



Migration Research Group

**Forecasting Labour and Skills Shortages:
How Can Projections Better Inform Labour Migration Policies?**

by Christina Boswell, Silvia Stiller and Thomas Straubhaar,
Hamburg Institute of International Economics (HWWA)

*Paper Prepared for the European Commission,
DG Employment and Social Affairs*

July 2004

1.	Introduction	3
2.	Labour and Skills Shortages: What are they, and why do they occur?	5
2.1	Definitions	5
2.2	Causes of Labour and Skills Shortages	7
3.	Current Trends Influencing Shortages in EU Labour Markets	9
3.1	Labour Demand	9
3.2	Labour Supply	13
4.	Methods for Estimating and Projecting Shortages	16
4.1	Estimating Current Shortages	16
4.2	Projecting Future Shortages	18
4.3	Best Practice in Projecting Shortages	21
4.4	Evaluation	35
5.	Implications for Policy and Research	38
5.1	Labour Shortage Projections and Migration Policy	38
5.2	Further Research Requirements	43
	References	47
	Statistical Annex	51

1. Introduction

Many EU states are experiencing serious skills and labour shortages in a number of sectors, despite persistently high rates of unemployment. Among the most widespread have been shortages of highly qualified workers in IT, and employees in the health sector, as well as consumer and commercial services (Germany), education, health and social services (Sweden), construction (France), or engineers and teachers (the UK) (OECD 2003a). These shortages can hamper productivity and growth, or can undermine targets in the provision of education, healthcare or social services. In most cases, such shortages are not caused by an aggregate shortage of labour, but can be attributed to problems of mismatch between labour demand and supply. Jobs remain unfilled despite high unemployment rates, because workers lack the relevant qualifications or skills, are reluctant to take up work in particular occupations or geographical areas, or have insufficient information about job opportunities. Alternatively (or in addition), employers are unwilling or unable to offer sufficiently attractive salaries or conditions to encourage occupational or geographical mobility.

Given that the causes of most shortages lie in insufficient mobility and market inefficiencies, one line of response has been to promote better matching of people to jobs. Indeed, efforts to increase occupational and geographical mobility have been a key element of the European Employment Strategy (European Commission, 2002a). However, such reforms are unlikely to eliminate problems of mismatch: they do not always have the desired impact on people's educational, occupational or location choices, and in any case can take several years to kick in. Under these conditions, many states have turned to labour migration programmes as a more rapid and effective means of addressing shortages.

There are several arguments in support of migration as a tool for filling skills and labour gaps. First, the growing importance of the knowledge-based economy makes it more important to have the necessary skills, a requirement which may not be possible to meet through domestic supply – at least not in the short- to medium-term, as there will be a lag in the impact of education reforms. Secondly, where shortages result from an inflexible labour force – a reluctance of domestic workers to do certain jobs, change occupations, or to relocate – it may not be socially or politically feasible to solve this type of mismatch through domestic reforms. And third, demographic trends imply that there could be across-the-board labour shortages in the future, necessitating an import of foreign labour to counter growing dependency rates. Thus for at least some types of shortages, labour migration may indeed be the only feasible response if states want to retain certain levels of economic growth, or current living standards. Moreover, a sufficient skill endowment will be crucial for ensuring that firms are internationally competitive.

However, labour migration also carries its own problems and risks. Large sections of public opinion in European states remain anxious or sceptical about the need for recruiting labour from third countries. The more or less explicit assumption is that additional immigration would generate competition with

indigenous workers for scarce jobs.¹ Moreover, the experience of large-scale labour immigration in many West European countries since the 1950s has made many governments and electorates cautious about embracing migration as an instrument of labour market policy. The idea that labour migration can provide a flexible and interim solution to labour shortages has been largely discredited in many countries. For these reasons, governments have tended to endorse labour migration as only one part of a package of reforms, with the emphasis clearly on domestic reforms as the first line of action to address shortages.

Governments introducing labour migration programmes as a means of addressing shortages therefore need to make a convincing case for adopting this response. Among others, this implies basing decisions on reliable data and projections. Policy planning needs to be informed by estimates of the extent and occupational composition of current and future shortages, but also by an understanding of their causes. The latter will influence whether shortages can be expected to persist, and whether they could be addressed through alternative labour supply-side domestic reforms. Therefore, estimating the need for labour immigration to fill labour gaps and shortages requires at least three steps:

- understanding the causes of current and potential labour and skill shortages;
- estimating and projecting their scale;
- evaluating the appropriateness of different policy responses for reducing shortages, including migration policy.

This paper will focus on the first two points, and conclude with a brief discussion of the third. It will start by defining shortages, and categorising the different determinants of these. The second part will outline the linear and cyclical trends that generate these shortages in European countries. Part three will review different methods for estimating and forecasting shortages, and examine how such estimates are made in a number of OECD countries. In the final part, the paper will consider for which kind of shortages migration policy may be a preferred or necessary solution.

It should be noted that the paper does not aim to offer its own projections of shortages, or to develop substantive recommendations for labour migration policies on the basis of existing forecasts. The contribution is rather focused at the meta-level: reviewing best practice for forecasting and planning labour migration policies.

¹ A more nuanced form of this substitution thesis is that the recruitment of foreign workers would delay or discourage the necessary domestic reforms to expand or better train the domestic labour force, or to make labour markets more efficient.

2. Labour and Skills Shortages: What are they, and why do they occur?

2.1 Definitions

As a first step in analysing labour and skills shortages, we need to define the scope of the labour market we are examining. There are three main relevant dimensions for characterising labour markets:

- occupation and/or skills;
- sector; and
- geographical area (regional, national, or EU level).

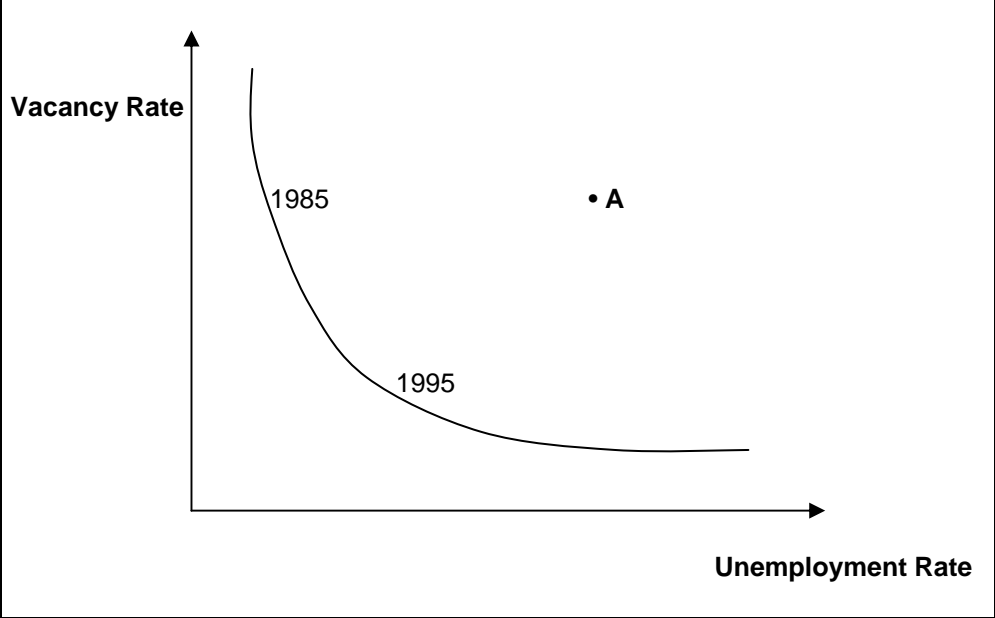
Once we have defined the labour market, we need to develop a working definition of different types of labour shortages. In the most basic sense, labour shortages occur where the demand for workers in a particular occupation exceeds the supply of workers who are qualified, available, and willing to do that job. Within this definition, we can distinguish between two types of shortage – aggregate labour shortage and shortages due to mismatch on the labour market.

1. *Aggregate labour shortage.* This occurs where there is (near) full employment, and a general difficulty in finding workers to fill vacancies.
2. *Mismatch on the labour market*
 - *Qualitative mismatch.* This arises when the qualifications of workers and the qualification profiles of vacancies are not matched. Qualitative mismatch may also be referred to as skills shortage, describing a labour market situation in which there is a lack of people with the qualification, skills or experience necessary to carry out the jobs in question.
 - *Regional mismatch.* This occurs where unemployed persons seeking work and firms offering suitable jobs are located in different regions, and the jobs and/or workers are immobile.
 - *Preference mismatch.* This refers to a mismatch between the types of jobs that unemployed people are willing to take on, and existing vacancies in the relevant region. Those out of work are unwilling to take up certain types of work because of inadequate remuneration or working conditions or status, despite the fact that such jobs match their qualifications and skills profile, or are located in the relevant geographical region.
 - *Mismatch due to information deficits.* In this case there is no aggregate shortage of labour or skills, but supply does not meet demand because of lack of information. Unemployed workers do not acquire information on relevant existing vacancies, because of inefficiencies on the labour market; and firms do not have the information necessary for finding persons with adequate qualifications.

It is important to note that shortages due to mismatch on the labour market can coexist with substantial levels of unemployment.

The quantity of mismatch and its development over time can be depicted by the Beveridge Curve. The Beveridge Curve is a graph of the inverse relation of unemployment to job vacancies. Vacancy rates are measured as the ratio of recorded vacancies to labour force. Unemployment rates are defined as the share of registered unemployed persons in the labour force. Figure 1 plots a stylised Beveridge Curve for a country over a specific period of time. In this country relatively high vacancy rates coincide with relatively low unemployment rates, and vice versa. Hence mismatch is not a significant problem for this country as a whole, e.g. as compared to a labour market situation depicted by point A. Nevertheless, in the example chosen there is mismatch at any point over the period of time in question, since unemployment coexists with job vacancies. However, it is not possible to ascertain the nature of the mismatch on the basis of the Beveridge Curve (for example, whether it is a qualitative or regional mismatch).

Figure 1. The Beveridge Curve



Following our definition of the scope of a labour market, Beveridge Curves can be derived for geographical areas, sectors within geographical areas, and different skill segments of labour markets. Generally, the further the curve is from the coordinates (along the 45° line), the lower the efficiency of the matching process. If an economy moves upwards along the Beveridge Curve it faces a situation of falling unemployment rates and rising vacancy rates, typical for a cyclical economic upswing. If the economy moves downwards along the curve, the opposite holds. (for Beveridge Curves for OECD and EU countries, see OECD 2003b, and European Commission 2002b).

As a third definitional point, we need to be clearer about what we mean by shortages. Here it is useful to distinguish between different degrees of acuteness. This is not just a question of how quantitatively significant shortages are at a given point in time, but also whether they persist over time, and how far they are responsive to changes in the strategies or behaviour of firms and workers (in other words, what we might term frictional problems, bottlenecks or “tightness”, rather than absolute shortages). In some cases, the problem of hard to fill vacancies may be addressed through offering more attractive

salaries or conditions, through more effective recruitment practices, or by lowering the qualifications necessary for the job. Alternatively, shortages could be addressed through restructuring the current workforce within a firm, increasing the hours worked by current employees, or further training or retraining of staff. On the supply side, even where employers do adjust conditions (for example by offering more competitive wages), there may also be a lag in workers' responses to these changes. In these cases, more flexibility on the part of employers or the workforce could ease tightness, so it may not be appropriate to talk about shortages. This is especially likely to be the case for labour mismatches, although less so for skills shortages (Haskel and Holt, 1999, 3).

However, the degree to which one expects or requires labour demand or supply to be more flexible will of course depend on a number of other considerations. On the demand side, institutional rules or narrow profit margins may make it impossible for employers to offer more competitive wages. While making do with less qualified staff may lower productivity or result in lower quality products or services. On the supply side, it may not be socially or politically acceptable to expect unemployed workers to take lower status or lower paid jobs, or to relocate to other areas. If this is the case, it may indeed be more appropriate to talk about shortages.

There are also some jobs, especially in the higher skills categories, for which workers are simply unavailable. Certain required skills may either be unique to those with knowledge of foreign markets and technologies; or relevant training and education measures to increase the supply of qualified domestic workers may only kick in in the medium term.

2.2 Causes of Labour and Skills Shortages

Estimates of current labour or skills shortages are essentially snapshots of the relationship between supply and demand in a given labour market at a particular point of time. Such shortages may be measured in absolute numbers for particular occupations, sectors or areas; or as vacancy and unemployment ratios, again differentiated by sector and/or region. Such estimates can tell us something about impending shortages on certain labour markets (more of this below). However, once we start to extrapolate and project possible future shortages, we need to base forecasts on a number of assumptions regarding the future development of factors determining labour supply and demand. Determinants of labour supply and demand can be derived from economic theories as well as from empirical studies. A detailed analysis of factors influencing supply and demand on the labour market is not only necessary to predict future shortages, but is also crucial from the point of view of defining policy responses. Depending on their causes, labour or skills shortages may be addressed by quite divergent policy tools.

There are two different levels at which one can analyse the causes of labour and skills shortages. First, one can conceptualise shortages from the micro-perspective. In this case, shortages may be explained in terms of a more or less rapid or persistent increase in labour demand, which outpaces the labour market's capacity to supply workers. Alternatively, it may be caused by a decrease in supply

which is greater than the corresponding decrease in demand. In both cases, the result is a disequilibrium on the labour market.

However, this micro-level analysis needs to be supplemented by a broader empirical analysis of the linear and cyclical economic, social and demographic trends which affect labour demand and supply. In the remainder of this section we shall provide an overview of these different determinants of labour shortages.

What sorts of factors are likely to cause surplus demand? Changes in **demand for labour** can be attributed to two main types of dynamics: a so-called “industrial effect”, i.e. growth or decline in a particular sector or industry; or an “employment effect” – a shift in the occupational composition of employment in a particular industry (Wilson 1994). The factors influencing industrial and employment effects are listed below.

Industrial effect:

- General economic growth will obviously affect overall demand for labour, although, as we shall see in the next section, not always in a straightforward way.
- Increased demand for particular goods or services affects growth in particular sectors and for particular occupations or qualifications.

Employment effect:

- International division of labour. The location of production and services will exercise a significant influence on demand for particular skills and occupations.
- Technological change and innovation, likewise, can influence demand for particular skills and occupations.
- Extent and nature of competition in particular sectors. This may affect the level and occupational composition of labour demand in different ways: for example by encouraging firms to rationalise production, or become more innovative.
- Regulatory frameworks can influence demand for particular occupations or skills. For example, new environmental or safety standards may oblige firms to recruit people with particular skills.
- Labour supply. A surplus or shortage of particular skills or occupations can influence the employment decisions of firms.

Concerning **labour supply**, the following determinants are important:

- Population/demographic trends, which will influence the size, age and gender composition of the labour force.
- Expected labour force participation rates, and especially the participation of what may otherwise be reserve labour: typically, married women, older workers, or the disabled.
- Net immigration, and the demographic composition and participation rate of flows.
- The education and training choices of individuals.

- Occupational preferences of domestic workers.
- Regional mobility, i.e. the readiness of domestic workers to relocate within their home country or the EU, depending on job availability or conditions.

It should be stressed that labour demand and supply should not be treated as two independently determined components: there are significant two-way causal influences between the two. In particular, one can expect labour surpluses or shortages to produce adjustments on the part of employers or (potential) workers. For example, demand for labour will influence occupation, location and education choices; and supply can influence firms' recruitment decisions, how they structure their workforce, as well as their productivity or quality of products.

3. Current Trends Influencing Shortages in EU Labour Markets

In this section we shall outline a number of the most important cyclical and linear trends influencing labour and skills shortages in the EU over the next decades. The aim is not to quantify the impact of these factors on shortages, but rather to provide a qualitative overview which can be used as a reference point for the appraisal of the different quantitative methods discussed in part four.

3.1 Labour Demand / Employment

Economic Growth

Economic growth depends on multiple factors, and is notoriously difficult to forecast, especially over a longer time-frame. Moreover, even if we could accurately forecast growth, there are additional difficulties in projecting its affect on the labour market. This is due to the fact that the structural and absolute employment effects of any particular economic growth rate will vary over time, depending on a number of specific circumstances of economic development. In particular, the extent to which economic growth will imply increased labour demand and whether it will result in labour shortages will depend on the labour intensity of growing sectors, technological progress and unexploited production potential. Furthermore, the influence of economic growth on labour market outcomes will crucially depend on whether growth is temporary or steady. These factors all imply that economic growth or slowdown will not necessarily produce either a shortage or surplus of labour or skills.

The impact of economic growth on labour demand may be mediated by a number of factors, especially in cases where growth is temporary. These include enhanced productivity, changes in the regulatory framework and hours worked. If additional labour demand in the course of a cyclical upswing is mostly met by extending the labour input of insiders there will only be weak increases in labour demand. Likewise, a shorter period of economic decline will not necessarily lead to a proportional increase in labour supply due to workers losing their jobs. For example, economic slowdown following the oil price shock in 1999/2000 did appear to dampen employment growth in

most OECD countries (it had been growing at a rate of around 1% per year since 1990), but not as much as expected. The negative impact of the general economic climate may have been partially dampened by structural reforms to labour markets (OECD 2003a). Conversely, growth may not translate into more jobs if accompanied by a rise in productivity. Thus while EU growth forecasts for 2004 and 2005 predict GDP growth at rates of 2% and 2.4% respectively, productivity growth over the same period of over 1.5% is expected to imply a limited growth in employment of 0.3% and 0.8% for 2004 and 2005 (European Commission, 2003a).

However, steady economic growth can be considered as the most important factor influencing labour demand. Altogether, forecasting the relation between economic growth and labour demand is a highly difficult and complex issue – but it is an essential element for forecasting labour and skills demand.

Structural Change

When it comes to analysing skills shortages, the question of sectoral growth becomes more important than the overall growth rate of economies. This can be attributed to the fact that the occupational composition of labour demand significantly differs between sectors. In the future we can expect continued structural change in Europe, i.e. a decrease in the employment share of the manufacturing and agricultural sectors, and an increase in the service sector share. These structural changes will be accompanied by changing qualifications requirements. While the share of the service sector in the EU-15 Member States is already relatively high, significant structural changes will take place in the new EU countries. In these countries a relatively high share of the labour force is still employed in the agricultural sector while the service sector is underdeveloped compared to the EU average. In addition, there are substantial mismatches dating back to transformation processes in these countries, which brought about a decline in the oversized public sector. The expected structural changes in the new Member States may entail serious labour market problems. Low-skilled workers will lose their jobs in the agricultural sector while parts of the expanding service sector will probably have to cope with skills shortages. These problems will become even more acute in the new Member States if brain drain occurs. It is reasonable to expect that serious regional and qualitative mismatches on labour markets in the new Member States will arise.

It is likely that structural development trends towards the service society and changing production processes will also increase mismatches on EU-15 labour markets. Sectoral changes can occur very suddenly – for example related to the explosive spread of the internet – and qualifications can only adjust with a time lag. Structural change and related skills shortages may therefore become a serious problem for economic growth throughout Europe. Such sectoral change can be the product of multiple factors, including demographic change, changes in consumer preferences, and the international division of labour. While there is insufficient space to describe all of the relevant factors influencing structural change in Europe, we can illustrate these trends drawing on a number of examples.

Among the origins of sectoral change, ageing is an important factor. As the demographic structure of European societies changes, demand for products and services specific to the elderly will increase

enormously (for example the health sector, tourism products for the elderly, and so on). At the same time, demand for products and services directed towards younger generations (for example education and universities) will decline. However, declining demand for education for younger people might be partly compensated by lifelong learning. Another expected development is that population decline will coincide with declining demand for housing, with feedbacks for the construction branch.

Trends resulting from changing consumer preferences and the general economic climate will also impact the equilibrium of skills demand and supply. While there are relatively steady trends for some goods and services, other branches are marked by strong fluctuation. Current examples of trends influencing the skills composition of labour demand are the focus on “wellness” products and services, increasing demand for computers, and the rising importance of “e-commerce” for daily life in the household as well as for business. Also of relevance for labour and skills shortages are product cycles.² Product cycles and trends in demand are difficult to forecast, as was clearly illustrated by the bursting of the internet bubble in 2000. But they may have a lasting impact on the skills composition of labour supply.

Another example of a foreseeable structural trend impacting the equilibrium of the labour market is in the transportation sector. International trade and traffic will rise in the context of an intensified international division of labour and the deepening of European integration, as well as the ongoing process of globalisation. This will impact transport volumes. Demand for highly qualified labour capable of developing intelligent logistics systems will rise, as this sector tries to cope with increased volumes of traffic and also related environmental problems.

Changes in the international division of labour will also impact the skills demand of EU firms. Moreover, it is important to bear in mind that economic growth in certain sectors in the EU will be increasingly driven by research and development which will increase demand for highly skilled workers.

The following three trends will influence the skills composition of demand.

Location of Production / Services

There is every indication that trends of delocalisation will be reinforced, with firms increasingly relocating labour intensive production from the EU-15 to countries with cheaper labour. This deindustrialisation is likely to decrease the demand for low-skilled workers in these countries. But high-skilled jobs in the EU will not necessarily be negatively affected: rather, for many multinationals, research and development, sales and organisational management may well continue to be based in

² As at 31 December 2000, there were around 8,900 IT vacancies registered at Employment Offices, and around 5,700 applicants: i.e. a vacancy/applicant ratio of 100:156. Just one year later the ratio had been reversed, at around 100:42. By the end of 2002, 100 applicants were competing for 14 vacancies. This situation prompted individual labour offices to organise information events targeted at IT workers (German Federal Employment Agency web-site).

Europe, because of the availability of highly skilled employees with the relevant language skills or knowledge of legal and institutional frameworks (Munz and Ochel, 2001, 54-5). Thus a decline in demand for low-skilled industrial labour may even be accompanied by a rise in demand for high-skilled workers in the EU-15. It is likely that the proportion of high-skilled labour within total labour demand will rise. Similar trends are likely to emerge in the new EU Member States, once they have passed through a phase of structural change. As wages rise, they will become less attractive for labour-intensive production.

Technological Development and Innovation

The now hackneyed concept of the “knowledge-based economy” describes an economy in which skilled and specialised human capital has become the most valuable factor of production. It has been estimated that more than half of GDP in OECD economies is knowledge-based rather than derived from the material value of goods.³ Thus productivity and competitiveness have become more than ever a function of having the right knowledge, information and skills.

The importance of the knowledge-based economy can be most obviously discerned in the burgeoning importance of information and communications technology (ICT). These new technologies, based on micro-electronics, computer software and telecommunications, provide the infrastructure for far more complex and rapid management of production and transactions. They have become increasingly important not just in the services sector, but also in manufacturing, which is increasingly dependent on IT for efficiency and competitiveness. Thus in Ireland, for example, more than 60% of ICT employment was in the manufacturing sector (OECD 2000). Overall, it has been predicted that by 2010, half of all jobs in the EU will be in industries that are either major producers or intensive users of ICT products and services (OECD 2000).

While the development of ICT may render certain qualitative shortages more acute, it can also help address problems of regional mismatches. For a number of jobs, ICT implies that place of work and residence need not be the same, with workers communicating and exchanging data with colleagues via ICT. We can expect these trends to be reinforced in the future, by ongoing innovations in the field of ICT.

The role of knowledge is not confined to ICT, but more generally concerns the importance of innovation in increasingly competitive international markets. Innovation in products and processes constitutes the basis for steady economic growth. Firms need labour with research and development qualifications in order to assure high rates of innovation. Moreover, companies need to constantly develop new strategies and forms of organisation and production that allow them to be more flexible and innovative. This requires not just keeping abreast of new technologies, but also extensive networking of customers, suppliers and research centres, and more flexible forms of work

³ Beudin and Breau 2001, p. 2

organisation. It requires employees who can adjust to constant technological change, and are willing and able to keep acquiring new information and skills – so-called “flexible specialisation” (ILO 1995).

However, skills shortages may occur where labour supply is unable to react immediately to very dynamic developments on the side of labour supply, especially where these developments are related to innovation and ICT. While demand for certain skills may rise very suddenly, the supply of skills can only adjust with a certain time lag, which can constitute a serious impediment to economic growth. Innovation can also affect labour demand through influencing the quality of economic growth: for example, innovations reducing the labour intensity of the production process may contribute to an overall reduction of labour shortages.

3.2 Labour Supply

Population Trends

Fertility rates in West European countries have been declining since the 1960s, while average life expectancy has risen from 66 in 1960 to 77 in the late 1990s (Visco 2001). Meanwhile, average retirement ages are getting lower, with less than half of the population aged between 55-65 in OECD countries in employment (Coppel et al. 2001). Taken together these factors are likely to generate a rise in the average age of the population and a decline in the proportion of the population in employment – hence a rise in the ratio of those dependent on state support to those economically active. Eurostat has estimated that by 2025 the over-65 age group in EU states will constitute 22.4% of the population, as opposed to 15.4% in 1995.⁴ Demographic trends are also likely to slow down the rate of growth of the labour force in the next three decades, and in some countries could lead to a decline (OECD 2003b). A number of studies have argued that the decline in the participation ratios and in the growth of the labour force will create a major shortage of labour in all sectors. Some sectors and occupations are likely to be especially badly affected, such as health care.

(See Figure 1 in the Annex.)

Participation Rates

This refers to the portion of the working age population who are employed or seeking employment. Trends in OECD countries since the 1970s have had mixed impacts on participation rates. A trend towards longer schooling and higher participation in tertiary education has raised the average labour market entry age in OECD countries (OECD 2003b). There is also an increasing trend of higher levels of female participation in most countries (although the trend tends to go in the other direction in former communist countries). On the other hand, there has been a trend towards earlier retirement ages, especially for men over 50. (See Figures 2 and 3 in the Annex.)

⁴ Cited in European Commission 2000a.

Participation rates can rise if average labour market entry ages decrease and retirement ages increase. There is also potential for increasing participation rates in all age categories, especially for women. Participation rates will be influenced by welfare and social support provisions, including childcare provisions, unemployment and social assistance schemes, and retirement and pension schemes. Education systems will also influence the proportion of young people who are economically active.

Immigration

Inflows of non-nationals through different labour migration or humanitarian routes can significantly affect the size of the labour force, and its skills composition. In the US, for example, an estimated 10% of high-skilled IT workers are immigrants entering under the H-1B programme (US National Research Council, 2001). However, where immigration is non-selective, it can exacerbate problems of mismatch. This may be particularly the case where there is a sizeable influx of low-skilled or non-skilled migration, for example through humanitarian routes. Having said this, in a number of countries there is demand for low-skilled immigrant labour to perform jobs that domestic workers are unwilling to take on, even in the context of high unemployment.

Clearly, European states have a number of national, EU and international commitments which delimit the scope for selecting immigrants on a purely economic basis (i.e. asylum, temporary protection or family reunion routes). European states have also encountered obstacles to controlling flows, overstay and employment of irregular migrants. However, there is clearly scope for influencing labour supply through the recruitment of immigrant labour or regularisation programmes, and as such, immigration policies can have a substantial impact on labour supply. Less open to influence are outflows of nationals, which can have an important impact on skills composition where high-skilled workers leave because of more attractive business or research conditions in third countries.

Education and Qualifications

Trends in education systems and qualifications can have two types of impact on labour supply. First, the duration of study and training programmes will influence the quantity of labour supply. As we saw above, later entry into the labour market can decrease participation rates. Second, a number of factors have led to a general rise in the skills levels of populations in all OECD states, implying an increasing proportion of highly qualified workers; and declining numbers of those without any qualifications. This qualitative change in the skills composition of the labour force can be attributed to the significant financial reward on the labour market derived from investing in education, as well as reforms to education systems broadening access.

(See Figures 4 – 8 in the Annex.)

Occupation Preferences

One of the most significant factors generating labour market mismatches is the unwillingness of resident workers to do certain low-skilled, low-status and low-paid work. The upward professional mobility of workers in west European states has been to a large extent facilitated through the import of low-skilled immigrant labour since the 1950s. Post-World War II immigration supplied workers for low-skilled manufacturing, construction, transport, and agriculture; and more recently for catering, domestic services or janitorial work. Many professions have now become associated with immigrant or ethnic minority workers, often implying a social stigma for native, or non-minority workers. Occupational preferences may generate serious mismatches in situations of high unemployment, especially where social benefit systems provide limited incentives to take up low-paid or seasonal work.

In a number of countries public sector jobs have also become less attractive, because of persistently poor pay, and corresponding decline in social status. In the UK, for example, this trend is particularly pronounced in medical professions and teaching. Other EU countries also face shortages in health care workers.

Mobility

Finally, shortages in particular regions may be a function of the reluctance of workers to relocate between EU states or sub-national regions. Overall, an estimated 1.4% of the working population in the EU moved to another region in 1999, although most of the movement was within one state. Interestingly, the EU countries with the highest mobility rates – Austria (4.4%) and the UK (2.3%) have relatively low unemployment rates (European Commission 2002a). Movement between EU countries is even lower, often because of legal, administrative, linguistic or cultural barriers.

Some studies have indicated that there could be more substantial flows of labour from the new Member States, following the removal of restrictions on access to the labour market after a two, five or seven year transition period (Boeri and Brücker 2001; Straubhaar 2001). However, it remains questionable how far intra-EU mobility can offset labour supply shortages, given that all European states face similar problems of ageing populations. EU countries will almost certainly find themselves obliged to look to third countries as a source of foreign labour, and to find ways of encouraging the mobility of workers with sought-after skills from outside Europe.

4. Methods for Estimating and Projecting Shortages

4.1 Estimating Current Shortages

The most widespread method for assessing current labour and skills shortages is the use of surveys. Employer surveys in particular are used to ascertain vacancy rates, which may then be compared to unemployment rates, to derive a picture of labour mismatches. Employer surveys may also be useful for the following purposes:

- to provide a more detailed picture of the occupational and qualifications composition of employment in different sectors;
- to contribute to understanding the impact of labour and skills shortages on productivity or growth;
- to help understand the impact of technological change or government measures on demand for labour or skills.

Panel surveys can provide a basis for extrapolating future trends on the basis of past developments when analysed as part of a model of labour market change, and as such may be a useful methodological component for projections (see discussion of projections below). Meanwhile, surveys of employees can be a valuable source of information on individuals' plans or motivations for training and education; or the potential for occupational or geographic mobility, or flexibility in working hours.

The advantages of surveys therefore lies not just in their usefulness as a source of data on current shortages, but also in their contribution to understanding the causes and implications of shortages.

Surveys also have a number of disadvantages:

- Relying on information given by employers may produce a partial picture of the scale and causes of shortages. For example, vacancies may be hard to fill because of a reluctance of firms to adjust recruitment conditions or production standards (tightness rather than absolute shortages).
- Data on numbers of vacancies will not differentiate between frictional and structural causes of vacancies. A number of professions have a high turnover, and in this case high vacancies may simply reflect the reallocation of jobs between those already active in the labour market. For this reason, some researchers have preferred to focus on the measurement of flows into and out of the labour force, rather than on stocks of vacancies (see the section on the Netherlands below).
- Surveys can only shed light on a small range of the determinants of labour shortages. As such, they have limited predictive potential (although, as mentioned, may be useful as one component of models for projecting shortages).

Most OECD governments have sponsored or carried out employer or employee surveys, but with varying goals and methodologies. We cannot hope to provide an exhaustive overview of these, but will list four examples of different types of surveys.

European Union

The European Commission compiles labour market surveys of employers and employees as part of its Joint Harmonised Programme of Business and Consumer Surveys. In 1999 the Directorate-General for Economic and Financial Affairs commissioned a special ad hoc survey to gather the views of employers and employees on actual and expected labour market evolutions. The most relevant aspect of the survey for this paper was the enquiry into skills mismatches and the consequences for business expansion. The sample consisted of more than 25,000 industrial firms, 15,000 firms in retail trade, and around 16,000 in the service sector (European Commission 2000b). Around 15,000 workers were also interviewed.

The survey did not aim to procure data on vacancy rates, but it did gather information on the skills composition of employment in particular sectors; on the reasons for increasing demand for labour (whether because of expected levels of demand, new technologies, government measures, and so on); and on the impact of technological change on the demand for labour. Interviews with employees provided information on flexibility with regard to working times and geographical mobility.

This type of survey may therefore be useful for providing a more detailed break-down of what sorts of skills are in demand, and how this is affected by technological change. Such data may help inform models for projecting future demand or extrapolation. The information on labour force flexibility may also help inform policy planning.

Germany

The Institute for the Study of Labour (IZA) conducted an International Employer Survey for the German Ministry of Education and Research on the reasons why firms recruited or were interested in recruiting foreign labour to fill skills gaps (IZA 2001). While the survey did not attempt to ascertain skills shortages as such, it did shed light on the extent and nature of demand for skilled immigrants. The survey tested two hypotheses: (a) a “complementarity” hypothesis that posits that foreign workers offer skills that almost by definition cannot be provided by domestic workers (e.g. native language skills, knowledge of foreign markets, or of technologies used elsewhere); and (b) a “substitution” hypothesis that foreign workers provided skills that could be offered by domestic workers, given the right training and education. Based on a sample of 850 firms in Germany, France, the UK and the Netherlands, the study found evidence of both hypotheses, implying that some jobs required skills that only foreign workers could provide, while others were filled by foreigners simply because a lack of suitably qualified domestic workers.

This type of survey is clearly useful for determining which sorts of supply-side measures are most appropriate for filling skills shortages: reforms targeted at education and training systems, and/or labour migration programmes.

United Kingdom

The Employers Skills Survey (ESS) was initiated in 1999, and examines the nature, extent, causes and implications of skills deficits in England. The 2002 ESS interviewed a sample of 4,000 employers with five or more employees, and asked if they had general vacancies, and if so, whether they were hard to fill (i.e. positions that did not have a large or any pool of applicants with the relevant skills or experience). Firms were asked about the perceived causes of problems filling vacancies, including whether there was a lack of applicants because of pay and poor conditions, or a lack of applicants with relevant skills. Employers were also asked about the extent of skill gaps in their firms, i.e. the existence of insufficient skills to perform job requirements to a satisfactory level of quality and efficiency.

The main value of this type of survey is to provide richer information on vacancies and reasons why they are hard to fill. In this respect it may be a valuable tool for informing short-term policy responses to skills or labour shortages, including migration programmes.

United States

US Bureau of Labor Statistics recently initiated a Job Openings and Labor Turnover Survey (JOLTS), which measures labour market tightness and efficiency (matching). It is a monthly study, which gathers data on total employment, job openings, hires, quits, layoffs and discharges, and other separations. Data is taken from a sample of 16,000 US businesses in all non-agricultural industries in the public and private sectors. Since January 2004 JOLTS also releases seasonally adjusted data series, and provides an analysis of over-the-month changes.

This type of panel survey can be extremely useful not just for gaining regular snap-shots of labour market matching, but also for analysing longitudinal change in labour markets. It can complement or provide a useful corrective for the type of forecast modelling described in the section below.

4.2 Projecting Future Shortages

Given the complexity of the determinants influencing labour shortages, attempts at forecasting are bound to be imperfect. We can distinguish between three main types of impediments to accurate forecasting:

- **Theoretical problems.** There are fundamental gaps in our understanding of the almost infinitely complex set of relationships determining labour demand and supply. Thus any attempt to capture all of these factors in a comprehensive theory, and to quantify their relative causal weight, is bound to be flawed. This limits the possibility for any sort of reliable prediction. The problem of

prediction is especially acute where outcomes are highly influenced by non-linear trends or exogenous factors, such as technological innovation, policy intervention, or economic cycles. Moreover, there is also the potential for “self-destroying prophesy” of any predictions: insofar as policy-makers, employers or the labour force adjust their decisions on the basis of forecasts, then the outcome will diverge from what was predicted. For this reason, researchers often prefer to talk about “projections” rather than forecasts.

- **Methodological problems.** Even if we could capture the complexity of these determinants, there is likely to be a trade-off between level of detail or disaggregation of the model, and its wieldiness. The more equations included in an econometric model, the more sophisticated the method has to be. The use of advanced software can to a large extent address this problem, capturing highly complex numerical relationships. However, other methodological problems remain more difficult to address, particularly the issue of how different forecasting models focused on specific aspects of the highly complex economic system can be integrated to derive labour market projections. In many cases, the integration of separately developed models fails because of divergent sector or occupational classifications.
- **Data problems.** These relate to a large extent to the degree of complexity of the model. There is inadequate data on many of the variables that highly complex and disaggregated models need to measure. Most models are heavily based on extrapolation from past trends, for example in the occupational composition of particular industries, or productivity, or labour force participation rates. There are numerous lacunae in the relevant data, as well as problems with categorisation, for example definitions of professions, which are subject to change or are differently recorded in different data sets. Moreover, the more detailed the analysis of the labour market, the more specific are the data required – for example in the case of data classified by sectors and occupations. Another problem with data is that many of the factors influencing labour demand can only be measured on an ordinal scale. Working with qualitative rather than quantitative data requires special methods, for example expert interviews.

The pitfalls of labour and skills forecasting models have not prevented governments and researchers from attempting to produce projections. Indeed, given the huge potential for rectifying mismatches or shortages through policy interventions – whether through education, social or welfare policy reforms, or immigration programmes – it is not surprising that governments have supported attempts to develop methods for forecasting which might better inform policy planning.

Attempts to forecast labour and skills needs date back to the early 1960s. At this time, attempts at forecasting aimed essentially to contribute to better coordination between the labour market and education systems, to avoid labour demand and supply mismatches. The prevalent methodology for forecasting labour demand followed the so-called manpower requirement approach. They began with general projections of GDP growth, and then in several steps derived the demand for labour and the required skills composition and education of the labour force (Heijke 1994). The projected labour force

was then derived from forecasts of the workforce and expected flows from the education system. Labour demand and supply were then compared to derive projected gaps, and these were used as a basis for readjusting education policies.

These methodologies were heavily criticised for their overly simplistic derivations of particular occupational or skills requirements from general GDP forecasts, on the basis of fixed coefficients. As argued above, correlations between labour markets and economic growth are time dependent. Therefore any model assuming time invariant coefficients for linking economic growth and skills demand almost certainly contains systematic errors. However, for a short period it might be reasonable to take fixed coefficients. Pursuing such an approach will clearly reduce the complexity of the forecasting model. Earlier methods for forecasting labour demand and supply were also criticised for failing to capture the dynamic relationship between the factors determining demand and supply, and especially the potential for adjustment (Heijke 1994). There were also more deep-seated theoretical objections about the possibilities of prediction, as well as serious problems with the available data.

Despite these objections, calls for better labour market forecasting resurfaced in the 1980s, partly because of an increasing interest in possibilities for supply-side approaches to addressing problems of labour market mismatch (Heijke 1994). Again, the driving rationale was the need to better forecast occupational and skills requirements, in order to adjust education policies to meet demand. The methodologies developed were similar to those of the 1960s. Labour demand was projected using a modified labour force requirement approach: demand was forecast on the basis of economic growth and employment needs, divided according to projected shares in different sectors, and the composition of employment by occupation and qualification. In most models, future supply was measured according to forecasts of population, labour force participation and qualifications, i.e. a “stock” calculation. In some cases, researchers have used inflow-outflow calculations instead, basing supply forecasts on projections of new entrants into the labour market, and departures from it.

In assessing these different projections, we need to bear in mind two sets of considerations. First, to what extent the methods fall victim to the types of theoretical, methodological or data-related problems outlined above. And second, how far they are structured to respond to the planning requirements of policy makers. Three factors are particularly important in this latter respect.

- **Adequate Time-frame.** First, is the time-frame of the projections appropriate for policy planning needs? In the case of education policy, for example, one may need to allow for a 5 year delay in the impact of reforms; for measures to encourage higher participation rates of women, relevant reforms to child-care provisions are likely to take longer to kick in; while the introduction of a labour migration programme, or allowing certain categories of migrants access to the labour market, may take effect almost immediately.

- **Level of Disaggregation.** Second, is the break-down of shortages by sector, occupation or skills detailed enough to inform policy planning? General shortages due to demographic factors may require less disaggregation, while shortages of highly specialised qualified workers will clearly need more detailed information on precise qualifications or occupational requirements.
- **Scenario-mapping.** Third, do the projections provide any indication of the impact of different supply-side policy reforms on these shortages? In other words, are they able to map different scenarios, varying according to plausible changes in participation rates or education patterns due to reforms? This will be especially important if projections are to be used as a basis for planning labour immigration. These various criteria are summarised below.

Scientific Criteria	Praxis-oriented Criteria
Theoretical	Time-frame
Methodological	Disaggregation
Data	Scenario-mapping

4.3 Best Practice in Projecting Shortages

This section will focus on six OECD countries that have been particularly active in developing such approaches: Australia, Canada, Germany, the Netherlands, the United Kingdom, and the United States. The description that follows will focus in particular on forecasts carried out in these countries. However, each of the forecasting models has its own very specific features, which we cannot discuss in detail here. Instead, our survey is designed to provide an overview of the state-of-the-art in modelling labour market issues, and the shortcomings of these approaches.

Australia

- **Centre of Policy Studies (COPS)**

In Australia, labour market forecasts are carried out by the Centre of Policy Studies (COPS), a research centre at Monash University devoted to quantitative analysis of issues relevant to Australian economic policy. The COPS system has been used since 1994 to provide a biannual briefing service to government agencies responsible for vocational education and training in Australia. The COPS forecasts are conducted within an economy-wide framework which integrates a macro model (to determine aggregate employment), an applied general equilibrium model (MONASH, to determine employment by industry) and a labour market extension (to determine employment by occupation).

As a formally specified system, MONASH's first role is to supply a framework for incorporating relevant data into the forecasting process. MONASH includes a large set of data, e.g. from national accounts, input-output tables, state accounts, population census, foreign trade statistics, capital stock statistics and income and expenditure surveys. Concerning future labour demand, forecasts of relevant variables exogenous to the model are integrated in the equilibrium model, e.g. from commercial forecasting agencies and the Australian Bureau of Agricultural and Resource Economics.

A MONASH forecast of the demand for labour proceeds in five stages applying a top down approach.⁵ The starting point is a macro scenario providing GDP forecasts which is derived from the Five Year Business Outlook. In the second stage GDP and its components are converted into output and employment by industries, taking into account forecasts of expert bodies regarding structural changes impacting labour demand. Afterwards, national forecast for output and employment are converted into regional forecasts (56 statistical divisions). The next step of the calculation is the conversion from an employment forecast on an industry basis to an occupational basis for 340 unit groups of the Australian Standard Classification of Occupations. Finally, employment forecasts are used to determine the employment outlook for workers identified by age, sex, qualifications and hours worked per week.

On the whole, the methodological approach chosen for Australian labour market forecasts is relatively advanced. In particular, the application of a CGE model reflects the state-of-the-art regarding economic modelling of quantitative forecasts. Moreover, the reliability and quality of the forecast is enhanced by the fact that the forecasting system integrates available forecasts for relevant determinants. The employment forecasts are provided for industries and occupations at a deeply disaggregated level, providing a broad information base. The disaggregated forecasts are consistent with a growth scenario for the macroeconomic development of Australia. And the model can also develop different scenarios regarding future development of labour markets. Furthermore, COPS is concerned to improve the model. To date, the development of the system has focused primarily on the effect of technological and social change on future labour demand. A complementary supply side forecasting system is currently in preparation.

To sum up, the Australian approach for labour market forecasts is highly informative, has practical relevance and is very useful for policy planning. It also has the advantage of being transparent and accessible. The forecast results are available on CD-ROM and accessible through user-friendly software, allowing policy analysts to interrogate the system independently.⁶ However, applying such a complex model makes high demands on data availability. Furthermore, from the point of view of policy advice it would be better to have such forecasts on an annual rather than a biannual basis. It may be that the model is only updated biannually because of its complexity. Thus there may be a trade-off

⁵ See Meagher et al. (2000), p. 4.

⁶ See Meagher et al. (2000), p. 2 and p. 9.

between the complexity of the model and up-to-dateness. When carrying out forecasts, this trade-off has to be carefully considered, since labour market forecasts are only relevant for policy planning if they are based on current data.

Canada

- ***Human Resources Development Canada (HRDC)***

The Human Resources Development Canada (HRDC) produces the Canadian Occupational Projection System (COPS).⁷ COPS provides forecasts for economic growth, industries and especially occupations. Occupational forecasting has a long tradition in Canada, dating back to first initiatives on these issues in 1969, conducted by the Department of Manpower in Canada. Initially, Labour Market Development Reports were purely informational. In the 1980s, initiatives were started to expand Canada's labour market information system within an entirely quantitative framework. COPS is the basis for the development of an integrated system of demand and supply projections by sectors and occupations.

The development of occupational employment projections at the national and provincial level has been facilitated over the last 15 years by a Federal-Provincial partnership involving all 10 Provinces and Human Resources Development Canada. COPS partnership allows Provinces to take advantage of economies of scale and federal resources to develop, maintain and update the data, macroeconomic forecasts and employment demand models necessary to provide 10 year occupational employment projections.⁸ COPS therefore links analytical work carried out centrally and a network of federal, provincial and territorial researchers.

COPS is an integrated demand and supply model providing forecast for 139 occupations and five broad skill categories. COPS was originally a demand side model forecasting manpower requirements. Since the mid 1990s it has brought in supply-side information on school-leavers, immigrants and labour force re-entrants. COPS projects shortages and surplus by occupations and level of education. It is basically based on five components:⁹

- Demand Model: $\text{New Openings} = \text{Expansion} + \text{Replacement}$
- Supply-Model: $\text{Supply} = \text{School Leavers} + \text{Immigrants} + \text{Re-Entrants}$
- Equilibrium: Combines Demand and Supply
- Excess Supply = $(\text{Supply} + \text{Unemployed}) - \text{New Openings}$: Surplus if > 0 , Shortage if < 0
- Outlook: Change in Excess Supply

⁷ The former department of Human Resources Development Canada has recently been split into two separate departments. Social Development Canada, Human Resources and Skills Development, Canada.

⁸ See Paul (2003).

⁹ See Smith (2002), p. 70.

1. *The Demand Model*

Occupational estimates are derived from the demand model based on estimates of industry employment from macroeconomic models. Each year, a ten year macroeconomic and industry employment forecast is produced for Canada and each of the Provinces. Up until 2003, a private sector forecasting firm produced these forecasts using a macroeconomic model with extensive input from the Provincial COPS partners and HRDC. This macroeconomic model utilised the Standard Industrial Classification System (SIC), and the employment forecasts for 33 industries are SIC-based. HRDC has recently decided to begin using a different forecast supplier, the Conference Board of Canada. The Conference Board of Canada has developed a macroeconomic model that uses the North American Industrial Classification System (NAICS), and their industry employment forecasts will be NAICS-based. The main purpose of the industry employment forecast is to provide a basis for development of more detailed occupational employment projections.¹⁰

The macroeconomic model provides industry employment forecasts which are disaggregated into occupational classes by applying an occupation by industries matrix. The coefficient matrix is developed with input from the Consensus Canada and from the Labour Force Survey. COPS is not based on fixed coefficients but considers changing coefficients over time. COPS produces annual estimates for new jobs in each of the occupations under consideration. New jobs result from replacement demand and expansion demand (derived from occupational forecasts).

2. *The Supply Side*

COPS provides detailed information on the supply side of the labour market, disaggregated by occupational classes. The basis for forecasting labour supply by occupations is a demographic model providing numbers of future school attendees. The break-down according to occupations is derived from the sum of school-leavers, immigrants and labour force re-entrants destined for the corresponding occupation. A school occupation transition matrix is applied for assigning school leavers to jobs. This matrix is developed considering surveys on occupations of past cohorts of school leavers, and by conducting separate estimates for different types of graduates. Since Canada receives substantial inflows of migrants it is important to consider the skills and education of immigrants when forecasting labour supply. Concerning re-entrants, the model is based on the assumptions that this part of the workforce returns to its previous occupation.

3. *Integration of Supply and Demand Side*

Supply and demand side data on occupational development are directly comparable. Excess supply and occupational shortages can therefore be computed by COPS for 139 occupation on a three digit level.

The COPS approach is broadly comparable with the Dutch ROA labour market forecasts, discussed below. However, unlike the Dutch approach COPS does not incorporate the impact of adjustments to disequilibrium situations on the labour market. COPS is strongly oriented towards practical relevance.

¹⁰ See Paul (2003).

Resulting estimates for occupations are widely used in the occupational and educational planning process in Canada. Job futures are also widely used by students and job seekers. This is supported by providing information on future labour market opportunities on regional levels, e.g. for Canadian provinces. COPS is also a positive example of how institutions from different regional levels can work together in order to enhance the quality of forecasts.

Germany

- **Institute for Employment Research (IAB)**

The Institute for Employment Research has been carrying out labour market analyses for the Federal Labour Office (Bundesanstalt für Arbeit) since 1969. These include compiling data on stocks and flows in the labour market and education system, as well as projections of the potential labour force and of labour demand. IAB started to project potential demand for labour by sector, occupation and qualification levels in 1985 (Fuchs and Tessaring 1994). Since then it has introduced various modifications to its methodology, and now carries out the following projections.

1. Employment Projections

Since 1996, IAB has been basing employment projections on the IAB/INFORGE (INterindustry FORecasting GERmany) model. INFORGE is an econometric input-output model projecting sectoral growth. The IAB/INFORGE model derives projections for Germany, but is also part of the international model association GLODYM. Thus in the IAB projections, Germany is not modelled as a closed economy, but the impact of Germany's international economic relationships on domestic labour markets is taken into account.

The model is based on a "bottom-up" principle, which derives projections from the detailed modelling of 59 different sectors, drawing on around 600 variables for each sector, as well as general variables for the economy as a whole (Distelkamp et al. 2003). INFORGE has a very complex model structure, incorporating a large share of endogenously determined variables. The model is highly interdependent, modelling, for example, quantity-price and wage-price interdependencies. Based on this model, IAB derives employment projections for 59 sectors. Data for the base year are derived from the German Mikrozensus and the National Account.

When assessing forecasting models, it is important to take into account that the determinants of sectoral labour demand can develop in distinct ways in the course of structural change (Lutz 2002). In the IAB forecasting model, overall employment development is projected on the bases of an aggregation of sectoral employment, taking into account the particularities of sectoral development trends. INFORGE can also incorporate a sub-national regional dimension, through a special sub-model, which produces projections for the 16 federal states, according to 11 sectors (Schur and Zika, 2002). Currently IAB projections extend to the year 2015, and the model is up-dated every year. The most recent projections confirm to a large extent the sectoral trend which has been observed in the

past: further losses in employment in agriculture and forestry, mining and manufacturing and increasing employment in the tertiary sector, where the greatest employment gains are expected in business related services (IAB 2002).

In general, forecasting economic growth by sector is essential for dealing with future labour demand. However, deriving quantitative estimates from INFORGE for skills shortages is not possible, as the model does not differentiate labour demand by qualifications or occupations. Nonetheless, one can derive assessments of general developments in labour demand and the potential for overall labour shortages or surpluses on the basis of models of the INFORGE type. This in itself is important information for policy makers. In addition, a sectoral breakdown of labour demand can provide the basis for advanced and more detailed analysis of labour markets.

2. *Projections by occupation and qualifications*

Since 1985, IAB has been carrying out numerous research projects together with PROGNOSE AG, on employment needs according to field of activity, occupational structure and qualifications.

The projections of labour demand differentiated by fields of activity are produced through “modified trend extrapolations”. This method of estimation takes into account that changes in occupational requirements are often related to sudden or rapid structural change (Weidig, Hofer and Wolff 1998). Extrapolations are derived from past determinants of developments by fields of activity combined with a rating of experts on the importance of these factors for future employment. Finally, the model is calibrated by applying it to past developments.

Historical trends are extrapolated into the future, factoring in a number of assumptions about future development trends in the determinants of labour demand. These factors may strengthen or reduce general employment trends in certain branches. Projections are based on past developments in employment disaggregated respectively by sector, occupation, and by a combination of the two. This approach allows one to differentiate between employment effects resulting from overall economic structural change on the one hand, and those produced by changing qualifications demand within branches on the other. Occupational trends within branches may be influenced by a bundle of factors (see Dostal, Rinberg and Schnur 2002): technological development (for example organisation, communication, automation and control technologies) and changing socio-economic conditions (such as demand structures, organisation of firms, norms for product quality). The forecasting period of current IAB/PROGNOS projections of occupation and qualifications ranges from 18 to 23 years.

The method for forecasting labour demand differentiated by field of activity has been continuously developed and improved by IAB and PROGNOSE. The latest projections, which run until the year 2010, consider 24 occupational groups, categorised into 7 occupational areas (Weidig, Hofer and Wolff 1998). In this projection, a differentiation is made between full- and part-time jobs. This distinction was an important addition, since part-time jobs are expected to become more important in the future. They

plan to make a further improvement to forecasts through combining INFORGE and projections of employment by field of activity (Weidig, Hofer and Wolff 1998).

Closely connected to the forecast of labour demand by field of activity are quantitative projections of labour demand by occupations, conducted by PROGNOSE (Schüssler,/Spiess/Wendland/Kukuk 1999). The latest study of this kind contains projections for labour demand classified by German qualification levels (equivalent to non-, low-, medium- and high-qualified). The analysis is based on an econometric model explaining past employment development by qualification. For projecting occupational demand, assumptions regarding future values of coefficients of the econometric model are developed.

These kinds of projections are highly helpful in providing detailed policy advice concerning education systems. In the future, an integration of advanced IAB sectoral growth models with projections classified by occupational structure should be aimed at. However, while 24 fields of activity are already incorporated into the model, a further disaggregated analysis would be even more helpful for policy advice.

3. *Projections of labour supply*

One recent IAB study on the long-term development of labour demand and supply by qualifications used the following method to project labour supply. For the “quantitative” component of supply it took long-term population trends, combined with projected participation rates. These latter were based on IAB calculations of long-term development of the labour force potential, based on statistics of the economically active, the registered unemployed, and the reserve labour force (i.e. non registered unemployed, but who would take up work under more favourable labour market conditions). Different projections of the labour force are offered, according to various levels of migration, and different participation rates of the domestic labour force (Reinberg and Hummel 2002). For projections of the “qualitative” component, i.e. skills composition, supply is calculated by extrapolating from past trends in qualifications, using data from the IAB’s “Bildungsgesamtrechnung” (BRG).

- **Institute for Economic Research (ifo)**

While IAB has the longest track record in this field in Germany, a number of other economics institutes also proposed methods for projecting shortages, as background reports for the German parliamentary Migration Commission, in 2001. The most advanced of these was the approach proposed by the Institute for Economic Research in Munich (ifo), which we shall briefly summarise below.

In 2001, the Institute for Economic Research (made two separate projections for labour demand and supply (Munz and Ochel 2001).

1. *Projections of labour demand*

This was projected in two main steps:

(a) Projection of overall economic growth and sectoral changes in employment for 22 branches, based on a regionally and sectorally differentiated prognosis model for the EU, developed by ifo. Intersectoral interdependences are modelled through input-output relationships. Data input is derived from two sources: forecasts supplied by Cambridge Econometrics, which forecast GDP, employment and interregional trade according to sector, on a regional level; and forecasts from the European Regional Economic Model (EREMED).

(b) Estimate of changes in occupational structure within each of the 22 branches, for 21 occupations. Trend projections concerning future occupational structure within branches are based on changes in the occupational composition of branches in West Germany over the past 20 years. Corresponding results combined with forecast of sectoral growth were used to produce matrices combining branches and occupations for the coming years up until 2015.

Ifo forecasts of changes in occupational structure were not model based, but based on four qualitative hypothesis.

- Growing regions in Asia and other regions of the world will attract a growing share of industrial production. This will reinforce the trend towards de-industrialisation in Europe.
- Eastern enlargement will expand the supply of relatively cheap labour. As a result, wages for low-skill jobs will decrease.
- It is assumed that no fundamental reforms of wages or social policy will be adopted in Germany. As such, Germany will remain a high wage country specialised in knowledge-intensive branches.
- Unemployment will remain on a high level despite declining population in Germany. Qualification will remain a decisive determinant for finding a job. Demand for higher education will increase.

The lack of a model-based econometric analysis of changes in occupational structure in ifo's forecasting model is a shortcoming, although it is one shared by other forecasting models. This omission probably results from the lack of data on the determinants of labour demand such as wages, technological and organisational change.

A second problem with the ifo model is the failure to base calculations on different scenarios of labour supply. This would have been especially useful for policy planning: it would have been useful to map scenarios which could have indicated, for example, how an increase in participation rates could contribute to reducing shortages.

2. *Projections of labour supply*

Similar to the IAB method, ifo's projection of labour supply was based on:

- (a) demographic projections from the German Statistical Office;
- (b) potential labour force participation rates, i.e. participation rates drawn from periods of full employment in West Germany (IAB 1999);

- (c) the assumption that qualifications profiles for different birth cohorts forming the labour force during the forecasting period will remain almost identical.

The Netherlands

- **Research Centre for Education and the Labour Market (ROA)**

The Research Centre for Education and the Labour Market (ROA) Maastricht has developed a forecasting model for the labour market position of different types of education with respect to the Dutch labour market. Every two years ROA compiles forecasts of changes in the labour market in the medium term (for a period of about 5 years), differentiated by a large number of economic sectors, occupational classes and types of education.¹¹ The most recent forecast for the period 1997-2002 is broken down into 13 economic sectors, 123 occupational classes and 98 types of education. ROA'S forecasts encompass the expansion of demand as well as the replacement demand. The sum of expansion and replacement labour demand is matched against the predictions of inflows, increase in labour supply, from each type of education. The forecasts are based on a theoretical framework incorporating both ex ante and ex post substitution processes in the forecasts of labour market situations for various types of education. Ex ante substitution processes refer to the demand-led substitution between types of education, e.g. due to the upgrading of skill requirements for a particular occupation. Ex post substitution refers to shifts in the educational structure of employment in an occupation due to the initially forecast gaps between demand and supply for various types of education.

1. Projected job openings

These are derived by forecasting expansion of demand (reflecting movement in employment levels in a particular occupational class for a particular type of education). This is based on the employment level forecasts of economic sectors, produced by the CPB Netherlands Bureau for Economic Policy Analysis. Replacement demand arises when workers leave, e.g. due to retirement or temporarily withdrawing from the labour market.¹² To estimate replacement demand, the model draws on cohort change rates to determine outflow by gender and by age group. In place of fixed coefficients for the occupational and training structure of employment, explanatory models are used to describe the changes in both structures over time.

2. Projected supply of job-seekers

This is given by the number of school leavers and the number of unemployed actively seeking work, e.g. after having visited training courses, or joining the job market from outside the regular education system. Forecasts of school leavers are derived from a students flow model indicating annual flows of students within the educational system, compiled by the Ministry of Education, Culture and Science.

¹¹ For a detailed description of ROA's forecasting model see de Grip and Heijke (1998).

¹² The authors argue that this concept avoids the problems associated with "vacancies", which do not differentiate between new openings and vacancies due to normal turnover, which essentially involves reallocation of the existing labour force.

ROA disaggregates these forecasts, and supplementary data is used to estimate the effects of the flows from non-regular education on the educational makeup of the flows entering the labour market. Unemployment data are obtained from the regional Public Employment Services, which provide information on educational background and labour market “suitability”¹³.

3. *Matching of labour demand and supply*

By matching labour demand with labour supply, ROA can then construct an indicator for the future labour market situation for each type of education. The indicator of future expected labour market prospects for a certain education is translated into a 5-point qualitative scale ranging from very good to poor prospects.

To sum up, the ROA model provides a comparatively solid theoretical framework. The ROA projection method is regularly improved by evaluating forecasting results. Moreover, the model is linked with other Dutch forecast models. Unlike other methods, the ROA model does not attempt to match total future labour demand with total future supply. Rather, its calculations are based on job openings and inflows on the labour market. Such an approach permits a far more sophisticated modelling of labour market issues than models that just refer to development of overall occupational demand and supply.

On the other hand, the ROA method does have shortcomings regarding detailed data on the level of birth cohorts. It is likely that the results of ROA forecast are more accurate concerning future job offers and seekers than results referring to the development of stocks. Altogether, because of the low level of aggregation used, the ROA forecast provides useful information for people who are involved in decisions about educational investments. Corresponding forecasts may be helpful in reducing skills shortages, especially in a comparatively small country such as the Netherlands. For larger countries, forecasts referring to surpluses or shortages on the national level have less potential to exercise a positive impact on labour market developments. This is due to the fact that labour market inflows and outflows might strongly differ between regions within a country. As long as interregional mobility is relatively low, regional mismatches might rise on a large scale, even where adjustments in education have been successful.

United Kingdom

The UK Department for Education and Skills (DfES) began to commission employment projections by occupation in 2000. The projects forecast sectoral and occupational employment for 2005 and 2010 at the UK level; and for the nine geographical regions in England. However, the Institute for Employment Research (IER) in Warwick has a longer record of research in this area.

¹³ Job-seekers are assessed according to whether they are considered to be suited for jobs for which they are officially qualified (or need re-training).

Institute for Employment Research (IER)

The projections were made by the Warwick Institute for Employment Research in collaboration with Cambridge Econometrics. The method essentially involves three steps (Haskel and Holt 1999):

- (a) projecting changes in employment in the economy as a whole. This is based on a multi-sectoral dynamics model for the economy (MDM) developed at Cambridge, an econometric model which includes over a thousand technical and behavioural relationships. The main components of the model are equations explaining consumption, investment, employment, exports, imports, and prices; as well as an input-output sector which includes flows of goods and services between industries (Wilson 1994).
- (b) projecting changes in the relative share of different industries. The MDM generates output and productivity estimates for 49 industries, based on the 1992 Standard Industrial Classification (SIC).
- (c) The IER has added a number of sub-models to the Cambridge MDM, to disaggregate employment by occupation and employment status. This enables them to project changes in the relative shares of different occupations within each industry. The occupational model is built around a series of matrices distinguishing 49 industries (SIC92) and 25 sub-major groups, from the new SOC 2000 occupational classification. Projections are extrapolated from data provided by the ten-yearly Census of Population and the Labour Force Survey. The projected occupational shares in each industry were then applied to the sectoral forecasts from the macroeconomic model.

The model therefore essentially involves a “top-down” approach: it begins by deriving industrial employment projections, which are then disaggregated into occupation categories for each industry.

IER has also projected labour supply on the highly skilled. Supply is based on the numbers of economically active persons holding higher qualifications; and projections for future years are derived from a stock-flow model. This is derived from the total number of qualified persons, subtracting losses due to deaths and net migration, and gains from new entrants; and then combined with projected participation rates by gender and age. Data on newly qualified graduates is derived from the Department of Education and Science (to supplement census information) (Wilson 1994).

It should be noted that the two models for supply and demand do not incorporate any adjustments which would bring supply and demand back into balance.

IER and DfES are currently exploring how to make better use of the UK Labour Force Survey to develop a more refined model of supply and demand for different occupations. DfES also plans to develop new databases, including a new historical database of employment by sector and region; and a corresponding database of key economic and related indicators (DfES).

- **Bureau of Labor Statistics¹⁴ (BLS)**

The US Bureau of Labor Statistics (BLS) has a longstanding tradition of examining future job prospects, spanning more than 50 years. Since the beginning of the 1970s projections were produced in a two year cycle. The BLS projections program has grown steadily from a project that initially reported simple descriptive material about available occupations, to an undertaking encompassing a model-based approach that develops projections of the macroeconomy, the labour force, industry employment and output, and occupational employment growth.¹⁵ Occupational growth patterns are also available for broad education/skill grouping.

BLS provides 10-year projections of employment and labour force. The latest projection, released in February 2004, covers the time period from 2002 to 2012. These projections reflect the 2000 Standard Occupational Classification (SOC) system and the 2002 North American Industry Classification System (NAICS). Until 1999, BLS produced projections under three different scenarios. BLS currently only produces one set of projections, because of the recognition that its users were only employing the moderate scenarios, and were sometimes misusing the alternative projections.¹⁶

The employment projection process consists of six components:¹⁷

Projection of Labour Demand:

- The growth of the aggregate economy.
- Final demand or GDP by consuming sector and product.
- Inter-industry relationships (input/output tables).
- Industry output and employment.
- Occupational employment.

Projection of Labour Supply:

- The size and demographic composition of the labour force.

BLS carried out a self-evaluation of its projections: 10-year macroeconomic forecasts are evaluated against the actual state of the economy in the end year of the projections. As would be expected, the projections generally perform better at higher levels of aggregation than for highly specific occupations, industries or groups.

¹⁴ Detailed information on the 2002-12 projections appears in five articles in the February 2004 issue of the Monthly Labor Review, published by the Bureau of Labor Statistics, U.S. Department of Labor.

¹⁵ See Horrigan (2004).

¹⁶ See Barnow (2002), p. 31.

¹⁷ See Barnow (2002), pp. 32-35.

1. *Projections of labour demand*

- *Aggregate growth of the economy*

BLS employment projections are based on a long-term view of the US economy that assumes a long-run full employment economy in which labour markets clear. BLS does not make its own projections of GDP growth. GDP input is provided by projection of a private-sector commercially available model. BLS makes its own assumptions of values for exogenous variables, but relies on the model for specifications about how the variables influence the economy.¹⁸ The long-term macroeconomic forecast of economic growth provides projections of personal consumption, investment, government, and foreign trade.

- *GDP by consuming sector and product*

The next step is the allocation of GDP among approximately 180 sectors of the economy. Estimates are derived from the related projections of four categories of expenditure – personal consumption, investment, government and foreign trade. Within each of these four broad categories, estimates for final demand are made by commodity sectors. It might be considered as a disadvantage of the BLS method that although analysts have significant flexibility in making the sectoral estimates, they are constrained by the sector forecasts produced by the macroeconomic model.¹⁹

- *Inter-industry relationships*

Furthermore, projections on intermediate flows of goods have to be made, since not all goods and services are involved in final demand. This stage of the projections process is based on input-output tables that relate final demand by commodity sector to industry output. With this step of the analysis, growth in the macroeconomy is translated into the levels of final market output of each industry and the levels of intermediates that are purchased by each industry to produce that output. Finally, a listing of industry output by sector is available.

- *Industry employment*

Projections of industry growth are then translated into projections of employment, classified by employees and self-employed, by industry (based on the 2002 North American Industrial Classification System - NAICS). Projections of average hours worked determine the number of jobs in the industry. On the basis of the results from the macroeconomic forecasting model, results on future unemployment rates and annual growth rates of productivity can be derived (Berman 2004).

- *Occupational employment*

On the basis of projections for industry employment, BLS calculates occupational employment by using an industry-occupation matrix that includes over 250 industries and 500 occupations.²⁰ Data

¹⁸ See Barnow (2002), p. 32.

¹⁹ See Barnow (2002), p. 33.

²⁰ See Barnow (2002), p. 33.

from the Occupational Employment Survey (OES) are then used to project the occupational staffing patterns needed in each industry. The OES provides detailed occupational employment information on each of the NAICS-based industries. These data are coupled with expert assessments of likely trends to produce employment projections for 725 occupations.

BLS also calculates inflows and outflows into the labour market, in its new Job Opening and Labor Turnover Survey (JOLTS). This covers turnover by industry, as well as replacement flows, by industry and occupation (Hecker 2004).

2. *Projections of labour supply*

Labour supply projections are based on the Census Bureau population projections, along with historical trends in labour participation rates. On this basis, the BLS conducts deeply disaggregated projections for labour force levels and participation rates by demographic characteristics. Projections encompass 130 age-sex-race/Hispanic origin groups. Having such a detailed labour force projection by age, gender, and race or ethnicity groups is a valuable feature of BLS projections. As empirical studies show, labour market behaviour substantially differs among demographic groups. Hence, modelling labour supply separately for different labour market groups contributes to enhancing the quality of labour supply forecasts.

3. *General assessment of BLS projections*

On the whole, the BLS system is based on an advanced method, which is well-equipped for labour market forecasts. However, regarding forecast of skills the model has to be further developed. Currently, BLS data generally do not include information on skills levels. Instead, BLS measures the preparation typically required to enter an occupation, with a BLS classification of training preparation which includes 11 categories (first professional degree required, doctoral degree required, master's degree required etc.). Barnow (2002) hints at the fact that one must be careful in interpreting corresponding data because most occupations have no standard for entry, and the BLS classification may not apply very well. Thus regarding forecasts of training and educational requirements, BLS projections have to be broken down into smaller categories.²¹

The BLS itself points out a number of problems in deriving projections of shortages from a comparison of employment and labour force projections:

- The number of projected jobs cannot be matched to the number of potential workers, as many people hold more than one job. Therefore the count of workers will be lower than the number of jobs.

²¹ It should also be mentioned that the US Employment and Training Administration (ETA) provides information on skills associated occupations. But these, at least to our knowledge, are not incorporated in labour market forecasts.

- Projections for industry employment rely on different data than those for labour force. Employment projections draw on the Current Employment Statistics survey, which counts payroll jobs at establishments; whereas labour force projections are based on data from a household survey which yields estimates of the number of individuals in the labour force.
- Projections of employment are essentially estimates of the labour required to produce projected levels of output by industry. But the supply of labour and skills, how it is organised, working times, technology, and so on will also influence sectoral growth.

It should be stressed that one clear advantage of the BLS approach is its efforts to make projections accessible to the public. Moreover, the website of the Office of Occupational Statistics and Employment Projections provides detailed employment projection statistics at no cost. Users have online access to the *Occupational Outlook Handbook* as well as to the *Career Guide to Industries*. Additionally, the Annual Occupational Outlook Handbook provides projections of employment requirements for occupations by skill, and provides guidance on what sorts of education or training yield good prospects on the labour market.

4.4 Evaluation

These studies represent just a sample of models offering quantitative projections for labour shortages. However, they provide a good basis for considering the strengths and weaknesses of existing methods in general, and for considering how these could be improved to better inform policy planning. In line with the criteria developed at the beginning of this section, we will distinguish six important requirements for projections of labour shortages. Three of these are scientific criteria: (1) theoretical problems, especially with prediction in an area with so many determinants; (2) methodological rigour – especially the problem of achieving a satisfactory level of disaggregation, and integrating models focused on different aspects of the economic system; and (3) data availability. In addition, we highlighted three praxis-related criteria: level of disaggregation, an adequate time frame, and the inclusion of scenario-mapping. With these criteria in mind, the following problems emerged as especially important.

- **Level of Disaggregation.** Models for projecting overall labour demand and supply are generally far more advanced than forecast methods differentiating labour market supply and demand *by occupation*. This is regrettable given the need for such differentiation for the purposes of policy planning. Nevertheless, economists providing labour market forecasts are aware of the importance of having labour market forecasts differentiated by skills. They have therefore made continuous efforts to improve their models in this respect.

One way of introducing more differentiation is through modelling economic growth via a bottom up rather than a top down approach. Bottom up approaches are derived by modelling economic development by sector, which allows a detailed analysis of sectoral development trends, which in turn provides a basis for forecasting the occupational composition of future labour demand. The

quality of labour market projections will depend on how deep the sectoral disaggregation of the respective forecasting model is. A good example of a bottom up model is the INFORGE model developed by the IAB, which includes 59 sectors. The forecasting model of BLS differentiates among x sectors, but unlike IAB projections it bases forecasts on a top down approach.

Having said this, projections of the occupational and qualifications composition of future labour demand cannot be derived directly from forecasts of structural developments. Employment by sector needs to be further broken down according to matrices showing the occupational composition of the labour force within sectors. Moreover, it is also questionable whether even a detailed break-down by occupation can be taken as a proxy for qualifications (Haskel and Holt 1999).

- **Integration of Demand and Supply Models.** There are important methodological problems faced by all of the studies discussed, stemming from their failure to integrate separate components of their models into one overall framework. In particular, most of the studies were based on separate projections for labour demand and labour supply. From a theoretical perspective, labour demand and supply should ideally be derived from one consistent model, as there are multiple interdependencies between the two. Where separate models are applied for labour demand and supply forecasts, one should expect at the very least that the classification by sectors and skills of labour demand and supply are consistent. This will be necessary for combining the results of corresponding forecasts and for deriving quantitative estimates for future skills shortages.

Clearly, any attempt to simultaneously model the demand and supply side of the labour market will face numerous theoretical and methodological obstacles. These problems become even more serious if one incorporates the occupational structure. However, some of the studies examined are relatively more advanced in this respect. The BLS provides detailed occupational structures for each of the sectors considered in its economic growth model. Within other studies, for example that of the IAB, development of the supply side by occupation is not directly linked with the economic forecasting model. Of course, that BLS is able to rely on a relatively detailed labour market model, stemming from a longstanding history of labour forecasts in the US. Moreover, differences in model structures can also be attributed to the fact that the data availability strongly differs between countries. The example of the BLS forecasts illustrates quite clearly that the combination of economic forecasts and complementary labour market surveys can produce highly differentiated projections: BLS forecasts are broken down according to 725 occupations.

- **Integration of factors determining participation rates.** A second methodological problem is the failure of most models to integrate parts of the model influencing participation rates into projections of labour supply. Participation rates are generally modelled separately from the applied economic forecasting models and population forecasts. This procedure overlooks the fact that participation rates to some degree depend on economic development and the assumptions made in population forecasting. For example, the development of wages, which is endogenous in some

of the economic growth models under consideration, influences participation rates. Concerning projections of participation rates, especially of women, the assumptions regarding trends in birth rates are highly relevant. This is just one example of an important interrelationship between economic development, assumptions of demographic forecasts and participation rates.

- **Extrapolation from past trends.** In general, the models project future developments on labour markets on the basis of past trends. In several models, the relation between labour demand and its determinants is captured in econometric models, which assume that the values of coefficients are time-dependent.

Likewise, in most of the studies, estimates of labour supply by skills base are based on time-dependent coefficients for the determinants of labour supply, taking into account that participation rates depend on a bundle of factors which cannot be assumed as constant in the future. This implies that an adequate analysis of skills and labour shortages requires detailed empirical studies on determinants influencing labour supply. For this purpose labour market surveys can be very helpful, especially if they are constructed as panel surveys. Indeed, most of the studies at hand incorporate results of labour market surveys in their forecasts. Most projection models also take into account the assessments of experts regarding the qualitative development of factors influencing labour demand and supply. Based on these assessments, trend extrapolations can then be carried out. The need to factor in such changes in the qualitative factors influencing labour supply is highly important for the quality of supply forecasts.

- **Data.** As argued above, well-informed policy planning for averting or addressing shortages requires highly disaggregated labour market forecasts. Yet there is a trade-off between level of disaggregation of the model, and data availability: the more complex and disaggregated a forecasting model is, the larger the data requirements are for solving the model empirically. Data requirements are especially demanding for short and medium-term forecasts differentiated by occupations and skills.

Some of the labour market models discussed clearly illustrate that the data availability could be enhanced if national institutions dealing with labour market issues, economic forecasts and demographic developments were to cooperate more closely – for example, through jointly developing a forecasting model for labour markets and building up a corresponding data-base. This would also make sense at the EU level. Other types of problems stem from the need for data input to be up-to-date: a problem that is especially pertinent for short-term labour market forecasts. Since labour supply and demand can change rapidly (for example due to cyclical trends), models can only provide useful results if data are constantly up-dated. In this respect, surveys are an important tool for supporting labour market forecast. Additional data input can be derived from empirical studies estimating coefficients and model parameters. Ongoing research is also important for this data, since factors influencing labour market participation and education (for example social security systems and family policy) can change from year to year.

The data requirements are therefore clearly high. Moreover, the goal of developing a harmonised data base with several institutions participating, spanning several countries, will need to overcome a number of obstacles. It could be the case that the effective functioning of the Dutch labour market information system can be attributed at least in part to the fact that the Netherlands is a comparatively small country.

- **Scenario-mapping.** Since the future quantitative development of most supply and demand factors cannot be predicted with any precision, labour market projections should be structured according to different scenarios capturing realistic trends. A baseline scenario as well as deviating scenarios should be developed in order to illustrate a corridor of possible future shortages. Such scenario-mapping, as well as sensibility tests regarding crucial factors, can provide helpful tools for developing appropriate policy instruments.
- **Time-frame.** Projections become more uncertain the longer the forecasting period is. The studies considered here attempt to address this problem through providing regular updates and implementing time horizons not longer than 15 years. As a rule, the time-period covered by labour market forecasts should be chosen according to their objective. For policy planning we need long-term, medium-term as well as short-term forecasts. The forecasting period of five years chosen by ROA is sufficiently long to produce useful labour market information for those who are investing in a course which will last for a number of years. However, short-term forecasts for the coming year or for a two-year period may be helpful for recruiting personnel for short-term training courses and other short-term labour market programmes, or for preparing people to enter the workforce.²²

Despite these shortcomings, labour market projections are essential for policy planning. This conclusion holds especially for countries facing demographic ageing and population decline, as is the case in Europe. In addition to these demographic trends, there are also a number of other changes which will have a significant impact on labour demand and supply in Europe, including changes due to technological progress, EU enlargement, and structural change. It will be imperative to develop adequate policy instruments for coping with the challenges that these changes pose to welfare systems, social services, and economic growth.

5. Implications for Policy and Research

5.2 Labour Shortage Projections and Migration Policy

This overview of methods for projecting labour shortages has a number of implications for policy-making. At the most general level, it suggests that there are significant impediments to deriving

²² See de Grip and Heijke (1998), p. 13.

accurate projections to help with the middle and long-term planning of policies to meet labour supply requirements. This is partly because of general theoretical problems with predicting phenomena which are influenced by such complex, often volatile factors, and which may also be significantly affected by policy developments in coming years. It is also a function of the methodological problems in deriving sufficiently disaggregated projections, especially regarding occupations and skills requirements. Moreover, projections cannot realistically cover more than a 15-year time-frame at the very most. More accurate or disaggregated projections may not be possible for more than one or two years in advance (if even that), and this is too short a time-scale for most areas of policy planning. However, the usefulness of the methods discussed will depend on the type of shortage which is being addressed. Here it is useful to return to our typology of shortages introduced in section two: aggregate shortages, and shortages due to qualitative or regional mismatch, or to information deficits.

Under each category of shortage, we shall briefly summarise the prospects for projecting future shortages, and the implications for policy and especially recruitment of foreign labour.

To help clarify options, we will divide labour migration policies into the following categories (a more detailed exposition of different types of admissions policy can be found in Papademetriou and O’Neill 2004):

Selection Criteria	Type of Programme
Human Capital-based	Points system
	Access to graduates
	Access to entrepreneurs
Sector-driven	Temporary/seasonal labour
	Fast-track work permits for particular sectors/occupations
Employment-based	Work permit (with labour market test)
	Regularisation/earned adjustment

It is important to note that policy planning for each type of selection criterion may require diverging levels and types of information. Sector-driven criteria are likely to require the most detailed breakdown of current and future shortages. By contrast, employment-based selection systems are more dependent on employers for defining shortages. Human capital based systems need to be based on information about skills or qualifications requirements, but this can be at a general level rather than based on a detailed occupational disaggregation.

- **Aggregate labour shortage**

This type of shortage is the least difficult to forecast, and most models perform fairly well in projecting general levels of labour demand and supply. Aggregate labour shortage could be caused either by

general economic growth, and/or by population decline or a significant decline in participation rates. In the case of demographic change, population projections provide a fairly reliable basis for labour supply projections, providing that they take into account different scenarios for migration and for factors influencing participation rates. Moreover, demographic trends can also provide a fairly good indication of the sectors which are likely to be most affected by ageing populations, thus providing good indications of areas which will face particular shortages due to shifting demographic structures.

Since these demographic projections can span several decades into the future, they can greatly facilitate policy planning in the area of welfare and social reform, and policies to encourage higher participation rates or prolong the number of years in employment. They can also help in the planning of measures to encourage more people to work in especially affected sectors such as health.

The notion that migration may be a significant part of the solution to problems of ageing and declining populations has been highly controversial. A much-cited United Nations report (UNPD 2000) indicating potential levels of “replacement migration” required to offset dependency rates has been widely criticised. Instead, most EU governments see migration as just one part of a package of reforms to increase participation rates, increase numbers of years spent in work, and encourage higher birth rates. Nonetheless, it remains open whether such reforms will have a sufficiently great impact on the behavioural patterns of EU citizens, such that the need for replacement migration is eliminated. Moreover, even where policies designed to influence birth rates, for example, do have an impact on behavioural patterns, these will require several decades to take effect. In the meantime, some shortages will almost inevitably occur. In these circumstances, governments may need to introduce targeted programmes to recruit people in particular sectors (for example in health) to meet shortages. However, foreseeing such gaps will require projections not just of aggregate labour demand, but a break-down of especially affected sectors and occupations.

One word of warning on the introduction of replacement migration programmes. Governments will need to be careful to avoid a situation in which the availability of low-skilled foreign labour delays the introduction of more capital intensive production techniques. This type of restructuring will be one important component of responses to rising dependency rates.

- ***Qualitative mismatch / skills shortage***

As we have seen, there are numerous impediments to projecting shortages by occupation and qualification. This is not just because of methodological problems with disaggregation, but also because skills and occupational requirements are themselves subject to change over time. Technological change frequently outpaces changes to education and training programmes. Since education and training reforms require some time to kick in, it seems unfeasible to expect projections to provide very detailed and timely guidance for policy planning. Having said this, more general trends in demand for particular occupations and skills can be projected, based on analysis of trends in de-industrialisation, the knowledge-based economy, and consumer preferences. Moreover, labour market

flows models, such as that developed by ROA in the Netherlands, can provide more disaggregated projections, although for a relatively short time-frame (up to five years).

The difficulty of deriving reliable, long-term skills shortage projections may not be fatal: in many cases the most critical skills requirement relates not so much to specific technical knowledge, but to a more general capacity for flexibility and lifelong learning. Promoting these types of skills can contribute to innovation and can also enhance labour supply flexibility, making workers more adaptable when it comes to learning new technologies, or switching between branches or occupations. Thus a number of EU states have attached special priority to ensuring a sound general primary and secondary education, which provides a good basis for subsequent higher education or lifelong learning (see, for example, DfES 2003; European Commission 2002a). In general, the onus should be on ensuring that both workers and education systems are sufficiently flexible to respond to rapidly changing qualifications and occupational requirements. Part of this implies the need for better access to information on (prospective) qualifications requirements in the labour market, so that those making education decisions or entering the labour market are better informed.

Even if governments could perfectly predict future skills shortages, these types of policies can at best seek to influence behavioural patterns regarding education, training or occupation choices. They cannot guarantee an adequate supply of the necessary skills. For this reason, three types of migration programmes may continue to be favoured by EU governments as a means of meeting shortages.

First, programmes targeted to recruit workers with specified skills or experience in specified occupations, for example areas of IT, engineering, or health care. Sectoral or occupation-based programmes such as the German Green Card scheme can attract qualified workers to address shortages in particular branches at relatively short notice. Such programmes are often designed as temporary programmes, often for political reasons. EU governments should, however, be realistic about the problems associated with temporary programmes. One of these is the difficulty of enforcing temporary stay where workers have been resident for a long period of time. Thus even assuming that education reforms take effect and the shortage in question can be met through domestic supply, it may not be feasible to expect workers to return home. A second problem is the difficulty in competing against other OECD countries for the best brains, especially in cases where workers are offered unattractive legal and social conditions.

A second type of programme is a points system, which sets out selection criteria based on factors such as age, dependants, qualifications, experience, salary, or even (as is the case in the UK, for example), occupation of spouses. Points systems assume that an increased supply of skilled workers will have a generally positive impact on innovation, productivity and growth. They also allow for more flexibility over time, as immigrants are not tied to particular occupations or jobs, but may be better able to respond to developing labour market conditions. Such programmes generally assume permanent settlement, rather than temporary migration.

Third, many EU states have broadened labour market access for third country nationals who have graduated in their country. This is a human capital-based selection system, with a similar logic to points systems, but also with important differences. Unlike a points system, access to foreign students does not permit selection based on demographic or other personal criteria. However, it does imply that those granted access already have some knowledge of the host country's society and culture, and may as such be considered as a good integration-oriented criterion for selection.

- ***Regional and occupational mismatch and mismatch due to information deficits***

Labour shortages due to the occupational or locational preferences of workers are the most difficult to project. Such shortages are not directly caused by trends in variables such as demographic change, participation rates, or economic and sectoral growth: rather, they depend on how workers subjectively weight a bundle of factors in making decisions about occupations or location of work. Such factors may include salaries and working conditions, loyalty to a particular location, or simply a lack of information on available jobs.

While it is therefore difficult to predict shortages due to such mismatch problems, as we have seen, surveys can provide vital information on other causes, and help to define policies which can seek to address them. Possible policies include introducing incentives or penalties to encourage the unemployed or reserve labour to take up work in other regions, or to take on otherwise unattractive jobs. Governments can also consider introducing more attractive remuneration or conditions for public sector jobs. Reforms can also be introduced to make labour market matching more efficient at local, national or EU-wide level.

However, where mismatch problems of this type have persisted in the past, EU governments have often responded by introducing temporary migration programmes for particular low-skilled sectors, especially in agriculture, food processing, construction, and hotel and catering. Such programmes may aim not just to fill gaps, but also to reduce the scale of illegal employment of foreigners. Governments have often introduced such programmes under pressure from business facing acute labour shortages. They may take the form of employment-driven schemes, i.e. based on work permits or regularisations. Or they may take the form of quotas for particular occupations or sectors, often through bilateral agreements. However, such temporary programmes often have a number of negative and unintended consequences:

- They can encourage increased illegal stay and labour, through the phenomenon of overstay of those entering on temporary permits, or through the expansion of migrant networks which can facilitate additional influx, stay and employment outside of legal programmes.
- Where immigration is planned as temporary but nonetheless evolves into permanent settlement, there may be serious integration problems because of the lack of measures to promote integration from the outset.
- Businesses may become structurally dependent on this source of labour. Thus even though programmes may have been designed as exceptional, one-off tools to fill gaps, firms will push for

the prolongation of programmes, or for the possibility of retaining workers who entered on temporary programmes but have now developed skills necessary for the job.

In general, given the political sensitivity of immigration, it is likely that governments will find it difficult to justify introducing programmes in the absence of already existing acute labour shortages. Even if projections could predict quantitative and qualitative shortages with a greater degree of certainty, governments may require more tangible “proof” in order to convince their electorates of the need for additional foreign labour. A clear example of this is the case of Germany: while the government could justify the Green Card on the basis of the clear shortage of skilled IT workers, it has been unable to generate sufficient political backing for a framework for a points system that would enable recruitment of workers according to projected demographic trends. This implies that while projections may provide a basis for policy planning in the areas of education, labour market, welfare or social reforms, because of the special political sensitivity linked to immigration, it is likely that migration policy will remain subject to more short-term, ad hoc planning.

5.2 Further research requirements

Research requirements for projections of labour shortages will vary, depending on:

- The type of shortage involved
- Its causes
- The type of policy responses that are considered appropriate (including migration)

The types of projections that may be helpful for particular types of shortages or policy responses are summarised in the table below.

Shortage	Cause	Policy Responses	Migration Programme?	Projections
Aggregate	Economic growth Declining participation rate Ageing populations	Encourage higher participation rates Lengthen years in work Encourage higher birth rates	Human capital-based Sector-driven	Aggregate shortages Especially affected sectors and occupations (qualitative trends)
Mismatch: Skills	Sectoral growth Delocalisation Technology/Innovation Education systems	Flexibility in education systems Lifelong learning Labour market information systems	Human capital-based Sector-driven Employment-based	Disaggregated projections by qualifications Flows model
Mismatch: Regional/ Preferences	Sectoral/regional growth Job preferences Low mobility	Incentives and conditionality to promote regional and occupational mobility	Sector-driven Employment-based	Disaggregated projections by region and occupation Employer/employee surveys

The best possible information basis for policy planning will therefore consist of a combination of different methods and types of projections. General projections of aggregate demand and supply will be useful for estimating potential shortages due to demographic change, and for planning longer-term policy reforms to increase participation and birth rates. Such projections will need to be disaggregated to help forecast which sectors will be particularly affected. For skills mismatches, projections need to be far more disaggregated: both to inform policy reforms, but also to provide relevant information to individuals making decisions about education, occupation or location. In this respect, a flows model such as that used by ROA appears particularly useful. While for mismatch due to locational or occupational preferences or a lack of information, surveys will also play an important role in trying to ascertain and explain the determinants of individuals' job and location choices.

This implies that more systematic attention should be given to developing such models and surveys at both national and EU level. In the meantime, particular emphasis should be placed on:²³

²³ Please note that this is a very general list: the authors can elaborate on proposals, based on feedback from DG Employment regarding where their priorities lie.

- **Exchange on Best Practice in Forecasting**

A concerted effort should be made to improve the coordination of research activities between researchers in EU Member States, as well as dialogue between EU, North American and Australian researchers. There are two main arguments for reinforcing dialogue between research institutes:

- First, to exchange best practices on methodology and data collection; such a dialogue should include relevant research bodies in OECD countries, as well as relevant government agencies involved in commissioning or carrying out research.
- Second, to explore and develop common approaches for forecasting shortages in different Member States. Experts from EU states would benefit from more intensive dialogue to explore and develop proposals for a common EU approach to projecting shortages.

Recommendation:

This dialogue could be brought forward in two stages.

1. An expert workshop, organised under the auspices of DG Employment, and coordinated by one or two EU institutes (for example HWWA, jointly with a second institute such as ROA in the Netherlands). The workshop would be based on several specially commissioned papers, devoted to questions such as comparative analysis of best practice, outstanding methodological issues, and problems of data gaps and harmonisation between Member States. The workshop would bring together selection of researchers and government agencies from OECD countries, as well as European Commission, Eurostat and OECD. The coordinating institutes would be tasked with drafting a set of follow-up recommendations.
2. Based on the follow-up recommendations, DG Employment could organise a second meeting bringing together representatives of all EU Member States (agencies or ministries responsible for compiling labour market data and commissioning or carrying out projections), as well as selected experts. The aim of the meeting would be to define concrete steps (a “road map”) towards developing a common method for forecasting shortages. It could be organised as a conference in cooperation with a Member State during its presidency.

- **In-depth Study on Data**

We would recommend that DG Employment commission a systematic study of data availability and gaps in different EU countries, as well as the possibilities for and impediments to ensuring consistent data between countries. This study could be conducted on the basis of a questionnaire to relevant statistical agencies, ministries and research institutes in all 25 Member States. The study would develop proposals for filling gaps in data, and for data harmonisation between EU countries. The results would also be presented and discussed at the expert workshop (see above).

- **Best Practice on Addressing Information Deficits**

In addition to dialogue on improving and harmonising labour market projections, it is vital that EU Member States consider best practice for dissemination of this labour market information to those entering the job market or taking decisions on education. DG Employment could also commission a study looking at this question in more depth, including comparing practice in different OECD countries, and evaluating its impact on users. This could involve carrying out user surveys, in collaboration with research institutes in relevant countries (we would initially suggest that the case studies include the US, Canada and the Netherlands).

References

Barnow, Burt S. (2002), "Occupations and Skills in the United States: Projection Methods and Results through 2008", in Neugart, Michael and Klaus Schömann, eds., *Forecasting Labour Markets in OECD Countries: Measuring and Tackling Mismatches* (Cornwall: MPG Books), pp. 26-65.

Berman, Jay M. (2004), "Industry Output and Employment Projections to 2012", *Monthly Labor Review* (US Bureau of Labor Statistics, February), pp. 58-79.

Boeri, Tito and Herbert Brücker (2000), *The Impact of Eastern Enlargement on Employment and Wages in the EU Member States* (Berlin and Milan: European Integration Consortium).

Coppel, Jonathan, Jean-Christophe Dumont and Ignazio Visco (2001), 'Trends in Migration and Economic Consequences', OECD Economics Department Working Papers No. 284 (Paris: OECD).

Department for Education and Skills (2003), "21st Century Skills: Realising Our Potential", Presented to Parliament by the Secretary of State for Education and Skills (London).

Distelkamp, Martin, Frank Hohmann, Christian Lut, Bernd Meyer and Marc I. Wolter (2003), *Das IAB/INFORGE-Modell*, Beiträge zur Arbeitsmarkt- und Berufsforschung (Nuremberg: IAB).

European Commission (2003a), Short-term Trends of EU Employment Growth, Employment and Social Affairs (Brussels, 10 November).

European Commission (2003b), Employment Outlook 2002 (Brussels).

_____(2002a), Communication from the Commission: Commission's Action Plan for Skills and Mobility (COM (2002)72 final), Brussels 13 February.

_____(2000a), Communication from the Commission to the Council and the European Parliament on a Community Immigration Policy (COM (2000) 575 final).

_____(2000b), "Performance of the European Union Labour Market: Results of an ad hoc labour market survey covering employers and employees".

Eurostat (2003a), *50 Years of Figures on Europe*, Luxembourg, 2003.

_____(2003b), *Jahrbuch 2003*, Luxembourg, 2003, p.114-115.

_____(2001a), "Regional labour force in the EU: recent patterns and future perspectives", in: *Statistics in focus*, Luxembourg, 2/2001, p.3.

_____ (2001b) *Europäische Sozialstatistik - Erhebung über Arbeitskräfte*, Luxembourg, 2001, p.57.

Fuchs, Johann and Manfred Tessaring (1994), "Medium and Long-term Forecasting of Employment in Germany", in Hans Heijke (ed.), *Forecasting the Labour Market by Occupation and Education: The Forecasting Activities of Three European Labour Market Research Institutes* (Boston, Dordrecht and London: Kluwer Academic Publishers), pp. 37-53.

de Grip, Andries and Hans Heijke (1998), "Beyond Manpower Planning: ROA's Labour Market Model and its Forecasts to 2002", ROA-W-1998/6E (Maastricht: ROA).

Haskel, Jonathan and Richard Holt (1999), "Anticipating Future Skill Needs: Can it be Done? Does it Need to be Done?", Skills Task Force, Research Paper 1 (September).

Heijke, Hans, ed. (1994), *Forecasting the Labour Market by Occupation and Education: The Forecasting Activities of Three European Labour Market Research Institutes* (Boston, Dordrecht and London: Kluwer Academic Publishers).

Hönnekopp, Elmar, Karl Wolfgang Menck and Thomas Straubhaar (2001), *Fachkräftebedarf bei hoher Arbeitslosigkeit* (Hamburg: HWWA).

Horrigan, Michael W. (2004), "Employment Projections to 2012: Concepts and Context", *Monthly Labor Review* (US Bureau of Labor Statistics), pp. 3-22.

ILO (1995), *World Employment 1995* (Geneva: ILO).

IZA (2001), *Die Nachfrage nach internationalen hochqualifizierten Beschäftigten: Ergebnisse der IZA International Employer Surveys 2000*, Gutachten im Auftrag des Bundesministeriums für Bildung und Forschung (Bonn: IZA).

Klos and Schäfer (2001), *Fachkräftebedarf bei hoher Arbeitslosigkeit*, Institut der deutschen Wirtschaft, Köln.

Meagher, G. A.; Adams, P. D. and Horridge, J.M. (2000), "Applied General Equilibrium Modelling and Labour Market Forecasting", Centre of Policy Studies, Monash University, Preliminary Working Paper No. IP-76.

Munz, Sonja and Wolfgang Ochel (2001), *Fachkräftebedarf bei hoher Arbeitslosigkeit* (Institut für Wirtschaftsforschung).

Nekkers, G., P. van Eiks, A. de Grip and B. Diephuis (2000), "Regional Supply-Demand Discrepancies. A Training Perspective", Research Centre for Education and the Labour Market (ROA), Maastricht.

Neugart, Michael and Klaus Schömann, eds. (2002), *Forecasting Labour Markets in OECD Countries: Measuring and Tackling Mismatches* (Cornwall: MPG Books).

OECD (2003a), "Immigration and Labour Shortages: Evaluation of Needs and Limits of Selection Policies in the Recruitment of Foreign Labour", Marco Doudeijns and Jean-Christophe Dumont, *The Economic and Social Aspects of Migration*, Conference Jointly Organised by the European Commission and the OECD, Brussels, 21-22 January 2003.

_____ (2003b), *OECD Employment Outlook 2003* (Paris: OECD).

_____ (2000), *Measuring the IT Sector*.

Papademetriou, Demetrios G. and Kevin O'Neill (2004), "Efficient Practices for the Selection of Economic Migrants", Draft Paper prepared for the European Commission DG Employment and Social Affairs (Hamburg: HWWA).

Paul, S. (2003), "B.C. Occupational Employment Projections 2001 to 2011 – An Overview and Highlights from the COPS BC Unique Scenario", Ministry of Advanced Education, BC.

Reinberg, Alexander and Markus Hummel (2002), "Zur langfristigen Entwicklung des qualifikationsspezifischen Arbeitskräfteangebots und –bedarfs in Deutschland", *MittAB 4/2002*, pp. 580-600.

Schnur, Peter and Gerd Zika (2002), "Längerfristige Arbeitskräftebedarfsprojektion und Politiksimulation im IAB", in G. Kleinhenz (ed.), *IAB-Kompendium Arbeitsmarkt- und Berufsforschung. Beiträge zur Arbeitsmarkt- und Berufsforschung*, pp. 203-19.

Smith, Douglas A., "Forecasting Future Skill Needs in Canada", in Neugart, Michael and Klaus Schömann, eds., *Forecasting Labour Markets in OECD Countries: Measuring and Tackling Mismatches* (Cornwall: MPG Books), pp. 66-79.

Straubhaar, Thomas (2001), "Ost-West Migrations-Potential: wie gross ist es?" *HWWA Discussion Paper 137*.

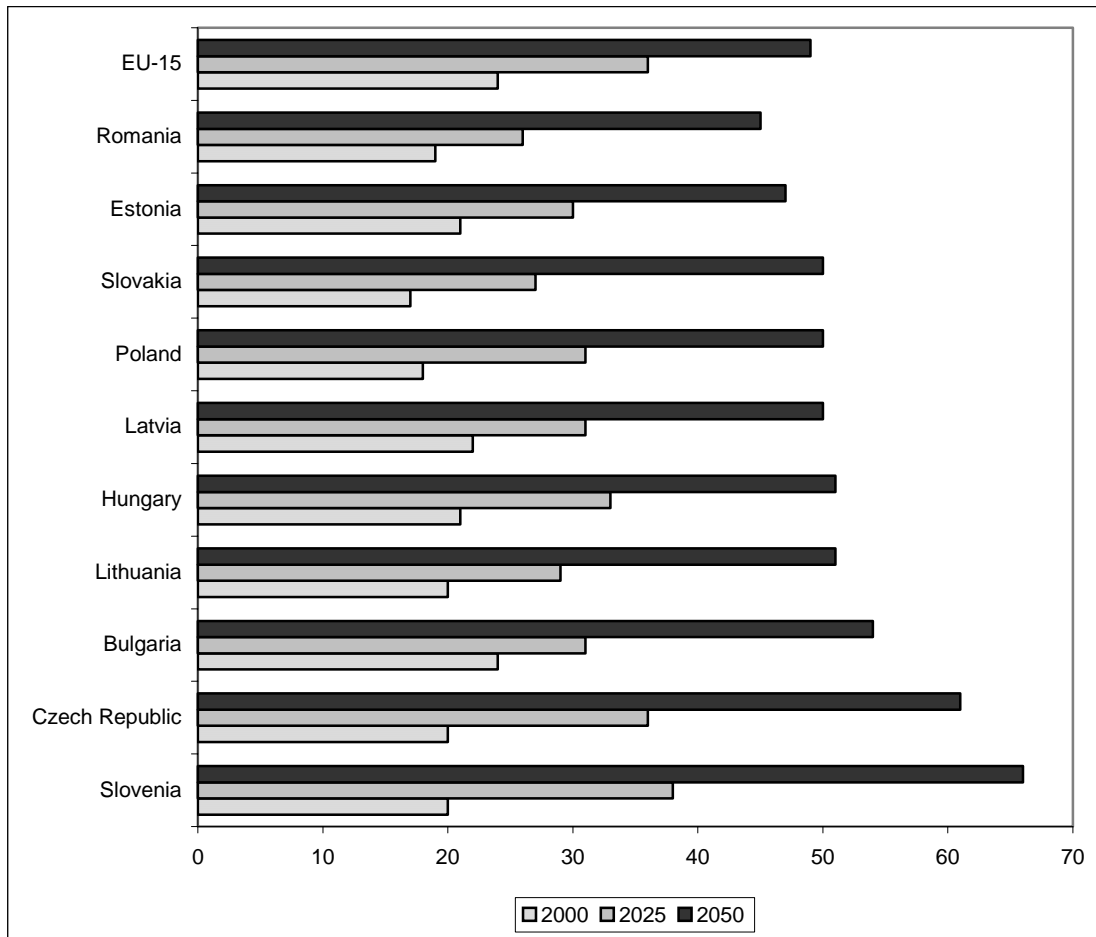
United Nations Population Division (2000), *Replacement Migration: Is It a Solution to Declining and Ageing Populations?* (New York: UNPD).

United States National Research Council (2001), *Building a Workforce for the Information Economy*, Committee on Workforce Needs in IT (Washington DC: National Academies Press).

Visco, Ignazio (2001) 'Ageing Populations: Economic Issues and Policy Challenges', Working Paper presented at the OECD Conference on *Economic Policy for Ageing Societies* (Paris: OECD).

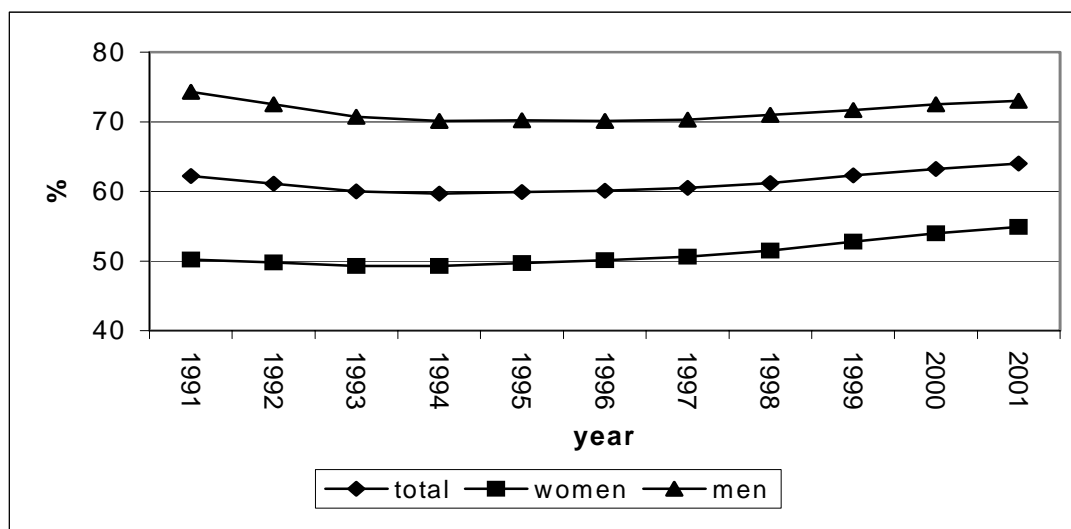
Wilson, Rob (1994), "Modelling and Forecasting the Structure of Employment in the United Kingdom", in Heijke (ed.), pp. 9-35.

Figure 1: Population share of people aged 65 years and more



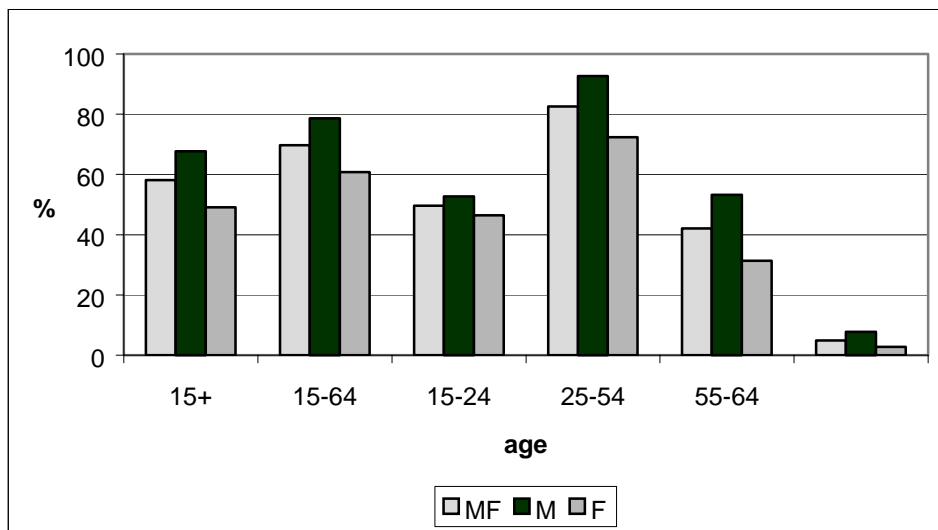
Source: Institut der deutschen Wirtschaft (2004).

Figure 2: EU Labour Force Participation Rates



Source: Eurostat (2003b).

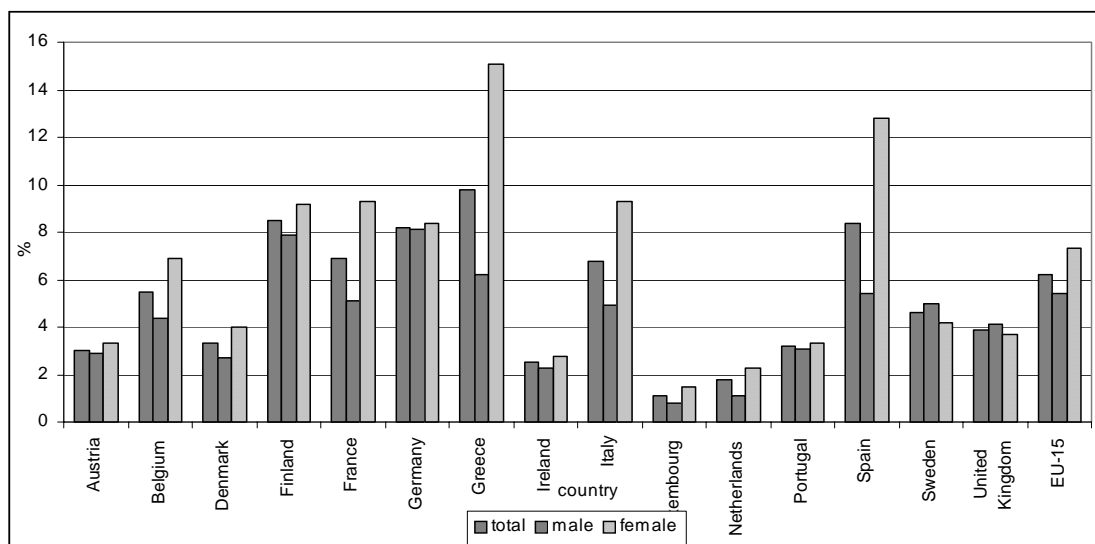
Figure 3: EU Labour Force Participation Rates, 1999



Note: data for Greece from 1998; data for Finland, France and Germany from 2000.

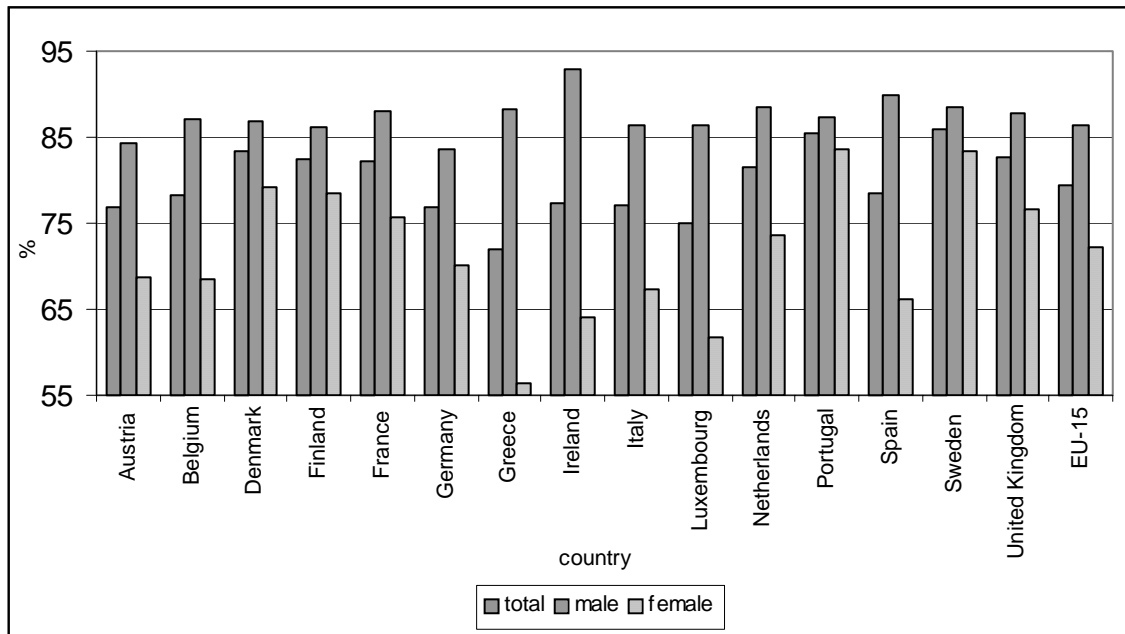
Source: OECD (2003b)

Figure 4: Unemployment Rates among Persons Aged 25-64 with Upper Secondary Education



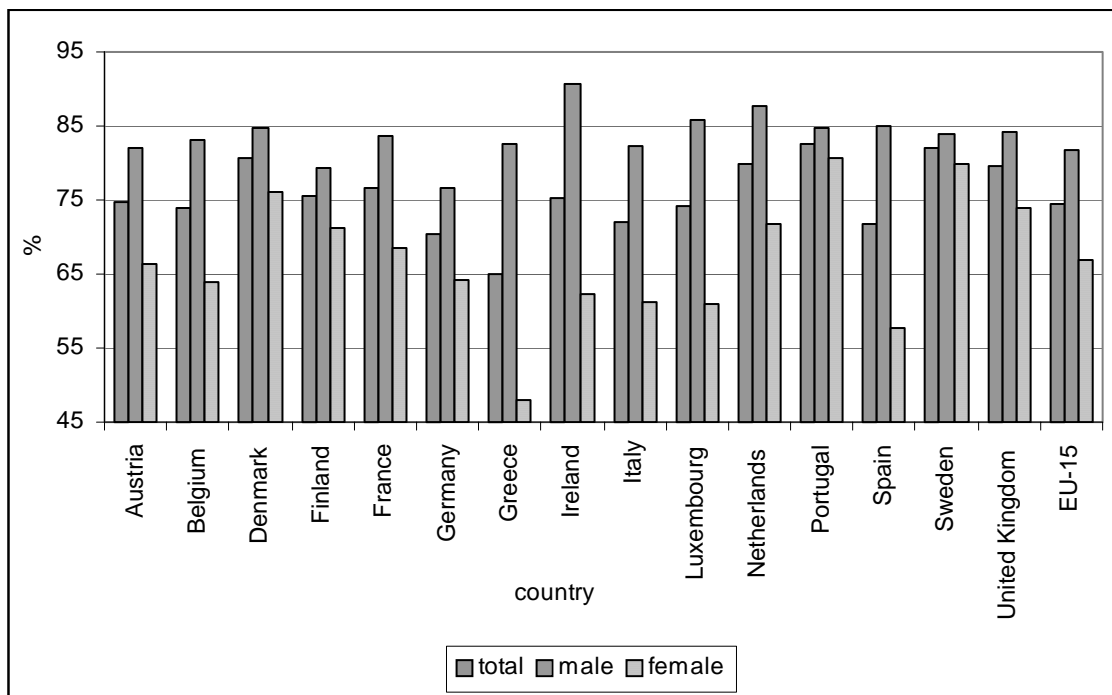
Source: OECD (2003b)

Figure 5: Employment/Population Ratios Among Persons Aged 25-64 with Upper Secondary Education



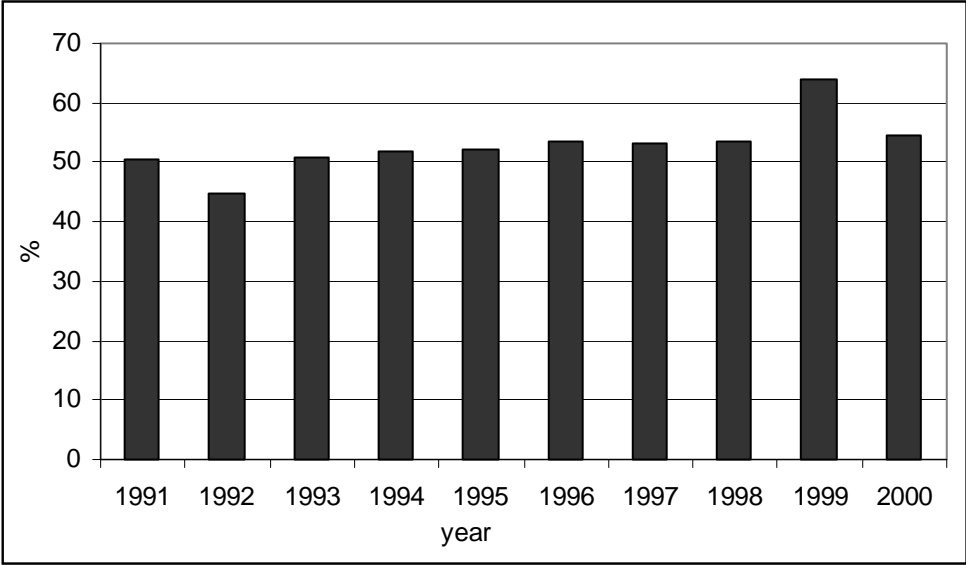
Source:OECD (2003b)

Figure 6: Labour Force Participation Rates among Persons Aged 25-64 with Upper Secondary Education



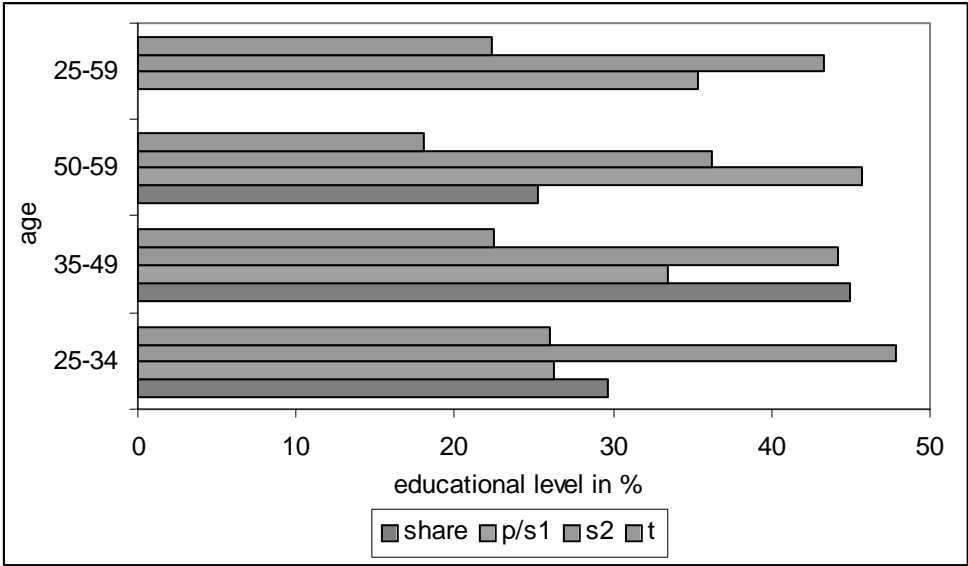
Source:OECD (2003b)

Figure 7: Per Cent of EU Tertiary Level Students in the Working Population



Source: Eurostat (2003b), and own calculations based on Regiodatabase

Figure 8: EU population and Level of Education 2001



p/s1 = primary + secondary I
 t = tertiary

Source: Eurostat (2001b)