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EXPERIENCE AND PRODUCTIVITY IN WAGE FORMATION IN FINNISH INDUSTRIES

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Experience and Productivity in Wage Formation in Finnish Industries

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Abstract

The aim of this paper is to discriminate between alternative compensation policies in Finnish industries using linked employer-employee data covering the period 1987-1992. Experience-related payments are shown to vary in industries and in education levels. Experience payments from initial tenure, and also from general experience, are increasing with education level. Earnings equations should also have a firm-level compensation term with a firm-specific intercept and seniority effect. There is a clear association of firm-level compensation to education, in contrast to weak correlation to other human capital components such as general experience. We also examine the efficiency of the compensation policies on the basis of their impact on labor and total factor productivity. We find seniority compensations efficient only from longer tenure. High productive industries are instead characterized by high general experience payments at the beginning of working career.

Keywords: wages, compensation policy, productivity, industry differentials
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1. Introduction

We discriminate between alternative compensation policies in Finnish industries using linked employer-employee data. We also examine related persistent industry differences, which are not explained by firm technology. Inter-industry wage differentials have been found to be fairly stable both in the U.S. (see Krueger and Summers, 1987) and in Europe, including Nordic countries (Holmlund and Zetterberg, 1991, Vainiomäki and Laaksonen, 1995).[1]

We follow Abowd et al. (1999) and Goux and Maurin (1997) and separate personal and firm characteristics in explaining wage variation and the inter-industry wage differentials. We also lean on earlier analysis of Krueger and Summers (1987) and Katz and Summers (1991).[2] A basic conclusion of these studies is that personal characteristics, both measurable and unobserved (non-time varying), account for the majority of the variation in annual wage rates. Seniority accounts for a much lower share of wage variation, especially when controlling for person fixed effects. Above this general rule, the seniority compensations vary a lot depending on the estimation techniques, i.e. OLS, firm random effects and firm fixed effects.

In the U.S. the average return to one year of additional seniority is 5 percent for the first five years according to Finer (1997) (see also Abowd, Finer and Kramarz, 1998). Experience and seniority payments account for a notable part of the rise in income inequality in the U.S. in recent decades (education is also more rewarding, see Slaughter and Swagel, 1997). The returns to seniority are smaller in Europe. Abowd et al. (1999) and Bronars and Famulari (1997) find that returns to tenure are from zero to around 1 percent a year in France depending on the estimation method (see also Cardoso, 1997).[3] Margolis (1996) controls firm age by introducing

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[1] Industry wage differentials are also fairly stable across occupations in some studies, i.e. all occupations in better paid industries are paid well (for the U.S. see, e.g., Katz and Summers, 1989).

[2] See also Abowd, Finer and Kramarz (1998), Bingley and Westergard-Nielsen (1996), Burgess, Lane, and Stevens (1997b), Goux and Maurin (1997), Finer (1997), Leonard and van Audenrode (1996, 1997), and Leonard, Mulkay and van Audenrode (1998).

[3] In Abowd, Kramarz and Margolis (1999) the seniority is directly available only for a limited number of the workforce and imputed for the others (for those entering the labor force before or during the first year of the estimation period).

cohort effects. The value of the estimated seniority slope is found to be close to zero. Barth (1997) estimates low seniority returns for Norway. One additional year of seniority adds approximately 0.3 to 0.4 percent to the individual's wage.

We have used data on individual employees from the Finnish Employment Statistics. This is a large data base that combines various registers kept by Statistics Finland and other authorities. There is information on each employee’s employer in the last week of the observation year. We took a sample of 1815 firms, which represent fairly well the Finnish manufacturing sector. The initial employee data covers 1 064 289 observations, which are individuals who have worked at least once in the sample firms in the period 1987-1992. The data used in the analysis covers 556 313 observations. Observations outside manufacturing consist of persons working outside the sample firms in some of the years (58 428) or working in the sample firms but in plants that are not in manufacturing (39 563). They account for altogether 18 percent of the sample.

We find that there is no clear difference between Finnish and European or U.S. companies in that the wage payments are mainly determined by personal ability and not by firm characteristics. Education, socioeconomic position and sex explain half of the wage variation. In inter-industry wage differentials, the correlation between the level and difference estimation results is high so that observed time varying personal characteristics explain an important part of the wage variation. Given the special importance of education level, we also analyze experience, seniority and general firm-level compensation in different education groups.

After controlling for person fixed effects, we find an average seniority effect of 0.7 percent weighting firm level figures by labor shares (1.5 percent for unweighted). The total firm effect consists of a firm-specific intercept and seniority and seniority squared terms that give different initial and longer-run seniority payments. Firm-level compensation varies depending on education, but it is weakly correlated with other human capital components such as general experience. We also show that experience and seniority related payments during the initial working career are more typical for the highly educated. Experience related payments from longer general experience are higher for the higher educated and lead to high wages in the industry. But seniority payments from longer tenure are decreasing with education level. The results imply segmentation, where longer run seniority payments are common for personnel that have higher than comprehensive schooling but no university degree. The personnel with university degree have clearly lower seniority payments from longer tenure, while the payments from general experience are higher. Piekkola (1999) shows that rent splitting, i.e. compensations contingent on firm performance, also interact positively with the education level.

We also examine the productivity effects of the various compensation systems. High productive industries have relatively high general experience related payments in the beginning of the working career. Seniority compensations are rather efficient from longer tenure. They promote productivity especially in the case of personnel with middle level vocational or comprehensive bachelor degree. The firm intercept, i.e., firm-specific compensation that is not based on seniority or other observable characteristics of the workforce, does not have a clear effect either on labor productivity or on total factor productivity. In contrast to Abowd et al. (1999) for France, even labor productivity is not higher in high-wage firms, i.e. in firms with high firm-specific payments.

Piekkola (1999) shows that the average general experience of the workforce in the firm has in general a negative effect on wages. It is clear that better performance of younger firms can be explained by younger and better-educated workforce and not only by newer technology. After controlling for experience, education and unobserved personal characteristics, we also find that there is no more a clear positive correlation between the age of the firm and total factor productivity.

This paper is organized as follows. In section 2, we explain industry wage differences by various industry dummies and then by industry dummies and various combinations of individual characteristics, also allowing for fixed person effects. Next, in Section 3 we use both individual and firm fixed effects. Finally, in Section 4, firm productivity is explained by personal characteristics and firm effects. Section 5 concludes the paper.

2. Industry Wage Differences

The basic model that combines industry effects and person characteristics is

$$ln(w_{it}) = b_0 + b_{1i}ind_{it} + b_2t + b_3sen_{it} + b_4sen_{it}^2 + b_5exp_{it} + b_6exp_{it}^2 \qquad (1)$$
$$+ b_{7i}ind_{it}*exp_{it} + b_{8i}ind_t*exp_{it}^2 + b_9edu_i + b_{10}sos_i + b_{11}sex_i + e_{it}$$

where *ind* denotes industry dummy, *t* year dummy, *edu* education (dummy variables for 13 educational categories), *sos* socioeconomic status (5 categories), *sen* seniority, *exp* experience and *e* is the error term; subscript *i* refers to individual and *t* to time. The variables are explained in detail in the appendix. The model allows the returns to experience to vary by industry, so that we can control for the different experience level in each industry. It is also possible that the time to reach a desired wage level varies across industries.

Next we allow for person fixed effects. This means that we can no longer include the time invariant personal characteristics: education, sex and socioeconomic position. The model is

$$ln(w_{it}) = q_i + b_{1i}ind_{it} + b_2t + b_3sen_{it} + b_4sen_{it}^2 + b_5exp_{it} + b_6exp_{it}^2 \qquad (2)$$
$$+ b_{7i}ind_{it}*exp_{it} + b_{8i}ind_{it}*exp_{it}^2 + e_{it}$$

where q_i is the fixed individual effect. The model is estimated in difference form to purge the fixed effects. This procedure also purges the industry dummies if an individual has stayed in the same industry during the whole data period. Therefore, industry effects can only be estimated through those individuals who have switched industry.

Before estimating model (1), we first include only the fixed industry effects through industry dummy variables ind_{it}. The industry wage differences are shown in table 1. The table presents the industry effects as differences from the weighted average using labor shares of each industry as the weights. We can distinguish a group of high wage industries: paper and pulp, printing, oil, chemicals, wholesale, business services, and mining, and a group of low-wage branches: clothing, furniture, hotels, bars, and restaurants and sanitary services, characterized by high proportion of small business. The division is similar to that obtained in other countries (see Krueger and Summers, 1988, Goux and Maurin, 1997). The main exception is the important paper and pulp industry in Finland.

Table 1. General Industry Differences

Variable	Coefficient	t-value
Mining	0.076	(7.2)
Food	-0.032	(24.5)
Textile	-0.210	(80.5)
Clothing	-0.295	(121.6)
Wood products	-0.124	(64.0)
Paper and pulp	0.139	(55.8)
Printing	0.133	(50.7)
Furniture	-0.192	(74.6)
Chemicals	0.097	(28.9)
Oil	0.198	(28.1)
Rubber	-0.067	(34.6)
Non-metallic products	-0.013	(14.0)
Basic metal	0.063	(14.1)
Metal products	0.002	(12.3)
Machinery, Transport Equip.	0.024	(ref)
Electronics	0.019	(1.9)
Other Production	-0.135	(46.5)
Energy	0.154	(20.8)
Construction	0.032	(2.4)
Wholesale	0.134	(42.2)
Retail sale	-0.164	(53.1)
Car Retail and Service	-0.079	(16.6)
Hotels, Bars, Restaurants	-0.217	(41.5)
Transportation	0.075	(19.7)
Finance, Real Estate	-0.018	(8.9)
Business, Personal Service	0.156	(40.2)
Public Service	-0.094	(15.1)
Education	0.092	(12.7)
Sanitary Services	-0.214	(36.9)
Recreation	-0.037	(10.3)
Sample size	556313	
Coeff. Degrees of Freedom	29	
Root Mean Squared Error	0.337	
R^2	0.103	

The results of level estimation, based on (1), are shown in table 2. The explanatory variables include education, socioeconomic status, sex, seniority, and work experience. Controlling for education, sex and socioeconomic factors lowers substantially the industry dummy effects (compare tables 1 and 2). We also have interaction terms between industries and work experience. The changes in the standard error of the regression (SEE) when human capital variables and industry dummies are added are shown in table 3.

Table 2. Level Estimation, Industry Differences							
Variable	**Coefficient**	**t-value**	**Industry * Experience**	**t-value**	**Industry * Experience^2**	**t-value**	**w_{22}**
Experience	0.026	(68.3)					
Experience^2	-0.00044	(32.4)					
Seniority	0.008	(72.3)					
Seniority^2	-0.00012	(57.8)					
Mining	0.040	(2.4)	0.000	(0.1)	-0.00005	(1.0)	0.372
Food	0.045	(10.1)	-0.004	(6.2)	0.00008	(5.8)	0.343
Textile	0.031	(5.7)	-0.011	(12.6)	0.00018	(10.2)	0.224
Clothing	-0.004	(2.4)	-0.010	(12.8)	0.00017	(10.4)	0.202
Wood products	-0.021	(0.7)	-0.006	(9.7)	0.00010	(7.3)	0.236
Paper and pulp	0.162	(27.0)	-0.003	(5.5)	0.00006	(4.4)	0.462
Printing	0.054	(12.1)	0.005	(8.6)	-0.00008	(5.7)	0.485
Furniture	-0.075	(5.6)	-0.005	(6.0)	0.00008	(4.2)	0.201
Chemicals	0.008	(4.4)	0.003	(4.5)	-0.00006	(3.8)	0.400
Oil	-0.049	(1.1)	0.010	(5.5)	-0.00015	(4.1)	0.450
Rubber	0.013	(4.8)	-0.003	(4.6)	0.00004	(2.7)	0.307
Non-metallic products	0.040	(8.3)	-0.004	(5.2)	0.00005	(3.7)	0.332
Basic metal	0.053	(8.0)	-0.003	(3.0)	0.00004	(2.3)	0.365
Metal products	-0.014	(2.2)	0.000	(0.5)	0.00000	(0.1)	0.340
Machinery, Transport Equip.	-0.026	(ref)	0.000	(ref)	0.00000	(ref)	0.323
Electronics	-0.105	(11.4)	0.010	(12.9)	-0.00019	(11.2)	0.359
Other Production	-0.019	(0.6)	-0.004	(4.5)	0.00008	(4.2)	0.275
Energy	0.068	(4.6)	0.005	(2.6)	-0.00010	(2.3)	0.483
Construction	-0.021	(0.5)	0.002	(1.9)	-0.00003	(1.4)	0.355
Wholesale	-0.050	(3.2)	0.010	(13.1)	-0.00019	(11.2)	0.427
Retail sale	-0.085	(6.4)	0.000	(0.3)	0.00002	(1.1)	0.282
Car Retail and Service	-0.125	(6.4)	0.007	(4.1)	-0.00014	(3.3)	0.311
Hotels, Bars, Restaurants	0.110	(10.3)	-0.008	(5.9)	0.00014	(4.3)	0.341
Transportation	0.026	(6.4)	0.003	(3.0)	-0.00002	(1.3)	0.418
Finance, Real Estate	-0.037	(0.9)	0.005	(4.3)	-0.00007	(2.2)	0.398
Business, Personal Service	-0.118	(10.6)	0.015	(16.5)	-0.00027	(12.5)	0.437
Public Service	-0.124	(5.4)	0.000	(0.2)	0.00020	(3.4)	0.315
Education	-0.289	(21.9)	0.022	(15.5)	-0.00036	(10.4)	0.359
Sanitary Services	0.037	(3.7)	-0.010	(5.5)	0.00024	(5.5)	0.282
Recreation	-0.086	(4.1)	0.005	(3.3)	-0.00004	(1.1)	0.356
Sex	0.245	(305.4)					

Table 2 continues

Variable	Coefficient	t-value
Vocational Degree < 3 yrs,		
General Programmes	-0.025	(2.8)
Fine Arts, Business, Health	0.012	(8.6)
Natural Science, Others	0.049	(55.9)
Vocational degree> 2 yrs,		
General Programmes	0.137	(64.6)
Fine Arts, Business, Health	0.100	(65.6)
Natural Science, Others	0.160	(109.3)
Bachelor comprehensive Fine		
Arts, Business, Health	0.229	(66.7)
Natural Science, Others	0.254	(118.1)
Bachelor Higher Institution		
Fine Arts, Business, Health	0.357	(115.2)
Natural Science, Others	0.180	(30.0)
Master's Degree		
Fine Arts, Business, Health	0.409	(135.1)
Natural Science, Others	0.459	(178.6)
Postgraduate or Equivalent	0.620	
Service Upper Management	0.483	(85.9)
Senior Research, Plan.	0.235	(42.4)
Lower-Level Employees	0.084	(15.4)
Manufacturing workers	-0.012	(2.1)
Year 1987	0.073	(62.5)
Year 1988	0.062	(54.1)
Year 1989	0.067	(59.4)
Year 1990	0.045	(40.5)
Year 1991	0.006	(5.2)
Sample size	556313	
Coeff. Degrees of Freed.	114	
Root Mean Squared Error	0.234	
R^2	0.567	

ref= reference industry. Reference in education is doctoral degree, in socioeconomic status workers, unspecified.

w_{22} = industry$_j$ + (experience slope+experience slope*industry$_j$)*22 + (experience squared slope+experience squared slope*industry$_j$)*22^2 shows experience and industry j effect in 22 years.

Table 3. Change in Standard Error of Regression

ΔSEE % Change	Model	R^2
	T + edu	0.25
-6.9	T + edu +sos	0.35
-7.9	T + edu + sos + sex	0.45
-7.2	T + edu + sos + sex + sen + exp	0.53
-4.1	T + edu + sos + sex + sen + exp + ind	0.56
-0.3	T + edu + sos + sex + sen + exp + ind + ind*exp	0.57

t=time, edu=education, sos=sosioeconomic status, sen=seniority & seniority^2 exp=experience & experience^2, ind=industry

Education, socioeconomic status and sex explain almost half of the wage variation (R^2=0.45). Experience and seniority drop the standard error of regression by 7.2 percent, the industry dummies by 4.1 percent and the interaction terms by 0.3 percent. In Asplund (1993), industry dummies dropped the standard error of regression less, around 2 to 2.5 percent (using the Finnish Labor Force Survey for 1987). The year dummies indicate a decrease in real wage in years 1991-1992. This period was characterized by a deep recession in Finland with a 6 percent decrease in GDP in 1992. However, besides the level shift it is hard to observe any systematic changes in the wage structure during the recession (except that later we find seniority payments to be lower). One reason can be that the decrease in net profits was mainly caused by higher financial expenses, while according to Piekkola (1999) there is no similar decrease in quasi rents that are more important for wage formation (value added less opportunity income to labor and capital).

The industry effects in tables 2 and 4 are deviations from the labor share weighted average industry effect. Similarly, the interaction terms are deviations of experience effects from the corresponding weighted average experience effects (shown as the experience and experience squared coefficients). The t-values are those of the original experience, industry and interaction terms (the reference group is machinery and transport equipment). From table 2, the average annual return for the first year of experiences is 2.6 percent and from the difference estimation in table 4 6.6 percent. Experience payments decline thereafter. Finally, the last columns w_{22} show the combined total effect of industry and experience on wages at 22 years of experience, which is the sample average. It appears that at 22 years of experience the traditional division to high wage and low wage industries, similar to that in table 1, holds. However, for labor market entrants (zero experience), transportation, oil, chemicals and mining do not appear to be high wage sectors.

Table 4. Difference Estimation, Industry Differences

Variable	Coefficient	t-value	Industry * Experience	t-value	Industry * Experience^2	t-value	w_{22}
Experience	0.067	(16.6)					
Experience^2	-0.0010	(71.1)					
Seniority	0.001	(3.6)					
Seniority^2	-0.00003	(3.8)					
Mining	-0.005	(0.1)	0.000	(0.4)	0.00003	(0.7)	0.994
Food	0.002	(0.6)	-0.001	(2.0)	0.00004	(2.5)	0.990
Textile	0.014	(1.4)	-0.002	(2.4)	0.00005	(2.0)	0.977
Clothing	0.002	(0.4)	-0.001	(1.4)	0.00001	(0.7)	0.976
Wood products	0.031	(4.1)	-0.003	(4.2)	0.00006	(3.9)	0.991
Paper and pulp	0.016	(2.5)	-0.001	(1.8)	0.00001	(1.5)	1.002
Printing	-0.012	(0.9)	0.004	(3.6)	-0.00012	(4.7)	1.019
Furniture	0.035	(3.4)	-0.004	(3.8)	0.00009	(3.4)	0.984
Chemicals	-0.006	(0.2)	0.000	(0.1)	0.00000	(0.4)	0.999
Oil	0.006	(0.4)	-0.003	(1.4)	0.00008	(1.8)	0.979
Rubber	0.001	(0.5)	-0.001	(1.4)	0.00003	(1.7)	0.993
Non-metallic products	0.011	(1.4)	-0.001	(1.1)	0.00001	(0.9)	0.999
Basic metal	-0.012	(0.7)	0.001	(0.3)	-0.00002	(0.5)	0.991
Metal products	0.005	(1.5)	0.000	(0.9)	0.00000	(1.0)	1.003
Machinery, Transport Equip.	-0.003	(ref)	0.001	(ref)	-0.00001	(ref)	0.999
Electronics	-0.025	(2.9)	0.003	(2.8)	-0.00006	(2.7)	1.002
Other Production	0.000	(0.3)	-0.003	(2.4)	0.00007	(2.8)	0.971
Energy	0.064	(4.3)	-0.005	(4.1)	0.00010	(3.5)	0.987
Construction	-0.007	(0.4)	0.000	(0.3)	0.00000	(0.5)	0.995
Wholesale	-0.007	(0.5)	0.001	(1.1)	-0.00003	(1.2)	1.004
Retail sale	-0.046	(4.8)	0.002	(1.5)	-0.00002	(0.5)	0.983
Car Retail and Service	0.012	(1.1)	0.000	(0.4)	-0.00003	(0.4)	0.993
Hotels, Bars, Restaurants	-0.004	(0.0)	0.000	(0.5)	0.00002	(0.7)	0.995
Transportation	-0.010	(0.6)	0.000	(0.7)	0.00000	(0.6)	0.983
Finance, Real Estate	-0.015	(1.3)	0.002	(1.2)	-0.00003	(0.9)	1.002
Business, Personal Service	-0.008	(0.7)	0.001	(0.4)	-0.00002	(0.6)	0.996
Public Service	-0.084	(5.3)	0.005	(2.3)	-0.00006	(1.1)	0.984
Education	-0.088	(8.2)	0.007	(5.6)	-0.00014	(4.6)	0.995
Sanitary Services	-0.022	(1.2)	-0.001	(1.0)	0.00006	(1.7)	0.976
Recreation	-0.015	(1.1)	0.000	(0.4)	-0.00001	(0.1)	0.979
Year 1988	0.012	(29.6)					
Year 1989	0.039	(85.8)					
Year 1990	0.035	(88.1)					
Sample size	450820						
Coeff. Degrees of Freedom	94						
Root Mean Squared Error	0.138						
R^2	0.044						

w_{22} = industry$_j$ + (experience slope+experience slope*industry$_j$)*22 + (experience squared slope+experience squared slope*industry$_j$)*22^2 shows experience and industry *j* effect in 22 years.

The labor share weighted standard deviation of the fixed industry effects is somewhat lower, 2 percent, in difference estimation than in the level estimation, 7 percent. However, they are the same, 7 percent, when also the industry specific experience effect is taken into account, evaluated at the average experience (last column). We can see that the industry differentials are substantial and they interact with the work experience. The F-test clearly rejects the hypothesis of the unimportance of the interaction terms both in level and difference estimation (F-value is 64.2 in the former and 4.6 in the latter, critical value at 1 percent level is 1.47).

Goux and Maurin (1997) argue that in France a major part of the inter-industry wage differentials is explained by unexplained worker characteristics such as physical endurance and intellectual ability. This is based on the low correlation, 0.25, in their level and difference estimations using 99 industries. In our study, the correlation is significantly higher, 0.58, without the interaction terms and 0.54 when considering the wage differences generated at 22 years of working experience (last columns in tables 2 and 4). The correlations fit the range 0.5-0.7 obtained for Finland by Vainiomäki and Laaksonen (1995) using a 37-industry classification in years 1975, 1980 and 1985. We therefore cannot deduce that most of the wage variation is explained by unobserved person characteristics. Admittedly, Goux and Maurin (1997) find a much higher correlation, 0.66, with a 14-industry classification. Hence, some of the high correlation can be attributed to aggregation errors. However, because the model includes the interaction terms with industries and work experience, multicollinearity limited the range of our industry classification.

We can see that industries with high productivity have experience related pay that initially exceeds the average (based both on level and difference estimations and on the experience-wage profile in the first years in the labor market). These are printing, furniture, chemicals, electronics, and possibly wholesale trade, business and personal services, and education in the service sector. In this division the high productivity manufacturing industries, except for printing and furniture, are the same as in OECD (1996), where the division is based on the R&D expenditure shares (see section 4). Industries with low productivity have experience related pay that is initially below the average. These are basic metal, paper and pulp, textile, clothing, food industries, and wood products, all low productivity industries in the OECD classification, too. Some industries with middle-level technology in OECD classification, rubber and non-metallic products, also have low experience payments for the first working years.

It is noteworthy that in the long run experience related payments are higher in industries with high wages: paper and pulp, energy, printing, chemicals and oil (from the last column in table 2). These are not necessarily high technology industries. One reason for both high wages and steeper long run experience-wage profile can be the relatively strong labor unions in these industries. This insider power leads to better wage performance for the more experienced. Besides the relative strength of labor unions, an explanation can also be found from the relatively low share of female labor and from the fact that these industries suffered less from the 1990's recession than domestic manufacturing.

3. Firm Characteristics in Wage Formation

This section examines wage variation not explained by personal effects. We specify a model where wage is explained both by individual fixed effects and firm fixed effects. There are alternative ways of estimating both sets of effects. We use the persons first method suggested by Abowd et al. (1999). In this method, the person effects are first estimated and given them, the firm effects. This belongs to so-called order-dependent methods, since calculating firm effects first may give different results. In practice, the differences between these methods and an order-independent method seem to be negligible when person effects are analyzed. Abowd et al. (1999) found that seniority compensations were stronger when firm effects are estimated first. We lean on the person first estimation, considered in general more reliable in Abowd et al. (1999). The basic model is

$$ln(w_{ijt}) = q_i + g_j + b_1 t + b_2 exp_{it} + b_3 exp_{it}^2 + b_4 exp_{it}^3 + b_5 exp_{it}^4 + e_{ijt} \qquad (3)$$

where wage is explained only by the time varying person characteristic, experience and time dummies. The subscript *j* refers to the firm, and q_i and g_j are the individual and firm fixed effects, respectively. The estimation proceeds by first estimating an equation, where the wage is explained, in addition to experience, also by variables *Z* which include interactions of person average and firm characteristics (interactions of average experience, average experience squared, seniority, firm size (average number of workers) and industry dummies).

$$ln(w_{ijt}) = q_i + b_1 t + b_2 exp_{it} + b_3 exp_{it}^2 + b_4 exp_{it}^3 + b_5 exp_{it}^4 + l Z_{ijt} + u_{ijt} \qquad (4)$$

The model is estimated in deviations from the individual means form to purge the person fixed effects. Adding the *Z* variables in the model creates an error term u_{ijt} that includes, in addition to the original error e_{ijt}, also the projection of the firm effects on the *Z* variables. Therefore, the *Z* variables should be such that the projection is orthogonal to the explanatory variables and person effects.

The person effects can then be calculated as averages of the error terms over time for each individual. The error terms for each firm can then be calculated as $ln(w_{ijt})^* = ln(w_{ijt}) - q_i' - b_1't - b_2'exp_{it} - b_3'exp_{it}^2 - b_4'exp_{it}^3 - b_5'exp_{it}^4$ where the primes denote estimates from the previous stage. Grouping all $ln(w_{ijt})^*$ observations for firm *j*, the last step is to estimate for each of the 1815 firms the model

$$ln(w_{ijt})^* = f_j + g_j sen_{ijt} + g_{2j} sen_{ijt}^2 + v_{ijt} \qquad (5)$$

Table 5 shows the coefficients for seniority and its square for different firm sizes and table 6 for various industries. Table 7 shows the means, standard deviations and correlations and tables 8, 9 and 10 the corresponding figures obtained from an estimation where the parameters were allowed to vary by different education levels. In tables 7-10 the firms are weighted depending on the number of observations (the size of workforce), whereas in tables 5 and 6 the means and standard deviation are calculated giving each firm equal weight. We can see from table 7 that a consistent coefficient of seniority, *g*, is 0.8 percent, which is surprisingly similar to the one obtained in the level analysis in table 2 (this figure is for the firms with at least 15 observations, which are included in the productivity analysis below). Further, the marginal impact of one additional year of seniority, or the slope of the seniority-wage profile $g+2g_2sen$ (evaluated at the average seniority, 11 years), is 0.9 percent and not very far from the initial slope 0.8 percent (evaluated at one year of seniority). The estimation period included the deep recession, where seniority returns were lower (reduced from 0.8 to 0.5 percent in the level estimation; results not reported). Without the recession, the actual seniority payments might have been higher.

Table 5. Seniority and The Size of Firm

The Size of Firm	Number of Firms	γ	Standard Deviation	γ_2	Standard Deviation	$\gamma + 2*\gamma_2 * Sen_{11}$
All firms (observations >= 15)	1671	0,0150	0,0390	-0,00021	0,00686	0,01041
Observations < 15	77	0,0059	0,0000	-0,00010	0,00000	0,00382
Personnel 5-19	446	0,0216	0,0583	-0,00017	0,01059	0,01783
Personnel 20-49	460	0,0177	0,0370	-0,00031	0,00719	0,01081
Personnnel 50-99	275	0,0134	0,0267	-0,00027	0,00304	0,00745
Personnel 100-499	426	0,0085	0,0184	-0,00020	0,00185	0,00416
Personnel 500-	141	0,0037	0,0058	0,00017	0,00262	0,00747

Last column shows seniority slope at average years of seniority, 11 years

Table 6. Industries and Seniority

Industry	Number of Firms	γ	Standard Deviation	γ_2	Standard Deviation	$\gamma + 2*\gamma_2 * Sen_{11}$
Mining	1	0,0056		-0,00007		0,00401
Food industry	74	0,0094	0,0293	-0,00015	0,00243	0,00607
Textile	79	0,0065	0,0306	0,00023	0,00301	0,01167
Clothing	118	0,0085	0,0385	0,00176	0,01222	0,04724
Wood products	116	0,0297	0,0527	-0,00117	0,00633	0,00381
Paper and pulp	63	0,0131	0,0352	0,00070	0,00601	0,02845
Printing	124	0,0121	0,0379	-0,00133	0,01363	-0,01727
Furniture	79	0,0142	0,0461	-0,00018	0,00490	0,01022
Chemical	69	0,0182	0,0399	-0,00033	0,00365	0,01093
Oil	3	0,0117	0,0147	-0,00029	0,00048	0,00543
Rubber	83	0,0160	0,0339	-0,00034	0,00278	0,00846
Non-metallic products	70	0,0120	0,0278	0,00025	0,00412	0,01744
Basic metal	37	0,0078	0,0308	-0,00039	0,00255	-0,00076
Metal products	278	0,0155	0,0374	-0,00003	0,00483	0,01486
Machinery, Transport Equip.	288	0,0158	0,0450	-0,00082	0,00733	-0,00220
Electronics	82	0,0321	0,0378	-0,00020	0,00546	0,02764
Other Production	59	0,0074	0,0184	0,00026	0,00132	0,01318
Energy, Construction	2	0,0087	0,0095	-0,00021	0,00029	0,00396
Wholesale	13	-0,0002	0,0243	0,00090	0,00389	0,01962
Retail and Car sale, service	9	0,0059	0,0264	-0,00004	0,00121	0,00503
Hotels, Bars, Restaurants	16	0,0106	0,0179	-0,00024	0,00056	0,00528
Transportation	3	0,0067	0,0054	-0,00008	0,00019	0,00499
Business, Personal Service	4	0,0122	0,0195	-0,00041	0,00072	0,00311
Recreation	1	0,0035		0,00027	.	0,00942

Last column shows seniority slope at average years of seniority, 11 years.
Education and Public Service are omitted because of low number of observations.

Table 7. Summary Statistics and Correlations 1987-1992

Variable	Mean	Std. D.	lnw	x β	θ	ψ	ϕ	γ	γ_2	γ * Seniority	γ_2 * Seniority^2	γ+2*γ_2 *Seniority
w, Log wages	11,6273	0,3527	1	-0,0348	0,3146	0,0765	0,0350	-0,0266	0,0007	0,0506	-0,0350	-0,0067
x β	-1,8186	1,1230	-0,0348	1	-0,9479	-0,2648	-0,0777	0,0999	-0,0287	-0,1130	0,0040	-0,0042
θ, Person effect	13,4207	1,1736	0,3146	-0,9479	1	0,2235	0,0578	-0,1065	0,0239	0,1052	-0,0112	-0,0030
ψ, Firm effect	0,0008	0,0673	0,0765	-0,2648	0,2235	1	0,5230	0,0543	0,0687	0,3374	-0,0598	0,0921
ϕ, Firm Intercept	-0,0505	0,0624	0,0350	-0,0777	0,0578	0,5230	1	-0,4783	0,1843	-0,3565	0,1718	0,0728
γ, Seniority slope	0,0082	0,0209	-0,0266	0,0999	-0,1065	0,0543	-0,4783	1	-0,5292	0,5931	-0,4246	-0,3131
γ_2, Seniority squared slope	0,00005	0,0038	0,0007	-0,0287	0,0239	0,0687	0,1843	-0,5292	1	-0,2605	0,2782	0,9716
γ * Seniority	0,0512	0,1177	0,0506	-0,1130	0,1052	0,3374	-0,3565	0,5931	-0,2605	1	-0,8513	-0,1260
γ_2* Seniority^2	0,0001	0,0854	-0,0350	0,0040	-0,0112	-0,0598	0,1718	-0,4246	0,2782	-0,8513	1	0,1928
γ + 2*γ_2*Seniority	0,0093	0,0747	-0,0067	-0,0042	-0,0030	0,0921	0,0728	-0,3131	0,9716	-0,1260	0,1928	1

Calculations use average seniority in each worker-firm combination.

If all firms are given equal weight, the marginal impact of the first year of seniority in the firm ($g+2g_2sen$, evaluated at sen=1) is to improve wages by 1.5 percent on the average in table 5. This initial seniority impact is clearly decreasing with firm size so the larger average seniority effect can be explained by small firms receiving equal weight as large firms. It is above the average for firms with personnel less than 50, while in the largest firms it is less than one fifth of the return in the smallest firms. When evaluated at 11 years of seniority (last column in table5), the seniority-wage profile again flattens with firm size, except for the largest size group. Since the labor union power can be assumed to increase with firm size, our findings show that the initial seniority effect is not related to the strength of the labor unions.

It is apparent from tables 8, 9 and 10 that seniority returns are initially increasing with education. The slope $g+2g_2 sen$, evaluated at sen=1, is 0.7 percent for a comprehensive degree, 1.5 percent for a vocational, comprehensive bachelor degree (16 percent of the workforce in the sample) and 2.0 percent for a university degree (4 percent of the work force). At the actual years of seniority the situation is reversed, with the slope decreasing with education level. The slope is around 1 percent for the lower and middle educational level, whereas around –0.2 percent for the highly educated.

Table 8. Summary Statistics and Correlations 1987-1992 Comprehensive, Lower Vocational degree

Variable	Mean	Std. D.	lnw	x β	θ	ψ	φ	γ	γ_2	$\gamma *$ Seniority	$\gamma_2 *$ Seniority^2	$\gamma+2*\gamma_2$ *Seniority
w, Log wages	11,5454	0,2769	1	-0,08655	0,30358	-0,0007	0,0323	-0,0398	0,00523	0,02822	-0,00432	-0,00524
x β	-1,9934	1,1235	-0,0866	1	-0,9644	0,00209	-0,0632	0,07536	-0,0125	-0,06568	-0,01994	0,00706
θ, Person effect	13,5135	1,1657	0,30358	-0,96439	1	-0,0025	0,04598	-0,0845	0,00927	0,05758	0,0179	-0,01318
ψ, Firm effect	-0,1292	6,5586	-0,0007	0,00209	-0,0025	1	-0,0046	0,00532	0,00072	0,00398	0,0029	0,00228
φ, Firm Intercept	-0,0514	0,0815	0,0323	-0,06324	0,04598	-0,0046	1	-0,5061	0,15946	-0,58676	0,36397	0,03683
γ, Seniority slope	0,0068	0,0222	-0,0398	0,07536	-0,0845	0,00532	-0,5061	1	-0,5112	0,61283	-0,48005	-0,29105
γ_2, Seniority squared slope	0,00018	0,0040	0,00523	-0,01248	0,00927	0,00072	0,15946	-0,5112	1	-0,23203	0,26387	0,97104
$\gamma *$ Seniority	0,0434	0,1544	0,02822	-0,06568	0,05758	0,00398	-0,5868	0,61283	-0,232	1	-0,86911	-0,08794
$\gamma_2 *$ Seniority^2	0,0087	0,1049	-0,0043	-0,01994	0,0179	0,0029	0,36397	-0,4801	0,26387	-0,86911	1	0,16029
$\gamma + 2*\gamma_2*$Seniority	0,0108	0,0798	-0,0052	0,00706	-0,0132	0,00228	0,03683	-0,2911	0,97104	-0,08794	0,16029	1

Table 9. Summary Statistics and Correlations 1987-1992 Vocational, Comprehensive Bachelor Degree

Variable	Mean	Std. D.	lnw	x β	θ	ψ	φ	γ	γ_2	$\gamma *$ Seniority	$\gamma_2 *$ Seniority^2	$\gamma+2*\gamma_2$ *Seniority
w, Log wages	11,7259	0,3610	1	-0,4529	0,6593	0,0483	0,0025	-0,0168	0,0120	0,0012	-0,0003	-0,0003
x β	-1,3973	0,9913	-0,4529	1	-0,9556	-0,1004	0,0160	0,0095	-0,0265	-0,0207	0,0178	-0,0215
θ, Person effect	13,0984	1,1836	0,6593	-0,9556	1	0,0799	-0,0132	-0,0132	0,0244	0,0171	-0,0150	0,0163
ψ, Firm effect	0,0032	0,2545	0,0483	-0,1004	0,0799	1	-0,0487	0,0891	-0,0018	0,0548	-0,0521	0,0698
φ, Firm Intercept	-0,0906	2,8269	0,0025	0,0160	-0,0132	-0,0487	1	-0,9166	0,2216	-0,9981	0,9930	-0,4940
γ, Seniority slope	0,0159	0,1650	-0,0168	0,0095	-0,0132	0,0891	-0,9166	1	-0,4831	0,9194	-0,9191	0,2739
γ_2, Seniority squared slope	-0,0003	0,0102	0,0120	-0,0265	0,0244	-0,0018	0,2216	-0,4831	1	-0,2295	0,2374	0,7098
$\gamma *$ Seniority	0,1102	5,5818	0,0012	-0,0207	0,0171	0,0548	-0,9981	0,9194	-0,2295	1	-0,9982	0,4877
$\gamma_2 *$ Seniority^2	-0,0187	2,7645	-0,0003	0,0178	-0,0150	-0,0521	0,9930	-0,9191	0,2374	-0,9982	1	-0,4787
$\gamma + 2*\gamma_2*$Seniority	0,0097	0,2051	-0,0003	-0,0215	0,0163	0,0698	-0,4940	0,2739	0,7098	0,4877	-0,4787	1

Table 10. Summary Statistics and Correlations 1987-1992 Higher Institution, University Degree

Variable	Mean	Std. D.	lnw	x β	θ	ψ	φ	γ	γ_2	$\gamma *$ Seniority	$\gamma_2 *$ Seniority^2	$\gamma+2*\gamma_2$ *Seniority
w, Log wages	12,0892	0,4430	1	-0,3969	0,6720	0,0028	0,0079	-0,0552	0,0498	0,0051	0,0080	0,0406
x β	-1,1682	0,8713	-0,3969	1	-0,9250	0,0043	0,0127	0,0579	-0,0534	-0,0344	0,0196	-0,0439
θ, Person effect	13,2322	1,1018	0,6720	-0,9250	1	-0,0035	-0,0106	-0,0677	0,0603	0,0246	-0,0113	0,0488
ψ, Firm effect	-0,0794	6,6191	0,0028	0,0043	-0,0035	1	-0,0852	0,0512	-0,0163	0,0845	-0,0771	-0,0009
φ, Firm Intercept	-0,0846	0,6099	0,0079	0,0127	-0,0106	-0,0852	1	-0,6655	0,1933	-0,9684	0,8964	-0,0108
γ, Seniority slope	0,0218	0,1003	-0,0552	0,0579	-0,0677	0,0512	-0,6655	1	-0,7052	0,6805	-0,6622	-0,4928
γ_2, Seniority squared slope	-0,0011	0,0150	0,0498	-0,0534	0,0603	-0,0163	0,1933	-0,7052	1	-0,2215	0,2420	0,9645
$\gamma *$ Seniority	0,0975	1,1916	0,0051	-0,0344	0,0246	0,0845	-0,9684	0,6805	-0,2215	1	-0,9734	-0,0183
$\gamma_2 *$ Seniority^2	-0,0112	0,6120	0,0080	0,0196	-0,0113	-0,0771	0,8964	-0,6622	0,2420	-0,9734	1	0,0502
$\gamma + 2*\gamma_2*$Seniority	-0,0014	0,2692	0,0406	-0,0439	0,0488	-0,0009	-0,0108	-0,4928	0,9645	-0,0183	0,0502	1

From table 7 it appears that the firm intercept f has a large variance with a standard deviation 0.06 (with mean value –0.05). The firm intercept is not correlated with wage, and the total firm effect, $y = f + g*sen + g_2*sen^2$, is correlated with $ln(w)$ only in the middle level educated group with vocational or comprehensive bachelor degree. In contrast to this, the individual effect q is clearly correlated with wage, especially in the two higher educated groups where the correlation is over 0.6. We can see that firm effects f and y are not correlated with the individual effects q and $x\ b$. This suggests that, apart from education effects, there is no strong association with human capital models and firm-level compensation design and bargaining approaches in explaining labor market behavior. However, there is a strong dependence of firm compensation on education level. Barth (1997) and Kramarz, Lollivier and Pelé (1996) also find a positive correlation of education with firm effects.

The firm intercept, f, is negatively correlated with the coefficient of the linear seniority term, g, with correlation coefficient –0.48. The correlation is most negative, –0.92, for the middle level educated. In conclusion, our results suggest that earnings equations should have a firm effect with a firm-specific intercept, seniority slope and seniority squared slope that give different initial and longer-run seniority payments. There is also a strong association with firm-level compensation and education, in contrast to other human capital components. Initial seniority payments are increasing with education. Longer run seniority payments are particularly common for personnel that have education which is higher than comprehensive schooling but below university degree. The personnel with university degree have clearly lower seniority payments despite them being initially higher.

Turning finally to industry differences in table 6, we can see that industries can be divided roughly to domestic sector manufacturing with low initial seniority payments and to other manufacturing with higher seniority payments. Electronics (3.2 percent) and wood industry (2.8 percent) clearly outperform other industries in seniority effects in the beginning of tenure

($g+2g_2sen$, evaluated at sen=1). The division is less clear with longer tenure. The seniority squared generally has a negative coefficient and therefore the wage profile becomes flatter over time (last column). The exception to this is domestic sector manufacturing, where seniority payments from longer tenure are more important. This may be explained by the high share of female labor in food, textile and clothing industries. Also Asplund (1993) found seniority to be relatively more important for females.

4. Compensation Policies and Productivity

We measure productivity by valued added per capita and by relative total factor productivity. The log of relative total factor productivity is measured by

$$\ln TFP = \ln\left(\frac{Y_{it} / L_{it}}{\overline{Y} / \overline{L}}\right) - 0.4 \ln\left(\frac{K_{it} / L_{it}}{\overline{K} / \overline{L}}\right) \ ,$$

where Y_{it} is value added, L_{it} labor input, and K_{it} capital input in plant i in year t, and 0.4 approximates the cost share of the capital input. Capital is accumulated investment in past eight years assuming 15 percent depreciation. Labor input is the number of employees at the end of the year. $\overline{Y}$, $\overline{L}$ and $\overline{K}$ are the geometric means of value added, labor and capital, respectively, in each industry. We explain value added per worker and total factor productivity by average personal and firm characteristics in each firm, i.e., the explanatory variables include time-varying variables (work experience), non-time varying person fixed effects, the coefficients of seniority and seniority squared, and firm intercept (for each firm).

We also make use of plant-level information available in the industrial statistics aggregating it to the firm level: white-collar share of workers, age of firm, share of exports in sales, and foreign ownership. We also have dummies for 11 regions and for 5 firm size categories. The number of firms in explaining valued added is 1601 and in explaining productivity 1531. We include only the firms with at least 15 employee combinations. We lose only 3% of personnel for which we were not able to match industrial and employment statistics by plant code or by firm code and industry code (the latter helps linking 7% of sample personnel located especially in paper and pulp). Tables 11 and 12 show the results from weighted least squares estimation.

Table 11. Generalized Least Squares Estimates of the Relation Between Log(Value Added/Worker) and Compensation Policy

Variable	Coefficient	t-value
X variables xβ	0.888	(8.7)
Person Effect θ	0.827	(8.3)
Firm Intercept ϕ	0.156	(0.8)
Seniority Slope γ	0.885	(1.4)
Seniority^2 Slope γ_2	3.525	(1.3)
Firm Age Group 1	0.000	(ref)
Firm Age Group 2	0.005	(0.1)
Firm Age Group 3	0.110	(2.4)
Firm Age Group 4	0.012	(0.3)
Firm Age Group 5	-0.007	(0.1)
Firm Age Group 6	0.074	(1.4)
Firm Age Group 7	0.104	(1.7)
White Collar Share	0.175	(1.9)
Export Share	0.105	(2.0)
Foreign Ownership 20-50%	0.122	(1.6)
Foreign Ownership > 50%	0.113	(1.6)
Regions:		
Helsinki, Itä-Uusimaa	0.026	(ref)
Länsi-Uusimaa	-0.075	(1.3)
Varsinais Suomi, Ahven.	0.039	(0.3)
Satakunta	-0.009	(0.6)
Tampere, Kanta-Häme	0.017	(0.2)
Päijät-Häme Kymenlaakso	0.005	(0.4)
Etelä-Karjala, Etelä-Savo	-0.127	(2.7)
Pohjois-Karjala	0.023	(0.0)
Pohjois-Savo	0.062	(0.5)
Pohjanmaa, Kainuu	0.029	(0.1)
Lappi	0.012	(0.2)
Firm Size 5-19	0.067	(1.9)
Firm Size 20-49	0.042	(1.5)
Firm Size 50-99	-0.015	(ref)
Firm Size 100-499	0.004	(0.5)
Firm Size 500-	-0.017	(0.0)
Food	0.088	(1.8)
Textile	-0.181	(2.3)
Clothing	-0.249	(3.8)
Wood products	0.076	(1.9)
Paper and pulp	0.026	(0.8)
Printing	-0.037	(0.1)
Furniture	0.055	(1.4)
Chemicals	0.188	(3.1)
Oil	0.536	(2.0)
Rubber	0.086	(1.9)
Non-metallic products	0.045	(1.2)
Basic metal	-0.084	(0.6)
Metal products	-0.003	(0.7)
Machinery, Transport Equip.	-0.033	(ref)
Electronics	-0.020	(0.2)
Other Production	-0.027	(0.1)
Sample size	1601	
Coeff. Degrees of Freedom	44	
Root Mean Squared Error	0.092	
R^2 (weighted)	0.207	
R^2 (unweighted)	0.194	

The size of firm and industry dummies are labor share weighted and region dummies use equal weights.

Table 12. Generalized Least Squares Estimates of the Relation Between LogTFP and Compensation Policy		
Variable	**Coefficient**	**t-value**
X variables xβ	0.469	(1.7)
Person Effect θ	0.456	(1.8)
Firm Intercept ϕ	0.012	(0.0)
Seniority Slope γ	0.312	(0.2)
Seniority^2 Slope γ_2	21.221	(2.0)
Firm Age Group 1	0.000	(ref)
Firm Age Group 2	0.033	(0.6)
Firm Age Group 3	-0.320	(4.3)
Firm Age Group 4	-0.163	(1.7)
Firm Age Group 5	-0.079	(1.3)
Firm Age Group 6	-0.029	(0.1)
Firm Age Group 7	1.479	(1.7)
White Collar Share	-0.192	(0.9)
Export Share	0.022	(0.4)
Foreign Ownership 20-50%	-0.093	(1.9)
Foreign Ownership > 50%	0.327	(3.7)
Regions:		
Helsinki, Itä-Uusimaa	0.204	(ref)
Länsi-Uusimaa	-0.644	(5.1)
Varsinais Suomi, Ahven.	-0.431	(11.9)
Satakunta	0.344	(1.6)
Tampere, Kanta-Häme	0.303	(1.4)
Päijät-Häme Kymenlaakso	0.438	(3.0)
Etelä-Karjala, Etelä-Savo	-0.508	(6.6)
Pohjois-Karjala	-0.190	(4.0)
Pohjois-Savo	0.179	(0.3)
Pohjanmaa, Kainuu	0.044	(3.0)
Lappi	0.262	(0.7)
Firm Size 5-19	0.140	(8.3)
Firm Size 20-49	0.124	(7.6)
Firm Size 50-99	-0.291	(ref)
Firm Size 100-499	0.119	(9.7)
Firm Size 500-	0.004	(5.4)
Food	0.558	(7.0)
Textile	0.098	(1.0)
Clothing	0.096	(0.7)
Wood products	0.439	(2.8)
Paper and pulp	-0.057	(0.9)
Printing	-0.408	(7.9)
Furniture	0.342	(3.4)
Chemicals	-0.071	(0.6)
Oil	-0.257	(0.1)
Rubber	-0.114	(1.2)
Non-metallic products	-0.046	(0.6)
Basic metal	-0.130	(0.8)
Metal products	-0.085	(2.0)
Machinery, Transport Equip.	-0.002	(ref)
Electronics	0.077	(0.6)
Other Production	-0.431	(5.0)
Sample size	1531	
Coeff. Degrees of Freedom	44	
Root Mean Squared Error	18.755	
R^2 (weighted)	0.990	
R^2 (unweighted)	0.200	

There is clearly heteroskedasticity, as the weighted R^2 is substantially higher than the unweighted one. It is seen from table 11 that personal characteristics, time varying variables such as work experience (through *xb* variables) and non-time varying person effects (through *q*), have a positive effect on value added per worker. Similar result is also found in other countries, as in Abowd et al. (1999). Personal characteristics (through *xb* and *q* variables) also have a positive effect on total factor productivity in table 12. In wage studies it has been observed that the schooling effect is mitigated when controlling for the share of manual workers (see Dickens and Katz, 1987, and Asplund, 1993, among others). Hence, fixed person effects would have had a more positive effect on productivity ignoring this variable. We investigated the model by including the interactions of education group dummies (results not reported here). When differences between educational groups were allowed, the positive effect of time varying personal characteristics (general experience) on total factor productivity was strongest for personnel with comprehensive-level basic education, while the labor productivity effects were the converse. Time-invariant person effect (schooling) has instead stronger positive effect on total factor productivity for highly educated. Seniority compensations from initial tenure enhanced total factor productivity when related to longer tenure (as in table 12), and productivity improvement from initial tenure was evident only for middle educated.

The firm intercept *f* has no clear effect either on value added per worker or on total factor productivity in tables 11 and 12. We conclude that the evidence on the positive relation of high wages and productivity is not strong. The nonsignificant effect on labour productivity is opposite to that found in Abowd et al. (1999). They also found that the probability of firm survival and profitability are decreased by higher firm specific intercept, while did not consider total factor productivity.

We have controlled for the firm age by dividing firms into 7 categories. From 1975 to 1992 we use the age of the oldest plant. For firms existing already 1974 we use three age groups according to the firm code number that is chronologically increasing. We can see that the age of the firm has no clear effect on valued added per worker, and total factor productivity is not higher for the newest firms, rather the reverse. Maliranta (1998) finds in a cohort study that total factor productivity is on the average decreasing as plants get older. After controlling for experience, education and unobserved personal characteristics, we find that there is no more a strong positive correlation between the age of the firm and total factor productivity.

Total factor productivity varies depending on the size of the firm. The firms in size class 100 – 499 employees are 12 percent and the largest firms with more than 500 employees 0.4 percent more efficient than the firms on the average (using the number of firms as the weights). This is roughly in line with Piekkola and Haaparanta (1998), where the largest firms do not perform very well.

In table 12 the high productivity industries are food, textile, clothing, wood products, furniture and electronics. The quality of personnel explains the bulk of the high productivity industries. If the quality of labor is controlled for, it is rather the domestic manufacturing that performs relatively well.

We have also considered foreign ownership divided to 20-50 percent and 50 percent share of the enterprise. We can see that value added per worker is higher for wholly foreign-owned firms (50 firms with above 50 percent share). Firms with foreign ownership between 20-50 percent or above 50 percent only in some periods (20-50 percent category) have total factor productivity which is comparable to wholly domestically owned firms. It is noteworthy that the foreign ownership effects strongly depend on the controlling factors.

5. Conclusions

The persistent inter-industry wage differentials are mostly explained by personal characteristics such as education and experience. We find that firm level compensations depend on the length of seniority but differently at different education levels. Seniority payments are also decreasing with firm size (and related to the share of female workers). We also analyze the total factor productivity implications of the various compensation policies. The firm-level compensations have no clear positive effect on total factor productivity, except for seniority payments from longer tenure. High productive industries are also characterized by high rewards from initial general experience rather than from initial seniority.

We see that the centrally negotiated wage bargaining clearly leaves room for experience-related payments and local bargaining within firms in Finland. The seniority and experience related payments are probably also important parts of wage drifts, reported by Holden (1998) to be around 30 percent of the whole wage change in Finland and 50 percent in Norway. Holden (1998) also shows that wage drift in the Nordic countries does not work in the direction of offsetting the effects of central negotiations.

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