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SUOMEN PANKIN KESKUSTELUALOITTEITA • FINLANDS BANKS DISKUSSIONUNDERLAG

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Abstract

This study examines wage paths in the Finnish manufacturing using the Johansen method in estimations. The empirical results have the following implications.

i) Wage-wage links in the Finnish manufacturing industry have been tight. In a longer perspective, wages in the high-pay branches and low-pay branches have followed a common path.
ii) An important characteristic of wage development in high-pay branches has been the tendency to counteract any attempts to improve the relative position of the low-pay branches with additional wage increases. A major part of the adjustment through which earlier wage structures have been restored has taken place within one year.
iii) The adjustment process due to wage-wage links seems to have changed since the devaluation of the markka in November 1991.

Result (ii) is of great interest for Finland and the other Nordic countries. This is because in Northern Europe wage settlements have been commonly designed to reduce wage differentials. In the Scandinavian literature, these have often been called "solidarity" or "solidaristic" type contracts.

The results imply that when wage differentials have been compressed through institutional arrangements, market forces have counteracted and nullified the effects on wage structures. These forces include both local and branch-specific trade union bodies as well as employers. Resulting wage adjustment has been so quick that most of it must be attributable to wage drift. For analysis of the Finnish inflation history it is of great interest to notice that efforts to reduce wage differentials through incomes policy have led to additional inflation. The earlier wage structures have been *fully* restored and only a higher wage and price level – ie a loss in competitiveness – has remained.

Against the commonly held view, wages in the low-pay sector have, in a sense, driven wages in the high-pay sector and "solidarity" in wage policy seems to have been part of the national behavioural model characterized by high inflation and repeated devaluations. In recent years, a change in this process appears to have taken place. Whether this is actually an indication of some profound change in wage-wage links remains to be seen.

Key words: Wage determination, wage differentials, wage-wage links, solidaristic wage contracts.

Tiivistelmä

Tämän tutkimuksen tulokset osoittavat, että

(i) Palkka-palkka -kytkökset ovat olleet Suomen teollisuudessa niin vahvat, että korkeapalkka-aloilla ja matalapalkka-aloilla ansiot ovat nousseet pitemmällä aikavälillä yhtä jalkaa.
(ii) Jos matalapalkka-alojen suhteellista asemaa on pyritty vahvistamaan solidaarisilla tuloratkaisuilla, korkeapalkka-alojen palkkareaktio on palauttanut nopeasti vanhat palkkarakenteet voimaan. Suuri osa tästä sopeutumisesta on tapahtunut vuoden kuluessa.
(iii) Palkka-palkka -kytkösten roolissa näyttää tapahtuneen muutos syksyn 1991 devalvaation jälkimainingeissa.

Tulokset ovat tärkeitä siksi, että Suomessa (samoin kuin muissa pohjoismaissa), tulopolitiikan yleisenä tavoitteena on ollut matalapalkka-alojen tukeminen. Nyt näyttääkin ilmeiseltä, että kun institutionaalisilla päätöksillä on yritetty kaventaa palkkaeroja, seuraus on ollut "markkinavoimien" vastareaktio. Näihin markkinavoimiin kuuluvat sekä vahvojen alojen ammattijärjestöt että työnantajat. Prosessi on ollut niin nopea, että sen on täytynyt tapahtua paljolti palkkaliukumien kautta.

Yritykset kaventaa palkkaeroja tulopolitiikalla ovat siis lisänneet inflaatiota. Entiset palkkarakenteet on palautettu ja solidaarisesta palkkapolitiikasta on jäänyt tulokseksi vain kansainvälisen kilpailukyvyn menetys. Oma mielenkiintonsa on sillä, että tämä on seuraus palkkakilpailusta SAK:laisten teollisuustyöntekijöiden välillä.

Vallitsevasta käsityksestä poikkeaa se tulema, että tietyssä erityisessä merkityksessä matalapalkka-alat ovat toimineet "palkkajohtajina" suomalaisessa teollisuudessa. Solidaariset palkkasopimukset näyttävätkin olleen osa sitä kansallista käyttäytymismallia, joka on ylläpitänyt kotimaista inflaatiota ja johtanut toistuviin devalvaatioihin. Yllä kuvatussa prosessissa näyttäisi tapahtuneen muutos vuoden 1991 devalvaation jälkeen. Tässä vaiheessa on kuitenkin ennen aikaista päätellä sitä, onko palkka-palkka -kilpailun perusvoima todella pysyvästi heikentynyt.

Entä mitä tapahtuisi, jos vanhaa mallia jatkettaisiin tulevaisuudessa ja solmittaisiin sellaisia solidaarisia palkkasopimuksia, jotka a) ottavat yleiskorotuksen lähtökohdaksi kansantalouden keskimääräisen tuottavuuskasvun, mutta b) takaavat matalapalkka-aloille esimerkiksi 0.5 prosenttiyksikköä yleiskorotusta suuremmat korotukset. Jos palkka-palkka -kilpailu toimisi kuten menneisyydessä, palkkaerot palautuisivat nopeasti. Kymmenen vuoden kuluessa palkkainflaatioon kumuloituisi 5 prosenttiyksikön lisä. Kansainvälisessä taloudellisessa ympäristössä, joka on sitoutunut matalaan inflaatioon, se tarkoittaa yritysten kilpailukyvyn merkittävää heikkenemistä ja työllisyystilanteen vaikeutumista. Laajemman keskustelun kannalta on syytä korostaa, että inflaation osalta EMUn ulkopuolella tuskin on tilaa sen löyhäkätisempään elämään kuin sisäpuolella.

Mutta voisiko vanha meno jatkua? Tuskin. Tästä pitänee huolen kilpailu, joka koskettaa kaikkea taloudellista toimintaa aivan toisella tavalla kuin entisinä aikoina.

Asiasanat: Palkanmuodostus, palkkaerot, palkka-palkka -linkit, solidaarinen palkkapolitiikka

Contents

1 Introduction

> *One dark and rainy night, a highway patrol officer was investigating a car which had spun off the highway and flipped into a ditch. Shining his flashlight into the nearly totalled vehicle, he found three slightly shaken and thoroughly inebriated college boys sitting in the back seat. "All right boys, who was driving?" he sternly inquired. The youngsters exchanged confused looks, then one happily reported, "Honest, officer, nobody was driving. We were all in the back seat singing!"*

The unionization rate in Finland is among the highest for any modern economy – around 80% of the entire labour force.[1] Wage settlements have been concluded (for 1–2 years) in a centralized manner and they are highly synchronized.[2] The agreements commonly give larger relative increments to low wage workers.[3] The union contracts automatically cover non-organized workers and firms as well.

In such surroundings, it is not easy to identify who is driving the wage setting process.[4] Certainly no industrial union leader claims such distinction. Rather, they prefer to give the impression they are just following what others are doing, ie they just want to defend the relative position of their members vis-à-vis workers in other branches.

In the literature, it has been repeatedly suggested that wage-wage-links are a feature typical for countries with collective wage setting and strong unions at the industry level. A common argument is that as central-level agreements take the productivity growth of aggregate economy as their reference, excessive wage increments in industries with weaker productivity performance follow.

But why is this so harmful? First, it tends to generate additional inflation. Second, adverse effects on structural adjustment and unemployment may emerge. These topics will be a addressed in the next section.

The rest of the paper is structured as follows. Section 2 briefly discusses economics of wage differentials and defines three questions posed in empirical analysis. Section 3 presents the econometric model. The data are introduced in Section 4. The fifth section presents the results and the final section concludes.

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[1] This estimate is according to the OECD (1994) harmonized standards.

[2] The period 1964–1996 saw only six years when no central agreement was reached. In these years, settlements were concluded at industry level. The timing of agreements is in almost completely synchronous and wage settlements take effect almost simultaneously in all industries in Finland. For a more detailed description of wage contracting in Finland, see Tyrväinen (1995).

[3] General pay rises are often specified in a "mixed form" (for example, X per cent, but at least Z markkas).

[4] This is probably why earlier studies have failed in this respect (see eg Pekkarinen, Petramaa & Virén, 1979, and Holm, Honkapohja & Koskela, 1995).

2 Centralized Bargaining and Wage Differentials

The relationship between wage differentials and centralized bargaining has been discussed by many authors. Recent contributions include the work of Andersen & Risager (1990), Flanagan (1990), Layard, Nickell & Jackman (1991) and Calmfors (1993).

Traditionally, the motivation for egalitarian wage policies in the Nordic countries has been twofold. On the one hand, ideological aspects related to equality have played an important role. On the other hand, an economic rational has been sought by arguing that centralized bargaining with the aim of evening out wage differentials can promote healthy structural change and productivity growth. The goal is to enhance the profitability of new production units with higher productivity and to reduce the profitability of old units with low productivity by setting wages equally across all firms. The desired outcome is a process of "creative destruction" (see Calmfors, 1993).

Flanagan (1990, p. 400) describes the development of these ideas as follows. "The 'solidaristic wage policies' of Nordic labour unions began as 'equal pay for equal work' policies and sought to use collective bargaining negotiations to narrow wage differences between plants, industries, regions, and the sexes for a given job or type of work. Over time, however, they have tended to evolve into 'equal pay for unequal work' policies..."

The outcome of this process led Calmfors (1993) to reconsider his favourable attitude towards centralized bargaining expressed in Calmfors & Driffil (1988). This is because "there exist various trade-offs, the most important of which appears to be that between real wage restraint and relative wage flexibility: centralisation favours the former but reduces the latter (Calmfors, 1993, p. 2)."

Changes in relative wages are an essential feature related to the continuous structural adjustment of an economy. Since high-productivity industries can afford to pay more than low-productivity ones, the former tend to attract more and better employees.

Problems arise when this process, whereby changes in relative wages send important signals to the economy, is not allowed to function properly. Such problems cannot be neglected, either, even if one believed that in the long run, after all adjustment processes in employment, wage setting and price setting have taken place, the relative wage structure would be independent of relative productivity differences. Centralized incomes policy "is bound to impose rigidity on the structure of relative wages. But the reallocation of labour may be much easier if relative wages rise where labour is scarce and vice versa. Without this, structural unemployment is likely to become worse..." (Layard et al, 1991, p. 68).[5] This view is shared by Calmfors (1993, p. 35).

However, in Nordic countries centralized wage settlements have not only attempted to keep wage differentials unchanged. In real life, they have been designed to *compress* wage differentials in favour of low-wage, low-productivity workers. Because the benchmark chosen for the general pay rise is commonly the average

[5] For further discussion on this issue, see Layard et al (1991), pp.204–209.

productivity growth in the economy, "solidarity" has lead to wage increments in low-productivity branches which exceed the sectoral productivity gain.

To consider the consequences, let us define two sectors: one is the "high-pay", high-productivity sector and the other is the "low-pay", low-productivity sector. In reality, the former consists of expanding, predominantly export-oriented industries. The latter group covers diminishing industries which often operate in the domestic sector of the economy and/or compete with imports.

If wage increments in low-pay industries exceed their productivity growth, a tendency to shift forward excessive wage increments into higher prices emerges. Consumer price inflation accelerates, and because wage claims in both sectors reflect increases in the CPI, wage inflation in the high-pay sector accelerates as well. Additional inflation weakens the country's competitive position and leads to an employment loss, first in the open sector, and because of interlinkages, later in the sheltered sector as well.

If low-productivity industries are not able to shift excessive costs forward to prices, a direct adverse effect on employment follows in that sector. If they do succeed in *fully* shifting excessive costs forward to prices, but wages in the strong sector do not respond, an adverse effect on employment will take place because the relative price of the products of the low-productivity sector become more expensive.

In the above scenario, no role is assumed for direct wage-wage links. If these links are tight, inflationary effects as well as the adverse impacts on unemployment would simply materialize more quickly.

Due to results in a study covering the Nordic countries, Flanagan (1990, p. 410) concludes that "... there is evidence that a higher relative wage for low-wage workers is subsequently associated with higher wage drift, reflecting the reestablishment of wage differentials narrowed in central negotiations... Centrally-determined compression of the wage structure can be an important source of decentralized wage pressure..."

In the present study, the hypotheses that in economies with centralized wage setting the procedures applied tend to generate rigidity to wage structures and more wage inflation will be scrutinized in the context of the Finnish manufacturing. We pose the following questions:

(i) How rigid has the relative wage structure been between the high-pay branches and low-pay branches? What can be said about the wage-wage links?
(ii) Can we identify who leads the adjustment process?
(iii) If signs of wage-wage links are found, have related processes remained unchanged over time?

3 The Econometric Model

To consider questions (i)–(iii) above we examine the properties of the sectoral wage series and their relationships using the Full Information Maximum Likelihood estimation method proposed by Sören Johansen and Katarina Juselius (1990). Since this method is presently well known from the literature, it is not necessary to discuss it thoroughly here. To facilitate interpretation of the results, some key concepts will, however, be briefly explained below.

3.1 An Attractor

Let us suppose that in Figure 1 there exists some mechanism whereby, when point (X,Y) moves away from line A, there will be a tendency for it to return towards the line. Because of this property, line A is said to act as an attractor. Owing to the existence of uncertainties, rigidities, contracts etc., the mechanism may not immediately bring the point to the exact position of the attractor, but there will be an overall tendency towards it.

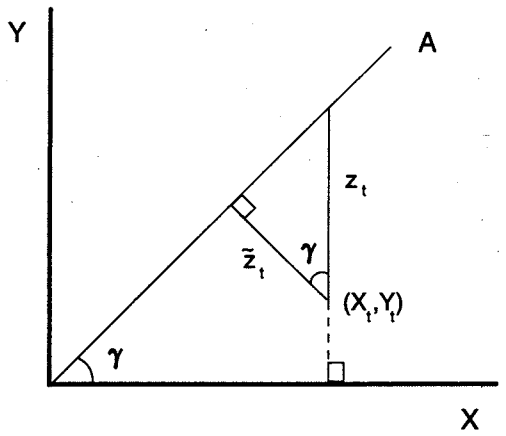
'If the economy lies on A, a shock will take it away. If there is an extended period with no exogenous shocks, the economy will definitely go to the line and remain there. Because of this property, the line A can be thought of as an "equilibrium", of the centre of gravity type' (Engle & Granger, 1991, p. 2).

The attractor is related to the concept of cointegration as follows. Let us consider the relation

$$Y_t = AX_t + z_t, \qquad (I)$$

where X is one variable or a vector of variables. If the error term z_t is stationary,[6] I(0), the system is said to be cointegrated. Under this condition, the line Y = AX corresponds to an attractor for the pair of series (Y_t and X_t) and z_t is the line indicated in Figure 1, which takes a negative value when the point is below the line. $\tilde{z}_t = z_t \cos \gamma$ is the orthogonal (signed) distance from the point (Y_t, X_t) to the line Y = AX. Since z_t is stationary with zero mean as in (I) above, then so, too, is its linear transformation $\tilde{z}_t$ (see eg Engle et al., 1991). If X_t and Y_t are each non-stationary, eg I(1), then point (Y_t, X_t) will tend to move widely around the Y-X plane, but as $\tilde{z}_t$ is stationary with

Figure 1. **An attractor**



[6] Stationarity is a statistical property of a series. A stationary, I(0)-series has a mean m and a constant (or bounded) variance. A series is integrated of order I(1) if it becomes I(0) when differenced once. I(2) series can be defined analogously. Engle & Granger (1991, p. 5) illustrate the differences in the appearances of I(0) and I(1) series as follows. First, I(0) series are generally less smooth with more obvious fluctuations than I(1) series. Second, an I(0) series returns to the mean value often whereas an I(1) series rarely returns to any particular value, including its starting value.

zero mean there will be a tendency for the points to be around the line, and thus for this line to act as an attractor. 'It is thus seen that cointegration is a sufficient condition for the existence of an attractor and this attractor can correspond to certain types of equilibrium that arise in macroeconomic theory' (Engle et al., 1991, p. 7).

It is well known that cointegrated variables can always be thought of as being generated by error-correction behaviour (see Engle & Granger, 1987). The intuition of this should be clear from the discussion of the role of attractors and disequilibrium above. In this interpretation, z_t (and $\tilde{z}_t$) is a measure of the extent to which the system is out of equilibrium. Accordingly, it has been called the 'equilibrium error'. If there is no disequilibrium, there is no incentive for any of the system variables to change.

3.2 Cointegrating relationships and error correction equations

Although the empirical analysis examining cointegration is mainly concerned with long-run relations, dynamics must be analyzed as well. The error correction property is a decisive characteristic of cointegrating relations and, therefore, its investigation is essential when one seeks to find out whether a certain relation acts as an attractor.

To illustrate this, let us consider a model with 2 variables. In the present context, these variables are wages in two different sectors, $W_{i,t}$, with i = 1, 2.

Whether there is a cointegrating relation with the exceptional role of an attractor is a matter of empirical examination. If an equilibrium relation in this bivariate case exists, then $\beta_1 W_{1,t} - \beta_2 W_{2,t} + z_t = 0$ holds so that z_t is stationary.

Let an asterisk, *, indicate the 'equilibrium'. If we "normalize" the equilibrium relationship, for example, with respect to W_1 which means assuming that $\beta_1 = 1$, the long-run equilibrium for W^*_1 can be written as

$$W^*_1 = \beta_2 W_2. \qquad \text{(II)}$$

In the present context it is straightforward to expect that $0 < \beta_2 \leq 1$.

The β_2-coefficient defines the outcome of the convergence if a shock has lead to a violation of the equilibrium relationship present in (II). The error-correcting adjustment is generated by the equilibrium error[7] $z_{i,t-1} = (W^*_{i,t-1} - W_{i,t-1})$.

Accordingly, the dynamics of the variables above can be described with error-correction equations such as[8]

$$\begin{aligned} \Delta W_{1,t} &= f_1(\Delta W_{1,t-j}, \Delta W_{2,t-j}) + \alpha_1(W^*_{1,t-1} - W_{1,t-1}) + \text{possible constant} + D_t + \epsilon_{1,t} \\ \Delta W_{2,t} &= f_2(\Delta W_{2,t-j}, \Delta W_{1,t-j}) + \alpha_2(W^*_{2,t-1} - W_{2,t-1}) + \text{possible constant} + D_t + \epsilon_{2,t} \end{aligned} \qquad \text{(III)}$$

---

[7] See equation (I) above.

[8] We follow here the notation in Johansen & Juselius (1992). Therefore, f_i indicates a linear function of the difference terms so that, for example,

$$f_1(\Delta W_{1,t-j}, \Delta W_{2,t-j}) \equiv \sum_{j=1}^{k-1} (\gamma_{1,j} \Delta W_{1,t-j} + \gamma_{2,j} \Delta W_{2,t-j}).$$

where D_t refers to possible dummies and j = 1,..., k-1 indicates the number of lags.

In the Johansen set-up[9], parameters related both to long-run relations and dynamic adjustments are estimated simultaneously using the Full Information Maximum Likelihood (FIML) method.

As far as empirical research is concerned, the strategy is as follows. We begin with the unrestricted VAR setup to check whether the residuals indicate that the series satisfy Gaussian assumptions (niid). We then proceed by testing whether the series are cointegrated. Given the cointegration rank, we test possible stationarity of the series (stationarity test) and whether one of the series could be *a priori* excluded from the system (exclusion test). As part of the joint-testing strategy, we also check whether there is a linear trend in the system, and whether there are signs of I(2)-ness. If one (or both) of the series turned out to be I(2), ie needs to be differenced twice to reach stationarity, some of the standard Johansen test procedures would not be valid.

If the tests above do not reveal problems and *if* a cointegrating relation is discovered, we proceed by testing structural restrictions. The Likelihood Ratio (LR) test will be used. We are particularly interested in possible long-run homogeneity between the wage series. In (II), it means testing the hypothesis that $\beta_2 = 1$.

We will also test for weak exogeneity which is, of course, related to examination of causality. Whether one of the series could be considered as a kind of "follower" is analysed by studying the α-coefficients. If, for example, the α_2-coefficient in (III) were not significantly different from zero, that means that W_2 is weakly exogenous. In the resulting equation, a disequilibrium between the two W_i's would not generate any error correcting adjustment in W_2. Thus, the discrepancy between the two wage series will be corrected through dynamic adjustment only in W_1.

Finally, we examine whether we can find signs of a change in the relationship at the end part of the observation period. The motivation for this is twofold. On the one hand, the excessive, market-led depreciation of the Finnish markka in 1991–1992 contributed to divergence in growth prospects between export industries and others. On the other hand, the deep recession lead to an increase in the unemployment rate from 3 percent in 1990 to almost 20 percent in 1994. This rise was not distributed evenly among all branches.

Dummy techniques will be used and three different time periods will be examined. Given the facts above, it seems natural to consider the devaluation in 1991Q4 as the benchmark for the dummy analysis. As far as the end point is considered, we allow it to vary; the choices are 1993Q4, 1994Q4 and 1995Q4 which is also the end point of our observation period.

It should be noted that in cointegration, the role of dummy variables differs importantly from their role in standard regressions. A dummy (D_t) such as in (III) enters just the short-run part of the model but not the long-run vectors. Centered[10] dummies are advocated. If the "same" dummy were supposed to enter the long-run part, it should be a stepwise dummy which cumulates the "levels" of the "difference dummy" D_t.

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[9] For a discussion, see Ericsson (1992), p. 273 in particular.

[10] Over the estimation period, values of a "centered" dummy sum to zero.

4 Data

In econometric analysis below, data for the manufacturing industry from the Level of Earnings Index is used. Unfortunately, branchwise quarterly series are only available from 1980Q1 onwards. The branches covered in our study are

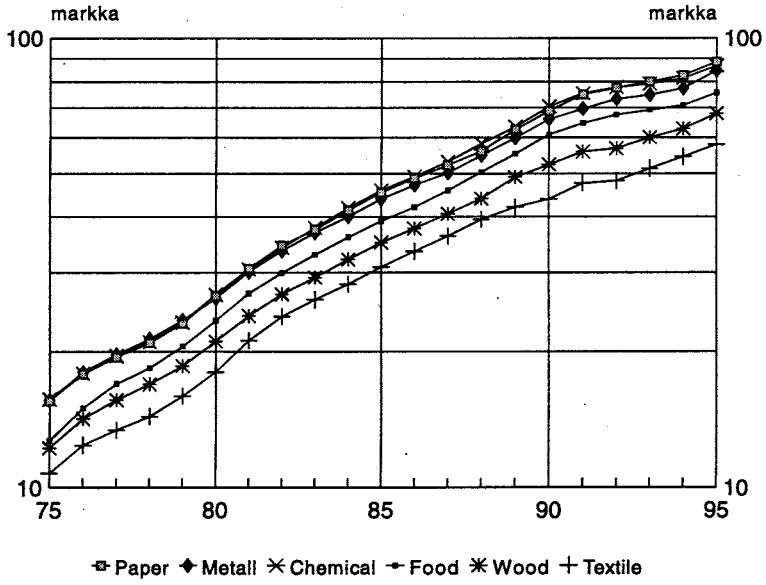
1) Manufacture of paper and pulp products,
2) Metal and engineering industries,
3) Manufacture of chemicals,
4) Manufacture of food, beverages and tobacco,
5) Manufacture of textiles,
6) Manufacture of wood products.

Obviously, the number of potential relationships between them is large. Because of the limited number of observations, full-scale testing of these relationships would be doomed to run into problems. Therefore, we prefer to proceed differently.

Within manufacturing industry, there are candidates both for wage-leaders (such high-pay export industries as the paper industry or the metal and engineering industries) but also for followers (such low-pay industries as food industry or textile industry). To clarify this issue, we will proceed by considering relative wage levels in the branches listed above.

The Earnings Index does not include information about wage levels in markka terms. To evaluate relative wages we must, therefore, find another source. For this purpose, we used National Accounts and calculated average wages[11] for the branches of interest. The resulting series appear in Figure 2.

Figure 2. **Average Wages in Manufacturing Industry in Finland,** 1975–1995, markka per hour



[11] The Earnings Index measures the pay for a normal working hour. The average wage is calculated by dividing the aggregate wage sum by aggregate hours. It is also influenced by changes in annual working hours (given that they are not fully compensated in wages), changes in the number of overtime hours (because extra hours are better paid) etc.

Below we will consider tensions which have emerged within the manufacturing industry by studying the relationship between wage paths in the "high-pay" branches vis-à-vis that in the "low-pay" manufacturing.

As Figure 2 indicates, high-pay branches (= MANHIGH) include

1) Manufacture of paper and pulp products (+11 %, share 29 %),
2) Metal and engineering industries (+8 %, share 58 %), and
3) Manufacture of chemicals (+11 %, share 13 %),

where the first numbers in parentheses show the percentage by which the average wage in the sector concerned exceeded the average of the six branches in 1975–1995 on average. When the series MANHIGH was calculated, the branchwise Earnings index series were weighted together with the 1995 wage sum shares used as weights. The second number in parentheses indicates that share.

Correspondingly, low-pay branches (= MANLOW) cover

1) Manufacture of food, beverages and tobacco (−3 %, share 53 %),
2) Manufacture of textiles (−24 %, share 17 %), and
3) Manufacture of wood products (−13 %, share 30 %).

The empirical analysis below is about the interrelationships between these two series, MANHIGH and MANLOW.

5 Estimation Results

To start, let us consider statistical properties of individual time series. Tests[12] reported in Table 1 in Appendix indicate that none of the series is stationary and none of them can be neglected from the estimation *a priori*. However, the tests suggest that MANLOW is probably weakly exogenous. This is will be scrutinized within the full model below.

Both the λ-max and the Trace-tests suggest that the two series of interest are cointegrated (Table 2A). This conclusion is strongly supported by considerations related to eigenvalues of the companion matrix (Table 2B). Furthermore, residual analysis reported in Table 3 indicates no problems. Examination of the eigenvectors did not indicate that there would be I(2)-ness in the system[13]. Therefore, there should be no reason to question appropriateness of the tests performed above or below.

The presence of a constant term in the dynamic part of equation (III) will be allowed at the outset. As is well-known, a constant term such as this one indicates the existence of a linear trend. Since the wage series are trended, it is of course natural to expect that the constant term differs significantly from zero.

As for the results, it is striking that already in the free estimation the β-coefficients are of opposite sign and almost identical magnitude; in the first

[12] For the test procedures, see Juselius & Hargeaves (1992).

[13] Results indicating this are available from the author upon request.

eigenvector in Table 4A, the normalized β's are 1.000 and –1.001. Therefore, it is no surprise that a test imposing long-run homogeneity, ie that $\beta_1 = -\beta_2$, passes the LR-test with an exceptionally high p-value[14] of .90. Because the α-coefficient related to the MANLOW variable is close to be insignificant in Table 4C, we proceed by testing hypothesis $\alpha_2 = 0$. As Table 4D shows, the joint-test for $\beta_1 = -\beta_2$ and $\alpha_2 = 0$ passes the LR-test with a high p-value (.17).

At the present point it is important to note, that comparison of the roots of the companion matrices in the free estimation and in the restricted estimation indicates that the restrictions imposed have not had unpleasant side-effects (see Tables 2B and 4G). Residual analysis related to the restricted model proves the same (Table 4F).

So, we have arrived at our preferred relationship reported in Table 4D. It implies that in the long run, wages have moved hand-in-hand in high-pay branches and low-pay branches within the manufacturing industry in Finland.

Further, wages in the low-pay sector have been weakly exogenous in the observation period. This implies that a consequence of a higher wage increase in the low-pay sector has been an upward adjustment of higher wages. Through this mechanism, earlier positions of relative wages have been restored[15].

According to preferred equation in Table 4D, 40% of the disequilibrium is already corrected within the next period. As our model is a quarterly one, within a year major part of the disequilibrium is corrected. This implies that, in practice, the channel we are discussing about is the wage drift. So, wage settlements which give larger relative increases to low-wage branches have lead to a reaction within the high-wage earners which has lead to higher wage inflation.

Finally, we wanted to consider whether the relationship above has changed in the 1990's. Indeed, signs of this could be found. The preferred equation in 4D contains a centered[16] dummy which receives a value of .86 in 1991Q3–1993Q4 and is -.14 elsewhere, is highly significant in the dynamic equation for MANHIGH. In the free estimation its t-value was 3.2 and in the preferred equation it is 2.9 (Table 4E).

As indicated in Section 3 above, we also experimented with centered dummies for 1991Q3–1994Q4 and for 1991Q3–1995Q4 which is the end-point of our estimation. Both dummies are significant[17], the first with a t-value of 3.5 and the second with a t-value of 2.2. In both cases the joint-test for $\beta_1 = -\beta_2$ and $\alpha_2 = 0$ passes the LR-test. In the former case with a p-value of .08 and in the latter with a p-value of .06. In both cases the α-coefficient has a value of around –.4 with values of t-statics which are 2.8 and 2.5 respectively. Interestingly, restrictions $\beta_1 = -\beta_2$ and $\alpha_2 = 0$ also pass if no dummy is included or if the estimation period is shortened to end before the 1991 devaluation. On the other hand, when we attempted to include a corresponding

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[14] The concept of the 'p-value' refers to the significance level. Usually, a hypothesis is rejected if the p-value related to the test is smaller than .05. In statistics, the concept of p-value is related to a 'type II error' which indicates acceptance of the H_0 hypothesis when it is, in fact, false.

[15] Andersen et al (1990, p. 162) conclude that, in Denmark, "the effect of a more egalitarian wage structure across skills is to boost inflation insofar as the rate of increase of the skilled workers' wage in the subsequent year will exceed the wage increase of unskilled... This result suggests that attempts to compress wage differentials across skills are futile, since wages of skilled workers quickly nullify such attempts."

[16] As indicated above, quarterly values of a centered dummy sum to zero over the estimation period.

[17] Data on this matter is available from the author upon request.

dummy (see the discussion in Section 3 above) into the level part of the relationship, dummies were insignificant with no exception[18].

We prefer the relationship reported in Table 4D because of statistical properties related to the tests performed as well as because of significance levels related to the adjustment coefficient α and the dummy variables capturing behavioural changes. However, none of the conclusions above or below is sensitive for the choice of this particular equation.

From the point of view of econometrics, the results above have two implications. First, the structure imposed in the preferred equation is robust and it is not conditional on inclusion of particular type of dummies. Second, significance of the dummies in the dynamic equations indicates that a change in the dynamics concerned has taken place after the devaluation of the Finnish markka in 1991Q3. There may be weak signs that the change in the behaviour is decreasing towards the end of the estimation period.

In recent years, "solidarity" incorporated in wage contracts has been less pronounced than in earlier decades. In particular, due to collective contracts for 1992–1994, no contractual wage increments took place. As wage structure was not compressed by external factors, compensatory error-correcting adjustment was not needed. Thus, this reduced degree of "solidarity" may have contributed to -- in addition to record high unemployment -- record low wage drift in the manufacturing industry during 1992–1995.

Finally, a closer examination of the dummy reveals that in the two equations it's values are almost identical (Table 4E). This could mean that the dummy does not necessarily pick up a change in the relationship between the wage series but rather captures the reduction in the inflation rate that took place. All these aspects further argue for cautiousness in interpreting the results indicating a change in the wage-wage -link.

[18] Regressions showing this are available from the author upon request.

6 Conclusions

Given the empirical results of the study, answers to the three questions posed at the out-set are as follows.

i) Wage-wage links in the Finnish manufacturing industry have been tight. In a longer perspective, wages in the high-pay branches and low-pay branches have followed a common path.

ii) An important characteristic of wage development in high-pay branches has been the tendency to counteract any attempts to improve the relative position of the low-pay branches with additional wage increases. A major part of the adjustment through which earlier wage structures have been restored has taken place within one year.

iii) The adjustment process due to wage-wage links has changed significantly in the 1990's. The break seems to have taken place after the devaluation of the markka in November 1991.

Result (ii) is of great interest for Finland and the other Nordic countries. This is because in Northern Europe wage settlements have been commonly designed to reduce wage differentials. In the Scandinavian literature, these have often been called as "solidarity" or "solidaristic" type contracts.

The results imply that when wage differentials have been compressed through institutional arrangements, market forces have counteracted and nullified the effects on wage structures. These forces include both local and branch-specific trade union bodies as well as employers. Resulting wage adjustment has been so quick that most of it must be attributable to wage drift. For analysis of the Finnish inflation history it is of great interest to notice that efforts to reduce wage differentials through incomes policy have led to additional inflation. The earlier wage structures have been *fully* restored and only a higher wage and price level – ie a loss in competitiveness – has remained.

Against the commonly held view, wages in the low-pay sector have, in a sense, driven wages in the high-pay sector and "solidarity" in wage policy seems to have been part of the national behavioural model characterized by high inflation and repeated devaluations. In recent years, a change in this process appears to have taken place. Whether this is actually an indication of some profound change in wage-wage links remains to be seen.

What would happen, however, if the old model were to be followed in the years to come so that egalitarian wage agreements were still settled a) using the average productivity growth in the economy as the benchmark for general pay rises and b) granting an additional wage increment for low-pay branches of a half percentage point? If wage-wage-competition acted as in the past, relative wages would, in fact, remain unchanged. Further, within ten years, a stimulus to wage inflation on the order of 5% would have emerged. Given the present general commitment to low inflation in all major economies, we can infer a considerable decline in the competitiveness of many Finnish firms under such a regime. Nor, as far as inflation is concerned, would life be any easier outside the EMU, than it would be inside.

Of course today, with competition influencing virtually all spheres of economic activity, the prospects for survival of this out-moded behavioural model become increasingly remote.

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Appendix Estimation Results

Endogenous series: MANHIGH and MANLOW, see Section 4 in the text.
Exogenous series: D9193C, a centered dummy (ie it sums to zero over the estimation period) related to depreciation of the Finnish markka which has a value of +.84 in 1991Q4–1993Q4 and is -.14 otherwise,
Unrestricted constant, 3 centered seasonal dummies

Estimation period: 1980Q1 to 1995Q4
Lags in VAR-model: 3
No. of observations: 61
Obs.- no. of variables: 50

Table 1. Testing time-series properties of individual series

1A. Test for exclusion: LR TEST $\chi^2(r)$ on 5 per cent significance level

Rank, r	Degrees of freedom	Critical value, χ^2 (1)	Values of the test statistic MANHIGH	MANLOW
1	1	3.84	9.32*	9.06*

1B. Test for stationarity: LR TEST χ^2 (p-r) on 5 per cent significance level

r	DGF	χ^2 (1)	MANHIGH	MANLOW
1	1	3.84	9.06*	9.32*

1C. Test for weak exogeneity: LR TEST χ^2 (r) on 5 per cent significance level

r	DGF	χ^2 (1)	MANHIGH	MANLOW
1	1	3.84	11.30*	3.08

Table 2. Tests for Cointegration Rank, r

2A. λ-max and Trace-tests, I(1) analysis

Eigen-values	Test statistics λ-max	Trace	H_0: r=?	Critical values λ-max$_{90\%}$	Trace$_{90\%}$
0.1889	12.77*	13.99*	0	10.60	13.31
0.0198	1.22	1.22	1	2.71	2.71

2B. Eigienvalues of the companion matrix

real	complex	modulus	argument
0.9938	-0.0000	0.9938	-0.0000
0.7992	-0.0000	0.7992	-0.0000
-0.6447	-0.0000	0.6447	-3.1416
-0.1709	-0.4394	0.4715	-1.9417
-0.1709	0.4394	0.4715	1.9417
0.3563	0.0000	0.3563	0.0000

Table 3. Residual analysis

Test for normality: $\chi^2(4) = 1.972$, critical value on 5 % level = 9.49, p-val = 0.74

Univariate statistics

Mean	Std.dev.	Skewness	Kurtosis	Maximum	Minimum	ARCH(3)	Normality	R-squared
0.000000	0.009303	0.045572	2.664106	0.021354	-0.025005	1.955	0.026	0.861
0.000000	0.006142	0.310552	2.846776	0.014979	-0.012626	5.872	1.148	0.856

Table 4. Analysis of cointegrating relationships

4A. Matrices based on free estimation of eigenvectors with no assumption about the cointegration rank, r

	Long-Run coefficients β	
	(1)	(2)
MANHIGH	1.000	-0.930
MANLOW	-1.001	1.000

	Adjustment coefficients α		t-values for α's	
DMANHIGH	-0.595	-0.015	-3.724	-0.171
DMANLOW	-0.198	-0.056	-1.879	-0.963

4B. Matrices based on free estimation with an assumption of 1 cointegration vector, r = 1

	Long-run coefficients β
MANHIGH	1.000
MANLOW	-1.001

	Adjustment coefficients α	t-values for α's
DMANHIGH	-0.595	-3.724
DMANLOW	-0.198	-1.865

4C. Matrices based on assumption r = 1, testing hypothesis that $\beta_1 = -\beta_2$

LR test, $\chi^2(1) = 0.02$, critical value on 5 % level = 3.84, passes with p-value = 0.90

	Long-run coefficients β
MANHIGH	1.000
MANLOW	-1.000

	Adjustment coefficients α	t-values for α's
DMANHIGH	-0.584	-3.728
DMANLOW	-0.198	-1.901

4D. Matrices based on assumption r = 1, testing hypothesis $\beta_1 = -\beta_2$ & $\alpha_2 = 0$

LR test, $\chi^2(2) =$ 3.53 ,critical value on 5 % level = 3.84, passes with p-value = 0.17

	Long-run coefficients β
MANHIGH	1.000
MANLOW	-1.000

	Adjustment coefficients α	t-values for α's
DMANHIGH	-0.398	-2.524
DMANLOW	0.000	0.000

4E. The centered dummy D9193C in the vector in 4D

D9193C	t-values
-0.013	-2.949
-0.011	-3.516

4F. Residual analysis of the restricted vector in 4D

Test for normality: $\chi^2(4)$ = 1.972, critical value on 5 % level = 9.49, p-val = 0.74

Univariate statistics

Mean	Std.dev.	Skewness	Kurtosis	Maximum	Minimum	ARCH(3)	Normality	R-squared
-0.000000	0.009382	0.073536	2.978143	0.021663	-0.027094	1.833	0.448	0.859
-0.000000	0.006363	0.178516	3.233030	0.017525	-0.015112	5.209	1.372	0.845

4G. Eigenvalues of the companion matrix related to the restricted vector in 4D

real	complex	modulus	argument
1.0000	0.0000	1.0000	0.0000
0.8011	0.0000	0.8011	0.0000
-0.666	0.0000	0.6666	3.1416
0.4900	0.0000	0.4900	0.0000
-0.1803	0.4368	0.4726	1.9623
-0.1803	-0.4368	0.4726	-1.9623

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