

# The information society and changes in the labour market: A comparison of work profile changes in the EU, the USA and Japan

Jari KAIVO-OJA, Ira AHOKAS, Pentti MALASKA and Jyrki LUUKKANEN  
Finland Futures Research Centre, Turku School of Economics and Business Administration, P.O.  
Box 110, 20521 TURKU, Finland, Tel. +358-2-3383526, Fax. +358-2- 2330 755, Email:  
jari.kaivo-oja@tukkk.fi

**Abstract.** In this study trend analyses of occupational structures in the U.S. economy, the Japanese economy and the EU economy are analysed and compared with each other. The authors use the Swyt-Malaska model for the U.S, Japan and EU countries. The results gained are presented for the entire labour force, the male labour force and the female labour force. The study shows that there are significant differences between the occupational structures of the U.S, the Japanese and the EU economies. An important finding of the study is that male and female occupational structures follow different trajectories when the Swyt-Malaska model system is used for gender specific analysis. The empirical analysis covers the years 1980-2000.

## 1. Introduction

Western industrialised countries are moving on a well-established trajectory of increased knowledge intensity. This is represented by the rise in the proportion of their workers employed in technical and professional occupations. In this study we shall present new empirical results on the trends of occupational structures in the United States of America (US), Japan and the 15 European Union (EU) countries. Our analysis is based on Swyt's model [1, 2], that was modified by Malaska [2]. This demonstration study analyses the trends of occupational structures from 1980 to 2000. In a previous study by Swyt, trends in the U.S. manufacturing labour force in the post-industrial era were analysed [2].

Technical and professional workers play a significant role in modern information societies. Bell [3], Machlup [4] and Porat [5], and others correctly anticipated that technical and professional workers would play a significant role in the information societies, or knowledge economies as they are sometimes called. Bell, in 1974, pointed to their primary role in the knowledge-transformative activity central to the United States' post-industrial society. Following both Machlup and Porat, Rubin together with Slamecka and then with Huber, provided a detailed analysis of the US knowledge industry and the US information economy [6, 7]. In this study we expand the research area and shall present new results concerning developments in the US, Japan and EU.

In general the study looks at changes in the labour force occupations of the US, Japan and EU economies as a whole. Our analysis is then focused on the different sector and occupational structures and does so from different perspectives. Firstly, as manufacturing changes from being the dominant sector of the overall economy to being part of a service dominated economy. Secondly, as the economy changes from being dominated by a particular occupational structure to having no particular dominant occupational structure.

## 2. The Swyt-Malaska approach to the analysis of occupational structures

Swyt's analysis of the US manufacturing labour force was based on the typology of occupations. This was constructed by grouping standard labour clarifications into four major categories or types. These four types differ from those of Porat in that they involve no subjective reallocation of activities associated with standard occupational classifications into more than one type [4, 2, 8].

The first type of occupation is called "physical-production" (PP) and consists of a standard broad group, which in turn consists of four standard classes: labourer, operative, precision-production, and craft. The second type of occupation is called "physical-service"(PS) and consists of a standard broad group consisting of a single class, service occupations, which includes, for example, hospital orderlies, parking-lot attendants, custodians, security guards and fast-food workers. The third type of occupation is called in Swyt's typology "managerial administrative" (MA) and consists not of a single broad group but three occupational classes: managerial and administrative, clerical and sales workers. The fourth type of occupation is called "technical-professional" (TP) and consists of a standard broad group consisting of two standard classes: technical and professional occupations, which includes, for example, engineers, doctors, scientists, financial analysts, nurses, accountants, technicians, and paraprofessionals of all types.

The basis for Swyt's construct of four occupational types is empirical, theoretical and conceptual. In his empirical analyses, Swyt presented the US economy and its labour force as showing highly ordered behaviour in terms of the specific relations amongst these particular four types. Theoretically, the four-component labour force results from a general systems-theoretical model. The general Swyt model includes, as dual dichotomies, four components linked four-ways in a system in which each component has a position-specific but general paradigmatic meaning. Swyt's model supported the conceptual interpretation of the types as corresponding to physical-production, physical-service, mental-production and mental-service, where production is defined as a substance-transforming activity and service is defined as ephemeral action-on-demand.

Swyt's model [2] is usually presented as a diamond diagram, which reduces the group of four numbers representing the percentages in four categories to a single (x, y) co-ordinate pair, which are located on a point within the figure. Along the vertical axis of the diamond diagram the difference between the respective percentages of physical-production (PP) and technical-professional (TP) workers is plotted on (PP-TP). Along the horizontal axis the difference between the respective percentages of managerial-administrative (MA) and physical-service (PS) workers is plotted (MA- PS). The sum of the four categories is 100%, thus

$$(PP - TP) = y \quad (\text{vertical axis}) \quad (1)$$

$$(MA - PS) = x \quad (\text{horizontal axis}) \quad (2)$$

and

$$(PP + MA + PS + TP) = 1 \quad (\text{total labour force}) \quad (3)$$

In this way the two basic variables can be derived from the four occupational group variables. These two variables can be then be represented in a system of co-ordinates. According to the definition, the sum of the four occupational group variables shall always be 1 (or 100%), so there are three independent variables. The occupational group PP refers to blue-collar occupations, the

group MA refers to white-collar occupations, the group PS refers to tan-collar occupations and the group TP to no-uniform occupations.

The equations above give an unequivocal representation from the MA, PS, PP and TP occupational profile to the (x, y) co-ordinates. Malaska has pointed out that from the direction of (x, y) into (MA, PS, PP, TP), the mapping is not unequivocal, in other words the proportions of people working in different occupational groups cannot be calculated on the basis of the (x, y) co-ordinates alone. [8]. Malaska [8] has noted that in the equation group there are 3 equations and 6 variables. When there are variables x and y, and one occupational variable is chosen as a free variable, the three remaining ones can be solved. Physical production (PP) is a good choice for the free variable, because it is known to reduce monotonically. The inverse transformation from space (P, x, y) to triad (MA, PS, TP) will produce equations:

PP, x, y given and then

$$TP = PP - y \quad (4)$$

$$MA = 1/2(1 + x + y) - PP \quad (5)$$

and

$$PS = 1/2(1 - x + y) - PP \quad (6)$$

By using the inverse transformations of equations (4-6) it is easy to confirm the results analysed by the Swyt-Malaska model. On the basis of this approach we can analyse trends in the US, Japanese and EU economies. It is also possible to make a country level comparative study of the 15 EU countries. Another interesting topic of analysis could be a comparative study of Eastern Europe and the EU countries. Here our aim is to describe the trends in occupational structures and analyse differences in the trajectories of the US, Japan and EU. In this study we shall present the following results on the basis of Swyt-Malaska approach:

1. A comparison of the US's, Japan's and EU's occupational trajectories for the entire labour force,
2. A comparison of the US's, Japan's and EU's occupational trajectories for their respective male labour forces
3. A comparison of the US's, Japan's and EU's occupational trajectories for their respective male labour forces
4. A comparison of the US's and Japan's and EU's occupational trajectories for their respective production and service occupations.

All the results presented cover the years 1980-2000. Here we present only some preliminary demonstration analyses and results from a larger Work Profile Study.

### 3. Data of the study

The occupational structure is presented for the entire labour force, plus the male and female labour forces of the US, Japan and EU. Due to a lack of data Luxembourg is not included in the results. The Occupational Structures data is based on the ILO International Standard Classification of Occupations 1968 and 1988 [9,10]. The classification consists of the following major groups (table 1):

**Table 1.** ILO International Standard Classification of Occupations and Swyt's typology of occupations

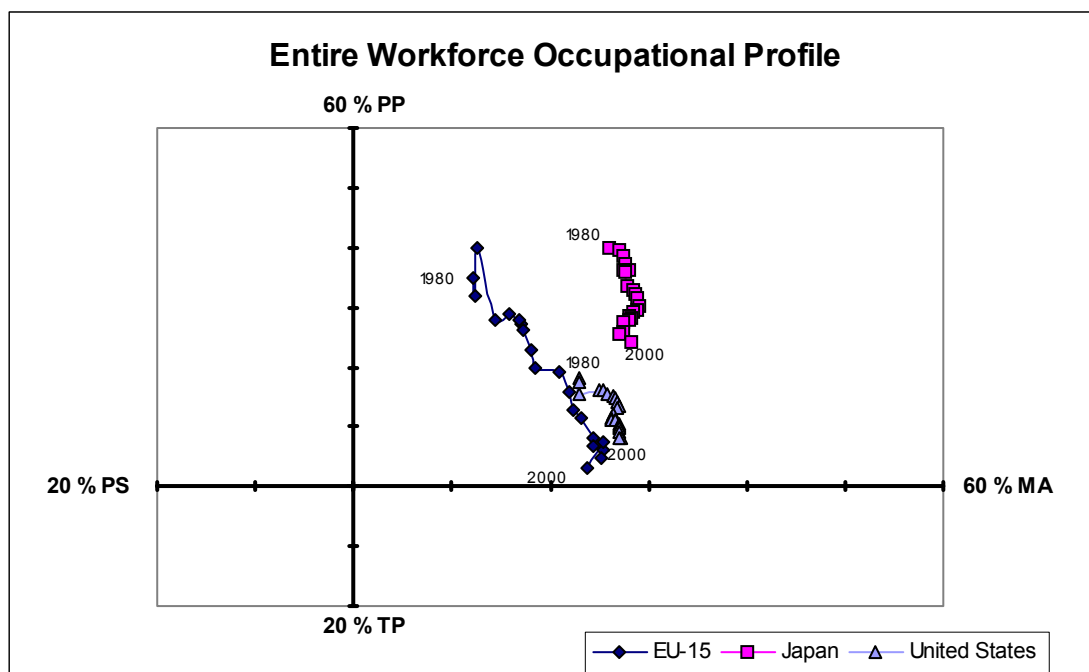
ISCO Major Group	Occupations	Swyt's typology of occupations
0/1	Professional, technical and related workers	TP
2	Administrative and managerial workers	MA
3	Clerical and related workers	MA
4	Sales workers	MA
5	Service workers	PS
6	Agriculture, animal husbandry and forestry workers	PP
7/8/9	Production workers, transport equipment operators and labourers	PP

France does not use the ILO International Standard Classification of Occupations. French data is based on its own national classification standard PSE-ESE [11-24]. The French data differs from ILO data by not being gender specific. All the available ILO data sources have been used in this demonstration study. The author's current database covers all the OECD countries. So it is possible to make the Swyt-Malaska analyses for all the OECD countries. The results of the analyses are presented in the form of percentages and not in absolute numbers of workers. It is assumed that the results presented are not biased, although there are some data deficiencies and problems with the ILO database. There are for instance some occupation grouping differences between ISCO 1968 and ISCO 1998.

#### 4. Comparative analyses

The occupational profile trajectories for the entire US, Japanese and EU economies' labour forces are presented within the modified diamond diagram in Figure 1 (all), Figure 2 (males) and Figure 3 (females). The decennial data is presented for the period 1980-2000.

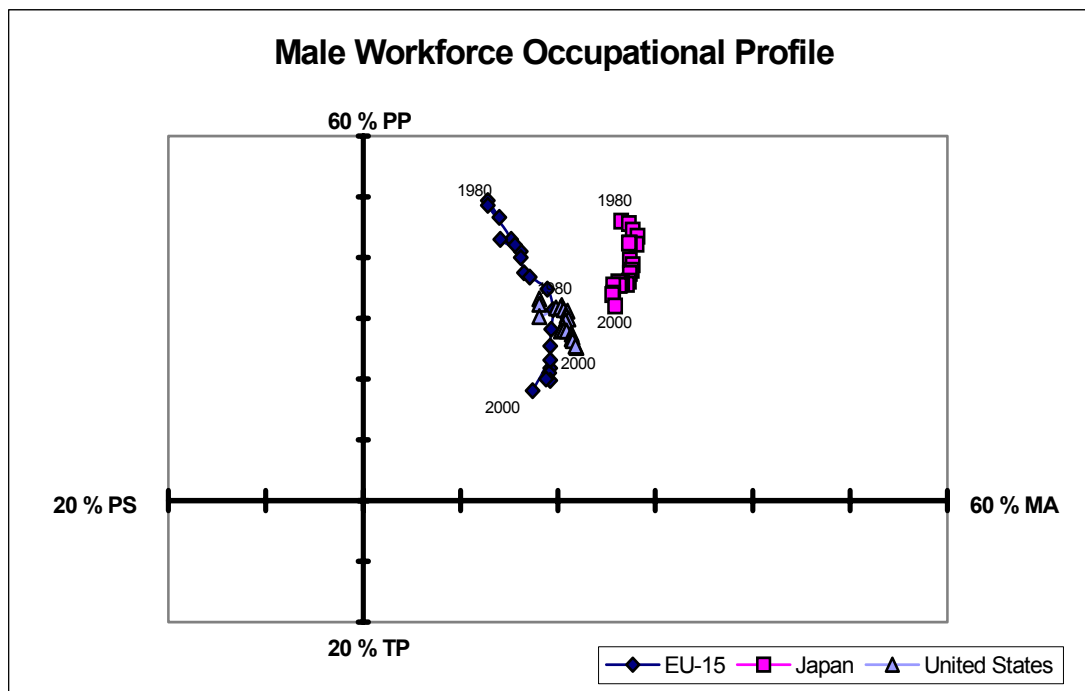
**Figure 1.** The occupational profile trajectories of the entire US, Japanese and EU labour forces within the modified diamond diagram: decennial data for the period 1980-2000



### Some brief comments on the entire labour force:

One can see on the basis of Figure 1 that structural changes within the occupational structures have been fastest in the EU countries in that period. It is interesting to note that the US and the EU have similar trajectories, but that Japan is lagging behind in the development of its occupational structures. One obvious result on the basis of Swyt-Malaska analysis is the EU economy is now more technical-professional oriented than the US economy. In the long run, the developments concerning the MA/PS -relations seem to converge for the US, Japan and EU. In the long run, the developments concerning the MA/PS relationship seem to converge for the US, Japan and EU. This shows that the economy is changing from being technology driven and is becoming a more service driven economy. Figure 1 also shows that the EU economy and US economies are clearly developing in the direction of more MA occupations, but that Japan has turned towards developing more PS occupations.

**Figure 2.** The occupational profile trajectories of the male US, Japanese and EU labour forces, within the modified diamond diagram: decennial data for the period 1980-2000



On the basis of Figure 2 it is observed that among the three male labour forces the structural changes in occupational structures were fastest in the EU economy. The US and the EU economies have, again, similar trajectories, but Japan is also lagging behind in its occupational structures in this case as well. It appears that the Japanese economy has remained on a lower level of technical-professional occupations in its male labour force markets. Figure 2 also reveals that the EU is now more technical-professional oriented than the U.S. in the male's labour market. The developments concerning the MA/PS -relations seem to suggest a convergence between the U.S. and EU economies, but not in the case of the Japanese male labour market. An interesting observation is that the Japanese labour market is more MA-oriented than the U.S. and EU.

**Figure 3.** The occupational profile trajectories for the female US, Japanese and EU labour forces within the modified diamond diagram: decennial data for the period 1980-2000

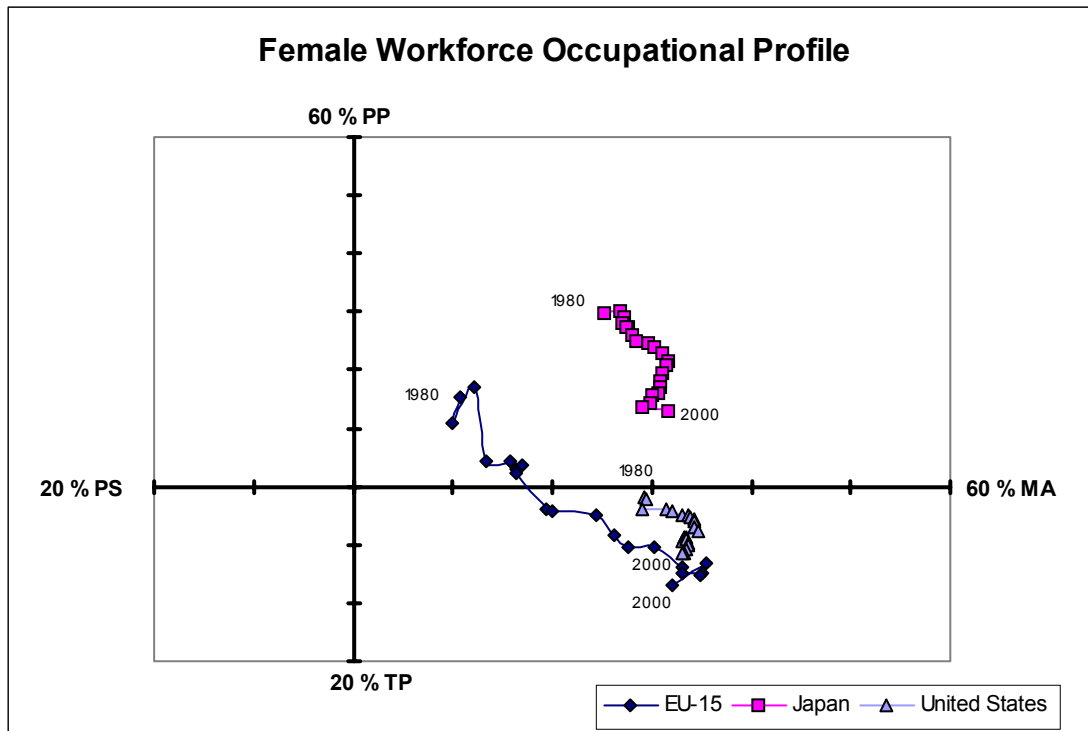


Figure 3 reveals that the structural changes in the occupational structures for females were clearly fastest in the EU economy. The U.S. and EU labour markets for females are developing in similar directions, but the rate of change is faster in the EU economy. In the EU economy females are more oriented towards MA and TP types of occupations, but in the Japanese and in the U.S. economy this trend is weaker. The Japanese economy has remained at a lower level of development with regard to technical-professional occupations for the female labour markets. The EU economy is now more technical-professional oriented than the U.S. economy in the female labour market. The developments concerning the MA/PS -relations do not seem to suggest convergence between those female labour markets. The Japanese economy is less TP-oriented than the U.S. and EU economies. Furthermore the EU economy leads in TP- and TP-orientation in the female labour markets.

In general, we can summarise that women play a greater role in the labour markets of the information society in the EU economy than in the U.S. or Japanese economies.

## 5. Summary

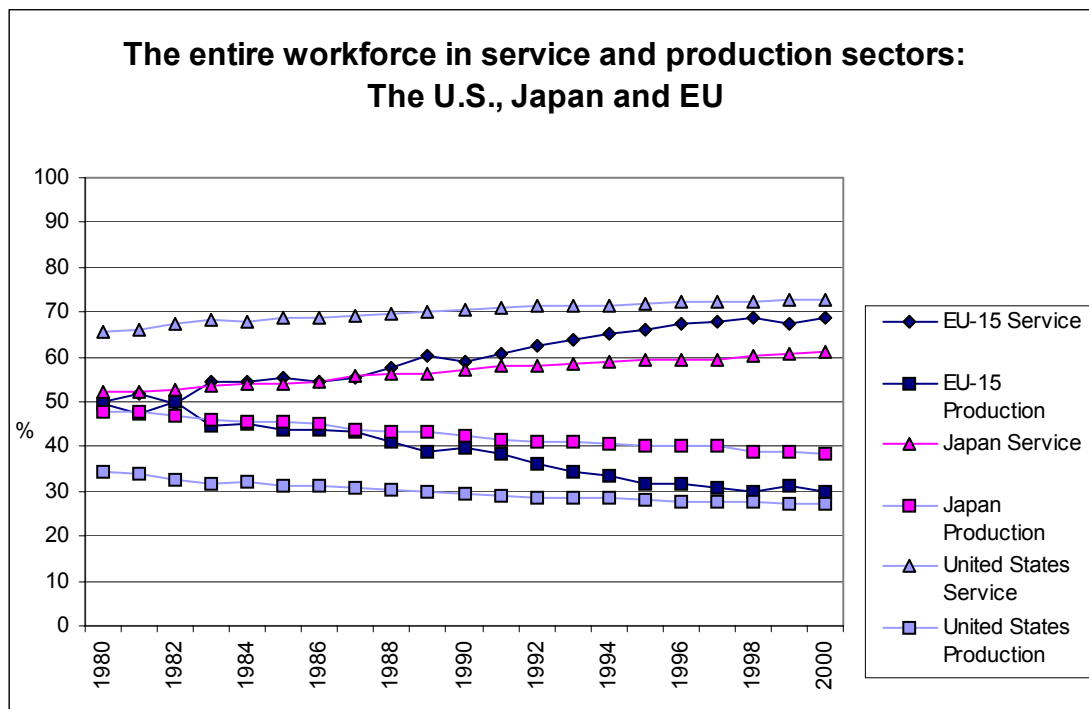
In this article the Swyt-Malaska model was used to analyse occupational profile changes in the EU, the Japanese and the U.S. economies. The empirical analysis of the study covers the years 1980 to 2000. In this article trend analyses of occupational structures in the U.S., Japan and EU were presented and compared with each other. The results were presented for the whole labour force, the male labour force and the female labour force. The study shows that there are significant differences between the occupational structures of the US, the Japanese and the EU economies. The results of this study indicate clearly that there are considerable differences in the occupational structures in the analysed economies. The occupational patterns of knowledge society are different, which also indicate that the role of e-work is different kind indifferent

economies. Basic patterns are a production-oriented e-work and the other basic pattern is a service-oriented e-work.

An important and policy relevant finding of the study is that male and female occupational structures follow very different kinds of trajectories, when the Swyt-Malaska model system is used for gender specific analysis. This study indicates clearly that the labour markets of the modern information societies are still gender specific and gender specific perspectives are extremely relevant, when we analyse information society issues like eWork and other new forms of work in the information society. Thus, the information society seems to suggest the continuation of different kinds of occupational structures for women and men.

Another interesting finding of this study is that the EU economy is clearly attaining trajectories of production and service occupations similar to the US. However, the Japanese economy is falling behind in developing and moving towards a service-oriented economy and away from a less production oriented society. In Figure 4 developments concerning the occupations in the service and production sectors of the U.S., Japanese and EU economies are reported. Figure 4 verifies in a concrete way this important finding.

**Figure 4.** The entire labour force in the service and productions sectors: the U.S., Japanese and EU economies, percentage data for the period of 1980-2000



## References

- [1] Swyt, D.A., U.S. Manufacturing Systems: Factories Past, Present, and Future, in Manufacturing Research Perspectives: USA-Japan. Arthur Gerstenfeld, Carole Ganz and Tohsio Sata, eds. Elsevier, Amsterdam, 1987.
- [2] Swyt, D.A., The Labour force of U.S. Manufacturing in the Post-Industrial Era. Technical Forecasting and Social Change, 34(x), 231-251 (1988).
- [3] Bell, Daniel, The Coming of the Post-Industrial Society, Heineman, London, 1974.
- [4] Machlup, Fritz, The Production and Distribution of Knowledge in the United States, Princeton University Press, Princeton, N.J., 1962.
- [5] Porat, Marc U., The Information Economy: Definition and Measurement, U.S. Department of Commerce, Office of Telecommunications, Washington, D.C., May 1977.

- [6] Rubin, Michael R., and Slamecka, Validimir, *Studies of the Information Economy in the United States*. Pergamon, Oxford, 1982, Part 1.
- [7] Rubin, Michael R., and Huber, Mary T., *The Knowledge Industry in the United States*, Princeton University Press, Princeton, N.J., 1986.
- [8] Malaska, Pentti, *Sociocultural Transients of Work in the Late-industrial Period: USA and Finland as the Empirical Cases*. A Paper presented in the III International Kondratieff Conference in Kostroma, Russia, May 18-22, 1998.
- [9] International Labour Office, *Yearbook of Labour Statistics 1989-1990*, Geneva 1991.
- [10] International Labour Office, *Yearbook of Labour Statistics 2000*, Geneva, 2001.
- [11] INSEE, *Structure des Emplois en 1984*, Paris, 1986.
- [12] INSEE, *Structure des Emplois en 1985*, Paris, 1987.
- [13] INSEE, *Structure des Emplois en 1986*, Paris, 1987.
- [14] INSEE, *Structure des Emplois en 1987*, Paris, 1989.
- [15] INSEE, *Structure des Emplois au 31 Décembre 1988*, Paris, 1991.
- [16] INSEE, *Structure des Emplois au 31 Décembre 1989*, Paris, 1991.
- [17] INSEE, *Structure des Emplois au 31 Décembre 1990*, Paris, 1992.
- [18] INSEE, *Structure des Emplois au 31 Décembre 1991*, Paris, 1993.
- [19] INSEE, *Structure des Emplois au 31 Décembre 1992*, Paris, 1995.
- [20] INSEE, *Structure des Emplois au 31 Décembre 1993*, Paris, 1996.
- [21] INSEE, *Structure des Emplois au 31 Décembre 1994*, Paris, 1997.
- [22] INSEE, *Structure des Emplois au 31 Décembre 1995*, Paris, 1999.
- [23] INSEE, *Structure des Emplois au 31 Décembre 1996*, Paris, 2000.
- [24] INSEE, *Structure des Emplois au 31 Décembre 1997*, Paris, 2000.