Keskusteluaiheita – Discussion papers

No. 717

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EMPLOYMENT AND UNEMPLOYMENT

IN FINNISH MANUFACTURING 1985-95:

IS TECHNOLOGICAL PROGRESS

THE CAUSE OR THE CURE?***

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ABSTRACT: This paper explores employment trends and structural changes in the labour force of Finnish manufacturing over the 10-year period 1985 95 and analyses the role thereby played by technological progress. The main results may be summarised as follows. The employment-enhancing role of high-tech manufacturing industries has strengthened remarkably in Finland during the deep recession in the early 1990s. Thus, in terms of employment stability it does matter in which industry one happens to work. The structure of the labour force, on the other hand, has been re-shaped in a highly similar way irrespective of whether the industry can be classified as being high-tech or not. In other words, neither the least educated nor the oldest workers seem to have been in a more vulnerable situation in high-tech industries. The overall decline in the demand for low-skilled workers in manufacturing puts considerable pressure on re-training policies and early retirement arrangements. It is hardly realistic to assume that the jobs created in today's Finland will automatically solve the unemployment problem of the low skilled.

KEY WORDS: employment, labour force re-structuring, manufacturing, technology, unemployment

TIIVISTELMÄ: Tässä tutkimuksessa selvitetään työvoiman rakennemuutoksia ja työllisyys-kehityksen suuntaviivoja Suomen tehdasteollisuudessa vuosien 1985 ja 1995 välisellä 10 vuo-den aikaperiodilla, yhdistettynä teknologisen kehityksen vaikutuksiin. Tutkimustuloksista voi-daan esittää seuraava yhteenveto. Korkean teknologian toimialojen työllisyyttä kasvattava vai-kutus vahvistui huomattavasti 1990-luvun alkupuoliskon laman aikana. Toimialalla on siis mer-kitystä työllisyystilanteen vakauden kannalta. Työvoiman rakenne on kuitenkin muuttunut sa-malla tavalla riippumatta toimialan teknologisesta tasosta. Toisin sanoen, iäkkäimpien ja vähi-ten koulutettujen työntekijöiden asema ei ole ollut sen huonompi korkean teknologian toimi-aloilla kuin muillakaan aloilla. Koko tehdasteollisuuden kattava heikosti koulutetun työvoiman kysynnän lasku lisää painetta järjestää toimivia uudelleenkoulutus- ja varhaiseläkejärjestelyjä. On tuskin realistista olettaa, että Suomessa nykyään syntyvät työpaikat automaattisesti ratkaisi-sivat heikosti koulutettujen työttömyysongelman.

AVAINSANAT: työllisyys, työvoiman rakennemuutos, tehdasteollisuus, teknologia, työttö-myys

CONTENTS

1.   INTRODUCTION

Fast-moving technological change has re-shaped the Finnish economy fundamentally over the past decade. New technology has been implemented at a tremendous pace. The technological revolution that the Finnish labour market has confronted, is evident from the fact that the share of employees using a computer at work has exploded in a few years' time. In 1996 this share amounted to close to 55 per cent, which is higher than in most other industrialised countries. Concurrently the wage premium arising from computer use has disappeared, which obviously reflects the spread of computer use to also relatively low-paid routine jobs.[1]

The opinions of researchers as well as politicians concerning the pros and cons of technological progress still diverge profoundly, especially when it comes to the impact of technology on employment. They seem to disagree to a much lesser extent concerning the conseq uences for the structure of the labour force; technological progress is commonly noted to be biased against skilled workers while simultaneously weakening the labour market position of the least skilled.[2]

In Finland the adjustment of the labour force to rising skill demands seems to have been fairly smooth during the boom years of the 1980s (e.g. Asplund and Lilja, 2000). The less educated turn out to have faced comparatively good opportunities to change occupation or, conditional on their age, opt for the retirement alternative. The deep recession in the early 1990s, however, put an end to this rather painless adjustment process. The possibilities of the least educated in particular to find a new job weakened substantially and unemployment became a much more likely alternative.

The present paper extends this analysis in an attempt to capture the influence of technological progress both on the employment trends and the structural changes that the labour force in Finnish manufacturing has experienced over the 10-year period 1985–95. B oth aspects are of considerable political relevance. First, if high-tech industries turn out to contribute more to employment creation and to also offer jobs of greater stability, public subsidies to high-tech industries and firms can be expected to enhance both employment growth and job sustainability.

Second, if the re-structuring of the labour force seems to follow a similar pattern in industries differing in technological advancement, the adjustment problem is more a q uestion of an overall decline in the demand for less-skilled labour than of high-tech industries being heavily skill-biased. These two situations definitely req uire different modes of adult training policies.

The investigated time span falls naturally into two period of highly different economic activity, viz . the boom years of 1985–90 and the recession years of 1990–95. Comparing these two periods puts the implication of technological change at its edge and, accordingly, also the importance of technology and labour market policies.

2.   THE DATA

The subseq uent analysis is based on a representative sample of 10 per cent drawn from the *Finnish Longitudinal Census Data File* compiled by Statistics Finland. This database contains

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[1]   See e.g. Asplund (1998) and Statistics Finland (1997).
[2]   For a recent comprehensive review of the literature, see Gregory & Machin (2000).

detailed information on the whole Finnish population for every fifth year starting in 1970. The most recent information concerns 1995.

The influence of technology is evaluated by dividing the manufacturing industries into three categories depending on their technological intensity and growth over the years 1980–94. The industries are classified as high-tech industries, other growth industries and slowly growing industries.[3] B y taking account of differences in technological as well as economic performance across manufacturing industries, this classification provides a comprehensive picture of the compositional changes having occurred in the labour force of Finnish manufacturing. Indeed, it may be argued that this classification paints a broader picture – both q ualitatively and q uantitatively – compared to a classification merely based on industry differences in technological levels, such as the classification developed by the OECD.

The technological strategies of Finnish manufacturing firms namely tend to be of two kinds: either they aim at the technological frontier in traditional product areas, or they try to be competitive in product areas where the technological race is very tough (see Asplund and Vuori, 1996). According to the OECD classification traditional products, such as paper and metal products, are labelled as low-tech or medium-tech products. In Finland, however, most of these product areas represent fast growing industries contributing substantially to the technological development in their field(s) of specialisation. Hence, along with high-tech industries also these industries exert a marked influence on both employment trends and structural changes in the labour force of Finnish manufacturing.

3.   TRENDS IN EMPLOYMENT AND EARNINGS

From *Table 1* it is evident that the share of slowly growing industries in manufacturing employment has declined rapidly from 1985 to 1995, both absolutely and relatively. The increase in employment has been concentrated to fast growing industries, and during the deep recession in the early 1990s almost entirely to high-tech ones.

Table 1.   Trends in employment in three industry categories 1985, 1990 and 1995

Industry category	Employment in 1985*	Growth (%)		Employment share (%)		
		1985–90	1990–95	1985	1990	1995
High-tech	3 660	14.5	45.6	11.0	11.9	17.7
Other growth	14 773	18.3	1.8	44.6	49.4	51.7
Slowly growing	14 699	-6.9	-23.2	44.4	38.7	30.6
Total	33 132	6.7	-2.7	100.0	100.0	100.0

Note: * Number of employees in the sample.

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[3]   The division of the manufacturing industries into three categories is given in Table A1 of the Appendix. The adopted classification and its underlying determinants are described in detail in Asplund and Vuori (1996).

Table 2 compares trends in average monthly earnings for the three industry categories. The overall impression mediated by the table is that earnings levels have developed in much the same way in the three industry categories over boom as well as recession years. Conseq uently also relative earnings have remained roughly unchanged.[4]

Table 2.   Trends in earnings in three industry categories 1985, 1990 and 1995

Earnings indicators	**Industry category**		
	High-tech	Other growth	Slowly growing
Monthly earnings, 1985, FIM	6 426	6 735	5 623
Earnings growth, 1985–90, %	48.8	47.3	50.3
" " , 1990–95, %	24.2	24.9	27.5
Relative earnings, 1985	1.00	1.05	0.88
" " , 1990	1.00	1.04	0.88
" " , 1995	1.00	1.04	0.91
D9/ D1 ratio, 1985	2.31	2.25	2.23
" , 1990	2.34	2.30	2.26
" , 1995	2.33	2.28	2.27

Notes: Earnings are average nominal monthly earnings. D9 refers to the 90th percentile and D1 to the 10th percentile in the earnings distribution.

Average monthly earnings have persistently been highest in fast growing industries and lowest in slowly growing industries. Earnings growth, however, was fastest among slowly growing industries both in the boom years and in the recession years, which resulted in a slight improvement in the relative earnings position of these industries. The conclusion that can be drawn based on this observation is obvious: The adjustment in Finnish manufacturing has taken place primarily through employment rather than through wages.

4.   LABOUR FORCE RE-STRUCTURING – SOME DESCRIPTIVES

At the same time the structure of the labour force of the three industry categories has undergone notable changes. The trends that emerge from simple data inspection reveal similarities as well as conspicuous dissimilarities. The relative share of employees having completed, at most, a basic (compulsory) education has narrowed considerably in all three categories; by one-third in high-tech industries, by more than one-fourth in other growth industries and by almost one-fifth in slowly growing industries *(Table 3)*.

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4   A conspicuous stability in relative earnings (measured by average hourly wages) has also been reported for non-manual workers in Finnish manufacturing for the period 1980–94 (see Asplund & Vuori, 1996).

Table 3. **Educational structure of the labour force of the three industry categories in 1985, 1990 and 1995**

High-tech industries			
Educational level	**1985**	**1990**	**1995**
B asic (compulsory) education	29.2	26.5	20.3
Secondary (vocational) education	56.0	57.0	56.9
Higher (tertiary) education	8.8	9.7	13.5
Licentiate or doctoral degree	6.0	6.8	9.3
Total	100.0	100.0	100.0
Other growth industries			
B asic (compulsory) education	42.3	36.7	30.7
Secondary (vocational) education	51.7	56.1	58.8
Higher (tertiary) education	3.5	3.9	6.2
Licentiate or doctoral degree	2.5	3.3	4.3
Total	100.0	100.0	100.0
Slowly growing industries			
B asic (compulsory) education	41.0	38.4	31.7
Secondary (vocational) education	54.3	56.1	59.6
Higher (tertiary) education	3.3	3.9	6.3
Licentiate or doctoral degree	1.4	1.5	2.4
Total	100.0	100.0	100.0

In non-high-tech growth industries, the least educated have been substituted mainly by people having completed a degree at the secondary level (vocational school). In high-tech industries, in contrast, the least educated have been replaced by individuals having completed a degree at the tertiary (higher) level (vocational college or university degree), while the relative share of those with a secondary education has remained approximately unchanged. In 1995 the share of the labour force with a higher education amounted to 23 per cent in high-tech industries, to some 10 per cent in other growth industries and to less than 9 per cent in slowly growing industries.

These differences in the educational structure of the labour force employed in the three industry categories are reflected at the occupational level as well. Comparison of the average educational level in occupations that are freq uent in all three industry categories reveals, however, that those employed in high-tech industries are not throughout clearly better educated than those working in the same profession in some other manufacturing industry (see Table A2 of the Appendix). Educational differences show up mainly in ' key professions' in technics, marketing and sales. On the other hand, those performing ' routine tasks' in high-tech industries have on average much the same, occasionally even less education compared to those performing similar tasks in other than high-tech industries.[5]

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[5]   A more detailed analysis of occupational differences lacks relevance in this context since the occupational structure of the three industry categories becomes too different when moving to more disaggregated levels. At the 3-

The age structure of the labour force has developed q uite differently in the three industry categories *(Table 4)*. This, however, is only to be expected in view of the educational restructuring discussed above. In 1985 the age distribution was q uite similar across industries. The most notable difference was a slightly higher share of employees aged 30–39 in high-tech industries and, correspondingly, a slightly smaller share of older employees compared to other industries. This difference in the age structure increased over the next 10 years due to a much slower decline in high-tech industries in the relative share of those aged less than 40 and, especially, of the youngest age groups. In 1995 less than 40 per cent of the labour force employed in high-tech industries was prime-aged or older compared to one-half in other industries.

Table 4. Age structure of the labour force of the three industry categories in 1985, 1990 and 1995

High-tech industries			
Age group	**1985**	**1990**	**1995**
Less than 30 years	39.6	26.7	19.3
30–39 years	42.7	46.0	42.3
40–49 years	11.4	20.2	30.8
50 years or more	6.3	7.1	7.6
Total	100.0	100.0	100.0
Other growth industries			
Less than 30 years	34.8	24.6	13.5
30–39 years	39.3	40.7	36.5
40–49 years	16.0	23.9	37.9
50 years or more	9.9	10.8	12.1
Total	100.0	100.0	100.0
Slowly growing industries			
Less than 30 years	39.5	26.0	14.8
30–39 years	38.4	40.5	36.6
40–49 years	13.5	23.5	37.4
50 years or more	8.5	9.9	11.3
Total	100.0	100.0	100.0

Apart from educational and age structures also the gender distribution deserves attention in this context. As can be seen from *Table 5*, the gender division has remained almost unchanged in high-tech and other fast growing industries. In 1995 the relative share of women in these two industry categories still amounted to just about one-third. In slowly growing industries, on the other hand, the relative share of women had in 10 years' time dropped from around 40 per cent (in 1985) to some 28 per cent (in 1995).

digit level the three industry categories have rather few occupational codes in common with a satisfactory number of observations (the major part of these occupations are listed in Table A2 of the Appendix).

Table 5.   Gender structure of the labour force of the three industry categories in 1985, 1990 and 1995

High-tech industries			
Gender	**1985**	**1990**	**1995**
Man	65.7	63.5	65.5
Woman	34.3	36.5	34.5
Total	100.0	100.0	100.0
Other growth industries			
Man	66.9	66.1	69.4
Woman	33.1	33.9	30.6
Total	100.0	100.0	100.0
Slowly growing industries			
Man	59.5	64.8	71.9
Woman	40.5	35.2	28.1
Total	100.0	100.0	100.0

5.   STAYERS AND MOVERS

The changes in the composition of the labour force employed in the three industry categories reflect the mobility of Finnish manufacturing workers over the years 1985–95. Workers en-dowed with certain characteristics tend to leave and new workers are recruited whose skills better fit the current demands of the industry.

The mobility of the workers classified into the three industry categories is analysed by com-paring their point-of-departure with their labour market status five years later. This is done separately for the three industry categories and for the two time periods, 1985–90 and 1990–95 *(Table 6)*. A total of six mobility tracks are distinguished: still working in the same industry category, moved to either one of the other two industry categories, employed outside manufacturing (mainly in the services sector), unemployed, retired or left the labour force for some other reason (e.g. studies, home work).

The mobility between the three industry categories is rather minor. Obviously this is mainly explained by the special skills that are often a pre-req uisite in many manufacturing industries. The probability of leaving the manufacturing sector altogether is notably higher. This suggests that moving between manufacturing industries req uires more of re-training and occupational changes compared to taking a job in the services sector.

Mobility from manufacturing to services was freq uent in all three industry categories in the boom years in the late 1980s, but slowed down markedly in the deep recession years in the early 1990s. The probability of moving into the services sector has persistently been highest among workers employed in high-tech industries, which no doubt reflects the importance of networks as well as the service intensity in the activities of high-tech firms.

Table 6. **Mobility of the workers employed in the three industry categories over two distinct 5-year periods, 1985–90 and 1990–95**

Labour market status in 1985	Labour market status in 1990, %-share							
	High-tech industry	Other growth industry	Slowly growing industry	Employed outside manuf.	Unem-ployed	Retired	Other	Tot.
High-tech industry	40.8	7.7	8.0	35.5	0.7	3.8	3.5	100.0
Other growth ind.	1.7	60.3	5.4	21.8	1.4	5.7	3.6	100.0
Slowly growing ind.	2.4	8.3	46.4	29.4	2.3	5.5	5.7	100.0

Labour market status in 1990	Labour market status in 1995, %-share							
	High-tech industry	Other growth industry	Slowly growing industry	Employed outside manuf.	Unem-ployed	Retired	Other	Tot.
High-tech industry	54.2	4.4	5.1	19.6	8.5	3.1	5.0	100.0
Other growth ind.	2.3	56.8	6.0	14.4	9.9	5.8	4.7	100.0
Slowly growing ind.	5.5	9.0	40.2	16.8	17.6	5.0	6.0	100.0

Those working in slowly growing industries have throughout experienced the highest risk of becoming unemployed. They were also most strongly hit by the dramatically worsened employment situation in the early 1990s. The probability of leaving for retirement, in contrast, was not much affected by the radical change in the activity level of the Finnish economy at the turn of the decade. Also the differences in retirement probabilities between the three industry categories have remained minor.

The concomitant changes in average nominal monthly earnings appear in *Table 7*. Among stayers earnings growth was in both periods fastest among those engaged in high-tech industries. In the other two industry categories earnings increased at approximately the same pace (44 per cent in 1985–90 and 22–23 per cent in 1990–95).[6]

Those high-tech manufacturing workers who five years later were observed to have moved to a non-high-tech manufacturing industry experienced, on average, much the same increase in their monthly earnings as did their colleagues who had stayed in a high-tech industry – but only in the boom period. In the recession years leaving the high-tech industry category resulted in a clearly slower growth in earnings, and especially if moving to the services sector (only some 3 per cent).[7]

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[6] Here it may be added that compared to the high-tech industry category average monthly earnings were in the starting year (1985 and 1990, respectively) some 10 per cent higher in the other fast growing industry category and some 10 per cent lower in the slowly growing industry category.

[7] In this context it is, however, interesting to note that in both periods those high-tech manufacturing workers who left the industry were on average earning better than those who stayed. The difference in average monthly earnings between stayers and movers varied between 2 and 7 per cent both in 1985 and 1990.

Table 7. Average nominal earnings growth (%) for stayers and movers according to industry category and time period

Industry in which employed in 1985	Industry in which employed in 1990, %-growth in average monthly earnings			
	High-tech industry	Other growth industry	Slowly growing industry	Employed outside manufacturing
High-tech industry	49.4	50.6	48.1	45.6
Other growth industry	47.1	43.7	43.0	29.1
Slowly growing industry	49.3	51.5	43.7	27.1

Industry in which employed in 1990	Industry in which employed in 1995, %-growth in average monthly earnings			
	High-tech industry	Other growth industry	Slowly growing industry	Employed outside manufacturing
High-tech industry	26.5	21.6	22.4	3.3
Other growth industry	22.9	23.3	23.5	-11.9
Slowly growing industry	26.1	25.9	22.1	-19.3

Those who left the industry category comprising other fast growing manufacturing industries managed to obtain the same or even higher earnings growth – as long as they stayed in manufacturing – compared to their colleagues who had stayed in the industry for another five years. Moreover, this pattern is repeated in both periods. On other words, leaving this particular industry category in the recession years did not have the same adverse effect on earnings growth, as did transitions out of the high-tech industry category. Moving into the services sector, on the other hand, has persistently had a disastrous impact on earnings growth.[8]

For those engaged in some slowly growing industry transition into some other manufacturing industry resulted in clearly faster earnings growth. This pattern is repeated in the boom as well as in the recession period. As for their colleagues engaged in non-high-tech fast growing industries moving into the services sector, however, gave a much smaller increase in earnings in the boom years, and even led to a considerable absolute decline (almost 20 per cent) in monthly earnings in the recession period.[9]

In sum, also Table 7 points to minor relative wage adjustments within the manufacturing sector over the years 1985 to 1995. The much weaker earnings growth experienced by those

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[8] Concerning other fast growing manufacturing industries it may be noted that in contrast to the situation among high-tech manufacturing workers, the highest average earnings are found among those who stayed in the industry category.

[9] As among high-tech manufacturing workers, those with the highest earnings capacity seem to have left the industry category. The exception are those who have moved into the services sector. Interestingly, their average monthly earnings were lower than for those who stayed in manufacturing and they also experienced a much weaker earnings growth. The same pattern is discernible among those engaged in other fast growing manufacturing industries, but not among those in high-tech manufacturing industries. Accordingly, the difference in earnings growth outcome among those who have moved from a manufacturing job into the services sector evidently reflects the presence of distinct selection processes.

having moved to the services sector might reflect the combination of three processes: an adjustment of relative wages between the manufacturing and the services sector; stronger relative wage adjustments within the services sector; and simply an adjustment of ex-manufacturing workers' wage levels to those of service sector workers.

Finally it might be of interest to comment briefly on the educational, age and gender distribution of the six mobility groups identified.[10] As is to be expected, the distribution in these three dimensions of those observed in the same industry category five years later, is very similar to the overall structure of the labour force of the three industry categories in, respectively, 1990 and 1995.[11] There is one notable difference, though: in all three industry categories the average educational level of those having stayed in the category is slightly lower than the average educational level of those observed to be working in the category in 1990 and 1995. This indicates that the educational level of the new hires has generally exceeded the average educational level of the current workforce, a pattern that is repeated in all three categories. The ageing of the workforce, in turn, is the result of two identical trends; that is, a steadily increasing average age both of those staying in the category and of the new hires. The gender distribution seems to be shaped by men having a higher probability than women of staying in high-tech and slowly growing industries, and of male-dominated industries attracting more men than women.

In sum, the overall trend in labour force structures has been q uite similar in the three industry categories both in the boom years and in the recession years. In particular, in all three categories the more educated, those over 40 years of age and men have had a clearly higher probability of staying in the industry. Simultaneously these same characteristics seem to have been dominant also among those recruited into the manufacturing sector irrespective of the technological level of the industry.

The three industry categories display minor differences also when it comes to the educational, age and gender distribution of those having moved from one industry category to another (Table A4 of the Appendix). Those having moved between industry categories have generally completed a degree at the secondary level; that is, they have a fairly good vocational education. Irrespective of the business cycle almost one-half of them represents the age group 30–39. During the boom years the other half consisted mainly of those below 30 years of age. The recession years, however, weakened markedly the opportunities of young people of moving between manufacturing industries, which was reflected in a strengthening of the relative position in manufacturing of older workers and especially of those in their 40s. Women have made up a declining portion of those moving between manufacturing industries.

The educational, age and gender distribution of those having moved to a non-manufacturing sector mirrors the overall pattern observed among those having moved between manufacturing industries (Table A5 of the Appendix). The most conspicuous difference is the higher share of women among those having moved outside the manufacturing sector.

The educational, age and gender distribution of those manufacturing workers who were recorded as unemployed five years later is displayed in Table A6 of the Appendix. Again the differences between high-tech, other fast growing and slowly growing industries are small or

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[10]   Apart from movements from one industry category to another, no attention is paid in this context to the working history of those observed in a particular industry category in a given year. The recruitment strategies of manufacturing firms differing in technological advancement are analysed in a separate study covering the years 1987–96 (Asplund, 2000a).

[11]   Cf. Table A3 of the Appendix and Tables 2–4 in the text.

negligible. A majority of those having become unemployed have, at most, completed a secondary education. Of the exceptionally small number of unemployed in the boom years in the late 1980s, two out of three were younger than 40. In the recession period, a growing share of the unemployed was found among prime-aged and older workers. The recession years also increased the relative share of women among the unemployed, except for the slowly growing industries.

The least educated and the oldest workers make up a large majority of those having retired within five years' time. The same pattern is observable for all three industry categories (Table A7 of the Appendix). Moreover, women stand for a growing share of the retired but, again, only if having been employed in a high-tech or some other fast growing industry. In slowly growing industries, the relative share of women has declined not only among those having become unemployed but also among those having retired. This finding, however, seems to reflect the rapid decline in the relative share of women in this particular industry category rather than slowly growing industries having offered women more secure jobs than high-tech and other fast growing industries.

All in all, the compositional change in the workforce of manufacturing industries has been very similar irrespective of whether the industry represents a high-tech, some other fast growing or a slowly growing industry. The educational and age distribution of those having left the industry in five years' time reveals no big differences between the three categories, either. In particular, neither the least skilled nor the oldest workers seem to have been in a more vulnerable situation in high-tech industries. It may, however, be asked whether this overall picture is retained when all three characteristics – education, age and gender – are accounted for at the same time. This q uestion is addressed in the next section.

6. INDIVIDUAL BACKGROUND AND MOBILITY

From the above it is evident that Finnish manufacturing workers have, during the past decade, faced many challenges due to changing labour market conditions. Many have changed jobs within the manufacturing sector or have been fortunate enough to find a job in some other sector of the economy. During the deep recession years an increasing portion of the manufacturing workers became unemployed or took early retirement.

The probability to move from one labour market status to another depends on a variety of things. In this section we study, with the help of a multinomial logit model[12], how well different background factors explain the observed mobility patterns in the manufacturing sector. The use of a logit model makes it possible to control for the simultaneous effect of different background factors on individuals' transition probabilities. For example, if the objective is to examine how the technological level of an industry affects worker mobility, this can be done by comparing the transition probabilities of individuals who are employed in industries differing in technology advancement but who are otherwise similar in terms of background factors.[13] Thus, the differences in transition probabilities calculated from such a model reveal

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[12]   See e.g. Greene (1993).
[13]   Next (and in general in this section) all comparisons are calculated for an individual whose background factors obtain the mean values of the explanatory variables included in the logit model.

'pure' industry-specific technology effects; that is, effects which are cleaned from the influence of other mobility-inducing background factors. Conseq uently, the mobility patterns reported in Table 6 above are likely to differ markedly from the mobility patterns that emerge when comparing transition probabilities of individuals with similar characteristics.

The logit model is estimated for five different transition categories; 1) still working in the same industry category, 2) moved to another industry category, 3) moved out from manufacturing, 4) became unemployed or 5) retired. These transitions represent 95 per cent of all possible transitions.[14] In the estimating data there are 31,621 observations for the period 1985–90 and 33,486 observations for the period 1990–95.

In the subseq uent empirical analysis both industry indicators and individual background variables are used to explain the propensity to move from one labour market status to another. The industry indicators correspond to the three industry categories, that is, working in a high-tech, in some other fast growing or in a slowly growing manufacturing industry. The individual background variables are restricted to the workers' educational attainment level, age and gender, all of which have been shown to affect substantially the stability that individuals experience in their labour market status.[15] The chosen variables appear to be highly statistically significant explanatory factors behind the observed transition probabilities for both periods, 1985–90 and 1990–95.[16] Let us start by reporting transition probabilities which are calculated from the estimated model for a 'reference' person; that is, for an individual whose background factors obtain, for respective time period, the mean values of the different explanatory variables *(Table 8)*.

Table 8.   Average transition probabilities

Transition period	Employed in manufacturing		Employed outside manufacturing %	Unemployed, %	Retired, %
	Same industry category, %	Different industry category, %			
1985–90	58.2	9.9	28.7	1.7	1.5
1990–95	56.6	11.5	17.5	13.1	1.3

It appears from the table that the reference person's probability of being in the same industry category five years later remained approximately unchanged (some 57–58 per cent) over the two time periods investigated. The propensity to move to another industry category was around 10–12 per cent. Hence, in both periods the probability of remaining employed in manufacturing was, on average, about 68 per cent, while the propensity of the reference person of ending up doing something else was 32 per cent. What exactly these other things are, is largely determined by the business cycle.

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[14]   See Section 5. The category of 'Other transitions' relates to very different situations in life such as full-time studies, maternity leaves and deaths.
[15]   See Asplund and Lilja (1998).
[16]   The original estimation results are provided upon req uest.

The deep recession of the early 1990s weakened considerably the probability of finding a job outside manufacturing (a drop from 29 per cent to less than 18 per cent for the reference person). Simultaneously the recession caused the risk of becoming unemployed to rise to an almost eight-fold number compared to the previous 5-year period. The propensity to retire was low in both periods due to the relatively young age of the reference person.

Table 9 shows the influence of the industry category in which employed on the workers' transition probabilities. It appears that working in a high-tech industry has induced relatively high employment stability but also higher than average mobility into other sectors of the economy. In the late 1980s the probability of remaining employed in a high-tech industry amounted to some 46 per cent while the probability of moving to some other manufacturing industry or to the services sector was even higher (over 50 per cent). Working in some other fast growing industry provided even higher employment stability but lower than average chances of moving to some other manufacturing industry and especially outside the manufacturing sector altogether. Employment in a slowly growing industry meant higher than average mobility but also a higher than average risk of becoming unemployed.

Table 9.   Industry-specific effects on transition probabilities

Industry category	Employed in manufacturing		Employed outside manufacturing, %	Unemployed, %	Retired, %
	Same industry category, %	Other industry category, %			
High-tech industries					
1985–90	45.5	15.9	36.5	0.8	1.3
1990–95	59.7	9.8	19.9	9.7	0.9
Other growth industries					
1985–90	66.3	7.4	23.5	1.5	1.4
1990–95	63.6	9.0	15.6	10.4	1.4
Slowly growing industries					
1985–90	52.5	11.6	31.9	2.4	1.6
1990–95	45.7	15.9	18.5	18.7	1.4

The deep recession that hit the Finnish economy in the early 1990s affected the three industry categories q uite differently. The weak demand for labour hampered the outflow from high-tech industries. Instead people tried to retain their jobs the best as they could. The probability of remaining employed in a high-tech industry rose to 60 per cent. The risk of becoming unemployed increased from less than one per cent to nearly 10 per cent. In other fast growing industries, in contrast, the slowdown in the outflow from the category was accompanied with weakening employment stability. As for the high-tech industry category, the unemployment risk rose to 10 per cent. The labour market situation (of the reference person) worsened most dramatically in slowly growing industries. Employment stability declined considerably, which was only partly alleviated by a slight improvement in the propensity to move to some other manufacturing industry. The job opportunities outside manufacturing were almost halved, and the risk of unemployment rose to close to 19 per cent.

The influence that industry-specific factors exert on individual transition patterns is to a large extent related to the demand for labour in different industries. In addition to demand factors, the mobility patterns depend also on individual characteristics, which can be taken also to reflect differences in preferences (supply factors). Here, these factors include education, age and gender. When testing the estimated models it appeared, however, that the effect of these individual characteristics did not vary in a statistically significant way across the three industry categories (for example, age had approximately the same impact on transition probabilities in high-tech and slowly growing manufacturing industries). Therefore, in the following the effects of individual characteristics are not evaluated separately for the different industry categories.

Table 10. The effect of education on transition probabilities

Educational level	Employed in manufacturing		Employed outside manufacturing, %	Unemployed, %	Retired, %
	Same industry category, %	Other industry category, %			
Basic (compulsory) education					
1985–90	60.0	8.9	27.2	2.1	1.9
1990–95	55.6	9.6	16.1	16.9	1.8
Secondary (vocational) education					
1985–90	57.5	10.7	28.8	1.7	1.4
1990–95	56.1	12.4	17.4	12.9	1.2
Higher (tertiary) education					
1985–90	49.6	11.0	38.0	0.7	0.7
1990–95	55.6	15.7	22.7	5.0	1.0
Licentiate or doctoral degree					
1985–90	55.1	9.8	34.1	0.3	0.8
1990–95	61.1	12.4	23.2	3.0	0.4

Let us start with the dependence of transition probabilities on the workers' educational attainment level. It appears from *Table 10* that in the late 1980s those with a higher education (but with otherwise average characteristics) were the most mobile ones; their probability of leaving the industry category was as high as their probability of staying there for another five years (some 49 per cent). Those having acq uired a licentiate or doctoral degree appeared to be less likely to leave for another industry. Since these post-graduated workers are often engaged in research and development, they may possess firm- and industry-specific knowledge that makes outside options less attractive. The lowest probability of moving to another industry is obtained for workers with a basic or secondary education; for example, their probability to leave manufacturing was nearly 10 percentage points lower than for otherwise similar work-

ers with a higher education. Despite the economic upturn they also faced a higher than average risk of becoming unemployed.

The economic recession had a varied impact on different levels of education. Manufacturing workers with a higher education were best able to keep their jobs. Indeed, their probability of staying in the same industry category improved when the employment possibilities outside manufacturing worsened. Their risk of becoming unemployed rose, but only to 3–5 per cent.[17] For manufacturing workers with a basic or secondary education the recession caused a dramatic increase in the unemployment risk. For those with only a basic education the risk of ending up in unemployment even exceeded the probability of finding a job outside manufacturing.

In previous tables the propensity to retire has been extremely low because the reference person is relatively young. *Table 11* displays how the transition probabilities vary with the age of the manufacturing worker.

Table 11. The effect of age on transition probabilities

Age group	Employed in manufacturing		Employed outside manufacturing, %	Unemployed, %	Retired, %
	Same industry category, %	Other industry category, %			
Less than 30 years					
1985–90	51.6	10.7	35.8	1.5	0.4
1990–95	53.7	11.4	21.4	13.1	0.5
30–39 years					
1985–90	60.1	10.1	27.1	1.4	1.2
1990–95	58.6	11.9	18.2	10.7	0.6
40–49 years					
1985–90	63.7	9.2	20.3	1.9	4.9
1990–95	58.4	11.2	15.9	11.9	2.6
50 years or more					
1985–90	35.6	3.7	12.7	2.8	45.2
1990–95	27.0	5.7	5.9	20.7	40.8

The highest propensity to stay in the same industry for another five years is observed among the 40–49 year-olds. Their younger colleagues have been much more likely to move outside the manufacturing sector. Among the oldest workers the retirement option has dominated; their probability to retire was over 40 per cent in both periods. They also suffered the most

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[17]   If further combined with the industry effects reported in Table 9 (remember that these are controlled for in the education-related transition probabilities given in Table 10), an even higher ' staying' probability and lower unemployment risk would be obtained for those with a higher education working in a non-high-tech growth industry.

from the recession. Their probability of keeping their jobs and of finding a new one outside manufacturing weakened considerably. Their risk of becoming unemployed rose to over 20 per cent at the same time as their chances to opt for retirement weakened. Hence, it seems that during the recession older workers that were previously ' pushed into' the retirement system were to an increasing extent ' stored' in unemployment records instead (cf. e.g. Asplund, 2000b).

In manufacturing over 60 per cent of the labour force are men. It is a well-established empirical observation that the labour market does not function similarly for men and women. *Table 12* shows how gender has influenced the transition probabilities during the two periods under study.

The probability of staying in the same industry for another five years has been about the same for men and women. Women, however, seem to be less likely to move within manufacturing and more likely to move outside manufacturing altogether. This is not surprising in that the demand for female labour is known to be high in services. During the recession women faced a somewhat higher risk of becoming unemployed.

Table 12. The effect of gender on transition probabilities

Gender	Employed in manufacturing		Employed outside manufacturing, %	Unemployed, %	Retired, %
	Same industry category, %	Other industry category, %			
Man					
1985–90	57.9	11.4	27.7	1.5	1.5
1990–95	57.0	13.3	16.4	12.1	1.3
Woman					
1985–90	58.5	7.6	30.3	2.1	1.5
1990–95	55.1	8.7	19.5	15.3	1.4

So far we have studied how different background factors influence independently the transition probabilities of manufacturing workers. With the help of these calculations we can evaluate which individuals have had the best chances of keeping their jobs and which individuals have faced the highest risk of unemployment. It appears that the highest employment stability is found among male employees, 30–39 years of age, with a licentiate or doctoral and employed in a non-high-tech fast growing industry. The highest risk of becoming unemployed is experienced by female employees, 50 years of age or older, with a basic education only and working in a slowly growing industry. The transition probabilities of these two groups (' winners' and ' losers') are reported in *Table 13*.

Even during the deep recession years the unemployment risk was, on average, less than two per cent in the group of ' winners'. The declining labour demand outside manufacturing, however, forced also these manufacturing workers to held on to their jobs; the probability of staying within the same industry category rose to 68 per cent and the overall probability of remaining in manufacturing employment increased to 80 per cent. Among the ' losers', on the

other hand, the probability of remaining employed collapsed during the recession. Compared to 1990, only 15 per cent of these manufacturing workers were in 1995 still employed in the same industry category, and only 19 per cent in manufacturing altogether. Their risk of becoming unemployed was 20-fold compared with the group of winners. Their propensity to retire was high in boom as well as recession years.

Table 13.   Winners and losers in the re-structuring of the manufacturing sector

	Employed in manufacturing		Employed outside manufacturing, %	Unemployed, %	Retired, %
	Same industry category, %	Other industry category, %			
Winners:					
1985–90	64.8	8.6	25.9	0.2	0.6
1990–95	68.0	10.9	19.3	1.7	0.2
Losers:					
1985–90	28.7	2.6	12.3	4.9	51.6
1990–95	15.4	3.6	4.8	32.5	43.7

7.   CONCLUDING REMARKS

The employment-enhancing role of high-tech manufacturing industries has strengthened remarkably in Finland during the deep recession in the early 1990s. In other words, in terms of employment stability it does matter in which industry one happens to work, especially since the re-structuring process of the Finnish manufacturing sector has been realised through employment adjustments rather than relative wage adjustments.

The structure of the labour force, on the other hand, has changed in a very similar way irrespective of whether the industry represents a high-tech, some other fast growing or a slowly growing manufacturing industry. Typical for all three industry categories is that those having stayed in the industry over the years 1985–95 have, on average, been more educated and also more experienced (older) compared to those having left the industry. Moreover, this skill-biased trend in the labour force employed in Finnish manufacturing seems to have been boosted by a tendency of hiring relatively more highly educated and skilled workers. Men tend to stick stronger to their manufacturing jobs than women do.

Those having left the manufacturing sector have, depending on their educational level and age, either found a new job outside the manufacturing sector, become unemployed or been retired. The more educated and younger, the better the prospects have been for the individual to get a new job, albeit the deep recession in the early 1990s worsened markedly the employment situation also of this group of manufacturing workers. Older, less educated workers, in contrast, have mostly been confronted merely with the unemployment and retirement alternatives. This overall picture is repeated in all three industry categories. It is noteworthy that these basic results are maintained also when using other data sets and classifications of manufacturing workers according to the technological level of their employer (see e.g. Asplund and Vuori, 1996, and Asplund, 2000b).

The policy implications that can be drawn from these results are twofold. First, the fast growing manufacturing industries and the high-tech ones in particular play a crucial role in employment creation. This process can, of course, be enhanced by properly designed science and technology policies. Second, all manufacturing industries – irrespective of technological and economic performance – tend to re-structure their labour force in the same way, that is, by ' pushing out' the same type of workers. This overall decline in the demand for low-skilled workers puts considerable pressure on both re-training and retirement policies. The jobs created in the manufacturing sector and elsewhere in the economy are to an increasing extent out of reach of the low-skilled unemployed.

REFERENCES

Asplund, R. (1998), *Are Computer Skills Rewarded in the Labour Market? – Evidence for Finland.* Bergen–Oslo: SNF Yearbook 1998.

Asplund, R. (2000a), *Recruitment into Finnish manufacturing: Are there jobs for the unemployed?* ETLA, Helsinki. (work in progress)

Asplund, R. (2000b), *Unemployment among Finnish manufacturing workers: Who gets unemployed and from where?* Helsinki: The Research Institute of the Finnish Economy ETLA, Discussion papers No. 711.

Asplund, R. & R. Lilja (1998), *Labour market transitions in Finland: Does background matter?* Helsinki: The Research Institute of the Finnish Economy ETLA, Discussion papers No. 660.

Asplund, R. & R. Lilja (2000), " Has the Finnish Labour Market Bumped the Least Educated?" , in Borghans, L. & de Grip, A. (eds), *The Overeducated Worker? The Economics of Skill Utilization.* Cheltenham: Edward Elgar Publishing Ltd.

Asplund, R. & S. Vuori (1996), *Labour Force Response to Technological Change − An Analysis of Finnish Manufacturing in 1980−1994*. Helsinki: The Research Institute of the Finnish Economy ETLA, Series B 118.

Greene, W.H. (1993), *Econometric Analysis.* New York: MacMillan Publishing Company.

Gregory, M. & S. Machin (2000), " The Downside of Trade or Technology Change? Explaining the Deteriorating Employment and Wage Position of the Low-Skilled" " in Gregory, M., W. Salverda & S. Bazen (eds), *Labour Market Inequalities: Problems and Policies in International Perspective*. Oxford: Oxford University Press. (forthcoming)

Statistics Finland (1996), *Population Census 1995. Handbook.* Handbooks 35, Helsinki. (in Finnish)

Statistics Finland (1997), *Tiedolla tietoyhteiskuntaan,* Helsinki. (in Finnish)

Appendix

Table A1. **Classification of manufacturing industries into high-tech, other growth and slowly growing industries**

High-tech industries

352200	Drugs and medicines
354000	Products of petroleum and coal
382300	Metal and wood working machinery
382420	Machinery used in construction and mining
382490	Other special industrial machinery
382500	Computers and office machinery
383100	Electrical industrial machinery
383200	Radio, TV and communication equipment
384200	Railroad equipment
385000	Professional and scientific equipment

Other growth industries

311000	Food (a)
312000	Food (b)
313000	Beverages
341000	Paper and paper products
342000	Printing and publishing
351000	Industrial chemicals
352000	Other chemical products
371000	Iron and steel
372000	Non-ferrous metals
381000	Fabricated metal products
382100	Engines and turbines
382410	Pulp and paper industry machinery
384500	Aircraft

Slowly growing industries

314000	Tobacco
321000	Textiles
322000	Clothing
323000	Leather and products of leather
324000	Footwear
331000	Wood, wood and cork products
332000	Furniture, except of metal
353000	Petroleum refineries
355000	Rubber products
356000	Plastic products
360000	Non-metallic mineral products
382200	Agricultural machinery
382900	Other machinery
383300	Domestic appliance
383900	Other electrical apparatus
384100	Shipbuilding
384300	Motor vehicles
384400	Motorcycles and bicycles
384900	Other transport equipment
390000	Other manufacturing

Source: *Asplund & Vuori (1996)*

Appendix
Table A2. **Average schooling years in certain occupations by industry category, 1985, 1990 and 1995**

Occupation (code)	1985			1990			1995		
	High-tech industries	Other growth industries	Slowly growing industries	High-tech industries	Other growth industries	Slowly growing industries	High-tech industries	Other growth industries	Slowly growing industries
Mechanical engineers and technicians	14.4	14.2	14.0	14.2	14.3	14.2	14.5	14.2	14.3
Machine technicians	11.8	11.6	11.5	11.6	11.5	11.6	11.9	11.8	11.8
Other technicians	11.5	11.0	11.0	11.7	10.8	11.1	12.3	11.3	11.4
Laboratory assistants	11.2	10.6	10.5	11.2	10.7	10.5	11.3	10.8	10.5
Managers of business enterprises	13.6	12.3	12.9	13.7	12.6	13.1	13.6	12.9	13.3
Secretaries	12.3	11.8	12.2	11.9	11.7	12.0	12.1	11.9	12.1
Bookkeepers	10.1	10.8	10.8	10.4	10.6	10.4	11.0	11.0	11.1
Road transport work	10.0	9.8	9.8	10.2	9.9	9.9	10.2	9.9	9.8
Machine fitters, etc.	10.6	10.4	10.6	10.7	10.6	10.6	10.8	10.8	10.7
Machine and engine mechanics	10.5	10.6	10.5	10.5	10.8	10.5	10.9	10.9	10.6
Platers	10.6	10.6	10.6	10.6	10.6	10.6	10.7	10.7	10.7
Welders, flame cutters	10.5	10.5	10.6	10.7	10.5	10.5	10.7	10.6	10.6
Machine and metal product assemblers	10.0	10.0	10.0	10.0	10.0	10.0	10.3	10.2	10.2
Other metal workers	10.7	10.7	10.7	10.6	10.8	10.8	10.7	11.0	10.9
Oil refining workers	10.3	10.0	10.1	10.2	10.2	10.0	10.1	10.4	10.1
Plastic product workers	9.8	9.8	9.9	9.6	10.0	9.9	9.5	10.3	10.1
Packers	9.5	9.7	9.8	9.9	9.7	9.9	10.1	10.0	10.1
Forklifters etc.	9.7	9.7	9.6	9.6	9.8	9.7	10.1	9.8	9.8
Maintenance men and riggers	10.5	10.4	10.4	10.6	10.5	10.4	10.7	10.6	10.7
Warehousemen	9.7	9.7	9.9	10.0	9.3	9.8	10.1	10.1	10.1
Cleaners and cleaning supervisors	9.6	9.6	9.5	9.8	9.7	9.5	9.9	9.9	9.7

Appendix

Table A3. **Five years later: those still working in the same industry category, by education, age and gender, %**

	Stayed in the same industry category					
	High-tech industry		Other growth industry		Slowly growing ind.	
	1985–90	1990–95	1985–90	1990–95	1985–90	1990–95
Educational level:						
Basic education	31	25	42	35	43	36
Secondary education	53	56	53	58	53	58
Higher education	15	19	6	7	4	6
Total	100	100	100	100	100	100
Age group:						
Less than 30 years	35	27	33	24	35	24
30–39 years	48	49	43	45	43	44
40–49 years	14	20	18	26	17	27
50 years or more	4	4	6	5	5	5
Total	100	100	100	100	100	100
Gender:						
Man	60	62	69	69	61	69
Woman	40	38	31	31	39	31
Total	100	100	100	100	100	100

Appendix

Table A4. **Five years later: those working in another industry category by education, age and gender, %**

	Moved to another industry category					
	From a high-tech industry		From some other growth industry		From a slowly growing industry	
	1985–90	1990–95	1985–90	1990–95	1985–90	1990–95
Educational level:						
Basic education	25	21	32	22	34	33
Secondary education	63	67	62	64	59	61
Higher education	13	11	6	14	7	6
Total	100	100	100	100	100	100
Age group:						
Less than 30 years	41	27	43	26	41	27
30–39 years	45	46	41	48	43	45
40–49 years	12	24	13	23	13	24
50 years or more	2	3	3	4	3	5
Total	100	100	100	100	100	100
Gender:						
Man	77	79	76	81	71	72
Woman	23	21	24	19	29	28
Total	100	100	100	100	100	100

Appendix
Table A5. Five years later: those working outside the manufacturing sector by education, age and gender, %

	Moved outside the manufacturing sector					
	From a high-tech industry		From some other growth industry		From a slowly growing industry	
	1985–90	1990–95	1985–90	1990–95	1985–90	1990–95
Educational level:						
Basic education	25	23	38	31	35	32
Secondary education	59	57	54	60	59	60
Higher education	16	19	8	9	6	8
Total	100	100	100	100	100	100
Age group:						
Less than 30 years	47	26	44	31	49	32
30–39 years	40	51	40	43	38	44
40–49 years	9	20	12	23	10	21
50 years or more	3	3	5	4	3	3
Total	100	100	100	100	100	100
Gender:						
Man	70	70	65	63	60	62
Woman	30	30	35	37	40	38
Total	100	100	100	100	100	100

Appendix
Table A6. Five years later: those having become unemployed by education, age and gender, %

	Moved into unemployment					
	From a high-tech industry		From some other growth industry		From a slowly growing industry	
	1985–90	1990–95	1985–90	1990–95	1985–90	1990–95
Educational level:						
Basic education	30	37	53	49	52	47
Secondary education	59	60	46	50	47	51
Higher education	11	3	1	2	2	2
Total	100	100	100	100	100	100
Age group:						
Less than 30 years	26	23	35	25	32	25
30–39 years	52	37	33	31	32	37
40–49 years	19	24	19	24	18	24
50 years or more	4	17	14	21	18	15
Total	100	100	100	100	100	100
Gender:						
Man	78	54	64	60	46	59
Woman	22	46	36	40	54	41
Total	100	100	100	100	100	100

Appendix
Table A7.   Five years later: those being retired by education, age and gender, %

Moved into retirement						
	From a high-tech industry		From some other growth industry		From a slowly growing industry	
	1985–90	1990–95	1985–90	1990–95	1985–90	1990–95
Educational level:						
Basic education	66	66	76	69	74	71
Secondary education	31	28	22	28	24	28
Higher education	4	5	2	3	2	1
Total	100	100	100	100	100	100
Age group:						
Less than 30 years	1	2	3	2	3	3
30–39 years	7	8	7	4	10	5
40–49 years	12	14	15	12	13	13
50 years or more	79	77	76	82	74	80
Total	100	100	100	100	100	100
Gender:						
Man	62	56	59	53	48	56
Woman	38	44	41	47	52	44
Total	100	100	100	100	100	100

YHTEENVETO

Nopea teknologinen kehitys on muuttanut Suomen talouden rakenteita perusteellisesti viimeisen runsaan kymmenen vuoden aikana. Uutta teknologiaa on otettu käyttöön erittäin nopeaa vauhtia. Suomen työmarkkinoita kohdannutta teknologista vallankumousta kuvaa hyvin tietokonetta työssään käyttävien osuuden räjähdysmäinen kasvu muutaman viime vuoden aikana. Vuonna 1996 tämä osuus oli noin 55 prosenttia työvoimasta, mikä on korkeampi kuin useimmissa muissa teollisuusmaissa. Samanaikaisesti tietokoneen käytön palkkapreemio on hävinnyt. Tämä johtuu tietokoneiden käytön yleistymisestä myös suhteellisen matalapalkkaisissa ja rutiiniluonteisissa työtehtävissä.

Tutkijoiden ja poliitikkojen käsitykset teknologisen kehityksen hyvistä ja huonoista puolista vaihtelevat suuresti. Näkemyserojen hajonta on kuitenkin kaikkein suurinta pohdittaessa teknologian vaikutusta työllisyyteen. Huomattavasti vähemmän erimielisyyttä liittyy teknologian työmarkkinoiden rakenteita muokkaaviin vaikutuksiin: teknologisen kehityksen on yleisesti tiedetty johtavan korkeasti koulutettujen työntekijöiden kysynnän kasvuun ja samanaikaiseen matalan koulutustason omaavien työmarkkina-aseman heikkenemiseen.

Suomessa työvoiman sopeutuminen nouseviin osaamisvaatimuksiin vaikuttaa sujuneen melko kivuttomasti 1980-luvun lopun korkeasuhdanteessa. Vähemmän koulutetuilla oli kohtuullisen hyviä mahdollisuuksia vaihtaa ammattia tai – iän sen salliessa – jäädä eläkkeelle. 1990-luvun syvä lama kuitenkin muutti tilanteen perusteellisesti. Matalasti koulutettujen mahdollisuudet löytää uutta työtä heikkenivät selvästi ja työttömyydestä tuli huomattavasti todennäköisempi vaihtoehto.

Tämän tutkimuksen tarkoituksena on selvittää teknologisen kehityksen vaikutusta sekä työvoiman rakennemuutoksiin että työllisyystrendeihin, joita Suomen tehdasteollisuudessa on vuosien 1985–1995 aikana esiintynyt. Kummatkin aspektit omaavat huomattavaa poliittis-ajankohtaista painoarvoa. J os korkean teknologian toimialoilla syntyy enemmän ja vakaampia työpaikkoja kuin muilla aloilla, voi julkisen tuen korkean teknologian toimialoille ja yrityksille olettaa lisäävän työllisyyden kasvua ja työpaikkojen pysyvyyttä. Toisaalta, jos työvoiman rakennemuutos on teknologian tasosta riippumatta samankaltainen kaikilla toimialoilla, työvoiman sopeutumisongelma liittyy ennemmin yleiseen huonosti koulutetun työvoiman kysynnän heikkenemiseen, kuin korkean teknologian toimialojen koviin osaamisvaatimuksiin. Nämä kaksi eri skenaariota edellyttävät toisistaan poikkeavaa aikuiskoulutuspolitiikkaa.

Tutkimuksessa käytetty ajanjakso kattaa kaksi selkeästi taloudelliselta aktiviteetiltaan toisistaan poikkeavaa periodia; nousukauden 1985–90 ja lamavuodet 1990–95. Näiden kahden jakson vertailu tuo esiin teknologisen kehityksen ja työmarkkinapolitiikan merkitykset.

Analyysi pohjautuu väestöä edustavaan 10 prosentin otokseen Tilastokeskuksen väestölaskennan pitkittäistiedostosta. Tiedostoon on vuodesta 1970 asti kerätty yksityiskohtaista tietoa koko Suomen väestöstä viiden vuoden väliajoin. Viimeisimmät tiedot ovat vuodelta 1995. Tehdasteollisuuden toimialat ryhmitellään kolmeen luokkaan toimialojen teknologiaintensiteetin ja kasvun perusteella vuosina 1980–94. Toimialat jaetaan huipputeknologian aloihin, muihin kasvualoihin ja hitaan kasvun aloihin.

Tulokset osittavat, että huipputeknologian alojen merkitys työllisyyden edistäjänä on voimistunut merkittävästi 1990-luvun alun laman aikana. Työpaikkojen vakauden ja pysyvyyden kannalta toimialat siis eroavat toisistaan. Suomen tehdasteollisuuden rakennemuutos

on tapahtunut ennen kaikkea työvoiman muutosten, eikä suhteellisten palkkatasojen muutosten kautta.

Työvoiman rakenne on sen sijaan muuttunut hyvin samalla tavalla eri teollisuusaloilla riippumatta siitä, onko kysymys huipputeknologian alasta, muusta kasvualasta vai hitaan kasvun alasta. Ajanjaksolla 1985–95 kaikissa kolmessa yllämainitussa ryhmässä alalla pysyneet ovat olleet keskimääräistä koulutetumpia ja kokeneempia (iäkkäämpiä) verrattuna alalta lähteneisiin. Suomen teollisuuden työvoimarakenteen muuttumista näyttäisi lisäksi nopeuttaneen pyrkimykset palkata entistä enemmän korkeasti koulutettuja ja kokeneita työtekijöitä. Miehet näyttävät myös naisia useammin pysyneen teollisuuden palkkalistoilla.

Teollisuudesta pois siirtyneet ovat koulutustasosta ja iästä riippuen joko onnistuneet löytämään uuden työpaikan teollisuuden ulkopuolelta, jääneet työttömäksi tai siirtyneet eläkkeelle. Mitä korkeamman koulutuksen saaneesta tai nuoremmasta henkilöstä on kyse, sitä helpommin on löytynyt uusi työpaikka. Syvä lama 1990-luvun alkuvuosina kuitenkin heikensi tämänkin työntekijäryhmän työllisyystilannetta merkittävästi. Vanhempien ja vähemmän koulutettujen työntekijöiden vaihtoehtoina ovat useimmiten olleet vain työttömyys ja eläkkeelle siirtyminen. Tämä kuvio toistuu kaikissa kolmessa teollisuusryhmässä niiden teknologisesta tasosta tai taloudellisesta menestymisestä riippumatta.

Poliittisen päätöksenteon kannalta nämä tulokset synnyttävät kahdensuuntaisia viestejä. Yhtäältä, nopeasti kasvavat teollisuusalat ja erityisesti korkean teknologian alat ovat merkittäviä uusien työpaikkojen luojia. Tätä prosessia voidaan kiihdyttää osuvalla tiede- ja teknologiapolitiikalla. Toisaalta, kaikki teollisuusalat – teknologis-taloudellisesta suorituskyvystä riippumatta – näyttävät muokkaavan työvoimansa rakennetta samalla tavalla. Samantyyppisiä työtekijöitä " siivotaan pois" kaikkialla. Yleinen heikosti koulutettujen työntekijöiden kysynnän lasku kasvattaa painetta uudelleenkoulutus- ja eläkepolitiikan saroilla. Teollisuudessa ja muualla syntyvät uudet työpaikat ovat yhä enenevissä määrin matalasti koulutettujen työttömien saavuttamattomissa.