

GENERAL DISTRIBUTION

OCDE/GD(93)7

**LABOUR MARKET AND SOCIAL POLICY
OCCASIONAL PAPERS
NO.10**

**PROJECTING THE OCCUPATIONAL STRUCTURE
OF EMPLOYMENT IN OECD COUNTRIES**

GERALD HUGHES

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1993

COMPLETE DOCUMENT AVAILABLE ON OLIS IN ITS ORIGINAL FORMAT

**DIRECTORATE FOR EDUCATION,
EMPLOYMENT, LABOUR AND SOCIAL AFFAIRS**

OCCASIONAL PAPERS

This series is designed to make available to a wider readership selected labour market and social policy studies prepared for use within the OECD. Authorship is usually collective, but principal writers are named. The papers are generally available only in their original language -- English or French -- with a summary in the other.

Comment on the series is welcome, and should be sent to the Directorate for Education, Employment, Labour and Social Affairs, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France. Additional, limited copies are available on request.

The opinions expressed and arguments employed here are the responsibility of the author(s) and do not necessarily represent those of the OECD.

Copyright OECD 1993

Forecasts of employment by occupation have been made in several OECD countries since the early 1950s. Medium to long-term projections are now made in most OECD countries, and a number of countries publish them regularly. This paper by Gerald Hughes, of the Economic and Social Research Institute, Dublin, examines how their objectives, methods and uses have changed over the last three decades. It covers technical issues such as the standard method of projection using statistics for employment cross-classified by industry and occupation, the integration of information from other sources such as surveys of employer expectations, the confrontation of employment forecasts with separate models of labour supply, and the competing "rate of return" approach to investment in human capital. It also considers management issues such as the institutional status of the bodies that make forecasts, and methods of disseminating the results to training institutions, career advisers and other users.

* * * * *

Plusieurs pays de l'OCDE effectuent des projections de l'emploi par profession depuis le début des années 50. Aujourd'hui, la plupart des pays font des projections à moyen-long terme, et certains les publient sur une base régulière. Cet article par Gerald Hughes, du Economic and Social Research Centre, Dublin, étudie comment ont évolué pendant trois décennies leurs objectifs, les méthodes employées et les utilisations. Il couvre des questions techniques telles que la méthodologie habituelle basée sur les statistiques ventilées par industrie et par profession ; l'intégration des informations provenant d'autres sources telles que des enquêtes auprès des employeurs ; la confrontation des projections d'emploi issues de différents modèles d'offre de main-d'oeuvre ; et une approche concurrente basée sur le "taux de rendement" des investissements en capital humain. Sont également soulevées des questions relevant de la gestion, telles que le statut des instituts de prévisions et la diffusion des résultats aux instituts de formation, aux conseillers d'emploi, et aux autres utilisateurs.

PROJECTING THE OCCUPATIONAL STRUCTURE OF EMPLOYMENT IN OECD COUNTRIES

TABLE OF CONTENTS

	Page
A. INTRODUCTION	6
B. PROJECTING OCCUPATIONAL EMPLOYMENT	7
B.1 Overview of occupational projections in six OECD countries	
B.2 Data requirements	
B.3 Forecasting methods	
C. PROJECTING MANPOWER REQUIREMENTS BY OCCUPATION AND LABOUR SUPPLY BY EDUCATION	14
C.1 Estimating manpower requirements	
C.2 Estimating labour supply by education	
D. OECD COUNTRY EXPERIENCES	17
D.1 Introduction	
D.2 United States of America	
D.3 Canada	
D.4 France	
D.5 Federal Republic of Germany	
D.6 Netherlands	
D.7 United Kingdom	
E. PERFORMANCE OF OCCUPATIONAL PROJECTIONS	29
F. THE NEO-CLASSICAL CRITIQUE AND THE RATE OF RETURN METHOD	31
G. DISSEMINATION AND USE OF OCCUPATIONAL PROJECTIONS	33
G.1 Dissemination	
G.2 Applications	
H. CONCLUSION	37
REFERENCES	39

LIST OF TABLES

Table 1: Main characteristics of early and recent projections of occupational structure in some OECD countries	8
Table 2: Accuracy of comprehensive occupational projections for the United States, Canada and France	30

PROJECTING THE OCCUPATIONAL STRUCTURE OF EMPLOYMENT IN OECD COUNTRIES¹

A. INTRODUCTION

1. Projections of employment by occupation have not figured very prominently in recent discussions in OECD countries of labour market analysis. Yet such projections have been published for many years for Canada, France, Germany, the United Kingdom, and the United States and also for the Netherlands in recent years. Occupational projections have also been published occasionally for Australia, Austria, Denmark, and Italy and Ireland, Japan and Spain are currently developing occupational projection systems.²

2. Occupational employment projections have many uses. They help individuals to choose a career and enable career guidance counsellors to advise students and other job seekers on future employment prospects. They enable decision makers with responsibility for education and training to decide which types of education and training should be financed. They provide information for managers and trade unionists on possible skill shortages. They assist in the development and evaluation of employment, education, and training programmes.

3. This paper discusses how projections of the future occupational structure of employment are made in OECD countries and considers the role which they can have in labour market policy. Section B gives a description of occupational employment projections based on detailed employment statistics classified by occupation and economic sector and it outlines the methods which are used to project the trend in the occupational structure of individual sectors. Section C describes the role of projections of labour supply classified by education and occupation. It also considers the attempts which have been made to combine these projections with occupational employment projections to identify areas of skill surplus and shortage. Section D describes the experience which six OECD countries have had in making occupational projections. Section E assesses the performance of occupational projections. Section F considers issues of labour substitution and relative wages. Section G describes how occupational projections are made operational instruments of labour market policy through the integration of qualitative information on labour market trends and the dissemination of the results in publications aimed at policy-makers and in computer diskettes designed for use by school-leavers and other job seekers. Section H gives conclusions.

¹ This paper is based on a more extensive study (Hughes, 1991) for a joint project by Foras Aiseanna Saothair (Ireland's Training and Employment Authority) and the Economic and Social Research Institute, Dublin. Financial support for the earlier study was provided by FAS and the ESRI. I am grateful to David Grubb and Abrar Hasan of the OECD for assistance in identifying organisations in OECD countries which produce occupational projections, for guidance on the structure of the paper, and for comments on an earlier draft.

² See Hughes (1991) and Nadel (1991) for further information on occupational projection work in OECD countries.

B. PROJECTING OCCUPATIONAL EMPLOYMENT

1. Overview of Occupational Projections in Six OECD Countries

4. It is helpful to consider post-World War II occupational employment projections for Canada, France, Germany, the United Kingdom, and the United States in terms of two periods. The first period ran from about the beginning of the 1950s to the aftermath of the first oil crisis in the early 1970s. The projection models which were developed and used during this period were strongly influenced by expectations of continuing economic growth and a general belief that the projection results would be sufficiently accurate to enable planners to quickly adjust outflows of labour from the educational system to the demands of the production system. The second period stretches from the early 1970s to the present day. The projection models which are currently used grew out of the experience gained during the earlier period. They were strongly influenced by the re-emergence of cyclical phases in economic growth, a realisation that the projection results were unlikely to be sufficiently accurate to permit fine adjustments in labour supply and demand, and a belief that projections of the future occupational demand could meet the needs of policy makers and individuals for information on the current and future employment outlook for different occupations. The models developed during these two periods will be referred to as first and second generation models.

5. The primary objective of the first period projections was to try to ensure, through educational planning procedures, a smoother adjustment of supply to demand in occupational labour markets than would have been possible by relying on market mechanisms alone. These hopes were not realised because of the great difficulty in making accurate occupational projections at a very detailed level and because the connection between education and occupation proved harder to predict than had been assumed by educational planning enthusiasts.

6. Occupational forecasters responded to the disappointing performance of the projection models in the first period by emphasising the greater accuracy of medium-term over long-term projections and arguing that they could be better used to provide general guidelines for governments, firms, and individuals for active labour market policies in the areas of training, job placement, and job creation rather than for educational planning purposes. They argued that high-quality research and background information on occupational labour markets, even when not suitable for direct mechanical application by users, could improve policy making or enter effectively into individuals' career choices.

7. These responses resulted in a change in the objectives of occupational projection models. The main objectives of the models which are currently in use is to highlight for policy makers the implications of existing occupational trends, to bring to their attention the effects which different courses of action could have on the level and structure of occupational employment in the future, and to provide information for individuals and careers advisers on the current and future position of occupational labour markets.

8. An overview is provided in Table 1 of the main characteristics of early and recent projections of occupational employment for Canada, France, Germany, the Netherlands, the United Kingdom, and the United States.

Table 1: Main characteristics of early and recent projections of occupational employment in some OECD countries

Country	Agency/ model & date	Coverage occ x ind	Base - final year	Method	Area	Form of publication
Canada	Meltz & Penz 1968	13 x 15	1961-1970	Trend extrap- olation	Canada	Govt. report
	COPS 1989	512 x 62	1989-2000	Fixed coeffs.	Canada/ provinces	Govt. report
France	CGP 1961	7 x 29	1962-1965	Project trend/ adj.oc. coeffs.	France	Govt. report
	BIPE 1989	18 x 40	1986-1994	Project trend/ adj.oc. coeffs.	France	BIPE report
Germany Fed. Rep.	Battelle Institut 1969	52 x 35	1969-1976	Trend & RAS method	Germany, Fed. Rep.	Batelle- Institut book
	IAB 1989	34 x 38	1988-2010	Project trend/ adj. oc. coeffs	Germany, Fed. Rep.	IAB book
Netherlands	ROA 1987	82 x 24	1987-1992	Regress- ion	Netherlands	ROA report
UK	MRG 1978	16 x 49	1978-1982	Project trend/ adj.oc. coeffs.	UK	MRG report
	IER 1991	22 x 49	1990-2000	Project trend/ adj.oc. coeffs.	UK & regions	IER report
USA	BLS 1963	162x124	1960-1975	Project trend/ adj.oc. coeffs.	US	BLS reports
	BLS 1991	500x250	1990-2005	Project trend/ adj.oc. coeffs.	US	BLS reports

Notes: (1) BIPE = Bureau d'Information et de Previsions Economiques, Paris; BLS = Bureau of Labour Statistics, Washington; CGP = Commissariat General du Plan, Paris; COPS = Canadian Occupational Projection System; IAB = Institut fur Arbeitsmarkt- und Berufsforschung, Nuremberg; IER = Institute for Employment Research, Warwick; MRG = Manpower Resources Group, Warwick; ROA = Researchcentrum voor Onderwijs en Arbeidsmarkt, Maastricht.

(2) adj. oc. coeffs. = adjusted occupational coefficients. The occupational coefficients given by mechanical projection of the trend are adjusted in the light of quantitative information on developments in occupational labour markets.

9. Towards the end of the 1950s economists in Canada, the United States, France, and Germany became concerned over the emergence of structural unemployment at a time when aggregate demand was quite strong. They were afraid there would be continuing shortages of qualified manpower in some areas (science, education, health) and surpluses of poorly educated workers in others (agriculture, building and construction). Denison's (1962) analysis of the sources of economic growth and the strong contribution to growth which highly educated workers could make focused attention on the quality of the labour force. These developments stimulated demands for projections of the occupational structure of employment by educational planners and policy makers responsible for the provision of training facilities.

10. These demands intensified in Canada in the 1960s when a Department of Manpower and Immigration was established in response to recommendations by the Economic Council of Canada that there should be greater concentration on education and training to promote economic growth. They also intensified at about the same time in the United States when legislation was passed establishing government programmes of vocational and technical training for the unskilled. This legislation stipulated that the authorities should make available information about the prospects for occupational employment at state and national levels.

11. The projections which were made in 1963 by the United States Bureau of Labor Statistics for the period 1960-75, to meet legislative requirements, covered 162 occupational groups in 124 industrial groups. The most recent projections for the United States, for the period 1990-2005, cover 500 occupational and 250 industrial groups. The initial projections made for Canada in 1968 by Meltz and Penz (1968) for the period 1961-70 covered 15 occupational and 13 industrial groups while the latest projections for the period 1989-2000 cover 512 occupational and 62 industrial groups.

12. Projections of national manpower requirements for France were initially made at an aggregate level in the First Plan, which covered the period 1947-50. Fears of skill shortages in the early 1960s led to demands for the employment projections for France to be broken down by skill level. This was first done in the Fourth Plan, which covered the period 1962-65, when projections were made for 7 occupational groups in 29 sectors. The most recent projection of the occupational structure for France for the period 1986-94, by the Bureau d'Information de Previsions Economiques, in Paris cover 18 occupational groups in 40 sectors.

13. Economists of the "Basle School" prepared projections of the expected demand for highly trained manpower classified by education and occupation for the Federal Republic of Germany in 1965 in response to concerns about skill shortages and the kind of graduates which the educational system should be providing. Some years later in 1969 the first comprehensive occupational projections for the Federal Republic of Germany were commissioned by the Ministry of Labour and Social Affairs from the Battelle-Institut. Projections were made by this institute for 52 sectors and 35 occupations for the period 1969-76.

14. Formal methods of forecasting occupational requirements came into use in the United Kingdom during the Second World War when the civil authorities needed to specify the kinds of labour which would be required for civil and military purposes. The statistical techniques for analyzing labour turnover and wastage which developed out of this experience were refined and developed after the war and used for human resource planning in Government Departments and firms in the private sector. These techniques continue to be extensively used at the micro level for human resource planning by operations researchers and personnel managers.

15. At the macro level an economy-wide analysis of labour supply and demand was undertaken by the British Government for the National Plan which was published in 1965. Economists at the University of Cambridge working on the Cambridge Growth Project and at the University of Warwick working on a Manpower Resources Group project for the Engineering Industry Training Board had reached a stage by the late 1970s where a collaboration on occupational forecasting was possible. The Cambridge multi-

sectoral model was adapted to enable the Manpower Resources Group to make projections of the occupational structure for the United Kingdom. The Manpower Resources Group published its first set of projections of the occupational structure of the UK labour force in 1978 for 16 occupational groups in 49 sectors. The Manpower Resources Group evolved into the Institute for Employment Research at the University of Warwick. The Institute has published regular projections of the occupational employment outlook since 1981. Its most recent projection covers 22 occupational groups in 49 sectors and discusses developments which are expected to take place in occupational labour markets over the period 1990-2000.

16. There have been significant differences between North American and Western Europe countries in the agencies making the projections and in the number of occupational groups covered. In North America the projections have generally been made by government departments and most of the projections have provided information for a large number of occupational groups. In Western European countries the projections were initially made by government departments or agencies and information has been provided for only a small number of occupational groups. Since the first oil crisis in the early 1970s there has been a change in most Western European countries from government agencies making the projections to independent research organisations making them on behalf of the government. One reason for this change may be that in North America governments have traditionally adopted a *laissez faire* approach to the labour market whereas in Western Europe governments have been more interventionist. Hence, in the United States and Canada it has been possible for government departments to produce detailed occupational projections without the government being expected to use them to intervene in the labour market. In Western Europe countries official agencies have not been able to make occupational projections without political consequences for their governments. This difference in public expectations of the role of government in relation to the labour market may explain why the preparation of occupational projections has come to be mainly undertaken by independent research organisations in Western European countries since the early 1980s, following the adverse effects of the first and second oil crises on projections which had been prepared by government agencies, and why IAB in Germany decided at the end of the 1980s that projections should be made for "branches of activity", using a number of different scenarios, rather than for more conventionally defined occupational groups.

17. Despite differing views about the appropriate role for government in the labour market in North America and Western Europe the demand for occupational projections has remained strong. The current position is that the United States Bureau of Labor Statistics and Canada's Employment and Immigration department publish comprehensive occupational projections every two years; the Commissariat General du Plan commissions projections for France from independent research organisations but it does not include the detailed results in the French Plan. However, it allows publication of the results by the research organisation undertaking the projection work; the Institute for Employment Research, IER, at Warwick publishes occupational projections for the United Kingdom at intervals of about 18 months; the Institut für Arbeitsmarkt-und Berufsforschung der Bundesanstalt für Arbeit, IAB (Institute for Employment and Occupational Research at the Federal Institute of Labour) at Nuremberg commissions projections by "branch of activity" for the Federal Republic of Germany from independent research organisations which may publish the results; the Researchcentrum voor Onderwijs en Arbeidsmarkt, ROA (Research Centre for Education and the Labour Market) in Maastricht publishes educational and occupational projections for the Netherlands under commission from the Dutch Ministry of Education and Sciences.

2. Data Requirements

18. The basic data required to forecast the occupational structure are statistics of employment classified by occupation. Although occupation is an imperfect proxy for skill, an occupational classification is needed because it indicates the quality of the labour force in terms of intrinsic abilities and skills acquired through education and training, as Crossley (1966) notes. It may also show the effect of technological change on the occupational structure. Technological change may have very uneven effects on the demand

for labour and a relatively long time may be required to change the supply of certain skills. The easiest way, therefore, to analyze the implications of changes in the demand for and supply of labour is in terms of the occupational distribution of the labour force.

19. The demand for labour can be thought of in terms of the requirements of individual sectors for workers with different kinds of skills. It can be represented by a matrix in which each row represents an occupational group and each column an industrial group. Summing the rows and columns gives total employment by occupation and industry. The primary interest in making occupational projections is in the row totals of employment by occupation but the whole matrix is needed to identify the reasons for changes in the occupational composition of the labour force over time. It enables analysts to decompose the change in the number employed in each occupation into the component due to the growth or decline of sectors, which change employment by similar proportions in each occupation within a sector, and the component due to other factors, such as technological change, which have differential effects on the occupational distribution within sectors.

20. The supply of labour can be thought of in terms of the skills which have been provided or developed through education. Assuming a classification by occupation and education for the whole labour force is available, the supply of labour can be represented by a matrix in which each row represents an occupation and each column represents a different level of education. The supply matrix shows that there are different ways of preparing for a particular occupation and that different occupational choices can be made by persons benefiting from the same educational process. Summing the rows and columns gives total labour supply by occupation and education.

21. The great value of the labour market information provided by the occupation by industry, and occupation by education matrices is that every occupation, sector, and educational level is covered. Depending on the degree of disaggregation adopted assessments of the employment outlook can be made at different levels which are meaningful to individuals seeking a job, employers and trade unions trying to anticipate skill shortages, and policy makers wishing to identify changing trends in occupational labour markets.

22. Unemployment and vacancy statistics classified in the same way as census or labour force survey data on employment by occupation and industry would provide additional information on the labour market situation for particular occupational and industrial groups. However, vacancy data are normally derived from administrative records and considerable care is needed in using them as institutional changes can have a serious effect on the number of vacancies reported. Abraham (1991, p. 458), for example, notes that in Germany "the share of all new hires mediated by the labour office fell from about 45% to under 25%" and that this "implies that the true level of vacancies was somewhat more than twice as large as the official level in 1970, but roughly four times as large by 1985."

23. Data on employment by occupation and industry, and on occupation classified by educational attainment, are available for most OECD countries from the Census of Population at five or ten year intervals, and for some of them at one or two year intervals from labour force surveys. The census data typically provide the detailed cross classifications which are required to project the occupational structure once estimates of employment by sector are available for the target year from a macroeconomic or Input-Output model.

3. Forecasting Methods

24. Over the years a variety of methods have been used to project employment classified by occupation. These can be divided into matrix and non-matrix methods. Matrix methods take account of interrelationships between different occupations in different sectors. The most commonly used matrix

approach is the manpower requirements method. In view of its importance for occupational projection work it will be discussed separately in the next section. Matrix techniques such as the RAS and Markov are used to implement the matrix approach.

25. *RAS Model:* This model grew out of work by Stone and others on the Cambridge Growth Project on the temporal behaviour of Input-Output relations. One of the purposes of this project was to estimate a detailed social accounting matrix for 1960 and to make projections of the matrix for subsequent years. The most recent matrix available was for 1954 but the assumption that its input coefficients would remain constant was thought to be unacceptable. Good estimates were available for 1960 of industries' intermediate output and input totals, i.e., of the row and column sums for the transactions matrix for target year. Stone noted that an estimate of the transactions matrix for the target year, \hat{A}_{ij}^{t+n} , could be biproportionally related to the matrix for the base year, A_{ij}^t , by taking account of the ratio of the vector of row, r , and column, s , totals in the base year to the projected totals in the target year i.e., $\hat{A}_{ij}^{t+n} = rA_{ij}^t s$, and using an iterative procedure, involving pre- and post-multiplication of the transactions matrix by row and column vectors, to ensure satisfaction of the row and column constraints for the target year. This approach came to be known as the "RAS" model after the basic equation used to update the original transactions matrix. The RAS model has been adapted to project the occupational and industrial structure of employment. The base year matrix of employment by occupation and industry is post-multiplied by a vector of the ratio of estimated employment by industry in the target year, \hat{V}_j^{t+n} , to employment in the base year, V_j^t . The resulting matrix satisfies the constraint that projected employment in each industry must sum to estimated employment in each industry. The result of the first iteration is:

$$\cdot_1 \hat{A}_{ij}^{t+n} = A_{ij}^t (\hat{V}_j^{t+n} / V_j^t) = A_{ij}^t \cdot_1 S_j$$

If the matrix of employment by occupation and industry given by the first iteration is pre-multiplied by the ratio of the vector of employment in each occupation in the target year, \hat{U}_1^{t+n} , to the sum of employment in each occupation given by this matrix, $\sum_j \cdot_1 \hat{A}_{ij}^{t+n}$ the second iteration will give a matrix of employment by occupation and industry which satisfies the constraint that the sum of employment in each occupation must equal estimated employment in each occupation in the target year. The result of the second iteration is:

$$\cdot_2 \hat{A}_{ij}^{t+n} = (\hat{U}_1^{t+n} / \sum_j \cdot_1 \hat{A}_{ij}^{t+n}) \cdot_1 \hat{A}_{ij}^{t+n} = \cdot_1 r_i A_{ij}^t (\hat{V}_j^{t+n} / V_j^t) = \cdot_1 r_i A_{ij}^t \cdot_1 S_j$$

Since this iteration violates the constraint relating to employment in each industry repeated iterations, which will in turn satisfy and violate the industry and occupation constraints, are necessary until the series $\cdot_1 A_{ij}, \cdot_2 A_{ij}, \cdot_3 A_{ij}, \dots$ converges to a solution where both the row and column constraints are satisfied simultaneously. At this point the ratio of projected employment by occupation in the target year to the row sum of employment given by the last iteration will be a unit vector, and this will also be the case for employment by industry.

26. The RAS model is particularly suited for integrating information from two or more sources. For example, when there exist independent projections of employment by occupation and industry (i.e. of the

row and column sums of the occupation by industry matrix), from employer surveys, trend projections or other sources, but not projections of the occupational structure within each industry, the RAS model can provide a projection of the full matrix of employment classified by occupation and industry.

27. *Markov Model:* A Markov chain process is used to project the evolution of the occupational structure by multiplying the occupational structure in the base year by a matrix of probabilities of transitions between occupations. The transition probabilities show the likelihood of remaining in the same occupation and of moving between occupations during the projection period. Employment by occupation in the target year is derived by multiplying the projected occupational shares by an estimate of total employment in the target year. The Markov method has been used by Sabolo (1971) to make projections of the occupational structure of South Korea and Taiwan.

28. Non-matrix methods are generally used to directly project occupational employment by sector or the occupational share of employment by sector. Non-matrix techniques include the employers' survey, international comparison, labour-output, density ratio, and trend projection models. It is possible to make projections of the occupational structure using a mixture of these single cell techniques. Single cell techniques treat each occupation, or occupational share of employment, separately when the projections are being made. Interrelationships between occupations may be taken into account by these techniques by scaling the results to ensure that total employment by occupation equals total projected employment.

29. *Employers' Survey:* A survey of employers is a simple method of making occupational projections. Employers' responses to questions about the kind and quantity of labour they expect to hire over a particular period are aggregated and adjusted to take account of deaths and retirements to give a forecast of the expected increase in the demand for labour by the target date. This method has been used in Canada, France, the United Kingdom, the United States and other countries as Blaug (1972) and Hinchliffe (1987) note. While this technique has been used to make long-term projections of the demand for technical and scientific workers, it has been mainly used to make short-term projections geared to general employment policy. It suffers from two drawbacks. First, individual employers are unlikely to make consistent assumptions about the growth and structure of output over the forecasting period and, second, there are likely to be considerable differences in the care with which individual responses are given.

30. *International Comparison:* Information on the structure of employment in advanced countries with well developed statistical services is sometimes used by less developed countries with poorly developed labour market information as a model of how the occupational composition of the labour force could change as economic development takes place. The central argument of the international comparisons approach, that less developed countries can forecast their future skill requirements by examining the occupational and industrial structures of more developed countries has been called into question by the results of an OECD (1970) study which found that there are widely differing skill densities in countries at the same level of economic development.

31. *Labour Output, Density Ratio, and Trend Projection:* These techniques require information on output and occupational employment trends. The labour-output approach extrapolates the relationship between the numbers in particular occupations and sectoral or national output. The density ratio model uses the relationship between particular occupations and the total labour force in each sector to project future requirements. The trend projection model regresses occupational employment on a time trend and uses the regression coefficients to extrapolate employment into the future.

C. PROJECTING MANPOWER REQUIREMENTS BY OCCUPATION AND EDUCATION AND LABOUR SUPPLY BY EDUCATION

1. Estimating Manpower Requirements

32. When employment in a particular occupation is growing, investment in the skills needed for the occupation is likely to be individually and socially profitable. Hence, current and planned training and education patterns should be skewed towards the growing occupations. To meet the need for evaluation of the future demand for labour the manpower requirements method was developed by the United States Bureau of Labor Statistics in the 1950s. It was adapted in the 1960s by Parnes (1962), and used in the OECD Mediterranean Regional Project, to permit evaluation of the balance between future demand and future supply by taking account of the supply of labour qualified for each occupation. This included assessment of links between output from the education and training systems and supply of labour to particular occupations.

33. The Mediterranean Regional Project was undertaken by the OECD during the 1960s to promote the growth of education needed to cope with the common problems which shortages of trained manpower posed for the economic and social development of Greece, Italy, Portugal, Spain, Turkey, and Yugoslavia. A common view at that time was that the distribution of graduates from different levels of the educational system should bear a reasonable relation to the distribution of job opportunities in the economy. This pointed to the need for educational planning over a 10 to 20 year time horizon since it could take that long to develop the human capital required to achieve economic and social development targets.

34. Parnes (1962, par. 27) suggested that educational requirements could be assessed by attempting "to foresee the future occupational structure of the economy and to plan the educational system so as to provide the requisite numbers of personnel with the qualifications which that structure demands." This is the essence of the manpower requirements method. Parnes (1962, par. 30) drew a clear distinction between manpower requirements and the demand for labour when he argued that:

estimating future manpower requirements in the context of educational planning is not the same thing as forecasting future demand in the market sense....Rather, the idea of manpower requirements...relates to the functional (occupational) composition of employment that will be necessary if certain social and/or economic targets are to be achieved. The concept in other words, is more a technological than an economic one.

35. He argued that for the majority of jobs, production targets determine manpower requirements although there is not a unique relation between the output of an industry and the occupational composition of its labour force. Substitution of factors of production, including different kinds of labour, means that a given output can be produced by different occupational mixes. Nevertheless, Parnes (1962, par. 33) argued that:

within limits, a given level of labour productivity in a branch of activity (output per man-hour), dictates the required technology and the manpower structure (at least in terms of broad categories). This seems to be the only meaningful sense in which one can speak about the shifts in manpower structure required to produce given rates of economic growth: Increases in output per worker (which are the principal source of improvement in per capita income) occur primarily as the result of changes in production techniques, and it is the latter that dictate the functional composition of the work force.

36. A framework for making occupational projections was developed during the 1950s. This framework is still used by most of the agencies involved in occupational projection work today. It required that the projections should be made in a sequence of steps which would yield estimates of manpower requirements classified by occupation and level of education and of the expected supply of labour classified by educational attainment. These steps involved consideration of the current manpower inventory, the size of the total labour force, employment by industry, the occupational structure of each sector, the distribution of educational attainment by occupation, and the outflow from the education system classified by educational attainment.

37. *The Current Manpower Inventory.* The data needed to make an inventory of current manpower are labour force participation rates by five-year age groups and by sex, unemployment rates by occupation, the distribution of employment by sector, occupation, and sex, the educational qualifications of employed workers by occupation, and the distribution of the labour force by level of education and sex. The International Standard Classification of All Economic Activities (ISCEA) and the International Standard Classification of Occupations (ISCO) are used to classify the occupation data by sector and education.

38. *The Size of the Total Labour Force.* The projection of the total labour force sets an upper limit for the summation of specific manpower requirements. The population classified by sex and five-year age groups is projected by extrapolating labour force participation rates by age and sex and taking account of expected changes in hours of work, part-time work, retirement, shifts in industrial structure and changes in school attendance.

39. *Total Employment by Sector.* If a formal model of the economy is not available sectoral employment can be projected by extrapolating employment trends, e.g., by projecting the trend in the ratio of non-agricultural employment to total employment and then the trends in the ratio of employment in each major industry division to total non-agricultural employment. This approach was used extensively in the first generation of projection models. If a macroeconomic or an Input-Output model is available projections can be made of output by sector and these projections can be transformed into employment forecasts by using information on proposed changes in hours of work and making some assumptions about the growth of labour productivity.

40. *Occupational Structure by Sector.* The next step in projecting manpower requirements is to project the occupational composition of employment in each sector by using one of the occupational models outlined in the previous section. At the end of these four steps estimates of the number of persons required in each occupation should be available. The first generation of projection models placed considerable emphasis on deriving from these occupational estimates the implications for the educational qualifications of the labour force in the target year.

41. *Conversion from Occupation to Education.* Occupational data cannot be automatically converted into educational and training requirements because many occupations can be entered with different levels of education and jobs with the same title may have very different levels of performance requiring different levels of education. The first generation of models converted occupational requirements into educational requirements by making assumptions about what proportion of each occupational category would require each of the various levels and types of education and training. These assumptions were based on information about educational and training qualifications of workers within each occupational category and likely changes in job content in the future.

2. Estimating Labour Supply by Education

42. *Estimating Future Supplies of Educated Manpower.* The future supply of manpower whether classified by occupation or level of education is equal to the number of persons currently in a particular

category plus new entrants or re-entrants minus withdrawals due to death or retirement. Where an occupational classification is used allowance must also be made for movement between occupations. Since educational qualifications vary by age and sex, withdrawals from the labour force should be estimated by age group and sex. Where there are data for the base year for the working population classified by age, sex, and level of education withdrawals can be projected by subtracting the number of persons projected in each educational category in each cohort at time $t+1$ from the actual number at time t . This calculation will reflect the effect of withdrawals due to death and retirement and the net effect of changes in labour force participation rates and of net migration over the projection period.

43. Additions to the labour force by level of education are estimated from projections of the relevant age cohorts completing each level of education and not going on to the next level multiplied by estimates of labour force participation rates.

44. Having estimated manpower requirements and manpower supplies in the target year the first generation models compared the two sets of estimates to discover if there were any discrepancies between manpower supplies and manpower requirements by level of education. Shortfalls in the different categories indicated the extent to which the "output" of the relevant educational category should be expanded during the projection period to ensure that production targets would be met.

45. The models which are currently being used to make occupational projections are intended to provide information on the occupational employment outlook which can be used by the authorities to develop active labour market policies for education, training, and job creation and by individuals to make career choices. Educational and training authorities use the occupational projections to draw their own conclusions about the provision of education and training facilities. Individuals and vocational guidance counsellors use them as a source of information on current and future employment prospects in occupational labour markets.

D. OECD COUNTRY EXPERIENCES

1. Introduction

46. This section will give an overview of occupational projection work in Canada, France, the Federal Republic of Germany, the Netherlands, the United Kingdom, and the United States. It will give some information on the history of occupational projections in these countries but it will mainly concentrate on their more recent experiences. There have been significant differences in the approaches taken to occupational projections in Canada and the United States on the one hand and the Western European countries on the other. The experiences of the United States and Canada will, therefore, be considered in the first part of this section and the experiences of the remaining countries will be dealt with in the second part.

2. United States of America

47. Projections of the occupational structure of the United States have been made by the Bureau of Labor Statistics since the Second World War when there was concern about job placement of veterans. By the early 1960s aggregate demand had intensified strongly and there were fears that there would be shortages of qualified workers in some areas and surpluses of uneducated workers in others. Legislation was passed stipulating that the authorities should make available information about the prospects for occupational employment at state and national levels. These developments stimulated interest in the Bureau's occupational projections.

48. In the early 1960s also there was a change of emphasis in occupational forecasting in the United States from "onlooker forecasts" to "policy conditional forecasts". Onlooker forecasts take labour supply as exogenous. They start with a demographic projection, transform it into a labour force projection and make assumptions about unemployment and productivity to derive an estimate of GNP. This "supply side" or "capacity approach" assesses the implications of the growth of the labour force for GNP. Policy conditional forecasts take GNP as exogenous. Reasonable assumptions are made about unemployment and labour productivity to derive manpower requirements. These requirements are compared with resources and if they do not balance the implication is that measures should be taken to adjust labour supply to requirements.

49. The latest occupational projections for the United States relate to the period 1990-2005 (see Kutscher, 1991). The BLS (1988, p. 62) points out that:

the basic principles underlying the procedures used to develop the projections have remained constant over the years, but many changes in procedures have been made as new series of data become available and as statistical tools improve. The current methodology has been relatively unchanged since the late 1970s.

50. The Bureau makes long-term projections from a base year to a target year and it does not attempt to project year-to-year changes except for the labour force. The occupational projections are made in a sequence of six steps in which interlinked models are used to make projections of the labour force, the aggregate economy, industry final demand, the input-output structure of the economy, industry employment, and occupational employment. The BLS used the Annual Model of the U.S. Economy of Data Resources Inc. to make projections for the aggregate economy for the period 1990-2005. This is a relatively small scale econometric model which provides long-term macroeconomic policy simulations. Although the sequence of projection procedures includes labour supply projections, detailed comparisons of occupational supply and demand are not made. Projections are published only for occupations containing at least 25,000 persons.

51. The results at each stage of the projection process are linked by means of bridging tables and reviews and analysis by the researchers who are responsible for the development and maintenance of each of the six projection models. Several iterations of these models are usually necessary before the BLS staff are satisfied that the results of the projections are reasonable and internally consistent.

52. In all projection work certain assumptions have to be made about the state of the world which is expected to obtain during the projection period. The basic assumptions which the BLS makes include the following:

- work patterns will not change significantly over the projection period;
- broad social and educational trends will continue;
- there will be no major war;
- there will be no significant change in the size of the Armed Forces; and
- fluctuations in economic activity due to the business cycle will occur.

53. Further assumptions are made about high, moderate, and low rates of growth for certain variables such as the labour force, GNP, unemployment, employment, and inflation and three levels of economic activity are projected for the target year. The projections are also modified in the light of the expert judgements of BLS analysts. The Bureau stresses that estimates of the numerical impact of changes in technology and other factors will vary among analysts. It therefore makes clear all of the important assumptions underlying its projections and provides alternative projections which reflect uncertainty about the future. The projections are updated every two years and their performance is evaluated when information becomes available for the target year.

54. Sectoral employment projections are used by the BLS to derive forecasts of employment by occupation using a variant of the manpower requirements model. A matrix for the base year showing the distribution of occupational employment of wage and salary workers by sector is constructed using information on industry staffing patterns for such workers from the Occupational Employment Statistics surveys, the Current Population Survey, and the Census of Population. Data on the self-employed and unpaid family workers are derived from the last two sources for the economy as a whole rather than for each industry. The Office of Personnel Management compiles data on employment within the Federal Government.

55. The results of the Occupational Employment Statistics surveys are used to derive the ratio of occupational employment of wage and salary workers to total employment in each industry. The Bureau's Current Employment Statistics programme provides estimates of total employment by industry. The industry employment estimates are multiplied by these ratios to give an estimate of occupational employment of wage and salary workers by industry in the base year. Information on occupational employment in agriculture and private households and on employment by occupation in the Federal Government from the Current Population Survey and Office of Personnel Management respectively are added to the occupation-industry matrix. The resulting matrix is summed across industries and added to the national estimates of occupational employment of the self-employed and unpaid family workers to give an estimate of total employment classified by occupation.

56. The occupational coefficients which are yielded by this series of steps, excluding self-employed and unpaid family workers, are projected forward to the target year by allowing for changes in staffing patterns which are expected to occur on the basis of detailed information about trends which are identified through studies of specific industries and occupations. These studies focus on such factors as technological change, innovation in business organisation, responses to government policies, and decisions on the development and scrapping of products. The changes expected in the occupational coefficients over the projection period are published in a table which classifies them as small, moderate, or significant and which gives details of the reasons for the expected change.

57. Finally, the projected occupational coefficients are multiplied by the industry employment projections for the target year, summed across industries, and added to national projections by occupation for self-employed and unpaid family workers to provide the projected estimates of total employment by occupation for the target year. Different versions of the high, medium, and low occupational projections are produced and reviewed by staff working on this and other stages of the projection procedures. Outside experts with knowledge of labour market trends are also asked to comment on the projections so the final results represent a broad consensus of the opinions of those who make the projections and those who use them.

3. Canada

58. The first generation of occupational projections for Canada spanned the period from the mid-1960s to the first oil crisis in the early 1970s. Unlike the approach taken in Western European countries during this period the Canadian projections were intended as an aid to an active manpower policy rather than as an instrument for educational planning. Skill shortages and surpluses in the early 1960s stimulated interest in the quality of the Canadian labour force. Application of Denison's (1962) analysis of the contribution which different factors made to economic growth suggested that deficiencies in the quality of the labour force, measured by educational qualifications, were limiting the Canadian economy's growth potential. A Department of Manpower and Immigration was established in 1966 in response to recommendations by the Economic Council of Canada and other organisations.

59. In 1968 the first set of projections were produced by Meltz and Penz (1968) using the manpower requirements method. The projections were policy conditional and they covered 13 occupational and 15 sectoral groups. Subsequent projections covered a much larger number of occupations and a somewhat larger number of sectors. The first generation of models used to make projections for Canada suffered from a failure to take current labour market information and expert assessments into account in adjusting mechanical projections of occupational coefficients for each sector.

60. The experience gained with the first generation models was used by the Department of Manpower and Immigration and the Ministry of State, Science and Technology to develop a second generation of models in the mid-1970s. The Department developed the COFOR -*Canadian Occupational Forecasting* - model to make national and provincial employment projections for the periods 1974-82 and 1977-85 for 390 occupations and 69 sectors for jobs requiring no more than a high school education. The Ministry developed the HQM - *Highly Qualified Manpower* - model in the 1970s and used it to make projections of needs for graduates in 1985 by level of educational attainment and field of study.

61. The COFOR and HQM models subsequently provided the basis during the period 1980-83 for the development of COPS - the *Canadian Occupational Projection System* (see Employment and Immigration Canada (1991)). This family of interlinked projection models was designed (see Employment and Immigration Canada (1983, pp. 1-2)) by the Labour Market Supply and Demand Analysis Division to:

- supplement information on the current supply of and demand for workers by providing a medium- to long-term view of how this situation may change;
- look far enough into the future to allow employers, workers and governments to use projections effectively;
- supply information that can be updated to reflect economic and other changes;
- provide a range of future estimates, because of the uncertain nature of most demand projections;
- provide information on the basis of occupation and province; and

- make use of expertise in both the public and private sectors, with regular inputs from labour unions, professional associations, educational and other institutions, provincial governments and federal agencies.

62. COPS is designed to meet these objectives by integrating the top-down macroeconomic model based approach to occupational projections, used in the COFOR and HQM models, with a bottom-up approach using qualitative information on national, regional, and local labour markets. This information is provided by Federal and Provincial Government departments with labour market responsibilities, by Canada Employment Centres from their contacts with business, trade union and educational interests, and by detailed analysis of human resources in specific occupational and sector studies. These studies are carried out as part of the work of the Labour Force Development Strategy of Employment and Immigration Canada.

63. *Demand Side.* The sequence of procedures followed by COPS in making demand side occupational projections is initiated by consultation with provincial governments on potential economic performance at national and provincial level during the projection period. The results of these consultations provide the assumptions for making output projections. These projections are made by Informetrica Ltd., a commercial organization based in Ottawa, using a large scale macroeconomic model containing around 4,200 equations. Most of the equations are identities associated with the model's Input-Output block and the remainder (about 750) are stochastic.

64. The national economic projections produced for COPS are generally based on a view of the growth potential of the Canadian economy if occupational imbalances are removed, rather than an actual forecast of what is expected to happen. The projections of occupational imbalances which are provided by COPS are intended to show what would happen if steps are not taken through training, immigration, and other means to avoid imbalances. If these steps are effective the projected imbalances will not, in fact, occur.

65. The initial output projections from the macroeconomic model form the basis for consultation with provincial governments and industry. The judgements emerging from these discussions are used to modify the output projections. The modified national output projections are then transformed into employment projections for over 60 sectors. The sectoral employment projections are converted to occupational projections, using Census of Population data on occupational employment by sector, by trend and RAS extrapolation of occupational shares in each sector. Projections are now made for over 500 occupations.

66. The occupational projections are broken down by province using occupation by industry matrices for the provinces and following consultation with provincial governments, industry, and trade unions in each province. The results are considered at a federal/provincial review conference. Employment and Immigration Canada models changes in the industry/occupational profiles over time using a number of different techniques including the RAS procedure mentioned in Section B.

67. *Supply Side.* After consultations with Employment and Immigration Canada regional offices, other Federal Government departments and provincial governments concerning assumptions of fertility/mortality rates, immigration, emigration and interprovincial migration, COPS uses the Statistics Canada Demography Model to produce projections of population by age and sex for Canada, its ten provinces and two territories. These projections are fed into the Informetrica macroeconomic model and the COPS educational model. Labour supply is then determined by applying specific age/sex labour force participation rates to the projected population. Consultations take place with provincial governments, business, labour, and educational interests before formal methods are used to project on an education/occupation basis the supply of labour from the education and training systems, the household sector and the armed forces.

68. *Education System.* New occupational labour supply from the formal education system is derived from the COPS Student Flow Model. The general process involves the application of enrolment rates, by level of study, against specific population age groups to yield enrolments by level of study. Graduation rates are then applied to enrolments to yield graduates by level of study which are subsequently disaggregated into graduates/drop-outs by major field of study. All rates in the Student Flow Model are derived through a consultative process and may be easily altered by the user. Every four years Statistics Canada conducts a two year follow-up survey of post-secondary graduates to ascertain, among other things, the labour force status, industry and occupation of the graduate. This survey is funded to a large extent by Employment and Immigration Canada. A coupling of results from this survey with projections of graduates by major field of study allows the determination of future occupational supply from the formal training system for all provinces and territories.

69. *Training System.* New entrants to high-skill trades are projected in essentially the same way as for the education system. Statistics Canada collects data on the number of persons receiving training from private firms and from the provincial apprenticeship systems. Combining this with assumptions about dropout rates, the duration of training, and future training capacity enables projections to be made for each province of new entrants to high-skill occupations.

70. *Household Sector.* The household sector is defined to include all persons of working age not in the labour force and not going to school. It is an important source of labour supply for the Canadian economy as "secondary" workers move in and out of the labour force and the education system in response to changes in economic conditions. The COPS approach is to project the flows between this sector and the labour force using a rigorous analysis of the determinants of these flows. This means that immigration is left as a residual which can be adjusted to eliminate imbalances in particular labour markets.

71. *Armed Forces.* Employment in the Armed Forces is excluded from the COPS occupational projections but the flows from the civilian labour force into the Armed Forces and *vice versa* have a significant impact on the supply of particular occupations in certain localities. Hence, it is necessary to project these flows. These projections are made by province and occupation, following consultation with the Department of National Defence, by extrapolating recent trends in recruitment and attrition using the data systems maintained by the Armed Forces.

72. An attrition model is used to estimate the reduction in labour supply by occupation by province due to death, retirement, and emigration. COPS does not estimate occupational imbalances in a general quantitative sense. However, qualitative statements relating to shortages/surpluses are found in some specific occupational studies and the Current Occupational Imbalances List.

73. The consultation mechanisms built into COPS have been refined as experience has been gained in operating the system. A sector study process has been developed to provide detailed current information on changes within specific industrial sectors and to engage different interest groups in dialogue on the key human resource issues facing their sectors. Since 1984 approximately 11 sector studies have been completed. A number of permanent training councils consisting of representatives of business, labour, and government have been established to implement the recommendations of the sector studies. The most prominent of these councils are the Canadian Automotive and Repair Sector Council and the Sectoral Skills Council of the Canadian Electrical and Electronics Industry. The Sector Study process now receives funding under the Labour Force Development Strategy for 14 studies per year.³

³ I am grateful to Mr. Wayne Roth, Director, Labour Market Outlook, Employment and Immigration Canada for the information in this paragraph.

4. France

74. Economic planning has been used since the end of the Second World War by governments of all political persuasions in France as an important instrument for the development of the economy. While projections of national manpower requirements were initially made in the First Plan, covering the period 1947-50, they were not broken down by skill level until publication of the Fourth Plan by the Commissariat Général du Plan, covering the period 1962-65. This plan used the manpower requirements method and the judgement of labour market experts to derive projections for 7 occupational groups in 29 sectors. The objective of the occupational projections was to establish if there would be sufficient qualified workers in each occupation to achieve the goals of the plan. The projections were first used for educational planning and training purposes in France during the periods covered by the Fourth to the Sixth Plans, i.e., 1962-65 to 1971-75.

75. The poor performance of the occupation-education projections in the Sixth Plan and the substantial underestimation of structural transformations resulting from the first oil crisis in 1973 contributed to some loss of confidence in economic and human resource planning in France. The Seventh Plan, covering the period 1976-80 did not assign a role to the educational system in balancing the supply and demand for different skills. In addition the "educational-training promotion" co-ordinating group responsible for the preparation of the occupational projections included in the Seventh Plan a critical appraisal of such projections and they questioned whether educational planning was needed in France at a time when the economy was experiencing labour surpluses.

76. This critique led to a fundamental reappraisal of some of the assumptions underlying the occupational projection work which had been undertaken in France. The hypothesis that quantitative and detailed forecasts of actual recruitment needs by occupation will allow the determination of the optimal flow through the education and training systems was rejected. Consequently the planning authorities decided that they would not include official occupational projections in subsequent plans.

77. Nevertheless, demands for such projections continued to be expressed by different interest groups. The Minister for Social Affairs and Employment responded to these demands in 1987 by convening a Round Table on occupational training which brought together employers, trade unions, and organisations representing particular occupations. Its work led to the establishment of six working groups of which one was responsible for occupational projections and training. This group made a number of proposals for a new framework within which national and regional occupational projections could be provided for France. Its proposals were endorsed by the Conseil National de la Formation Professionnelle (National Council for Occupational Training) and officially agreed structures were established to permit a new start on projecting sectoral and occupational employment on an experimental basis in 1987.

78. These structures consist of a central authority and of Observatoires Régionaux de l'Emploi et de la Formation (Regional Observatories for Employment and Training) for the co-ordination of employment projection work on which employers, trade unions, and professional organisations are represented. They have three main objectives:

- (a) at macroeconomic level to provide a general framework for the analysis of medium-term occupational trends and the examination of alternative employment scenarios;
- (b) at regional level to arrange contracts between the State and the regions which will allow the development of regional employment projections;
- (c) at occupational level to provide for Contrats d'Etudes Prévisionnelles (Forecasting Study Contracts) between the State and occupational interest groups which will permit a common approach to occupational evaluation by the public and private sectors.

79. Following the establishment in 1987 of new structures for projecting employment by occupation two kinds of studies have been undertaken:

- (a) At the aggregate level a privately financed research organisation, the Bureau d'Information et de Prévisions Economiques (BIPE) which specialises in economic forecasting, uses a number of different models to quantify different scenarios relating to recruitment needs by occupational group. This organisation was commissioned by the Commissariat Général du Plan to prepare manpower projections for the period 1986-94 (see BIPE, 1990). Although the Commissariat Général du Plan continues to commission such projections as background material for the planning process it includes in the plan only projections relating to the aggregate labour market (see Commissariat Général du Plan (1988)).
- (b) At the occupational level studies of the changing structure and contents of employment have been carried out by organisations representing particular occupations. These studies have been financed out of the Fonds de la Formation Professionnelle (Funds for Occupational Training).

5. Federal Republic of Germany

80. Interest in occupational projection work in the Federal Republic of Germany dates from the mid-1950s when expansion of higher education due to social demand began to pose questions about the co-ordination of supply and demand in occupational labour markets. The manpower requirements approach was first used in Germany in the mid-1960s to project the expected demand for highly educated workers and to draw out the implications for the kind of graduates which the educational system should be providing. The Ministry of Labour and Social Affairs commissioned projections of the whole occupational structure from the Battelle-Institut in 1969 for the target year 1975/76. The Employment Promotion Act 1969 gave official responsibility for labour market projections to the Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbeit (Institute of Employment and Occupational Research at the Federal Employment Agency) in Nuremberg.

81. Labour market analysts in Germany hoped that their work would help to avoid labour imbalances and cyclical fluctuations. However, critics of the manpower requirements approach argued that these hopes were misplaced because the requirements approach does not take account of skill substitution possibilities within and between industrial sectors. They also argued that strict implementation of the requirements approach was not compatible with the exercise of freedom of choice by individuals in deciding on an education or an occupation. The poor performance of occupational projections during the 1970s allied with the provision in Article 12 of the Constitution that "all Germans have the right to choose freely a profession, a work place and an institution of education" led to the development of six main approaches to the relationship between education and employment as Teichler and Sanyal (1982, Chapter 6) note.

82. The approaches which were developed are:

- (1) The human capital approach: this studies the differences between the training with which graduates of the education system are equipped and the training they require to cope with job tasks. The results provided the basis for recommendations for curriculum reform.
- (2) The absorption approach: this focuses on the conditions under which the occupation system could absorb growing numbers of graduates of the education system.
- (3) The flexibility approach: this concentrates mainly on the extent to which persons with different training and educational levels could substitute for those presently employed.

- (4) The insertion approach: this studies the qualifications required for specific occupations and how enterprises introduce workers with different levels of education into the work process.
- (5) The rationalization approach: this looks at the interrelationships between technological development and the socio-economic system. While technological development raises educational requirements this approach emphasizes, as Teichler and Sanyal (1982, p.97) point out, that "the profit motive tends to lead to the rationalization decision to get by with personnel whose educational level is lower".
- (6) The status selection approach: this stresses the role of education and occupation in maintaining and legitimizing the social hierarchy.

83. The flexibility approach has had the greatest impact on occupational projections for Germany. It was adapted by the Institut für Arbeitsmarkt- und Berufsforschung of the Federal Employment Agency for its work on sectoral and occupational trends in labour markets. This change of approach occurred to take account of criticisms of the early occupational projection studies in Germany and it resulted in IAB ceasing to publish projections for conventionally defined occupational groups. The concepts of "branches of activity" and "professional profiles" were developed as alternatives to take account of substitution possibilities between different skills and levels of education.

84. Nadel (1991, Section 1) explains how these concepts were used to make projections for Germany for 42 branches of activity, 34 professional profiles and 5 levels of education for the period 1987-2010. The main activity of an individual is allocated to one of ten branches, (branch 5, for example, is writing, calculating, programming, while branch 7 is coordinating, organising, directing, managing). The professional profile is built up from information on the individual's main function, (for example, driving, repairing), the sector in which it is exercised, (agriculture, transport), and profession and level of qualification (supervisor, head of team).

85. The qualification projections are based on the projections of employment by field of activity. It is assumed that the shares of each qualification in the field of activity will approach limiting values in the course of time. These values, as Tessaring (1992) notes, are determined by fitting exponential trends to educational shares for the period 1976-1987 and using the results to project the shares to the target year using different assumptions about economic growth and the development of the qualification structure during the projection period.

86. The approach which IAB has developed allows for substitution between occupations and a range of possible qualifications. The primary objective of IAB is to provide projections, based on differing assumptions about the future development of the German economy, which will "sketch a broad range of possible futures" as Tessaring (1992, p. 23) points out. The provision of such information is intended to help policy makers to make informed decisions when considering alternative possibilities for the future development of the education system and for the attainment of greater efficiency in the operation of occupational labour markets. IAB emphasises, as Nadel (1991, p. 82) reports, that its projections do not have the properties required to guide individual choices in relation to education or occupation.

6. The Netherlands

87. There is a legal responsibility in the Netherlands for the government to provide adequate education for all individuals or groups for all levels of education, as Ruiter (1965) points out. Hence, the authorities are obliged to try and anticipate the demand for education at different levels by qualified individuals and to provide the necessary educational facilities to accommodate it. As in the German case legal requirements, therefore, account for the concern about the educational implications of occupational projections in the Netherlands.

88. The initial projections which were made for the Netherlands at the end of the 1950s were restricted to highly qualified manpower because it was thought that imbalances for jobs requiring only a short training period would be rectified quite quickly by the labour market. The projections were gradually extended during the 1960s to cover all educational levels and all occupations using the manpower requirements approach. This approach was criticised for not taking account of substitution possibilities for people with different levels of education and skills.

89. Efforts were made to develop models which would take account of substitution possibilities. These models used classifications of level of education and field of study which were too broad to be helpful in making educational or career choices. In the mid-1980s the Dutch Ministry of Education and Sciences commissioned the Researchcentrum voor Onderwijs en Arbeidsmarkt (Research Centre for Education and the Labour Market), to develop an information system for the educational labour market which would help second and third level students in making their educational and vocational choices [see Heijke and de Grip (1991)].

90. ROA uses Central Planning Bureau employment projections to forecast developments in education and the labour market for 23 sectors, 79 occupational classes, 5 levels of education, and 53 educational disciplines. Biennial Labour Force Surveys undertaken from 1975 to 1985 and annual surveys dating from 1988 are used to estimate regression equations which explain the occupational structure of each sector in terms of the past occupational structure, investment, and capacity utilization. The educational structure of the occupations represented in each sector is explained in terms of the relative share of each educational level in the potential labour force, investments in each sector as a proportion of value added in the sector, and the proportion of automation experts employed in each sector.

91. Changes in the educational share of an occupation are expected to depend on downward displacement of the less educated out of an occupation by the more educated. Beekman, Dekker, de Grip, and Heijke (1989) attempt to capture this substitution effect by including in their regression of occupational employment shares by level of education a variable for the share of the education level in the potential labour force. If there is downward displacement this variable will have a positive coefficient which increases as the level of education under investigation rises.

92. The share of each educational discipline in each education level is projected from a regression of this share on dummy variables for occupation and sector and a time trend. The number of persons in a particular educational discipline expected to be employed in all occupations in the target year is estimated by multiplying the discipline's occupational employment share by the occupational projection.

93. The employment prospects of new labour market entrants depend on retirements as well as new jobs. Replacement demand for the Netherlands is estimated by occupational class, level of education, and discipline. Adding the expected change in employment and replacement demand for each occupation gives total demand for labour by occupation. Since labour market re-entrants will fill some of these jobs the demand for school leavers by occupation is equal to the change in employment by occupation plus the outflow minus re-entrants. The sum of the last two components is equal to the net outflow from an occupation and they are estimated together for the purposes of calculating the demand for school leavers, as de Grip, Heijke, Dekker, and Groot (1987, p. 23) note. The results show those occupations where the demand for school leavers is expected to be strong and weak.

94. The outflow from each occupation is multiplied by the shares of graduates from each educational category in each occupational class to give outflows by educational category. Summing over occupational classes gives estimated replacement demand by discipline. The total demand for new workers with a particular education can be derived by summing the expected change in employment and the expected replacement demand for each educational category. The demand for labour by discipline and for graduates

by discipline are both expressed as a percentage of the number employed in each discipline. The strength of expected demand by discipline is then measured by the ratio of graduate demand to total demand.

7. United Kingdom

95. Occupational projections for the United Kingdom were first made during the Second World War to meet the demand for information on manpower requirements for war industries and for post-war reconstruction. After the war reform of the health and education systems led to a demand for projections of manpower requirements in occupations such as teaching and nursing. Numerous studies were subsequently carried out of manpower requirements for specific occupations by organisations in the public and private sectors. However, the British Government never assumed responsibility for making comprehensive occupational projections. Such projections were made from time to time during the 1950s and the 1960s by researchers working at different universities. Comprehensive occupational projections first became available during the 1970s when the Engineering Industry Training Board provided financial support for a Manpower Planning Unit at the University of Warwick. This unit provided the basis for the establishment of a Manpower Research Group and subsequently for the Institute for Employment Research, IER, which was set up by the University of Warwick in 1981.

96. The projections made by the IER have gone through several phases of development. The initial projections used the manpower requirements approach. The RAS method was used to try and refine the projections. Although it was found that the RAS model can provide better projections than some other simple models, it proved difficult to give a meaningful economic interpretation of the results. In the late 1970s a collaboration was entered into with researchers working on the Cambridge Growth Project to use and adapt the Cambridge Growth Model to make sectoral employment projections for the United Kingdom.

97. *Occupational Demand.* These estimates of sectoral employment provide the basis for making comprehensive occupational projections for the United Kingdom. The most detailed description of the projection procedures followed by the IER is given in a paper which Lindley (1984) read to the Fourth International Symposium on Forecasting in 1984. Although sub-models have been added since then and some of the procedures have changed following further work on the determinants of sectoral employment, the principles underlying the projections remain unchanged.

98. The Institute for Employment Research has always considered a full macroeconomic model an essential tool for labour market analysis and occupational forecasting. The Institute's view is that planning is necessary and that it is done by all economic agents. A model of the economy is, therefore, essential to bring out the consequences of proposed policies, to stimulate thinking about alternative policies, and to allow evaluation of policy options. IER uses a considerable degree of judgement in conjunction with formal models to make its economic and occupational projections. Lindley (1980, p. 7) stated that the primary objective of the Institute for Employment Research is:

to provide a set of "points of reference" for policy-makers, indicating the sort of environment which they are likely to face, highlighting the main problem areas, giving some quantitative guide to the scale and dimensions of these problems and attempting some estimates of the impact which different proposals would have upon them.

99. The Cambridge multi-sectoral dynamic model provides projections of employment in 49 sectors. An occupational model is used to project the occupational structure of each sector. The occupational projections for 1989 and previous years were made as follows:

- (i) Occupational coefficients in terms of persons employed in the Warwick Occupational Categories were estimated for each industry from two or more censuses;

- (ii) These occupational employment coefficients were extrapolated to the base year and scaled to sum to unity;
- (iii) Estimates of the non-manual/manual split were made for the base year and projected to the target year for each sector using Census of Population data for past decades and a combination of Census of Production and New Earnings Survey data for more recent years;
- (iv) The base year projections of occupational coefficients were adjusted to agree with the non-manual/manual split estimated in (iii);
- (v) Further adjustments were made to individual occupational categories in the light of other *ad hoc* information;
- (vi) The procedure outlined in steps (ii) to (v) was then repeated for the target year.

The *Review of the Economy and Employment 1991* (IER, 1991A, p. 38) reports that there has been a major reassessment of the occupational model which "has involved a substantial number of detailed revisions of the way in which occupational structure is projected within each industry" but it does not give any other information about the revisions.

100. *Labour Supply.* The demographic basis of the labour force projections is the official projection of the population for the target year by the Office of Population Censuses and Surveys. Projections of the labour force by age and sex are derived by applying estimates of labour force participation rates in the target year to the population projections. These participation rates take account of recent trends in age and sex-specific participation rates as shown by the Labour Force Surveys. The labour demand projections are allowed to influence the participation rates for certain age/sex groups. This is done by allowing sex specific participation rates to be influenced by sex specific unemployment rates. The impact of government employment and training programmes is also taken into account in projecting labour supply by assuming that some of the participants on the programmes would have been employed in the absence of the schemes.

101. When the projections of the labour force are complete they are compared with the employment projections to give the projection for total unemployment in the target year. The unemployment projection is adjusted to take account of the fact that not all of the unemployed will be eligible for unemployment insurance benefit because of inadequate National Insurance records or failure to meet the "availability for work" test. Information from the Labour Force Surveys is used to estimate "unemployed claimant" ratios which are used to convert the unemployment projection into an unemployed claimant projection, i.e., the official definition of unemployment.

102. *Regional Projections.* The introduction of the Training and Enterprise Councils (TECs) has stimulated considerable demand for information on training and skill issues at regional and local levels. IER has responded to this demand by developing a new forecasting model for the 11 U.K. standard regions to provide regional projections for 9 major occupational groups and 15 sectors. IER (1991B, p. 7) points out that this model "provides a bridge between the IER's existing occupational model and the Cambridge Econometrics (CE)/Northern Ireland Economic Research Centre (NIERC) regional model". The connection between the occupational and regional models is made by using a regionally-disaggregated version of the IER's occupational model.

103. *Employment by Qualification.* The projections of labour supply and employment by sector and occupation are linked to the demand for and supply of different educational qualifications by a qualifications model. IER notes that the *demand for qualified persons* is primarily related to changes in the occupational structure of employment and that qualified workers are concentrated in a relatively small

number of the Warwick Occupational Categories, WOC. In order to provide more detail these categories are disaggregated and the projections are made using a sub-WOC occupational model and a qualifications model. These models distinguish between males and females, 3 qualification levels, 10 subject categories, and 74 occupational categories. The qualifications data come from the Census of Population and Labour Force Surveys.

104. The occupation-industry matrix for each sex from an earlier stage of the projection procedures is used as input for the sub-WOC occupational model. It is aggregated across all industries to distinguish occupations in which the highly qualified are concentrated. The sub-WOC model is used to disaggregate these occupations into 74 sub-groups. The coefficients for persons holding different qualifications in each occupation are computed from the Census of Population for 1971 and 1981. Changes in the qualification coefficients are extrapolated to the base year for the projection and constrained to sum to unity for each occupational category. They are then compared with qualifications data from some of the Labour Force Surveys since 1979 and adjusted in the light of trends in educational qualifications shown by these surveys. The RAS procedure is used to ensure that the base year extrapolations agree with the Labour Force data on qualifications for the base year (see Wilson, Bosworth, and Taylor, 1990B). These adjustments are taken into account in extrapolating the proportion qualified in each occupation to the target year. The numbers expected to be employed in each occupation in the target year are multiplied by the scaled qualification coefficients to yield projections of absolute numbers employed classified by qualification.

105. The *supply of labour classified by qualification* is projected by using a simple stock flow equation in which the stock of qualified persons in the current year is linked to the stock in the previous year and inflows and outflows during the intervening period. An economic activity equation is used to project the number of qualified persons who are economically active. Rates of outflow by age and sex are determined by mortality and migration. Analyses of net migration indicate that this factor is of minor importance for the United Kingdom, although it may become more significant with the completion of the single European market after 1992. Mortality data, therefore, are used to provide estimates of outflows from the labour force. Simple autoregressive equations are used to project the inflow of new graduates as a proportion of the population at risk classified by sex, subject, and level of qualification.

106. Activity rates for most highly qualified persons tend to be around 100 per cent and they have varied little over time. It has been assumed by IER in projecting the supply of qualified labour to the year 2000 that these rates will move in line with those for the population as a whole.

107. Following completion of the demand and supply projections for the highly qualified the results are compared to show in what areas excess demand or supply are likely to arise. IER emphasises that its labour market balance results are based on two quite separate models which do not have adjustment mechanisms for bringing supply and demand for qualified labour back into balance. The projections do not, therefore, show what will happen. Instead, as Wilson, Bosworth, and Taylor (1990A, p. 49) note, they:

map out the implications of past trends in the patterns of supply and demand and highlight those areas where significant market adjustments will be required, and where policy intervention, by either government, employers or other key actors in the labour market for the highly qualified may be necessary. To the extent that these adjustments do take place, any projected imbalance will be reduced.

E. PERFORMANCE OF OCCUPATIONAL PROJECTIONS

108. Evaluations of comprehensive occupational projections have proved difficult for the United States and the Federal Republic of Germany because of intercensal revisions to the occupational classifications. In the United States, for example, projections were made in the early 1960s for 162 occupations for the period 1960-75. Changes in the occupational classification system between the 1960 and 1970 censuses left only 76 of the 162 detailed occupations sufficiently comparable for evaluation. There have been no evaluations yet of the occupational projections for the United Kingdom. However, the Institute for Employment Research at Warwick does plan to undertake an evaluation in the future and it should be noted that the Cambridge Econometrics multi-sectoral dynamic model, which provides employment projections by industry for the IER, has been evaluated and found to perform satisfactorily. A preliminary evaluation has been undertaken of ROA projections for the Netherlands for the period 1985-1992. The evaluation is tentative because the projection period still has some time to run and quantitative results are not yet available. Nevertheless, Heijke (1992, p. 9) reports that ROA's qualitative assessments of the labour market prospects for each educational discipline "were strikingly accurate", and that the quantitative projections of employment for each occupational group appear to be reasonably accurate.

109. The results of evaluations for the United States, Canada, and France are given in Table 2. There is no absolute way of judging the performance of occupational projections so three different measures are used in Table 2. The first is the mean absolute percentage error:

$$MAPE = 1/n \sum |E_j|$$

where E_j is the percentage error for the category j and n is the number of categories. This statistic is a common summary measure for evaluating the general performance of projections. The second measure is the distribution of the forecast errors. This provides information on the accuracy with which the actual values in the cells of the occupation by industry matrix are projected. Table 2 shows what proportion of the cells were projected to within plus or minus 10 per cent, 10 to 20 per cent, and more than 20 per cent. The third measure is the range of the projections. This shows whether the projections fall within a broad or narrow band around the actual values.

110. If a mean absolute percentage error of less than plus or minus 10 per cent or at least half of the cells being projected to within plus or minus 10 per cent are used as criteria of accuracy it is clear from Table 2 that the performance of the projections for all three countries for broadly defined occupational groups is satisfactory while that for more specifically defined occupations leaves scope for improvement. It is also clear that the range of the projections is directly related to the number of occupations included in the projection model. Hence, the additional information provided by projections for a larger number of occupations has to be balanced against the likelihood that the projection errors will increase.

Table 2: Accuracy of comprehensive occupational projections for the United States, Canada, and France

Country	Fore-caster	Period	Occs.	MAPE	Percentage error			Range (%)
					<10	10 to 20	>20	
United States	BLS	1960-75	76	21%	29	37	34	-43 to +136
	BLS	1960-75	9	6%	89	11	0	-7 to +10
	BLS	1970-80	64	22%	38	12	50	-47 to +89
	BLS	1970-80	9	7%	67	33	0	-17 to +1
Canada	Meltz & Penz	1961-71	12	10%	58	33	8	-46 to +15
	Ahamad	1967-75	12	12%	42	42	16	-40 to +14
	COFOR8 2	1974-81	10	13%	70	0	30	-43 to +10
France	CGP	1966-70	105	(10%)				-63 to +21
	CGP	1966-70	16	(6%)	94	6	0	-63 to +21
	CGP	1971-75	40	(12%)				

111. Although projection methods have improved over the years the performance of the occupational projections made for the 1970s for the United States and Canada was, in general, no better than the performance of projections made for the 1960s. However, two points should be borne in mind in considering this outcome. The first is that the United States and Canada, and many other countries, had to cope during the 1970s with severe structural adjustment problems due to the rapid increase in the price of energy which followed the first oil crisis in the early 1970s. The second is that the advantages of better forecasting techniques may have been eroded by an increasingly complex economic structure as Greenspan (1991) argues, and by lack of up-to-date time series data on such aspects of occupational labour markets as employment, unemployment, vacancies, wages and hours of work. It is encouraging, therefore, that there was no obvious deterioration in the performance of occupational projections for the 1970s for the United States and Canada.

F. THE NEO-CLASSICAL CRITIQUE AND THE RATE OF RETURN METHOD

112. When projections of the occupational structure of employment are combined with independent forecasts of labour supply, based on examination of retirements from the labour force and entries to occupations from the educational system, large discrepancies between supply and demand are often projected. In practice, such large discrepancies may not arise because when unemployment rates for particular occupations are high workers may be able to switch to different occupations. When vacancy rates are high wages may rise to choke off excess demand, workers may train for the skills which are in short supply and employers may adjust production techniques to substitute workers with a related skill who are in plentiful supply. The important question is: how long does it take the labour market to make these adjustments? Economists of the neo-classical and structural schools provide different answers which stem from their views about the way labour markets work.

113. In general, neo-classical economists argue that labour markets are flexible, that skill substitution is relatively easy, and that wage differentials adjust to quickly eliminate any imbalances which affect particular occupations. According to their critique of occupational forecasting, in its extreme form, this capacity of the economy to adjust means that there is very little need for occupational projections, and even less for government intervention in the labour market. However, neo-classical economists do accept that there is a need for information on the skills and occupations in which the best returns to investment in human capital can be earned. Individuals should move into occupations which currently have low unemployment rates and which have high wages, relative to the investment in training they require. This is the common sense basis of the human capital approach which was developed by Becker (1964) and others during the 1960s.

114. Becker pointed out that education and training could be viewed as a form of investment by the individual and the state in human capital which yields benefits to both in the form of increased productivity and earnings. The human capital approach, therefore, focuses on the returns to investment in education and training and does not attempt to make explicit projections of the demand for each kind of labour. It allows for substitution of one type of labour for another and of one factor for another, e.g., semi-skilled for skilled labour or energy for materials. It uses lifetime earnings functions and information on the direct cost of investment by the State and the individual in the different kinds of education and training and indirect costs by way of foregone earnings to derive estimates of the social and private rates of return to such investment.

115. If the social rate of return on the investment is greater than the social discount rate the investment should be undertaken whereas if it is less it should not be. The private rate of return is calculated in similar fashion and it can be used as an indicator of occupations where the private demand for education may exceed or fall short of the demand which planners deem desirable on social grounds.

116. The main difficulty with implementing the rate of return approach is that for most countries the detailed earnings and cost data which are required for different occupations and levels of education are not available. Normally the analysis can only be developed to give information on the rate of return to very broadly defined educational or occupational categories, e.g., secondary, vocational and third level, or skilled and unskilled.

117. The structural school argues that labour markets are relatively inflexible, that skill substitution is difficult, and that wage differentials do not adjust quickly to clear the labour market. Their view of the labour market convinces them that there is a need for occupational projections to identify the size and characteristics of potential imbalances in particular labour markets. They believe that such projections can help to:

- (a) highlight the implications of existing occupational trends;
- (b) provide information for policy makers on the current position of occupational labour markets and the sort of changes which might occur in the future;
- (c) bring to the attention of policy makers the effect which different courses of action could have on the level and structure of employment in the future;
- (d) provide general guidelines for active labour market policies in the areas of training, job placement, and job creation.

118. Lindley (1980, p. 15) notes that "evidence of market failure or very slow operation of the market mechanism is commonplace" at the disaggregate level. Haskel and Martin (1990, p. 2) note in their paper on skill shortages in Britain that business surveys showed that skill shortages existed throughout the countries of the European Community during the period 1987-89 and that "shortages of skilled labour are a peculiarly British problem." The Commission of the European Communities (1991, Chapter 7) points out that its quarterly business surveys suggest that skill shortages increased throughout most of Northern Europe during the 1980s.

119. The aggregate evidence relating to the scope for skill substitution has been reviewed by Stewart (1978). She shows that the choice of production technique is bound up with the question of substituting less skilled for more skilled labour. Hence, the scope for skill substitution is part of the larger question of the scope for factor substitution. A survey by Morawetz (1976) of studies of the elasticity of factor substitution in different manufacturing industries in developing countries shows that the estimates range in value from 0 to 2 but that on average they are quite low with an overall mean value of 0.95. Colclough (1990, p. 12) notes in commenting on these results that:

There are, of course, major difficulties in interpreting these econometric estimates. The CES production functions from which they are derived have to adopt highly restrictive assumptions.... There are also inherent conceptual problems arising from their treatment of the measurement and aggregation of capital. Nevertheless the judgement they suggest - that actual substitution elasticities are generally low - is strengthened by evidence from micro studies. These studies indicate that whilst a range of technically efficient techniques does usually exist in manufacturing, viable choice is fairly restricted, and is less influenced by factor prices, and more by history and circumstances than many economists believe.

The evidence from macroeconomic and microeconomic production function studies therefore suggests that the scope for skill substitution is rather limited.

120. These results together with Freeman's (1977, p. 165) demonstration that the manpower requirements approach "does *not* hinge solely, as is usually argued, on the extent of factor substitution" point to a role for occupational projections in identifying areas of future mismatches between the demand for and the supply of labour and upwards pressure on wages. It should also be recognised that while the ideal forecasting procedure might be to model the production function and the labour supply decisions of individuals and substitution between occupations in production, using occupational wage data as well as employment data, such detailed data are rarely available and the manpower requirements approach remains the most practicable means, for most countries, of projecting the structure of employment by occupation.

G. DISSEMINATION AND USES OF OCCUPATIONAL PROJECTIONS

121. Projections into the medium- and long-term future of the occupational structure of employment and, if available, the occupational structure of labour supply cannot be expected to be highly accurate. They are best used as indicators of the area of potential mismatch and stress in the labour market that will arise assuming a continuation of known trends and patterns of investment in education.

122. To be of practical use, the information obtained via the projections needs to be disseminated to actors in the labour market such as individuals making career choices, vocational guidance officers, and the managers of education and training institutions and the government departments which influence them through planning and financing. The projections may be most useful when combined with further information of a qualitative kind, perhaps with a focus on certain types of specialized training and education. This section gives some specific examples from a number of countries of the ways in which occupational projection results are made available to a variety of actors in the labour market and the different uses which have been made of such projections by a range of government departments and other organisations.

1. Dissemination

123. Different kinds of publications have been developed by the projection agencies to meet the demands of users for general and specific information on the employment outlook in forms which are tailored to fit their interests. These publications include flagship reports, reference reports, handbooks, computer diskettes, compact disks, and specific sectoral and occupational studies.

124. *Flagship reports* are used to make available detailed information on the occupational projections and to give a broad overview of likely developments in occupational labour markets during the projection period. The results of the projections for the United States are first published in the *Monthly Labor Review* in the Autumn of odd-numbered years in separate articles on the labour force, the aggregate structure of the economy, industry output and employment, and occupational employment. The projections are also published in the *Occupational Outlook Quarterly* together with special articles on new occupations and changing job market conditions for existing occupations. Detailed projection results for the United Kingdom are published every 18 months or so in the Institute for Employment Research's *Review of the Economy and Employment* and summaries are published in the Institute's quarterly *Bulletin*.

125. *Reference reports* are used to make generally available the projection results produced for Canada by COPS and by ROA for the Netherlands. The reports for Canada provide information on the national reference outlook and the outlook for the Provinces while those for the Netherlands give forecasts of employment growth, replacement demand, and inflows of school leavers as well as information on job openings and labour market prospects.

126. *Handbooks* for guidance counsellors and job seekers are used to present the projections in a context where they can be used in conjunction with a wide range of information on jobs to help reach decisions on education and career choices. Qualitative information on the outlook for over 200 occupations in the United States is published in the *Occupational Outlook Handbook* which is the primary source of information for people wishing to choose a career. This handbook also presents information for each occupation on the nature of the work, working conditions, training requirements, earnings, related occupations, and sources of additional information. A statistical and research supplement entitled *Occupational Projections and Training Data* is published biennially to accompany the occupational handbook. A two volume publication called *Job Futures* is published for Canada by Employment and Immigration Canada. These volumes are designed for guidance counsellors and employment professionals.

The first volume, *Job Futures: Occupational Outlooks* provides information on nearly 200 occupational categories. It outlines the nature of the work in each category, the educational background and skills needed to enter the occupation, the source of supply for the occupation, market conditions and job prospects, annual earnings, and employment trends. The second volume, *Job Futures: Experience of Recent Graduates*, provides information on 187 fields of study at trade/vocational, community college, undergraduate, graduate, and doctoral level. It outlines entry requirements and course content, provides information on graduate trends and projections, the labour market experience of recent graduates, and how recent graduates rate their courses in the light of labour market experience. A handbook called *Jobs of the Future: A Guide for Youth* is also published. It contains a summary of the information from the *Jobs Futures* publications on 64 occupations. For these occupations it describes the job, education and experience requirements, employment prospects, and information on earnings.

127. *Computer diskettes* are used by the Bureau of Labor Statistics Division of Financial Planning and Management to make available to private organisations and the employment agencies of State governments the matrix showing the projected occupational structure of each industry in percentage terms. This information is used to develop occupational projections at State level. The COPS data base and occupational projections for Canada are available on diskettes which can be accessed by personal computer using the COPS Information Manager. The information manager is designed to give Employment and Immigration Regional Officers access to a wide range of information on national and regional labour markets and to allow them transfer data to a Lotus spreadsheet for further analysis. The projections made by ROA for the Netherlands are used as an input to the I-See! *compact disk* system operated by the Landelijk Dienstverlenend Centrum voor studie- en beroepskeuzevoorlichting (National Career Guidance Information Centre) at the Hague. I-See! (Information System on Education and Employment) contains, on CD-ROM, labour market projections for around 100 occupational classes and about 50 different types of education, data on more than 17,000 training programmes and 1,500 job profiles. It has three interlinked modules dealing with training, occupations, and jobs. Users can get information about the relationship between training courses, the jobs which can be done after completion of a specific course, and job prospects. The main clients for I-See! are school counsellors, career advisers, personnel officers and employment counsellors.

128. *Sector and occupational studies* for Canada within the COPS framework are issued by Employment and Immigration Canada. Similar studies are undertaken for the United Kingdom by the Institute for Employment Research at Warwick. These studies focus on employment and technology trends and the labour market outlook for particular occupations. To date sector studies for Canada have been published on automotive repair, trucking, electrical/electronic manufacturing, Canadian textile industries, technology change in Canadian municipalities, aircraft maintenance, commercial printing, and restaurant and food services. Occupational studies have been published on mechanical construction, nursing, the piping trades, and engineering technicians. For the United Kingdom the Institute for Employment Research has published occupational studies for managers and administrators, professionals, associate professionals, clerical and secretarial occupations, craft and skilled manual occupations, sales occupations, plant and machine operatives, construction occupations, and other occupations.

2. Applications⁴

129. Occupational projections have served as inputs to the program needs of a range of government departments and other agencies. In the United States the Department of Housing and Urban Development, for example, has used employment projections for construction occupations to assess the manpower implications associated with residential housing construction goals; the National Science Foundation has used the Bureau's projections to assess the implications for scientific manpower of alternative assumptions regarding research and development expenditures. The Department of Health and Human Services uses the projections for health workers to monitor supply-demand conditions for professional and allied health personnel. The Hudson Institute was commissioned by the Department of Labor towards the end of the 1980s to undertake a study of the forces shaping the American economy and to look at the implications for work and workers in the year 2000 (see Johnston and Packer, 1987). The foundation for the Institute's employment scenarios was provided by the BLS occupational and industrial projections.

130. The BLS uses its projections, as Kutscher (1991, p. 3) notes, to draw attention to:

(1) education and training needed for the projected jobs, (2) variation in job opportunities for those with different levels of education, (3) the range of three alternatives prepared by BLS and their employment and other implications, and (4) the changing race, age, and sex mix of the labour force.

The Bureau believes from its contacts with human resource planners that its projections are very useful in formulating policies to ensure that the labour force in the United States will be properly equipped with the skills needed for tomorrow's jobs. The Bureau also emphasises that while its detailed occupational projections are primarily designed for use by school leavers and other job seekers the questions which policy makers pose, for example in relation to the provision of educational programmes, cannot be answered without such detail.

131. Occupational projections for Canada have been used in a variety of ways. Human resource planners have found them helpful in investigating the labour market outlook for a wide range of occupations. Educational institutions have employed them to help guide their course offerings and longer-term planning. Labour unions have applied them to the exploration of medium-term employment prospects for their members. Business organisations have utilised them to identify potential skill shortages and the growth of occupations using business services. Guidance counsellors have found them invaluable in helping students with career and course choices. Employment and Immigration Canada itself has used the projections to take decisions on the provision of training places and the admission of immigrants. Other government departments and agencies have used them to identify the demand for and potential sources of supply of highly qualified workers.

132. In West Germany manpower forecasts have been used in the Federal Ministry of Labour and Social Affairs to explore a range of options for the potential labour force in the light of long-term population projections. The forecasts have also been used to analyse the implications of past trends for short-term changes in the labour market.

⁴ Information for this section has been kindly supplied by Mr. Ronald Kutscher, Associate Commissioner, Office of Employment Projections, Bureau of Labor Statistics, and Mr. John Paty, Special Assistant to the Deputy Under Secretary, Department of Labor, United States of America; by Mr. Wayne Roth, Director, Labour Market Outlook, Employment and Immigration, Canada; by Mr. Dietrich Willers, Policy and Planning Directorate, Federal Ministry of Labour and Social Affairs, Germany; by Mr. P. A. Boot, Ministerle van Social Zaken en Werkgelegenheld and Mr. N. Veeken, Training and Training Providing Division, Arbeids Voorziening, the Netherlands; and by Mr. Stephen Creigh, Resources and Strategy Directorate, Department of Employment, United Kingdom.

133. The projections produced by ROA for the Netherlands of expected future demand for labour by occupation and of future supply by type of education are used in conjunction with the National Career Guidance Information Centre's large data bank on training courses and job profiles in the I-See! system to link information on the labour market, education, and jobs. The user is informed about the relationships between educational courses, the range of jobs which he or she is equipped for by following a specific course, and the labour market prospects of these jobs. The I-See! system has been especially developed as an advisory tool for training and career guidance. The main client groups for I-See! are school counsellors, careers advisers, personnel officers and employment counsellors.

134. Occupational projections for the United Kingdom have been used to brief Ministers and senior official on likely general trends in employment patterns over the medium-term. The projections provide one input into official thinking on the future "shape" of the British labour market. The actual numbers in the projections are treated as indicating possible orders of magnitude of employment change by industry and occupation rather than as forecasts of what the future labour market position will be. The Department of Education and Science, the Department of Employment, and the Welsh Office have used the IER projections of change in employment by occupation for the period 1989-2000 as an input into the British Government's plans for improving and developing the United Kingdom's education and training system. These plans have been published in *Education and Training for the 21st Century* (see HMSO (1991)).

H. CONCLUSION

135. The reasons for which occupational projections have been made have changed over the years in response to changing economic circumstances and greater understanding of the relationships between occupational labour markets and the education and training systems. Occupational projections were originally developed, during World War II and its aftermath, and used by central planners in some OECD countries to mobilise labour during wartime and to minimise the disruption which unregulated demobilisation of the security forces would have caused in occupational labour markets in peacetime. During the economic expansion of the 1950s and 1960s occupational forecasts were adapted by educational planners to help anticipate imbalances in labour markets and to regulate the outflow of qualified manpower from the educational system. In the more volatile economic climate of the 1970s and 1980s occupational forecasts have been used by labour market analysts to provide individuals with information on the current position of occupational labour markets, the implications of existing occupational trends, and the sort of changes which might occur in the future. They have also been used to bring to the attention of policy makers the effects which different courses of action could have on the level and structure of employment in the future, and to give them general guidelines for active labour market policies in the areas of training, job placement, and job creation.

136. Despite these changes occupational forecasting work has suffered from its early association with central planning and it has continued to suffer from unrealistic expectations of how accurately it can anticipate future developments in occupational labour markets. There have been repeated and sustained criticisms of manpower forecasting practice and continuing arguments that such work should be abandoned because it is alleged to do more harm than good. Psacharopoulos (1991), for example, refers to these criticisms and argues that manpower forecasting may have contributed to the increase in unemployment among school-leavers over the years.

137. Labour market analysts have been clear, since at least the mid-1970s, that the initial emphasis which was placed in some OECD countries on the uses of manpower forecasts for central planning purposes was misplaced. They responded to criticisms of the first generation of projection models by reappraising their methods, improving current information on labour markets, and changing the emphasis of the projections from a concern with educational planning to the provision of information for active labour market policies in the areas of training, job placement, and job creation. They also followed Cairncross's (1969) advice that forecasts should not be taken too literally, or presented as telling policy makers what to do, but that they should be offered as one among many pieces of information which decision makers require to assess the risks inherent in the present labour market situation. They consistently emphasise that the primary purpose of occupational forecasting is to provide policy makers and individuals with a basis for more informed analysis of current and future labour market conditions in a context where it is not easy to interpret labour market signals.

138. It should also be borne in mind that the performance of occupational projections for broadly defined groups does not appear to have been any worse than the performance of forecasts for other economic aggregates. For example, during the period from the end of the 1960s to the end of the 1980s the performance of macroeconomic forecasts was very mixed. This led some commentators to question their usefulness to policy makers. However, Wallis (1989, p. 56) points out in his survey of the macroeconomic forecasting record during this period that "forecasting disappointments led not to complete changes of direction but to constructive reappraisals and eventual improvements, also changes of emphasis." The response of labour market forecasters to criticisms of their work has, therefore, been similar to that of other economic forecasters. Like other economic forecasts occupational forecasts provide, in Colclough's (1990, p. 20) words, "a detailed, consistent and plausible picture (if properly done) of how the future might look". This picture is worth providing because it can reduce uncertainty about the future and make an

important contribution to the decisions which policy makers and individuals have to take with regard to education, training, and choice of occupation.

139. Labour market analysts faced with increasing demands for information on the current position of occupational labour markets and for greater accuracy in their occupational projections can take encouragement in their occupational forecasting work from Zarnowitz's (1991, p. 25) comment on the question "has macroeconomic forecasting failed?":

as a practical activity the results of which are marketed, recorded, researched, and tested, macroeconomic forecasting is very young by any standard. There is little doubt that it will always disappoint the hopes of many, but also a high probability that it can be developed well beyond its present early stage. If macroeconomics has a long way to go, as I believe to be the case, then macro-forecasts too should still be far from the limits on their improvability, even if such limits were to prove much narrower than the early enthusiasts thought."

REFERENCES

- Abraham, K.G. (1991), "Mismatch and labour mobility: some final remarks", in F. Padoa Schioppa, (ed.), *Mismatch and Labour Mobility*. Cambridge: Cambridge University Press.
- Becker, G. (1964), *Human Capital*. New York: Columbia University Press for NBER.
- Beekman, Th. B. J., R. J. P. Dekker, A. de Grip, and J. A. M. Heijke (1989), "An Explanation of the Educational Structure of Occupations", Research Centre for Education and the Labour Market, Maastricht, ROA-W-1989/3E.
- Blaug, M. (1972), *An Introduction to the Economics of Education*. Harmondsworth: Penguin Books.
- BIPE (1990), *Mise en Place du Systeme d'Observation et de Prevision des Emplois et des Formations a Moyen Terme (Modele CALIFE)*. Paris: Bureau d'Information et de Previsions Economiques.
- Bureau of Labor Statistics (1988), *Projections 2000*. Washington, D.C.: Government Printing Office, Bulletin 2302.
- Cairncross, A. (1969), "Economic Forecasting", *Economic Journal*, Vol. LXXIX, No. 316.
- Colclough, C. (1990), "How can the manpower planning debate be resolved?" in International Labour Office, *Quantitative Techniques in Employment Planning*, Geneva: International Labour Office.
- Commissariat Général du Plan (1988), *Relations Sociales et Emploi*. Paris: Commissariat General du Plan, Commission No. 3.
- Commission of the European Communities (1991), *Employment in Europe*. Brussels: Directorate-General for Employment, Industrial Relations and Social Affairs.
- Crossley, J. R. (1966), "Essential Statistics for Manpower Forecasting", in B. C. Roberts and J. H. Smith, (editors), *Manpower Policy and Employment Trends*. London: Bell and Sons for the London School of Economics and Political Science.
- Denison, E. F. (1962), *The Sources of Economic Growth and the Alternatives Before Us*. New York: Committee for Economic Development, Supplementary Paper No. 13.
- Employment and Immigration Canada (1983), *COPS: An Overview, An In-Depth View*. Ottawa: Employment and Immigration Canada, Strategic Policy and Planning, Labour Market Outlook and Structural Analysis Directorate (WH-3-337).
- Employment and Immigration Canada (1991), *Notions and Numbers: The Canadian Occupational Projection System (COPS)*. Ottawa: Employment and Immigration Canada, Labour Market Outlook and Sectoral Analysis, Strategic Policy and Planning.
- Freeman, R. B. (1977), "Manpower Requirements and Substitution Analysis of Labor Skills: A Synthesis", in R. G. Ehrenberg, (ed.), *Research In Labor Economics: An Annual Compilation of Research*. Connecticut: JAI Press.

- Greenspan, A. (1991), "Economic Forecasting in the Private and Public Sectors", *Business Economics*, January.
- Grip, A. de., J. A. M. Heijke, R. J. P. Dekker, and L. F. M. Groot (1987), "Labour Market Prospects for Occupations and Academic Studies in 1992", Research Centre for Education and the Labour Market, Maastricht, ROA-W-1987/1E
- Haskel, J., and C. Martin (1990), "The causes of skill shortages in Britain", Queen Mary and Westfield College, University of London, Department of Economics, Paper No. 226, (mimeo).
- Heijke, J. A. M. (1992) "ROA: Activities and Plans Relating to the Information System on Education and the Labour Market", Research Centre for Education and the Labour Market, Maastricht. Paper presented at the ROA Symposium, *Education and the Labour Market: From Research to Information for Policy-Making*, Maastricht, 8 May, 1992.
- Heijke, J. A. M., and A. de Grip (1991), "The Information System on Education and the Labour Market Developed by ROA", Research Centre for Education and the Labour Market, Maastricht, ROA-W-1991/2E.
- Hinchliffe, J. K. (1987), "Forecasting Manpower Requirements" in g. Psacharopoulos (editor), *Economics of Education: Research and Studies*. Oxford: Pergamon Press.
- HMSO (1991), *Education and Training for the 21st Century*, Volumes 1 and II. Department of Education and Science, Department of Employment, Welsh Office, Cm. 1536.
- Hughes, G. (1991), *Manpower Forecasting: A Review of Methods and Practice in Some OECD Countries*. Dublin: FAS/ESRI Manpower Forecasting Studies, Report No. 1.
- Institute for Employment Research (1991A), *Review of the Economy and Employment: Occupational Assessment*. Warwick: University of Warwick, Institute for Employment Research.
- Institute for Employment Research (1991B), *Review of the Economy and Employment: Regional Assessment*. Warwick: University of Warwick, Institute for Employment Research.
- Johnston, W. B., and A. H. Packer (1987), *Workforce 2000: Work and Workers for the Twenty-first Century*. Indianapolis: Hudson Institute.
- Kutscher, R. E. (1991), "New BLS projections: findings and implications", *Monthly Labor Review*, November.
- Lindley, R. M. (ed.), (1980), *Economic Change and Employment Policy*. London: Macmillan.
- Lindley, R. M. (1984), "Forecasting the Labour Market". Paper presented at the Fourth International Symposium on Forecasting, London, July 8-11, 1984.
- Meltz, N. M., and G. P. Penz (1968), *Canada's Manpower Requirements in 1970*. Ottawa: Queen's Printer.
- Morawetz, D. (1976), "Elasticities of substitution in industry: What do we learn from econometric estimates", *World Development*, Vol. 4, No. 1.

- Nadel, H. (1991), "L'Experience Etrangere en Matiere de Prevision de l'Emploi, des Metiers et des Qualifications", in Rapport du groupe de travail preside par Monsieur J. Freyssinet, 1991. *Pour une Prospective des Metiers et des Qualifications*. Paris: Commissariat General du Plan.
- OECD, (1970), *Occupational and Educational Structures of the Labour Force and Levels of Economic Development: Possibilities and limitations of an international comparison approach*. Paris: Organisation for Economic Co-operation and Development.
- Parnes, H. S. (1962), *Forecasting Educational Needs for Economic and Social Development*. Paris: Organisation for Economic Co-operation and Development.
- Psacharopoulos, G. (1991), "From manpower planning to labour market analysis", *International Labour Review*, Vol. 130, No. 4.
- Ruiter, R. (1965), "Manpower forecasts and educational planning in the Netherlands", in OECD, *Human Resources Development: Manpower Forecasting in Educational Planning*. Paris: Organisation for Economic Co-operation and Development.
- Sabolo, Y. (1971), "A structural approach to the projection of occupational categories and its application for South Korea and Taiwan", *International Labour Review*, Vol. 103, No.2.
- Stewart, F. (1978), *Technology and Underdevelopment*. London: Macmillan.
- Teichler, U., and B. C. Sanyal (1982), *Higher Education and the Labour Market in the Federal Republic of Germany*. Paris: UNESCO, International Institute for Educational Planning.
- Tessaring, M. (1992), "Manpower Requirement by Qualifications in the FRG Until 2010". Paper presented at the ROA Symposium, *Education and the Labour Market: From Research to Information for Policy-Making*, Maastricht, 8 May, 1992.
- Wallis, K. (1989), "Macroeconomic Forecasting: A Survey", *Economic Journal*, Vol. 99, No. 394.
- Wilson, R. A., D. L. Bosworth, and P. C. Taylor (1990A), "Projecting the Labour Market for the Highly Qualified", University of Warwick, Institute for Employment Research (mimeo).
- Wilson, R. A., D. L. Bosworth, and P. C. Taylor (1990B), "Projecting the Labour Market for the Highly Qualified: Statistical Annex", University of Warwick, Institute for Employment Research (mimeo).
- Zarnowitz, V. (1991), "Has Macro-forecasting Failed?", NBER Working Paper No. 3867.

LABOUR MARKET AND SOCIAL POLICY OCCASIONAL PAPERS

(Already available, free of charge)

- No. 1 *AN ECONOMIC FRAMEWORK FOR THE EVALUATION OF CHILD CARE POLICY* (1990)
(Donald Verry)
- No. 1 *UN CADRE ÉCONOMIQUE POUR L'ÉVALUATION DES POLITIQUES DE GARDE D'ENFANT* (1990) (Donald Verry)
- No. 2 *HEALTH AND PENSION REFORM IN JAPAN* (1990)
- No. 3 *WRONGFUL TERMINATION LITIGATION IN THE UNITED STATES AND ITS EFFECT ON THE EMPLOYMENT RELATIONSHIP* (1990) (Susan R. Mendelsohn)
- No. 4 *STATISTICS OF ANNUAL EARNINGS IN OECD COUNTRIES* (1990) (David Grubb)
- No. 5 *WAGE DIFFERENTIALS, ENTRY AND THE JOB GENERATION PROCESS IN GERMANY* (1990) (Tito Boeri)
- No. 6 *EQUAL PAY FOR WORK OF COMPARABLE WORTH: The Experience of Industrialised Countries* (1991)
- No. 6 *SALAIRE ÉGALE POUR UN TRAVAIL DE VALEUR COMPARABLE : L'expérience des pays industrialisés* (1991)
- No. 7 *THE LONG-TERM UNEMPLOYED AND MEASURES TO ASSIST THEM* (1992)
- No. 8 *EMPLOYMENT POLICIES FOR PEOPLE WITH DISABILITIES: Report by an Evaluation Panel* (1992)
- No. 9 *FROM LABOUR SHORTAGE TO LABOUR SHEDDING: Labour Markets in Central and Eastern Europe* (1992)

Mailing List for Labour Market and Social Policy Occasional Papers

Please include the following name on the mailing list: (write in capitals)

Name _____

Organisation _____

Address _____

Country _____

This form should be returned to:

Labour Market and Social Policy Occasional Papers
Directorate for Education, Employment, Labour and Social Affairs
Office 110
OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, FRANCE

A SELECTION OF OECD PUBLICATIONS ALSO AVAILABLE

"OECD SOCIAL POLICY STUDIES" SERIES

- No. 3 *LIVING CONDITIONS IN OECD COUNTRIES: A Compendium of Social Indicators* (1986)
(81 85 04 1)ISBN 92-64-12734-8, 166 pp. £6.50 US\$13.00 FF65 DM29
- No. 5 *REFORMING PUBLIC PENSIONS* (1988)
(81 88 04 1)ISBN 92-64-13123-X, 250 pp. £15.50 US\$29.00 FF130 DM56
- No. 6 *THE FUTURE OF SOCIAL PROTECTION* (1988)
(81 88 03 1)ISBN 92-64-13152-3, 64 pp. £8.50 US\$15.50 FF70 DM31
- No. 7 *HEALTH CARE SYSTEMS IN TRANSITION: The Search for Efficiency* (1990)
(81 89 05 1)ISBN 92-64-13310-0, 206 pp. £17.00 US\$30.00 FF140 DM55
- No. 8 *LONE PARENT FAMILIES: The Economic Challenge* (1990)
(81 89 04 1)ISBN 92-64-13303-8, 284 pp. £20.00 US\$34.00 FF160 DM66
- No. 9 *PRIVATE PENSIONS AND PUBLIC POLICY* (1992)
(81 92 06 1)ISBN 92-64-13790-4, 160 pp. £25.00 US\$35.00 FF150 DM60

EMPLOYMENT

- OECD EMPLOYMENT OUTLOOK* July 1992 (published annually)
(81 92 04 1)ISBN 92-64-13720-3, 284 pp. £24.00 US\$42.00 FF220 DM80
- THE INTEGRATION OF WOMEN INTO THE ECONOMY* (1985)
(81 85 05 1)ISBN 92-64-12735-6, 184 pp. £10.00 US\$20.00 FF100 DM44
- MEASURES TO ASSIST THE LONG-TERM UNEMPLOYED:
Recent Experience in Some OECD Countries* (1988)
(81 88 06 1)ISBN 92-64-13134-5, 100 pp. £7.50 US\$13.50 FF60 DM26
- LABOUR MARKET FLEXIBILITY: Trends in Enterprises* (1989)
(81 89 03 1)ISBN 92-64-13286-4, 74 pp. £10.00 US\$17.00 FF80 DM33
- NEW TECHNOLOGY IN THE 1990S: A Socio-Economic Strategy* (1989)
(81 88 07 1)ISBN 92-64-13180-9, 130 pp. £11.00 US\$19.00 FF90 DM37
- LABOUR MARKET POLICIES FOR THE 1990s* (1990)
(81 90 01 1)ISBN 92-64-13363-1, 130 pp. £13.00 US\$23.00 FF110 DM43
- ENTERPRISING WOMEN* (1990)
(81 90 02 1)ISBN 92-64-13436-5, 112 pp. £11.00 US\$20.00 FF95 DM37

EVALUATING LABOUR MARKET AND SOCIAL PROGRAMMES. The State of a Complex Art (1991)
(81 91 01 1)ISBN 92-64-13537-5, 200 pp. £20.00 US\$37.00 FF155 DM60

MANAGING MANPOWER FOR ADVANCED MANUFACTURING TECHNOLOGY (1991)
(70 90 03 1)ISBN 92-64-13467-0, 150 pp. £20.00 US\$36.00 FF170 DM66

NEW DIRECTIONS IN WORK ORGANISATION. The Industrial Relations Response (1992)
(81 92 01 1)ISBN 92-64-13667-3, 266 pp. £20.00 US\$40.00 FF210 DM60

DEMOGRAPHY

AGEING POPULATIONS: The Social Policy Implications (1988)
(81 88 02 1)ISBN 92-64-13113-2, 90 pp. £12.00 US\$22.00 FF100 DM43

MIGRATION: The Demographic Aspects (1991)
(81 90 03 1)ISBN 92-64-13439-5, 92 pp. £15.00 US\$26.00 FF125 DM48

HEALTH CARE POLICY STUDIES

No. 1 *U.S. HEALTH CARE AT THE CROSS-ROADS* (1992)
(11 92 03 1)ISBN 92-64-13780-7, 80 pp. £9.00 US\$15.00 FF60 DM25

No. 2 *THE REFORM OF HEALTH CARE SYSTEMS:
A Comparative Analysis of Seven OECD Countries* (1992)
(81 92 01 1)ISBN 92-64-13791-2, 210 pp. £30.00 US\$46.00 FF180 DM74

OECD HEALTH CARE DATA Version 1.01 (1991)
available in English or French £300 US\$550 FF3 000 DM900
on 5¼-inch HD or 3½-inch DD diskettes

*Prices charged at the OECD Bookshop.
THE OECD CATALOGUE OF PUBLICATIONS and supplements will be sent
free of charge on request addressed either to OECD Publications Service,
2, rue André-Pascal, 75775 PARIS CEDEX 16
or to the OECD Distributor in your country.*