point.

Finally, there is again a reason to have a closer look at the union power. The coefficient of our proxy is negative in the equation for the entire private sector, positive in manufacturing. In all cases the t-statistics are high. - Strengthening unions appear to have been able to push up both jobs and hours worked in manufacturing. Perhaps manufacturing unions have thus been able to influence corporate employment decisions. Or perhaps they have not desired to exploit the fruits of their increased strength solely in the form of higher wages.

Or perhaps they have not been able to do that because of employer resistance. What ever is the reasoning here, the consequences may have contributed to the fact that in Finnish manufacturing the unemployment rate has remained clearly lower than in most other European countries.

Stability of the long run equations

Before proceeding the stability of the cointegrating regressions is briefly discussed. Two approaches to evaluate the matter were applied. The first indicating rather stable relationships was reported in section 3.1.1 above. The second follows the standard Chow-test procedure and the results are reported in Table 6. Wage equations appear to be quite robust. As far as employment is considered, results are controversial. With number of employed persons as the dependent variable, potential instability of coefficients emerges whereas in equations for hours worked there is absolutely no sign of this.

3.2 Error Correction Equations

In the following, we shall examine the short-run dynamics. At the first stage, level-form regressions were estimated. At the second stage, the one-quarter difference in the dependent variable is regressed on the differences of the variables included in the level-form equation with four lags in each variable. An additional right hand side variable is the lagged residual of the level-form equation. Its presence imposes reasonable long-run properties to the ECM. For the dynamics no restrictions are, however, set. The further strategy follows the "general-to-simple" modelling methodology (see e.g. Hendry (1986)). The initially overparametrized model is then simplyfied and reparametrized step by step until a parsimonious presentation of the data generating process is achieved. Jenkinson (1986) follows the same strategy.

The preferred level-form equations were carried with to the second stage of the procedure. Two alternative wage equations for manufacturing are included. In order to facilitate the reading of what follows, we have assembled in Table 5 the long-run elasticities implied by the relevant cointegrated regressions.

Table A in Appendix 2 reports the parsimonius error correction equations. On top of the table is the number of the level-form regression to which each difference equation is connected with. Tyrväinen (1988a) reports the initial overparametrized error correction equations. In the iterative procedure the least significant lag was removed one at a time. The criterion here was the White's heteroschedasticity adjusted t-statistic. The procedure was continued as long as the statistical properties of the equations were not weakened. Attention was paid especially to behaviour of the standard error as well as to R^2 adjusted for the degrees of freedom. However,

TABLE 5. SUMMARY OF THE LONG RUN RELATIONSHIPS IMPLIED BY SELECTED COINTEGRATING REGRESSIONS

Independent variables	Dependent variable: Wages W, Private sector (5)*	Wages W, Manufacturing industry (9)*	Wages W, Manufacturing industry (10)*	Employment N, Private sector (13)*	Employment N, Manuf. ind. (16)*	Hours worked H, Private sector (19)*	Hours worked H, Manuf. ind. (22)*	Hours worked H^c, Manuf. ind. (25)*
P_c	1.000[1]	1.000[1]	1.000[1]	-	-	-	-	-
P_c/P	-	-	-	-.412	-.464	-.458	-.400	-.348
PCD	-.102	-	-.162	-	-	-	-	-
$(1+\tau_3)$	-1.000[1]	-	-1.000[1]	-	-	-	-	-
$(1+\tau_1)$	-1.000[1]	-1.000[1]	-1.000[1]	-.293	-	-.042	-	-.366
$(1-\tau_2)$	-.482	-.534	-.163	-	-	-	-	-
(P_m/P)	-.080	-.072	-.124	-.040	-.049	-.023	-.035	-.159
Q	.105	.060	-	.256	.246	.353	.328	.420
UNION	.138	.256	.319	.055	.224	-.065	.120	.250
(K&TIME)	.637	.381	.560	-.099	-.229	-.252	-.395	-.515
B	-	.032	.033	-	-	-	-	-.089
H_N	-	-1.000[1]	-.263	-	-.122	.164	-	-

P_c = consumer prices, P = producer prices, P_m = import prices of raw-materials and semi-products (incl. energy), PCD = $P_c/P(1+\tau_3)$, τ_1 = employers' social security contributions, τ_2 = marginal rate of income taxes, τ_3 = indirect taxes on consumption, Q = total production of the sector in concern, UNION = unionization rate, K = capital stock, B = replacement ratio, H_N = normal annual working time.

1 The long run coefficient is restricted to take value of one.

TABLE 6. STABILITY OF PREFERRED LONG RUN EQUATIONS

Results of a Chow-test[1]

Equation	Values of Chow-statistic	Critical values with significance level of 5 per cent	1 per cent
WAGES			
Private sector (5)	F (7,42) = 0.780	2.2	3.1
Manufacturing (9)	F (7,42) = 2.102	2.2	3.1
Manufacturing (10)	F (8,40) = 1.458	2.2	3.0
EMPLOYMENT: HEADS			
Private sector (13)	F (7,66) = 2.428	2.2	2.9
Manufacturing (16)	F (7,66) = 4.470	2.2	2.9
EMPLOYMENT: HOURS			
Private sector (19)	F (8,64) = 1.288	2.1	2.8
Manufacturing (22)	F (6,68) = 1.292	2.2	3.1
Manufacturing (25)	F (8,64) = 1.270	2.1	2.8

1 The observation period was devided to two equally long subperiods in all the cases.

also the DW-statistic and the effect of the omittance on other coefficients was monitored. Finally, F-tests where used when the sum of the lags of a variable was close to zero, but individual coefficients were significant. This gave a basis for dropping some groups of lagged variables.

Some of our final equations include variables whose t-values do not quite reach the 5 per cent significance level. Their omission was experimented with. If this raised standard error as well as reduced the adjusted R^2, the variable in question was left in the equation. In borderline cases, our qualitative judgement concerning the sign and size of the coefficient in concern supported this without exception.

3.2.1 Wages

The unionization rate has been calculated from year-end observations, and the quarterly time series have been disaggregated from the annual one with technical methods. In the short-run analyses, one could expect that the synthetical nature of the UNI variable might cause problems. However, this did not appear, the positive effect on wages of the union power is visible also in short-run dynamics. On the other hand, the role of (K & TIME) in the short-run wage equations (28) and (29) is confusing. The coefficients of the lags swing from positive to negative. The F-test does not imply that their combined effect would be zero. The sum of coefficients calculated from the lags in equation (28) is zero, marginally positive in equation (29).

The dynamics implied by the equations in Table A is difficult to outline. It would be misleading to evaluate it on the basis of the coefficient of the lagged residual only. Dynamics are in fact generated through three different channels. In addition to the lagged residual, the contemporary and the lagged coefficients of the shock variable matter as also the lags of the dependent variable. To find out the properties of an error correction model estimated in two-stages with free dynamics, simulation of the so-called step response function is required. They tell how rapidly and through what kind of path the convergence to the long-run equilibrium takes place.

Figure 3 presents results of various simulations. The step response functions have been calculated assuming that a permanent shift of 10 percentage points occures in exogenous variables one at a time in the first quarter of 1985. The convergence path has been obtained as the difference between the shock solution and the control solution.

Generally, the adjustment of real wages towards their equilibrium level is fairly rapid. In the aggregate private sector, for instance, a deviation from equilibrium due to a shift in demand is for the major part corrected within a year. The remainder is corrected gradually and at the end of the second year the overall effect of the shock has been transmitted. In manufacturing, the adjustment appears to be a little slower at least for some shock alternatives. There, adjustment to a change in the income tax rate is still on it's way during the third year.

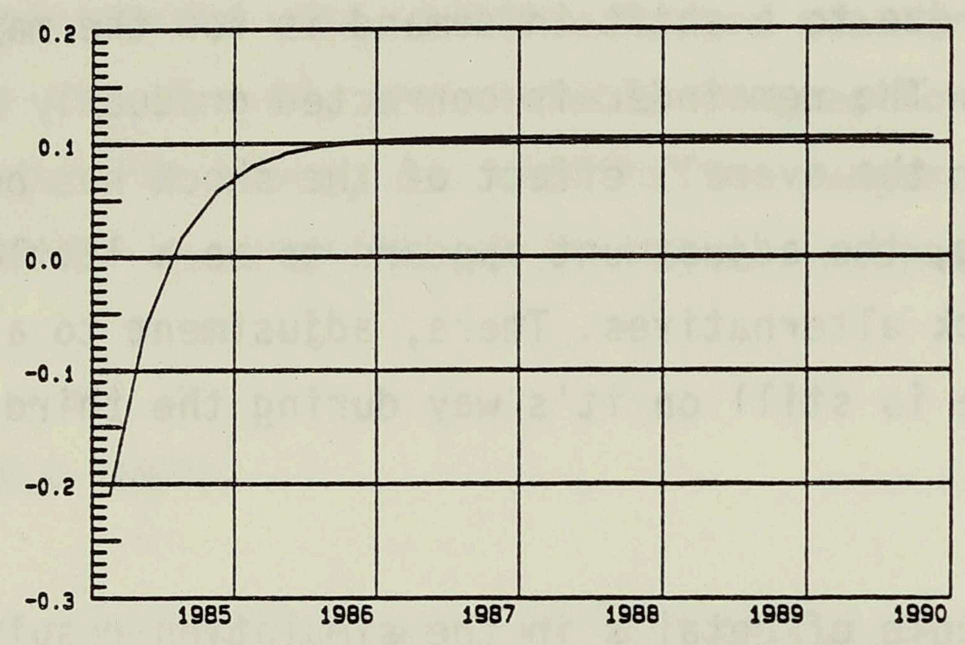
Let us pay attention to a couple of details in the simulation results. A negative immediate wage effect appears to be connected with a demand shock, though the effect turns to positive later on. This may be due to random factors, but also a statistical, more technical explanation could be found. The dependent variable is the average wage. If new workers are recruited as output expands and their wages are smaller than wages of senior workers, the average wage in the branch declines. This reasoning gains credibility from the direct positive output response visible in the employment simulation (Figures 6a and b).

The short-term negative effect on wages of rise in raw material prices is greater than the long-term effect (Figure 3e). We shall return to this when the employment equations are examined. Figures 3c - d show how the easing of the marginal tax rate is gradually transmitted to a lower real wage. In Figure 3b employers' social security contributions are transmitted to wages in full.

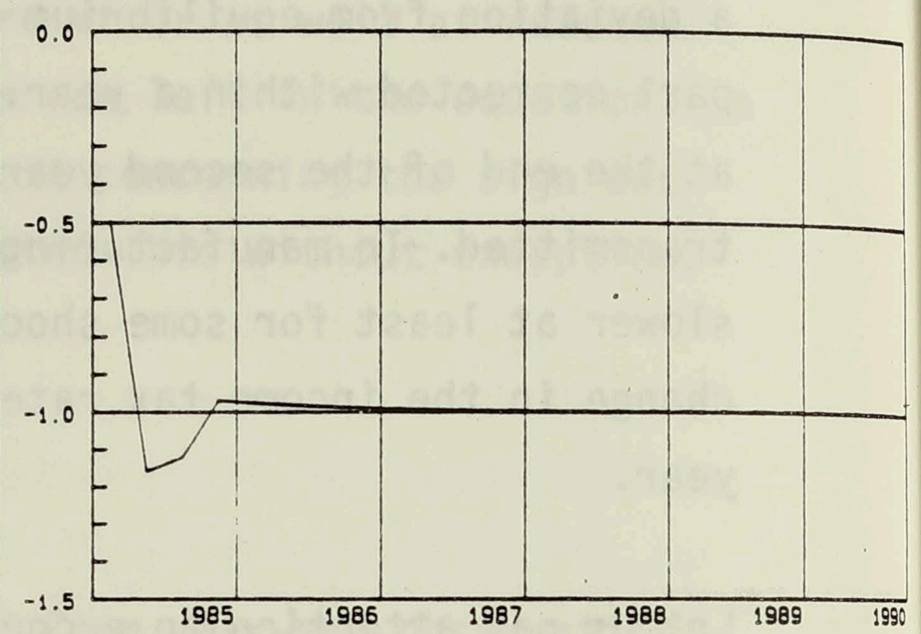
FIGURE 3. Step response functions simulated for wages

The figures show the adjustment paths of wages obtained by means of dynamic simulation after a shock has been fed into the system. The shock was induced as a permanent shift of 10 per cent in the level of an explanatory variable starting in 1985Q1. The simulations for private sector are based on the regressions (5) & (27) and for manufacturing equation (9) & (28) were used.

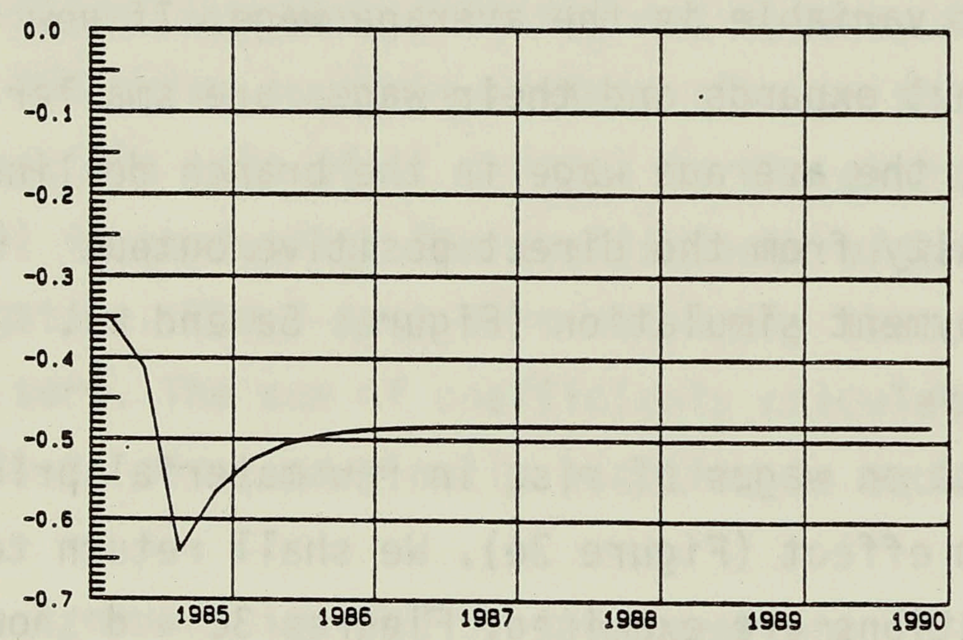
a) A shift in demand (= output), private sector



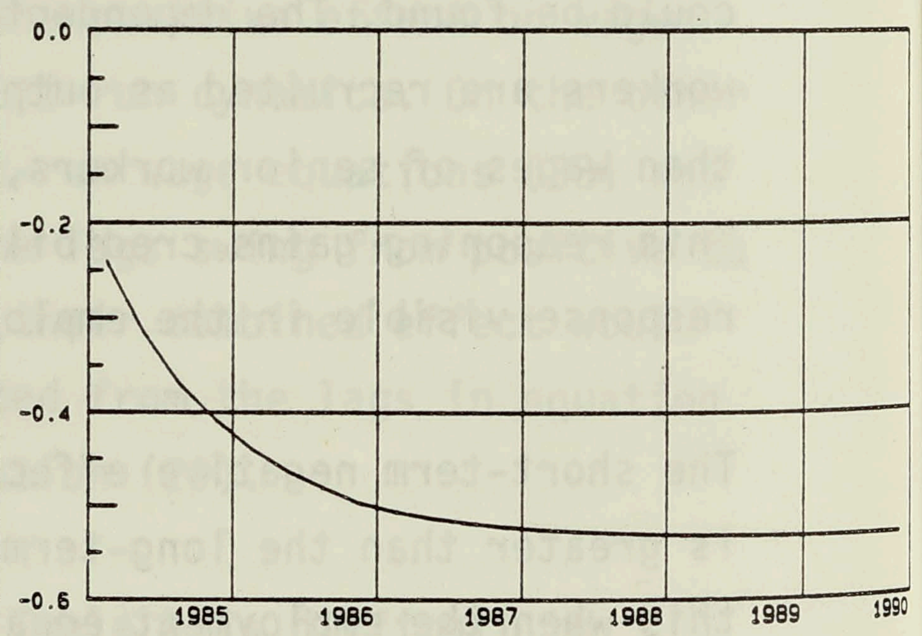
b) A rise in employers social security contributions, manufacturing



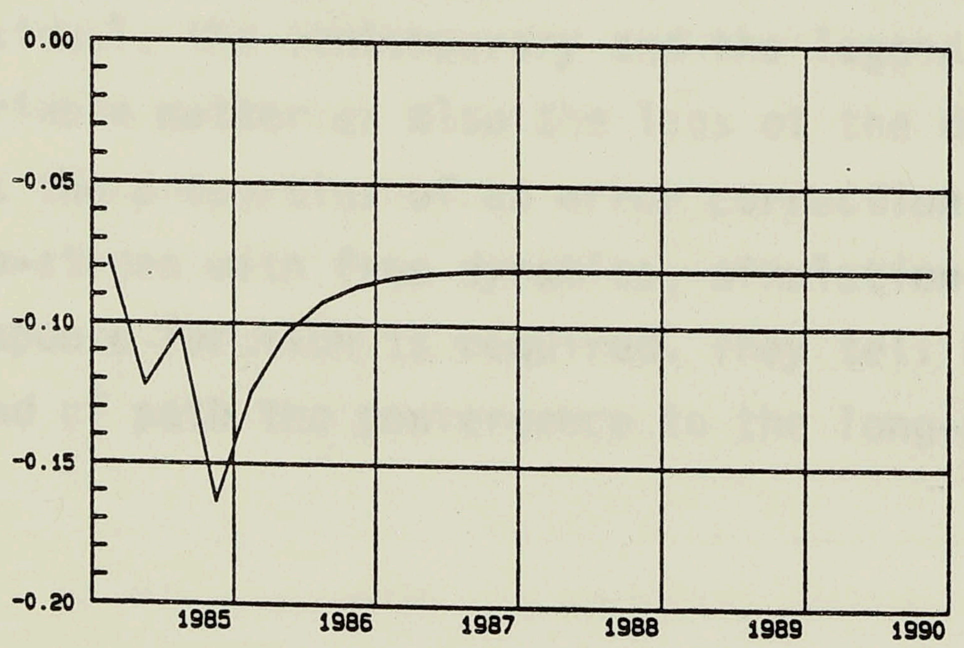
c) A reduction in the rate of marginal income tax, private sector



d) A reduction in the rate of of marginal income tax, manufacturing



e) A rise in relative price of raw materials (incl. energy), private sector



f) A rise in unionization rate, manufacturing

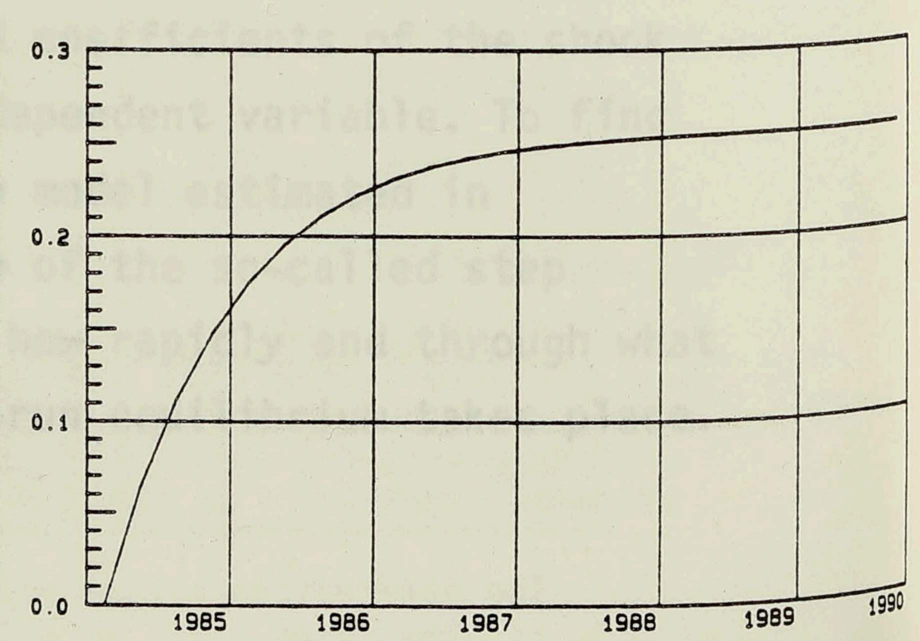


FIGURE 4a. Wage equation in (real) levels (5), private sector

Actual
Fitted --------

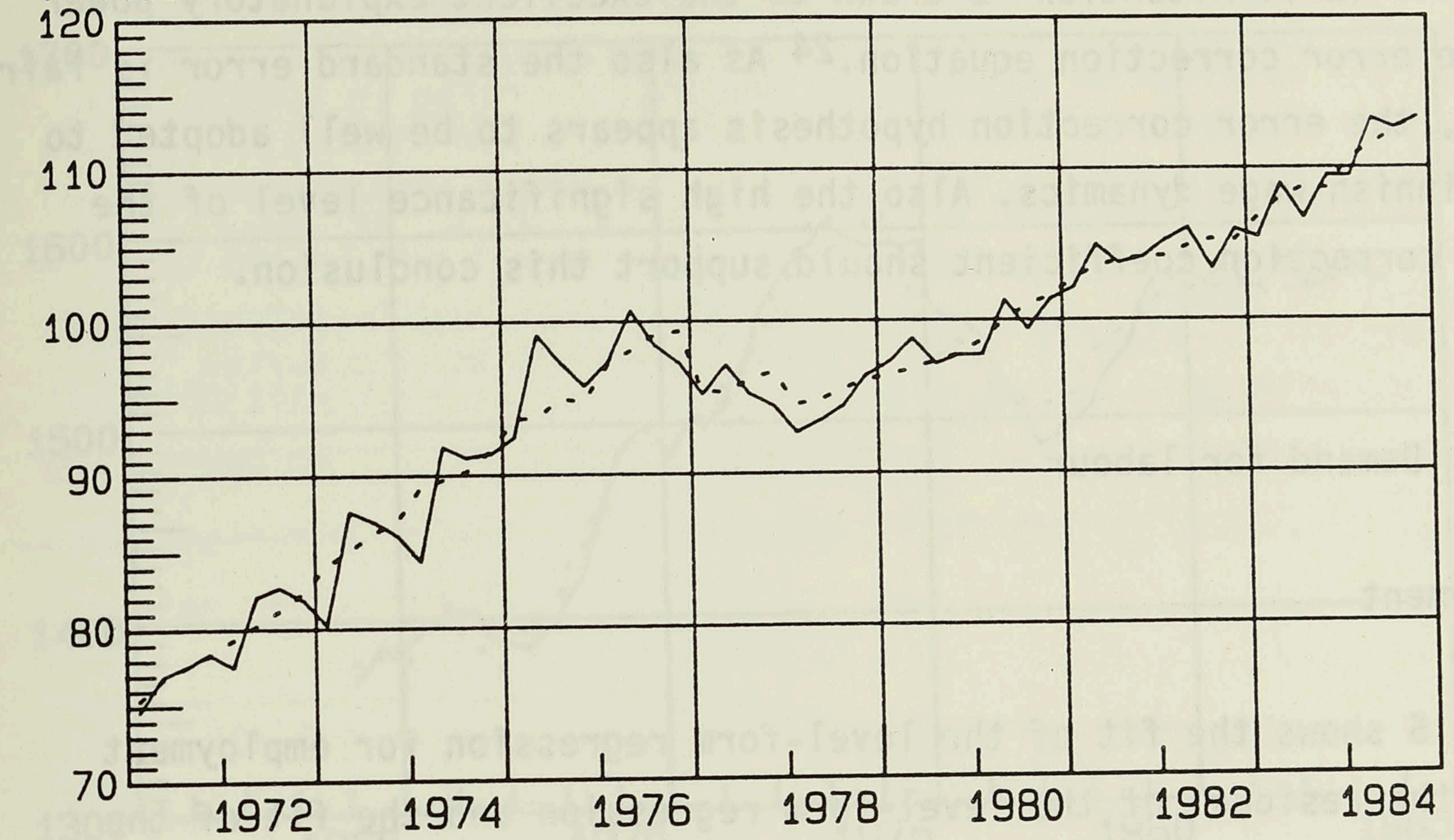


FIGURE 4b. Residual of the equation above

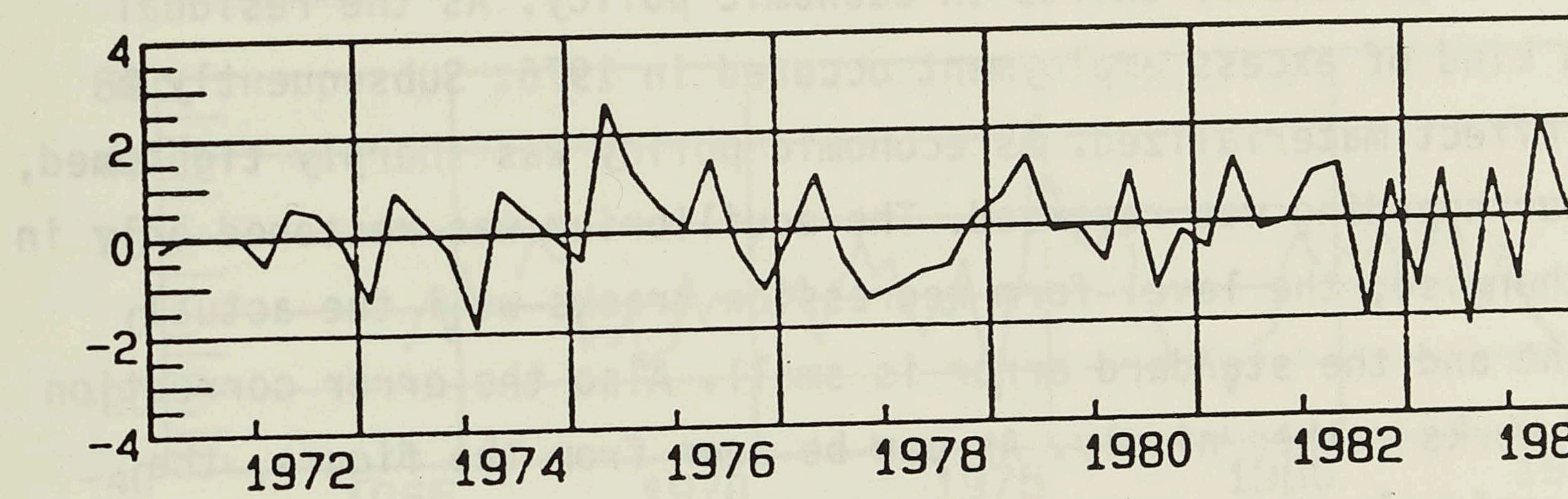


FIGURE 4c. ECM on (nominal) wages (27)

Actual change from the previous quarter, per cent ——
Fitted change from the previous quarter, per cent --------

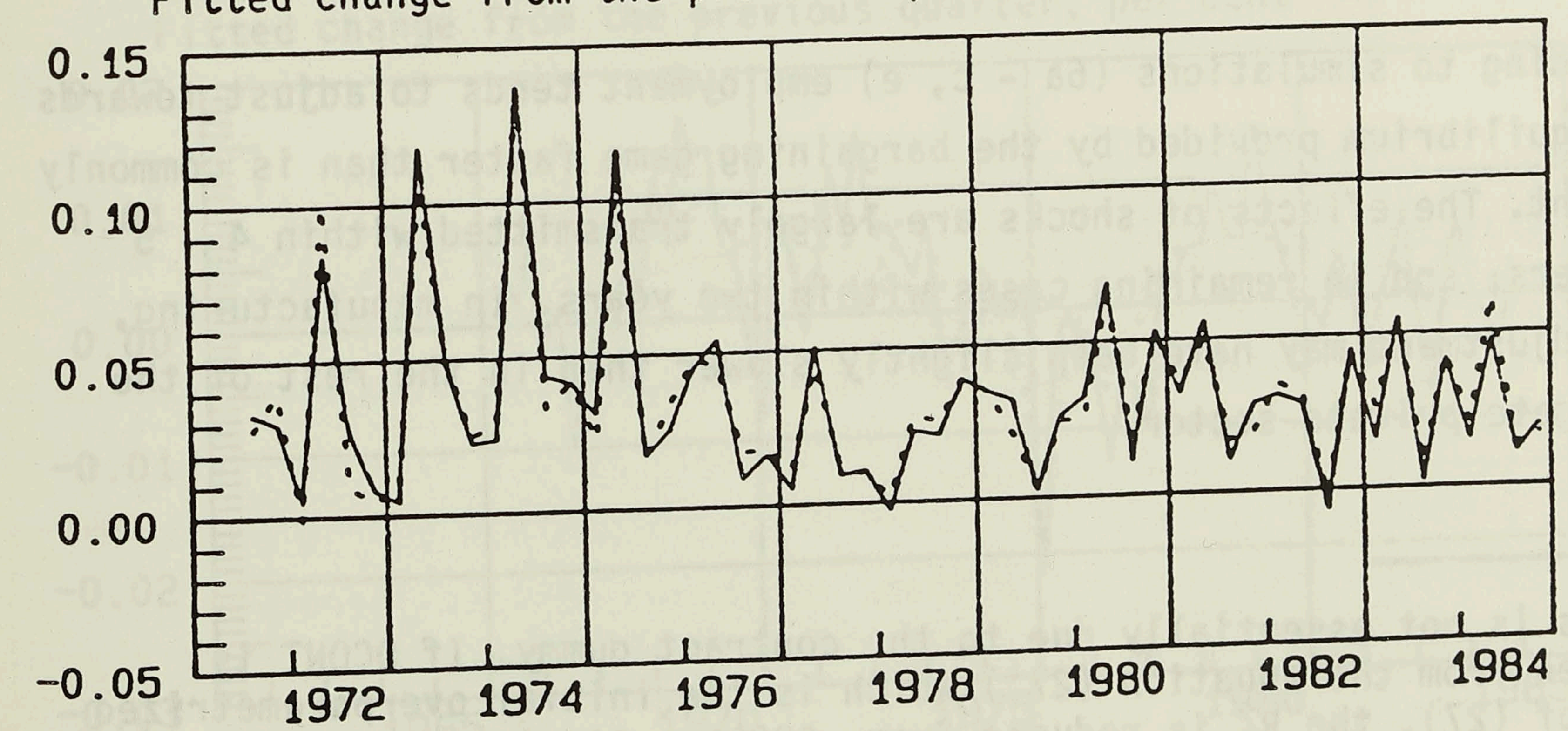


Figure 4 presents the fit of the level-form regression (5), the error term of the level-form regression and the fit of the error correction equation (27). Attention is drawn to the excellent explanatory power of the error correction equation.[24] As also the standard error is fairly small, the error correction hypothesis appears to be well adopted to the Finnish wage dynamics. Also the high significance level of the error correction coefficient should support this conclusion.

3.2.2 Demand for labour

Employment

Figure 5 shows the fit of the level-form regression for employment (13), the residual of the level-form regression and the fit of the error correction equation (30). The actual employment was overestimated in the latter half of the 1970s. Our explanatory variables do not capture full effects of shifts in economic policy. As the residual shows, a kind of excess employment occured in 1976. Subsequently a counter effect materialized. As economic policy was sharply tightened, the labour hoarding was reversed. The equilibrium was restored only in 1980. Otherwise, the level-form regression tracks well the actual employment and the standard error is small. Also the error correction equation works rather nicely. As can be seen from the figure, the largest residuals are again connected with the period of transition in policies referred to above. The standard errors of the ECMs are strikingly small.

According to simulations (6a - c, e) employment tends to adjust towards the equilibrium provided by the bargaining game faster than is commonly thought. The effects of shocks are largely transmitted within 4 - 5 quarters, and in remaining cases within two years. In manufacturing, the adjustment may have been slightly slower than in the rest of the aggregate private sector.

---

[24] This is not essentially due to the contract dummy. If DCONT is dropped from the equation (27') which is the initial overparametrized form of (27), the R^2 is reduced from .980 to .944 (see Tyrväinen (1988a)).

FIGURE 5a. Employment equation in levels (13), private sector

Actual ————

Fitted --------

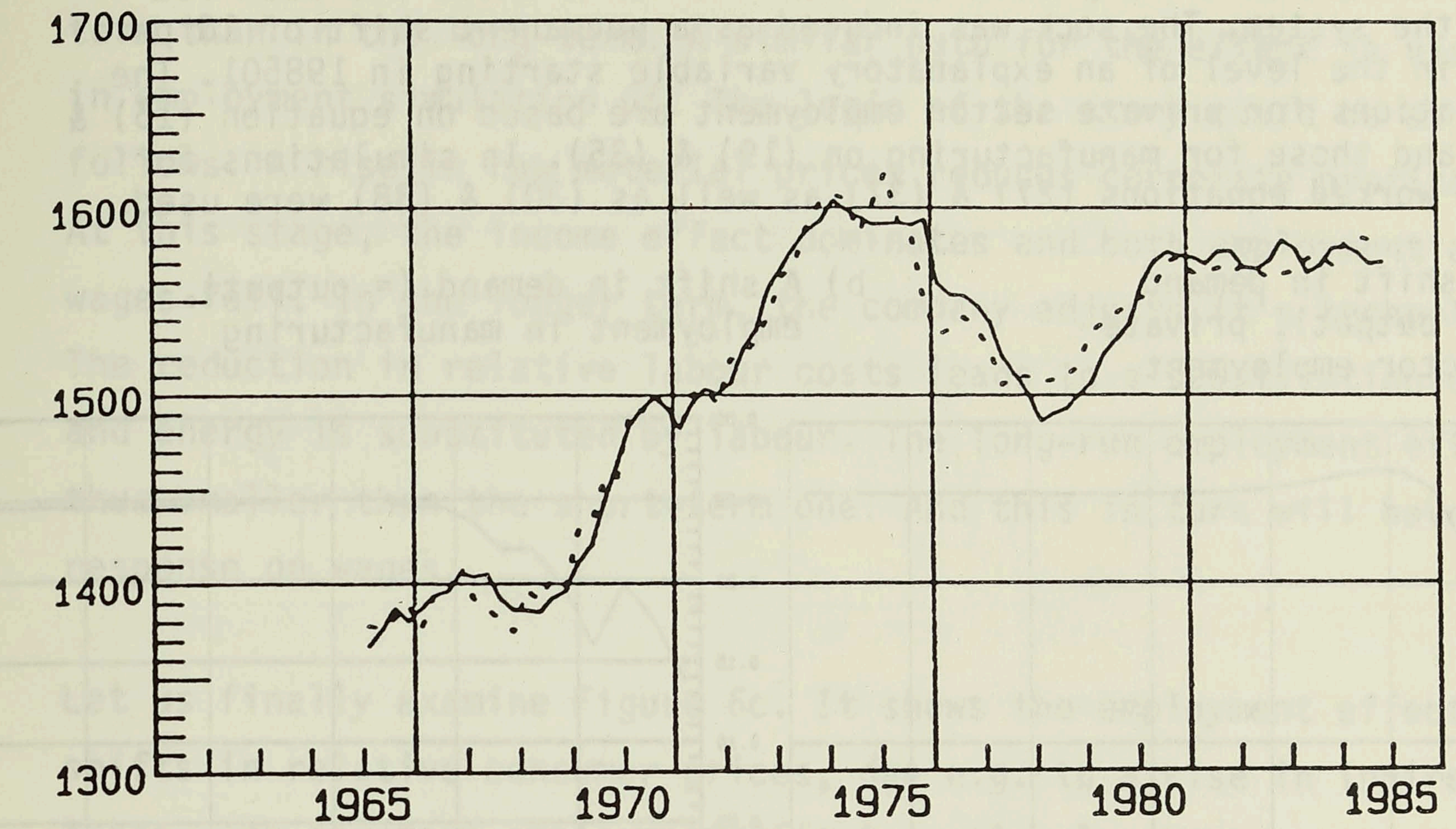


FIGURE 5b. Residual of the equation above

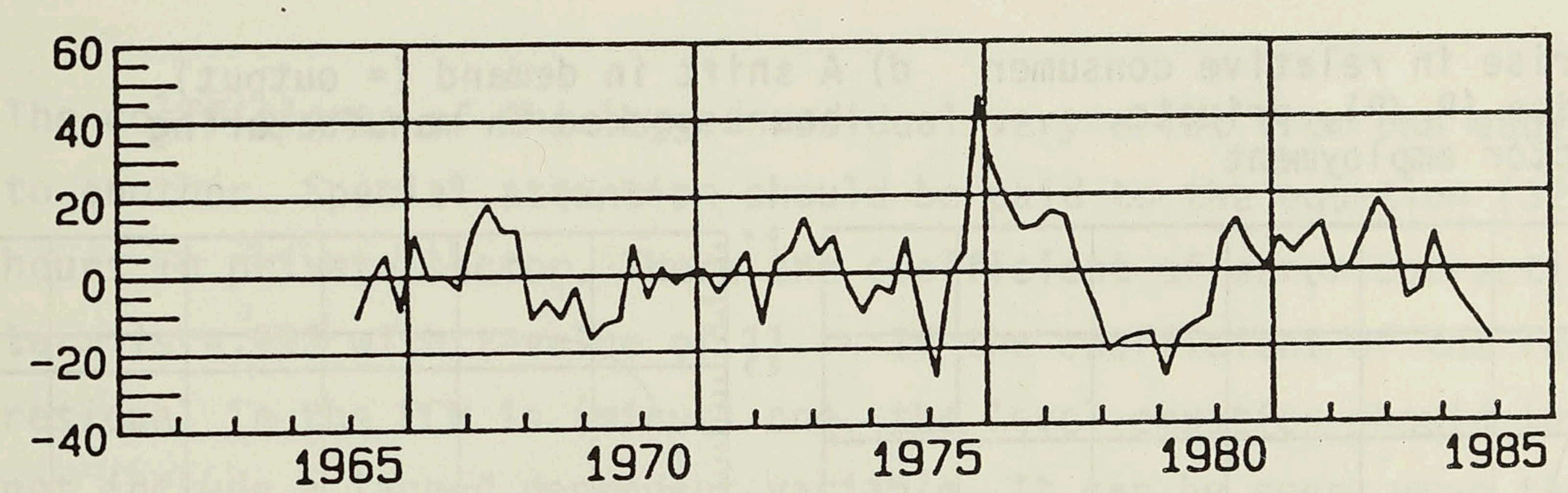


FIGURE 5c. ECM on employment (30)

Actual change from the previous quarter, per cent ————

Fitted change from the previous quarter, per cent --------

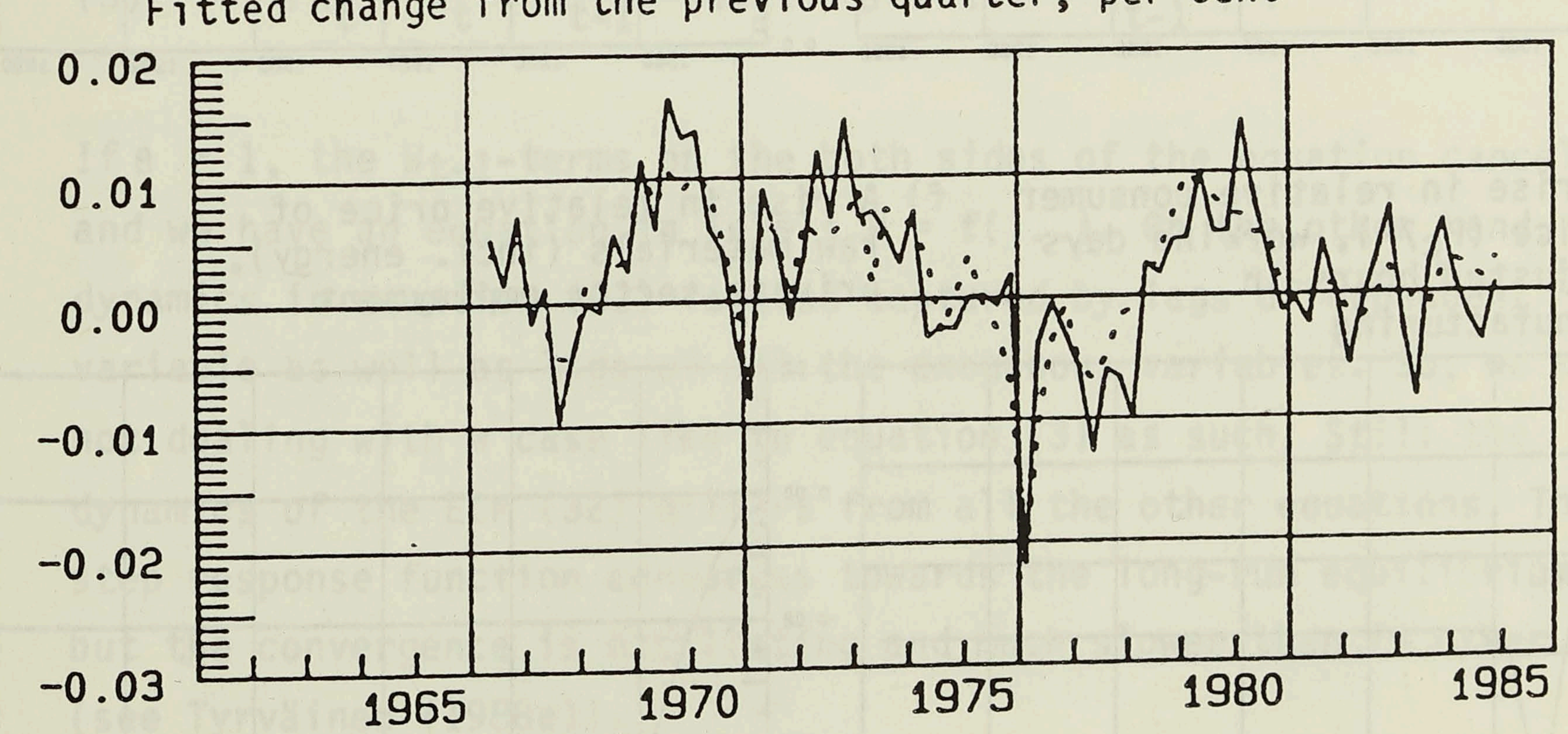
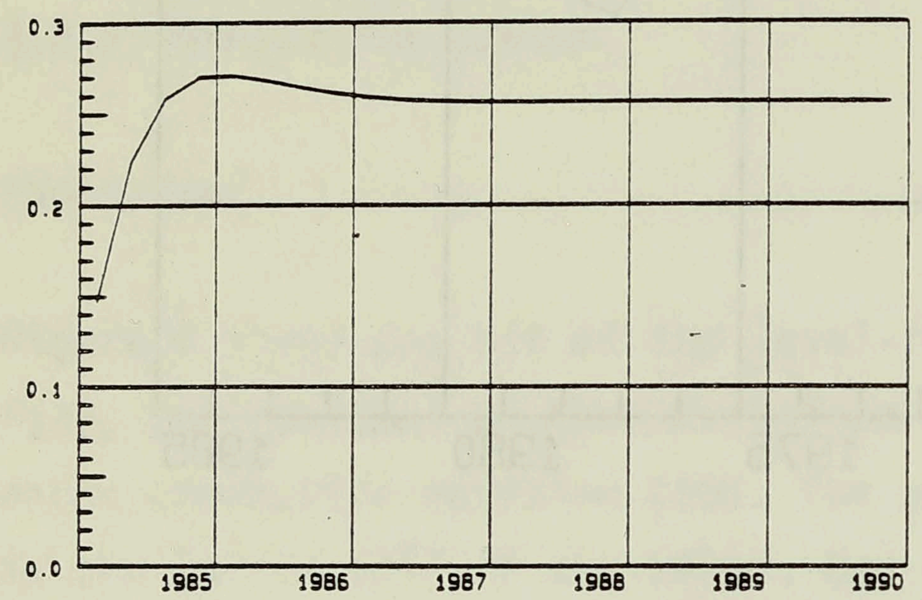


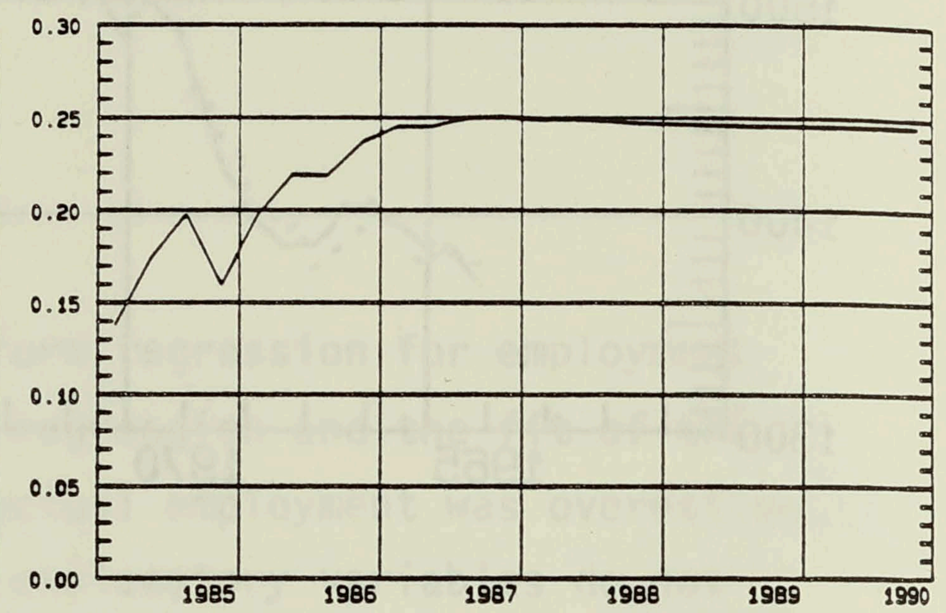
FIGURE 6. Step response functions simulated for demand for labour

The figures show the adjustment paths of employment and hours worked obtained by means of dynamic simulation after a shock has been fed into the system. The sock was induced as a permanent shift of 10 per cent in the level of an explanatory variable starting in 1985Q1. The simulations for private sector employment are based on equation (16) & (34) and those for manufacturing on (19) & (35). In simulations for hours worked equations (27) & (37) as well as (30) & (38) were used.

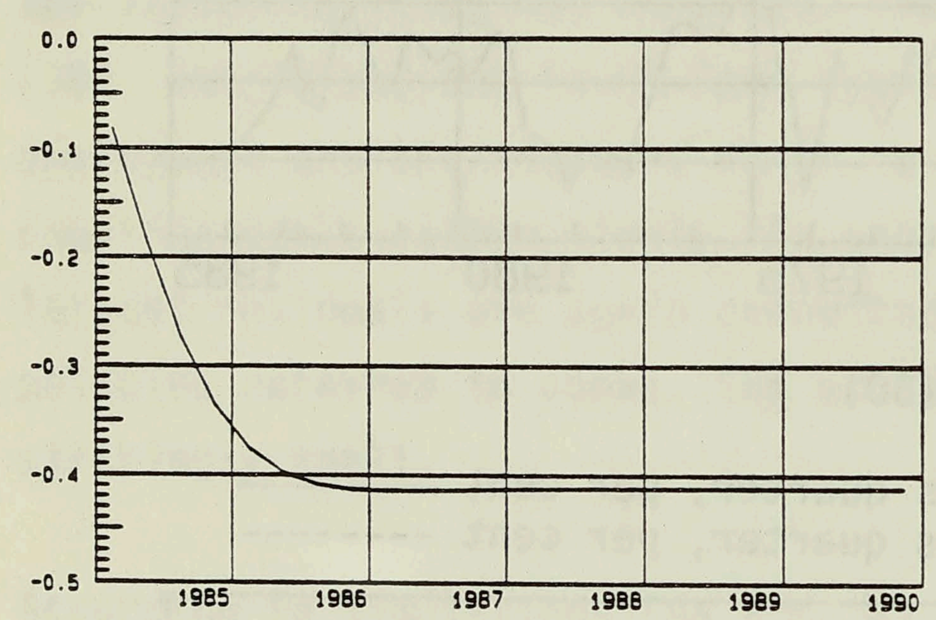
a) A shift in demand (= output), private sector employment



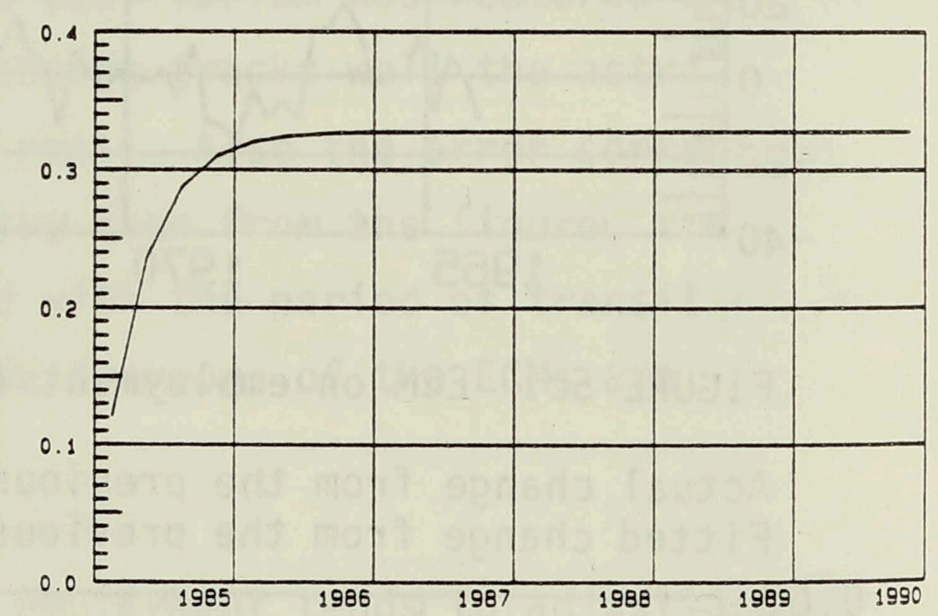
b) A shift in demand (= output), employment in manufacturing



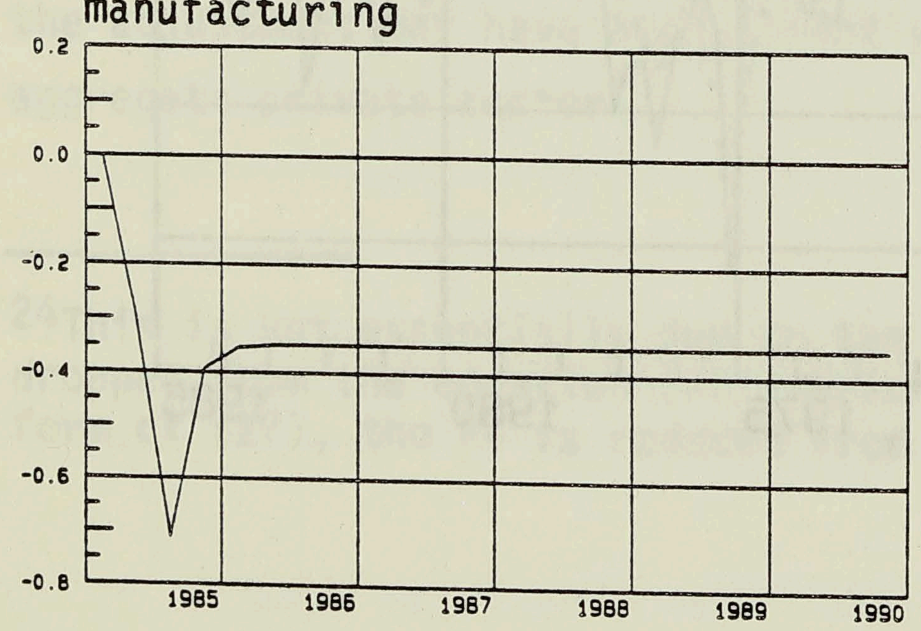
c) A rise in relative consumer price (P_C/P), private sector employment



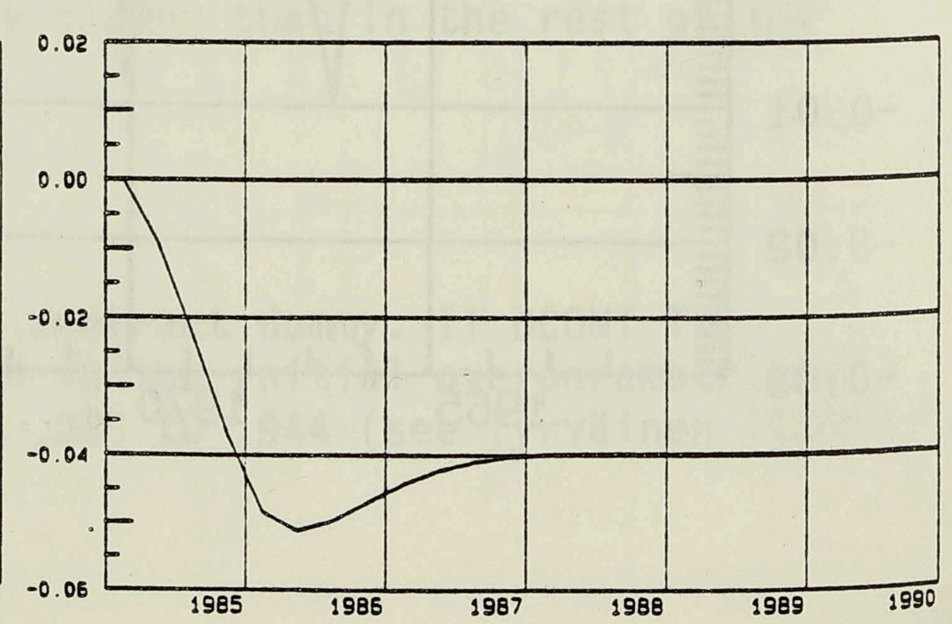
d) A shift in demand (= output), hours worked in manufacturing



e) A rise in relative consumer price (P_C/P), workind days adjusted hours in manufacturing



f) A rise in relative price of raw materials (incl. energy), private sector employment



The immediate response of employment to changes in output was referred to already above. It was further noted that the negative effect on wages of the increase in raw material prices is greater in the short-term than in the long-term. A similar path for the effect is visible in employment simulation 6f. The logic of the story could be as follows. A rise in raw material prices reduces corporate profitability. At this stage, the income effect dominates and both employment and wages fall. In the longer term, the company adjusts it's technology. The reduction in relative labour costs leads to a substitution effect, and energy is substituted by labour. The long-run employment effect is thus smaller than the short-term one. And this in turn will have its response on wages.

Let us finally examine Figure 6c. It shows the employment effects of shifts in relative consumer prices, due e.g. to a rise in indirect taxes. The negative employment effect is clearly shown.

Hours worked

The coefficients of the lagged residual vary a lot from one equation to another. Special attention should be paid to the equation (32) for hours in private sector. There the coefficient of error correction term is -.992 with t-value of 11. - If the coefficient of the lagged residual in the ECM is (minus) one, the level equation should in fact not include a lagged dependent variable. It can be seen, when the ECM is written as follows:

$$(3) \qquad \Delta W_t = W_t - W_{t-1} = ... + \beta \cdot (... - W_{t-1}) .$$

If $\beta = 1$, the W_{t-1}-terms on the both sides of the equation cancel out and we have an equation in levels W = f(...). On the other hand, the dynamics in equation (32) is also captured by lags of dependent variable as well as lags of all the exogenous variables. So, we are not dealing with a case like in equation (3) as such. Still the dynamics of the ECM (32) differs from all the other equations. The step response function converges towards the long-run equilibrium, but the convergence is oscillating and much slower than in other cases (see Tyrväinen (1988a)).

FIGURE 7a. Equation in levels on hours worked (13), private sector

Actual ________
Fitted --------

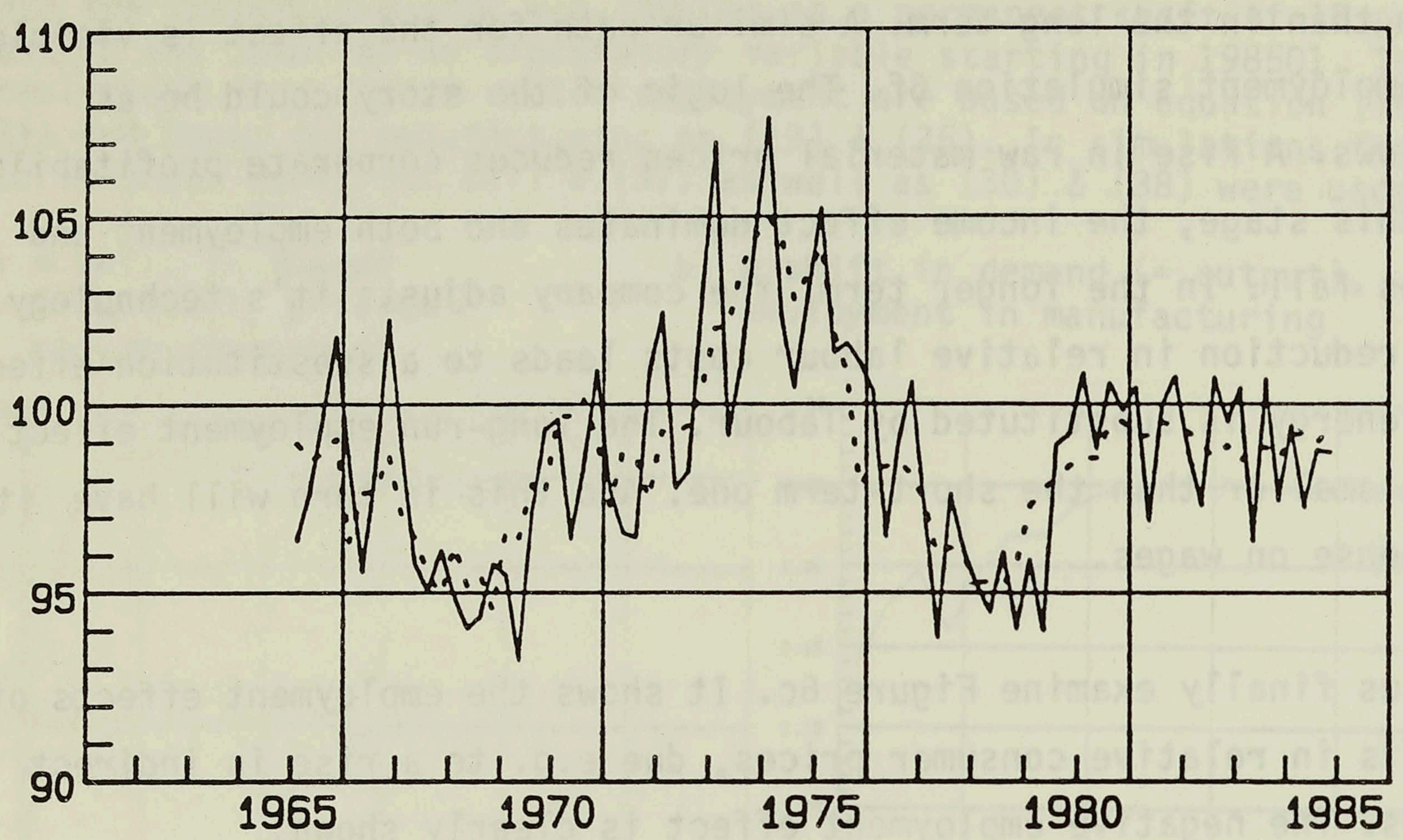


FIGURE 7b. Residual of the above equation

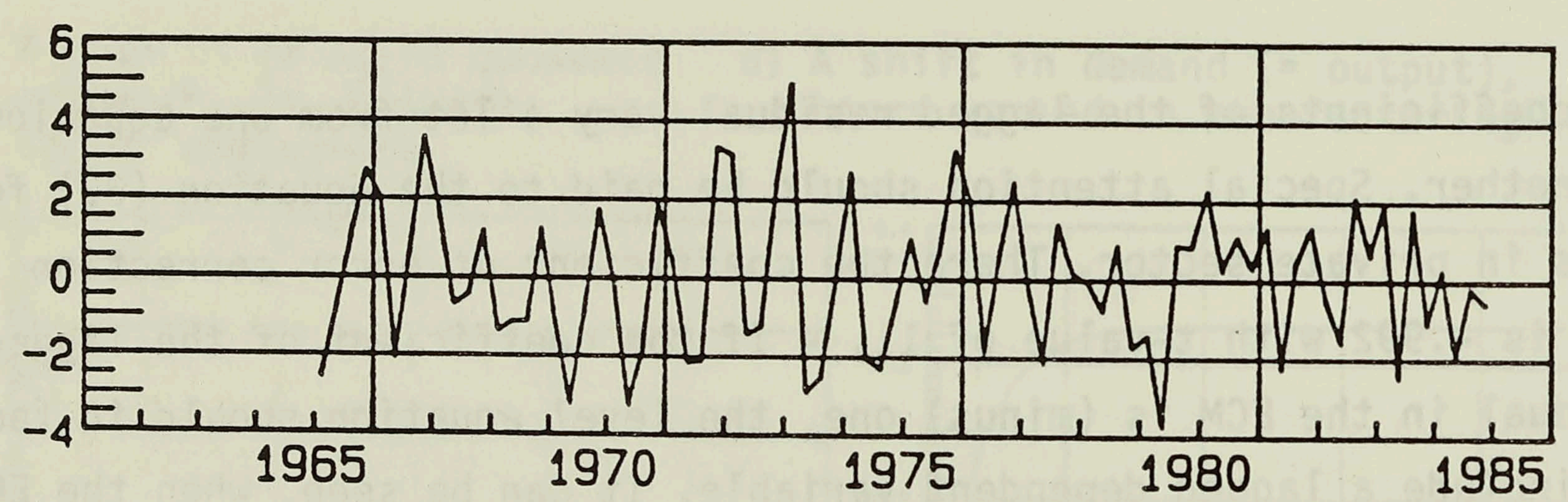
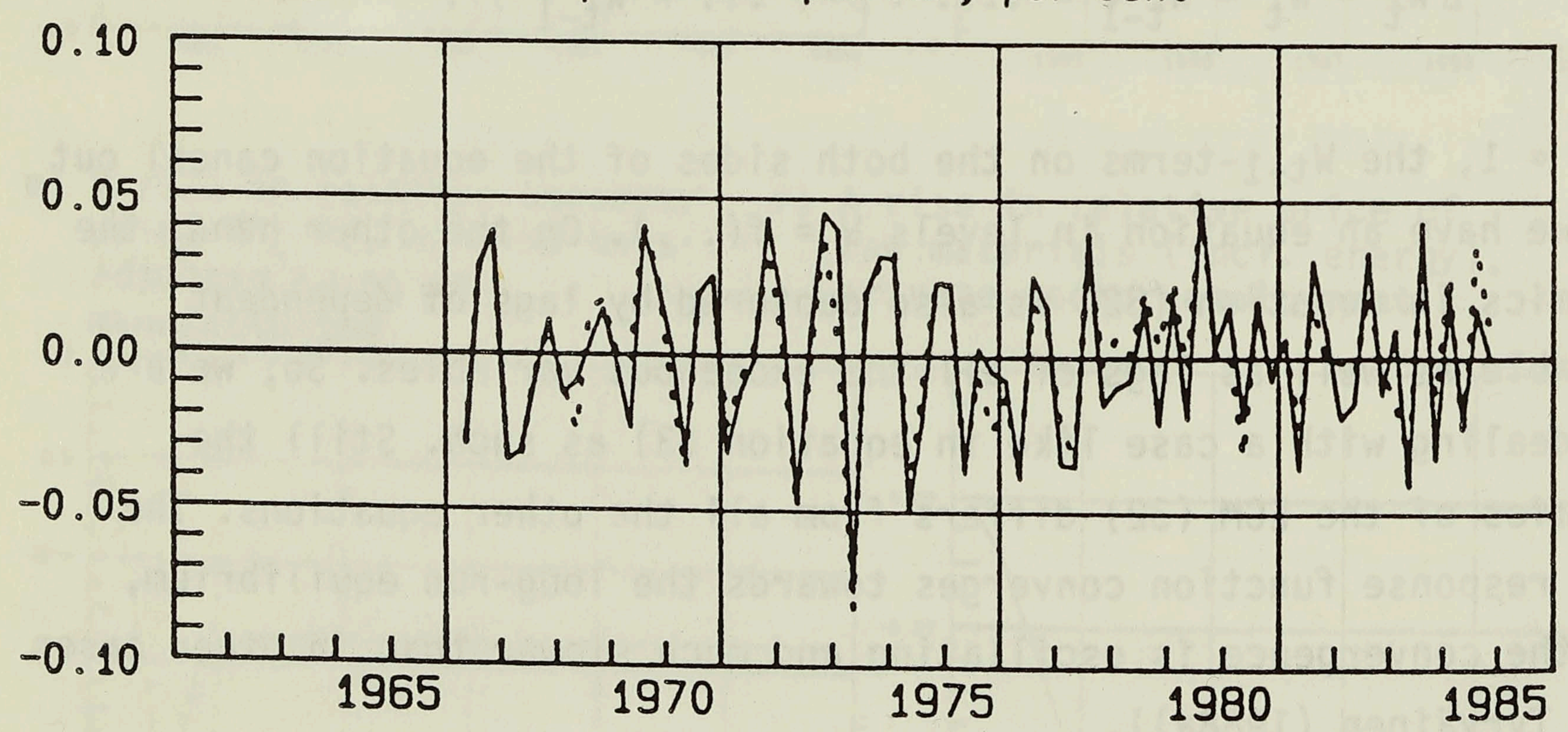


FIGURE 7c. ECM on hours worked (30)

Actual change from the previous quarter, per cent ________
Fitted change from the previous quarter, per cent --------



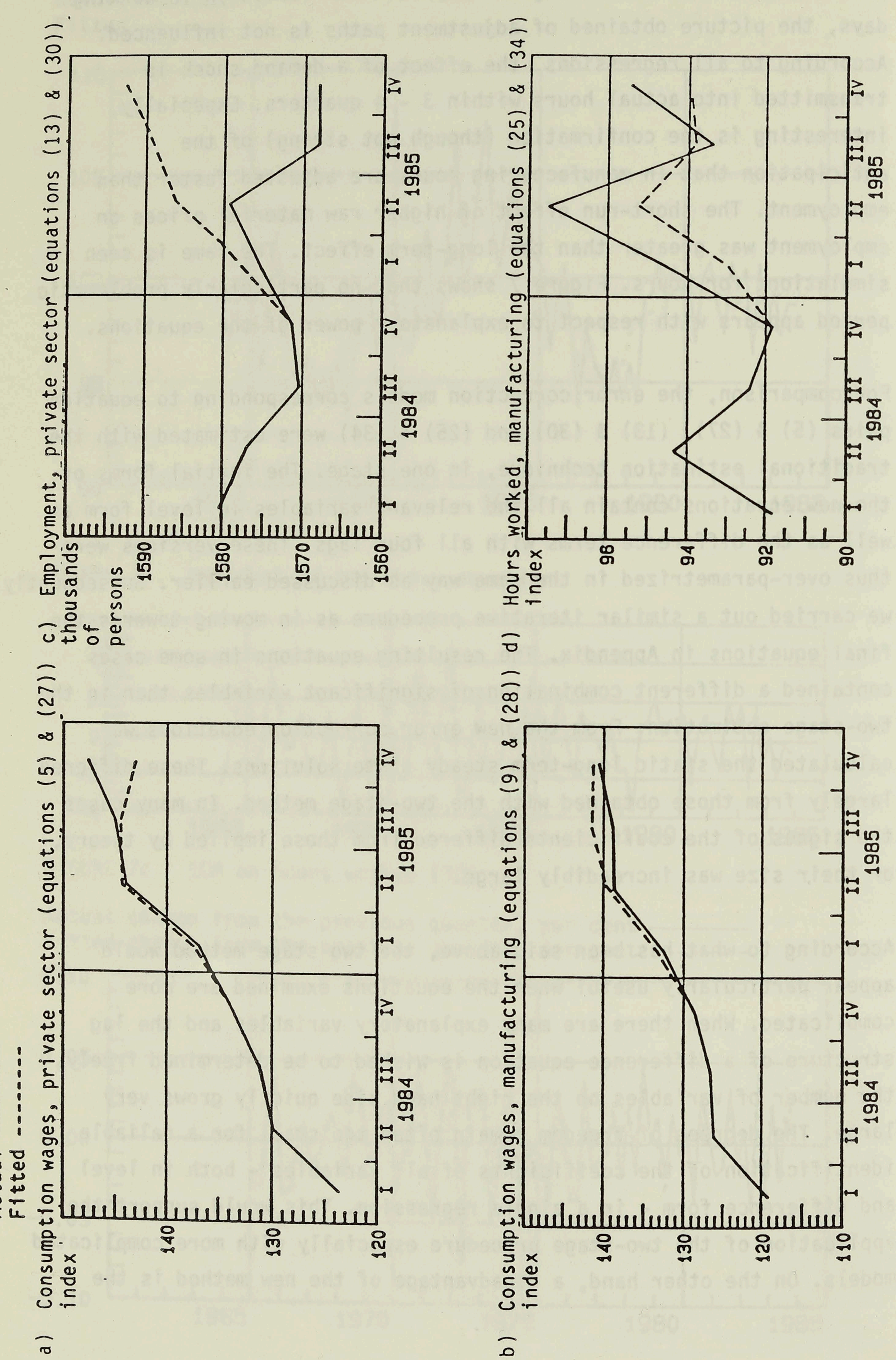
In manufacturing problems like the one above do not emerge. When the hours worked in manufacturing are adjusted for variation in working days, the picture obtained of adjustment paths is not influenced. According to all regressions, the effect of a demand shock is transmitted into actual hours within 3 - 4 quarters. Especially interesting is the confirmation (though not strong) of the anticipation that in manufacturing hours are adjusted faster than employment. The short-run effect of higher raw material prices on employment was greater than the long-term effect. The same is seen in simulations for hours. Figure 7 shows that no particularly problematic period appears with respect to explanatory power of the equations.

For comparison, the error correction models corresponding to equation pairs (5) & (27), (13) & (30) and (25) & (34) were estimated with the traditional estimation technique, in one stage. The initial forms of the new equations contain all the relevant variables in level form as well as the difference terms with all four lags. These versions were thus over-parametrized in the same way as discussed earlier. Subsequently, we carried out a similar iterative procedure as in moving towards the final equations in Appendix. The resulting equations in some cases contained a different combination of significant variables than in the two-stage estimation. From the new error correction equations we calculated the static long-term steady state solutions. These differed largely from those obtained with the two-stage method. In many cases the signes of the coefficients differed from those implied by theory, or their size was increadibly large.

According to what has been said above, the two stage method would appear particularly useful when the equations examined are more complicated. When there are many explanatory variables and the lag structure of a difference equation is wished to be determined freely, the number of variables on the right hand side quickly grows very large. The degrees of freedom remain often too small for a reliable identification of the coefficients of all variables - both in level and difference form - in a single regression. This would support the application of the two-stage procedure especially with more complicated models. On the other hand, a disadvantage of the new method is the

FIGURE 8. Post-sample forecasts for 1985, calculated by dynamic simulation

Actual ————
Fitted --------



complicity of reporting the results and their poor transparency. These properties are underlined as the models grow more complicated.

Although, short-term forecasts give only a limited picture of the forecasting properties of the model, we used our equations to simulate forecasts for 1985Q1 - Q4 for wages, employment and hours worked. Actual data was used for the exogenous variables. Lagged endogenous variables were taken from the model solution in a dynamic simulation.

Some short-term post-sample forecasts are shown in Figure 8. The forecasts do rather well with the exception of the employment equation. The actual number of persons employed in 1985 was 20 000 less than predicted by the model. This forecast error may, however, be due to an actual change in firms' behaviour; a recently released survey (Borg (1988)) suggest that firms reacted strongly by reducing recruitment when a law improving employees' security against dismissal came into effect on 1 September 1984. Some estimates indicate that as many as 20 - 30 000 jobs were involved. On this point, the results of our forecasting exercise and the survey of professor Borg are well in line.

4 CONCLUSIONS

The error correction hypothesis appears to fit Finnnish wage and employment data well. Adjustment lags are fairly short. This supports the argument that developments in actual employment - in so far as they are considered unfavourable - cannot be attributable primarily to "too slow" adjustment of wages, i.e. wage rigidity.[25] It is rather that the equilibrium level is inappropriate.

Unions are often accused of exacerbating economic rigidities. The findings of this study do not support this view. Moreover, according to Manning (1987) the potential pareto-inefficiency of pay settlements is not due to unions per se but rather to the fact that unions are less able to influence employment than wages. There is a third connected piece of evidence concerning the macroeconomic impact of unions. According to Bean & Layard & Nickell (1986), the degree of corporatism[26] is related to the ability of labour markets to adjust. Finland belongs to countries where adjustment is fast. The authors conclude sarcastically that "the results are not very supportive of the notion that unions per se inhibit the efficient functioning of the labour market" (p. 19).

The model specified a set of factors affecting equilibrium wages and employment. Table 7 shows the decomposition of the effects on employment of these factors. The calculations are based on the employment equation (14). This exercise should be treated with

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[25]This result is in line with studies (e.g. OECD (1986)) according to which real wages in Finland are more flexible than in most other OECD countries.

[26]Nations are deemed to be corporatist if wage bargaining is highly centralized, wage agreements do not have to be ratified at a local level, employers are organized, and local union officials have limited influence. - It is here worth pausing to correct an error in Bruno & Sachs (1985). According to Table 11.3. on page 225, the average unionisation rate in Finland was 43.3 % in 1965 - 77. This figure does not appear to include all the central unions as it underestimates the actual rate. This error has been transferred to Bean et al. (1986, p. 7). Had the correct figure been used in the last-mentioned study, it would have added to the evidence supporting the conclusions expressed by the authors.

caution. It is presented here, however, because it helps to rank the role of different factors. The role of demand is clearcut as the key factor sustaining employment growth. The large negative contribution of tax wedge is also seen. Here, in particular, the exact values should be treated with caution and should instead be interpreted as indicating the importance of this issue.[27] The same is true for the result of the positive impact of union growth on employment. In addition, this results thoroughly from the positive effect within manufacturing industry as was shown in section 3.1.2 above.

TABLE 7. FACTORS AFFECTING EQUILIBRIUM EMPLOYMENT IN FINLAND IN 1965 - 1984, PRIVATE SECTOR

	Contribution, percentage points
Demand	+ 33
Technological progress, productivity	- 5
Tax wedge	- 14
Relative raw material prices (incl. energy)	- 2
Other relative prices (excl. effect of indirect taxes)	1
"Union power"	2
Total	15
Actual change in employment	15 %

The hypothesis of monopolistic competition on product markets gains support, since the activity variable is an important explanatory variable in all the relevant equations. Andrews (1987, p. 6), too,

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[27]In general, the relative importance given here to different factors seem to be broadly in line with those presented by Bean et al. (1986). They estimate the impact of various factors on unemployment growth in different countries. In Finland, the unemployment rate was 3.8 percentage points higher in 1980 - 1983 than in 1956 - 1966: demand contributed 1.5 percentage points, tax developments 1 percentage point and import prices 0.1 percentage point, while some 1 percentage point was due to a fall in the intensity of job search.

stresses that "It is this channel that distinguishes this model from the competitive special case, and consequently the search for the significant presence for aggregate demand variables is an important aspect of their empirical implementation."

We are also able to discuss whether the determination of wages and employment in the Finnish labour market could be judged to take place in line either with the market-clearing model or with the bargaining model, which assigns a role to the unions. The results point clearly and unequivocally in favour of the bargaining model. The union density rate, used as the proxy for union power, is a key right hand side variable in all the relevant equations. We can, however, draw still another conclusion of this. Our result also rejects the monopoly union model, where the union power in wage determination is by definition (constantly) one. If there would be no variation in union power, it should be captured wholly by the intercept of the equation. This is especially so as union wages are applied for non-unionized workers also in Finland.

Union power has undoubtedly increased in Finland during the period examined. The qualitative view on the changes in their influence accords well with trends in the unionization rate. The estimations suggest that the growth in bargaining power has led to higher equilibrium wages. This influence could be of the order of 10 - 15 per cent.[28]

The structure of bargaining can be evaluated via the sign of the coefficient of the union power-variable in the employment equation. The results give some clues as regards conclusions, but caution is needed here. This is so because of the preliminary stage of theoretical analysis in the field. The aggregate analysis of the results and the prevailing view about the behaviour of the Finnish labour market indicate, however, that the bargaining procedure in manufacturing industries lies somewhere in the no-mans land between the efficient-

[28] It is interesting to note that according to Lewis (1986), in the United States the difference in wages between organized and non-organized workers of equal quality may have been as high as 14 per cent in 1967 - 79 in average.

bargaining and the right-to-manage models.[29] The unions of manual workers appear to have been able to influence at least to some extent (some) firms' employment decisions. This has induced a positive union effect on employment as also on hours worked in manufacturing industry. We need to be, however, cautious as long as our results have not been confirmed by further research. On the other hand, if we follow Manning (1987) and move within an area between "orthodox" models, the coefficient of the union power variable may change its sign without any indication of discrete changes in behaviour. Furthermore, it should not be forgotten that unions never get all they want. The firms always play a role and they are able to create resistance against union claims. So, the actual outcomes should always be considered as results of a "cooperative game" between the two parties.

[29] This follows exactly the conclusion of Alogoskoufis & Manning (1987) for the UK. In a test where the "general bargain model" of Manning (1987) nests the "efficient bargain model" which in turn nests the "labour demand curve model", the latter two specifications were clearly rejected.

APPENDIX 1

DEFINITIONS AND SOURCES OF SERIES

1) τ_1 = rate of employer's social security contribution

$$= \frac{\text{social security contributions}}{\text{wage sum}}$$

Source: BOF4

2) τ_2 = marginal income tax rate of the "representative tax payer"
Source: BOF4

3) τ_3 = rate of indirect taxes on consumption
= indirect taxes collected on basis of consumption less connected subsidies
Source: BOF4

4) W = nominal average (consumption) wage

$$= \frac{\text{wage sum}}{\text{hours worked}}$$

Source: BOF4

5) P = producer price
= the deflator of gross production in the sector in concern
Source: BOF4

6) P_c = deflator of private consumption
Source: BOF4

7) P_m = the input price of raw materials and semiproducts (incl. energy), proxied by the import price of raw materials and semiproducts.
Source: BOF4

8) N = number of persons employed according to National Accounts
Source: BOF4

9) H = hours worked
Source: BOF4

10) H^c = hours worked, adjusted for variation in quarterly working days.
The series of BOF4 has been devided by an implicit adjustment factor. This factor was calculated by deviding the index of industrial production adjusted for working days by the corresponding unadjusted series. It is not possible to calculate this factor for the aggregate private sector, as the Central Statistical Office does not compute the adjusted aggregate production.

11) H_N = normal annual working time
Source: Incomes Policy Information Commission (1986).

The lower bound of the normal working time refers to senior workers with longer annual vacations whereas the upper bound refers to junior workers. As no information about the distribution of groups with different vacations was available, the normal annual working time has been proxied by the arithmetic average of the upper and the lower bound.

12) B = unemployment benefits
Source: Ministry of Social Affairs and Healt
A daily benefit from an unemployment insurance fund system managed by the unions. It had an equal markkavalue in all unions until the end of 1984. All members with membership longer than 6 months, who become unemployed, are covered by the system.

13) UNI = number of union members
Source: The Statistical Yearbook of Finland.
The number of union members in the end of the year is published in Statistical Yearbook. The figure for private sector has been calculated by subtracting from aggregate figures those who work in public sector. This can be done quite reliably. In line with our sectoral definition, we also subtracted the estimated number of union members in agriculture and forestry. A synthetic quarterly series was disaggregated from the annual data with technical methods.

14) UNION = unionization rate

$$= \frac{\text{UNI}}{\text{N}}$$

15) Q = gross production, the volume of GDP
Source: BOF4

16) K = capital stock
Source: BOF4

17) TIME = time trend

18) K & TIME = The contribution of capital stock and technical progress on productivity growth
$= (K^h) * (e^{\xi * TIME})$, where
h = the income share of capital
ξ = the rate of increase in overall productivity

h is calculated from National accounts as an average over the sample period s.t.

$$h_i = 1 - \frac{(\text{Wage sum + social security contributions})_i}{\text{value of GDP}_i},$$

where i refers to the sector in concern and ξ is calculated by taking the average over the sample period

$$\Delta \log(Q_i - h_i \Delta \log(K_i) - (1-h_i)\Delta \log(H_i)$$

19) DCONT = An "institutional" dummy which captures the differences in quarterly timing of wage settlements in different years. The sum of the quarterly dummies is one in each year. If the only rise of the year comes effective in the beginning of March, the contract raises wages in the first quarter only with a weight of 1/3 while the main part 2/3, of the effect of the rise is observed in the wage index only in the second quarter. Our contract dummy (DCONT) obtaines the value 0.333 in the first quarter and 0.666 in the second. In the log-linear difference equation to be estimated it is a separate additive right-hand-side variable (see also Tyrväinen (1988a)).

20) DSTAB = a dummy for stabilization policy. It is 1 in 1968Q2 - 1970Q4 and otherwise nill.

21) DN = a dummy for a change in private sector employment statistics. It is 1 before the change took place, that is 1965Q1 - 1975Q4, and otherwise nill.

22) DL = a dummy for a strike in metal and engineering industry. It is 1 in 1971Q1, and otherwise nill.

APPENDIX 2

TABLE A. THE PARSIMONIOUS ERROR CORRECTION EQUATIONS or THE SECOND PHASE OF THE GRANGER & ENGLE TWO-STEP ESTIMATION PROCEDURE

Estimation method: OLS
Estimation period: for wages 1971Q3 - 1984Q4,
for demand for labour 1966Q2 - 1984Q4

		Cointegrating equation which the ECM in concern is connected to: (5)	(9)	(10)	(13)	(16)	(19)	(22)	(25)
		Dependent variables[1]							
Independent variables	Lag	ΔW priv. (27)	ΔW manuf. (28)	ΔW manuf. (29)	ΔN priv. (30)	ΔN manuf. (31)	ΔH priv. (32)	ΔH manuf. (33)	$ΔH^C$ manuf. (34)
ΔW	3	-	-.122 (1.70) (2.65)	-					
ΔN	1				.355 (5.16) (5.22)	-			
"	3				-	.245 (3.33) (3.13)			
ΔH	2						-.250 (4.13) (4.68)	-	-
"	3						-.557 (8.90) (9.94)	-	-
$ΔP_C$	0	.627 (7.01) (6.52)	1.030 (6.58) (8.25)	.426 (3.48) (5.22)	-	-	-	-	-
Δ(PC/P)	0	-	-	-	-.082 (2.25) (1.89)	-.237 (3.33) (4.96)	-	-.348 (2.83) (2.96)	-
"	1	-	-	-	-	-	.409 (3.49) (4.90)	.334 (2.68) (2.40)	-
"	2	-	-	-	-	-	-	-	-.370 (1.73) (1.55)
"	3	-	-	-	-	-	-.278 (2.11) (2.96)	-	-
ΔPCD	3	-.160 (1.72) (2.00)	-	-	-	-	-	-	-
$Δ(1+τ_3)$	1	-1.102 (4.17) (4.84)	-	-	-	-	-	-	-
"	2	-	-1.217 (5.40) (8.01)	-	-	-	-	-	-
"	3	-.918 (3.67) (8.04)	-1.120 (5.71) (6.42)	-	-	-	-	-	-

[1] Below parameter estimates first the standard t-ratios and then the White's heteroscedasticity adjusted t-ratios are given.

TABLE A. (continues)

Independent variables	Lag	ΔW priv. (27)	ΔW manuf. (28)	ΔW manuf. (29)	ΔN priv. (30)	ΔN manuf. (31)	ΔH priv. (32)	ΔH manuf. (33)	ΔH^C manuf. (34)
		Dependent variables							
$\Delta(1+\tau_1)$	0	-1.186 (3.63) (4.33)	-.496 (1.24) (3.32)	-	-	-	-	-	-
"	1	-	-.539 (1.64) (3.13)	-	-	-	-	-	-
"	2	-	-	1.510 (5.05) (8.37)	-	-	.802 (1.91) (2.96)	-	-1.410 (2.21) (2.07)
"	3	-	-	.834 (3.84) (4.96)	-	-	-	-	-
$\Delta(1-\tau_2)$	0	-.337 (3.67) (5.29)	-.240 (2.33) (6.51)	-.160 (2.68) (5.45)	-	-	-	-	-
"	2	-.198 (2.35) (3.22)	-	.178 (2.19) (5.34)	-	-	-	-	-
$\Delta(P_m/P)$	0	-.072 (3.09) (3.54)	-.085 (3.09) (4.62)	-.099 (5.05) (6.33)	-	-	-	-.046 (1.55) (1.49)	-.214 (3.75) (2.91)
"	1	-.040 (1.61) (1.77)	-.055 (2.08) (2.13)	-	-	-	-	-	-
"	2	-	-	-	-.010 (1.20) (1.39)	-	-.040 (1.45) (1.56)	-	-
"	3	-.072 (2.98) (3.81)	-.121 (4.51) (4.93)	-.053 (2.60) (3.07)	-	-.043 (2.34) (2.71)	-	-	-
ΔQ	0	-.211 (2.71) (3.04)	-	-	.147 (6.49) (7.07)	.138 (3.87) (5.93)	.334 (3.83) (5.10)	.121 (1.76) (2.24)	.324 (2.42) (3.03)
"	1	-	-.230 (3.59) (4.39)	-	-	-	-	-	-
"	2	-	-	-	-	-	.244 (2.89) (3.92)	-	-
"	3	-	-.122 (2.60) (4.73)	-	-	-.088 (2.36) (2.71)	.327 (3.72) (4.87)	-	-
Δ UNION	0	.174 (2.98) (3.13)	-	-	-	-	-2.571 (3.79) (4.51)	-	-
"	1	-	.433 (3.13) (3.93)	-	-	.143 (2.44) (2.35)	4.395 (3.55) (3.90)	-	-
"	2	-	-	-	-	-	-2.195 (3.25) (3.47)	-	-

TABLE A. (continues)

Independent variables	Lag	ΔW priv. (27)	ΔW manuf. (28)	ΔW manuf. (29)	ΔN priv. (30)	ΔN manuf. (31)	ΔH priv. (32)	ΔH manuf. (33)	ΔH^C manuf. (34)
		Dependent variables							
ΔB	0	-	-	.055 (2.58) (2.42)	-	-	-	-	-
"	1	-	-	-.144 (6.26) (10.96)	-	-	-	-	-
"	2	-	.084 (2.68) (3.22)	-	-	-	-	-	.078 (1.22) (1.89)
"	3	-	.071 (2.26) (3.43)	-	-	-	-	-	-
ΔH_T	0	-	-.798 (1.43) (3.58)	-	-	-	-	-	-
"	1	-	-	1.330 (3.40) (5.57)	-	-	-	-	-
"	2	-	-	1.053 (2.65) (4.88)	-	-.176 (1.80) (11.13)	-.290 (1.90) (5.52)	-	-
"	3	-	-1.247 (2.51) (5.30)	-	-	-	-.256 (1.65) (3.55)	-	-
Δ(K&T)	1	-	10.821 (5.58) (6.52)	-	-	-	-	-	-
"	2	-	-6.715 (3.34) (5.17)	-	-	-	-	-	-
"	3	-	-4.182 (2.57) (3.11)	-3.294 (2.83) (3.21)	-	-	-	-	-
"	4	-	-	4.128 (3.62) (4.25)	-	-	-.534 (2.10) (2.35)	-	-
Δ(DCONT)		.074 (11.38) (9.49)	.058 (8.88) (11.65)	.057 (12.52) (18.24)	-	-	-	-	-
Δ(DN)		-	-	-	.019 (4.51) (11.34)	-	-	-	-
Δ(DL)		-	-	-	-	-	-	-.049 (3.81) (6.93)	-.166 (6.62) (6.77)
61 RESID	1	-.450 (4.66) (5.55)	-.249 (2.76) (3.95)	-.557 (7.28) (7.59)	-.226 (3.66) (3.66)	-.334 (4.93) (5.99)	-.992 (11.21) (12.84)	-.558 (5.85) (6.08)	-.875 (7.54) (6.27)
R^2		.945	.909	.950	.694	.591	.843	.575	.731
R^2C		.928	.859	.928	.672	.548	.804	.544	.708
DW		2.430	1.743	1.915	1.934	2.105	1.823	1.963	2.071
SE		.008	.009	.006	.004	.008	.012	.014	.026

REFERENCES

ALOGOSKOUFIS, G.S. & MANNING, A. (1987) Tests of Alternative Wage Employment Bargaining Models with an Application to the UK Aggregate Labour Market, University of London, Birkbeck College, an unpublished manuscript.

ANDERSEN, T.B. & RISAGER, O. (1988) Wage Formation in Denmark, Institute for International Economic Studies, Seminar Paper No. 414, University of Stockholm.

ANDREWS, M.J. (1987) Some Models of the Aggregate Labour Market, University of Manchester, Department of Econometrics and Social Statistics, Discussion Paper ES184.

BANERJEE, A. & DOLADO, J.J. & HENDRY, D.F. & SMITH, G.W. (1986) Exploring Equilibrium Relationships in Econometrics Through Static Models: Some Monte Carlo Evidence, Oxford Bulletin of Economics and Statistics, vol. 48, No. 3, Special Issue.

BEAN, C.R. & LAYARD, P.R.G. & NICKELL, S.J. (1986) The Rise in Unemployment: A Multi-Country Study. Economica vol. 53 No. 210, Supplement.

BINMORE, K. & RUBINSTEIN, A. & WOLINSKY, A. (1986) The Nash Bargaining Solution in Economic Modelling, Rand Journal of Economics, vol. 17, no. 2.

BOF3 The Quarterly Model of the Finnish Economy (1985), Bank of Finland D:59.

BORG, O. (1980) Increase of the Influence of Wage Earner Organizations in 1945 - 80 (in Finnish), University of Tampere, Institute of Political Science, Research Reports, No. 56.

BORG, O. (1988) Yrittäjäjärjestön jäsentutkimus 1988. Tiivistelmä tutkimusraportista (in Finnish). SYKL:n puheenjohtajien neuvottelupäivät 7. - 9.2.1988.

BRUNO, M. & SACHS, J. (1985) The Economics of Worldwide Stagflation, Basil Blackwell, Oxford.

CALMFORS, L. & DRIFFIL, J. (1988) Bargaining Structure, Corporatism and Macroeconomic Performance, Economic Policy No. 6.

CALMFORS, L. & FORSLUND, A. (1988) Wage Setting in Sweden, Institute for International Economic Studies, University of Stockholm, an unpublished manuscript.

CARRUTH, A.A., OSWALD, A.J. & FINDLAY, L. (1986) A Test of a Model of Trade Union Behaviour: The Coal and Steel Industries in Britain, Oxford Bulletin of Economics and Statistics, vol. 48 No. 1.

ENGLE, R.F. & HENDRY, D.E. & RICHARD, J-F. (1983) Exogeneity, Econometrica vol. 51, No. 2

ENGLE, R.F. & GRANGER, C.W.J. (1987) Co-integration and Error Correction: Representation, Estimation, and Testing, Econometrica, vol. 55, no. 2.

ENGLE, R.F. & YOO, B.S. (1987) Forecasting and Testing in Co-integrated Systems, Journal of Econometrics 35.

FEHR, E. (1988) A Theory of Equilibrium Unemployment, Aggregate Supply and Nominal Wage Rigidity, Department of Economics, University of Technology, Vienna, Discussion Paper (August 1988).

GRANGER, C.W.J. (1986) Developments in the Study of Cointegrated Economic Variables, Oxford Bulletin of Economics and Statistics, vol. 48 no. 3.

HENDRY, D.F. (1986) Econometric Modelling with Cointegrated Variables: An Overview, Oxford Bulletin of Economics and Statistics, vol. 48, No. 3, Special Issue.

HOLMLUND, B. (1983) Payroll Taxes and Wage Inflation: The Swedish Experience, Scandinavian Journal of Economics, vol. 85, no. 1.

HOLMLUND, B. (1987) Wages and Employment in Unionized Economies: Theory and Evidence, forthcoming in FIEF Studies on Labour Market and Economic Policy, Oxford University Press.

HOLMLUND, B. & PENCAVEL, J. (1987) The Determination of Wages, Employment, and Work Hours in an Economy with Centralized Wage-Setting: Sweden 1950 - 83, Fackföreningens Institut för Ekonomisk Forskning, Working Paper No. 29.

INCOMES POLICY INFORMATION COMMISSION (1986) Incomes Policy Settlements in Finland 1950 - 1986, The Prime Minister's Office, Publication No. 1.

INGBERG, M. (1984) Payroll and Income Taxes and Wage Inflation in Finland 1960 - 80, Pellervo Economic Research Institute, Reports and Discussion Papers No. 36.

JACKMAN, R., LAYARD, P.R.G. & NICKELL, S.J. (1988) The Effect of Unions on Unemployment, an unpublished manuscript for a chapter forthcoming in Jackman - Layard - Nickell: Unemployment.

JACKMAN, R. (1989) Wage Determination in the Nordic Countries Viewed from an International Perspective, London School of Economics, Centre for Labour Economics, Working Paper No. 1042.

LEWIS, H.G. (1986) Union Relative Wage Effects, in Ashenfelter, O. & Layard, R. (eds.): Handbook of Labor Economics, Elsevier Science Publishers BV.

MANNING, A. (1987) An Integration of Trade Union Models in a Sequential Bargaining Framework, The Economic Journal, 97.

McCALLUM, J. (1986) Unemployment in OECD Countries in the 1980s, The Economic Journal, December.

MOLINAS, C. (1986) A Note of Spurious Regression with Integrated Moving Average Errors, Oxford Bulletin of Economics and Statistics, vol. 48, No. 3.

NICKELL, S.J. (1984) The Modelling of Wages and Employment, in Hendry, D.F. & Wallis, K.F. (eds): Econometrics and Quantitative Economics, Basil Blackwell, Oxford.

NICKELL, S.J. (1986) Dynamic Models for Labour Demand, in Ashenfelter, O. & Layard, R. (eds.): Handbook of Labor Economics, Volume I, Elsevier Science Publishers BV.

NICKELL, S.J. & ANDREWS, M. (1983) Unions, Real Wages and Employment in Britain 1951 - 1979. Oxford Economic Papers 35, Supplement.

NICKELL, S.J. & WADHWANI, S.B. (1988) Employment Determination in British Industry: Investigations Using Micro-Data, London School of Economics, Centre for Labour Economics, Working Paper No. 1096.

OECD (1986) Finland, OECD Economic Surveys 1985/1986.

PEHKONEN, J. (1988) On Modelling the Aggregate Labour Market: A Study of Finland, Report from the Department of Economics and Management No. 11, University of Jyväskylä.

PEISA, P. & SOLTTILA, H. (1986) Output, Wages and the Demand for Labour: Some Evidence from Panel Data, Bank of Finland, Economics Department, Discussion Papers KT 10/86.

PEISA, P. & SOLTTILA, H. (1987) Työvoiman kysyntä: Tuloksia yhdistetystä aikasarja- ja poikkileikkausaineistosta (The Demand for Labour: Results of analysis using combined time series and cross-section data, in Finnish), Bank of Finland, Discussion Papers VP 6/87.

SAIKKONEN, P. & TERÄSVIRTA, T. (1985) Modelling the Dynamic Relationship between Wages and Prices in Finland, Scandinavian Journal of Economics 87 (1).

SANTAMÄKI, T. (1980) Potentiaalisen tuotannon estimointi Suomen kansantaloudessa. (Estimating the Potential Output in Finnish Economy, in Finnish), Helsinki Business School B-42.

TYRVÄINEN, T. (1988a) Palkat ja työllisyys järjestäytyneillä työmarkkinoilla (Wages and Employment in an Unionized Economy, in Finnish), Bank of Finland D:68.

TYRVÄINEN, T. (1988b) Wages and Employment in a Unionized Economy: Practical Implications of Theoretical Considerations in the Context of Finland, Bank of Finland, Discussion Papers 20/88.

WADHWANI, S.B. (1987) The Effects of Inflation and Real Wages on Employment, Economica Vol. 54, No. 213.

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