Supply and demand for different kinds of labour*

Nils Martin Stølen

The labour force is composed of persons with different kinds of education and different qualifications. If supply and demand do not grow at the same path, shortages or surpluses of different labour categories may arise. On the basis of demographic and economic models developed in Statistics Norway, it is possible to project possible future imbalances in the labour market. Given the assumptions applied, these projections show that there may continue to be a shortage of physicians, nurses and auxiliary nurses the next few years. Low recruitment to engineering studies may also result in a shortage of this category. The increased number of students the last decade may, on the other hand, imply an excess supply of social scientists. This may to some extent also be the case for lawyers and humanists.

Introduction

According to figures from the national accounts, employment in Norway rose by as much as 226 000 persons from 1993 to 1998. Even though the sharp growth in employment has resulted in an increase in the labour force, unemployment has also declined. Measured as an annual average, and applying the definition used by The Labour Force Surveys (LFS), unemployment decreased to 3.2 per cent of the labour force in 1998, against more than 6 per cent in 1993. A shortage of several kinds of labour has been registered the last few years. Wage developments in 1998 and 1999 also indicate pressures in some labour market segments.

The labour force is composed of people with different kinds of education and qualifications. If supply and demand for different types of labour do not grow at the same path, the shortage of labour in some sectors may be so great that wage growth accelerates even if there are still several people unemployed in other parts of the economy. A shortage of some kinds of skilled labour may also restrict the possibilities of implementing high-priority tasks in society. It is therefore important to have an overview of potential imbalances in the labour market and how these imbalances can develop in the years ahead. Such knowledge may assist the authorities in the adaptation of capacity in various educational institutions.

In order to obtain greater insight into these issues, Statistics Norway has developed a model for projecting supply and demand for various kinds of labour by education. The model is based on Statistics Norway's macroeconomic and demographic models, and therefore provides a picture that is consistent with projections from these models. However, due to the uncertainty concerning macroeconomic developments, political priorities, changes in various sectors' demand for different kinds of labour, as well as changes in propensities to study, the results must be interpreted with caution. The composition of employment in various industries may, for example, be influenced by the supply of persons with different educational backgrounds, and expected imbalances in the labour market can influence the choice and level of education. The projections must therefore be interpreted as estimates of developments in the labour market given certain assumptions, and not as forecasts for trends in unemployment for different kinds of labour. In important public sectors, such as the health and social sector and the education sector, political priorities will be of considerable importance both in terms of supply and demand for different kinds of labour. A more detailed planning tool has therefore been developed for these areas for use in the ministries concerned.

Statistics Norway's general model for projections of supply and demand for different kinds of labour is documented in Drzwi et al. (1994). An updated application was published in Cappelen and Stølen (1994). Later, results based on updated assumptions have been published as part of Statistics Norway's Economic Survey of the previous year, most recently in Statistics Norway (1998).

Since the publication in 1998, the underlying material in the model has been extensively updated. This applies to:

Nils Martin Stølen is Head of Division for Public Economics. (nils.martin.stoelen@ssb.no)

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- New supply projections based on updated and improved assumptions concerning choice of education
- New macroeconomic calculations of importance for the demand for labour in various sectors
- Transition to new industry classifications in accordance with international recommendations (NACE) and subsequent adjustments of the industry classification in Statistics Norway's macroeconomic models
- The main revision of the national accounts, which has resulted in an upward adjustment of the estimates for employment in various service industries
- Updated information on the composition of employment by different categories of education in each sector
- Reconciliation of the supply and demand side according to the composition of unemployment by education in 1997 (compared to 1995 in Statistics Norway (1998))

Among these factors, the updated supply projections have been of greatest importance to the results for various categories of education.

Supply of labour by education

The projection of supply of various categories of labour by education is based on the demographic microsimulation model MOSART (see Fredriksen, 1998). In the calculations, the number of economically active persons with a given education is increased by the supply of recent graduates, while further education, transition to social security or withdrawal from labour force activity for other reasons result in a reduction. The projection of the number of students is based on propensities to study from 1993, and it is assumed that the educational propensities remain unchanged at this level throughout the projection period. Even though the changes in propensities to study have not been as great as in the period from 1987 to 1993, the time that has elapsed since the last updating increases the uncertainty of the results. However, work has been in progress to update the propensities to study so that they correspond to the situation in 1997. Revised projections for developments in the labour market will probably be published in half a year.

One limitation of supply projections in MOSART is that they are exclusively based on demographic characteristics. Economic factors that might influence labour force participation for various groups are not included. However, these factors are included in the macroeconometric model MODAG (see Cappelen 1992) where labour force participation for a rough classification of the population by gender and age (but not education) is influenced, among other factors, by unemployment and wage conditions. Total labour supply is therefore projected using MODAG, while the results from MOSART are used to distribute the total supply on different categories of education.

Table 1. Supply of labour by education 1997-2010. 1 000 persons

	1997	2000	2005	2010
Primary school/first year upper secondary school	821	754	646	558
Secondary school, 2-3 years	789	846	919	999
University/college level (four year programme)	470	520	583	650
University/college level over four years	114	127	148	165
Unspecified	70	79	92	106
Total*	2 263	2 325	2 388	2 478

* Excluding conscripts and foreigners in ocean transport
Source: Statistics Norway

Labour supply projections for the main categories of education are shown in table 1. When conscripts and foreigners in ocean transport are disregarded, labour supply is estimated to grow by 215 000 persons, or 9.5 per cent, from 1997 to 2010. Of this, 97 000 persons can be ascribed to demographic factors related to growth in the working-age population. The remainder may be ascribed to an assumption of a further rise in the labour force participation rates for women and youths, but at a slower pace than through the period of economic growth from 1993 to 1998. After the increase of more than 30 000 persons in the labour force in 1998, a slower rate of growth in the Norwegian economy indicates that labour supply only may expand by about 10 000 persons a year in the period 1999-2004. This is slightly higher than the growth implied by demographic factors. Experience shows that a possible growing shortage of labour from around 2005 may have a positive effect on labour force participation for women and youths, so that the growth in the labour force may reach between 15-20 000 a year from 2005 to 2010.

The sharp rise in capacity at universities and colleges the past decade is the main reason why labour supply for the group with education at the university/college level (lower degree) is projected to increase by 180 000 persons, or 38 per cent, from 1997 to 2010. The labour force for the group with the highest university/college education may increase by nearly 45 per cent in the same period. Persons with a university degree in social sciences are expected to record the sharpest increase. A considerable growth is also expected for the humanities, law and among health personnel at college level. The labour supply from engineers, on the other hand, is only expected to show a slight increase.

For persons with an upper level secondary school education, labour supply may increase by about 210 000 from 1997 to 2010, and approach 1 million. The number of persons with only primary school/lower level

secondary school education shows a clear downward trend as the oldest segments of the population with a relatively high share of only primary education reach retirement age. An increase in the number with unspecified education in the projections of the labour supply contributes to some uncertainty concerning the distribution of labour supply by education.

Outlook for employment trends in various sectors

The projections of demand for labour are based on calculations using Statistics Norway's macroeconometric model MODAG from the summer of 1999. Even though 1996 was the base year for the projections, they were reconciled with preliminary national account figures for actual developments in 1997 and 1998. The relatively sharp growth in employment that took place in these years has thus been incorporated. The calculations for 1999 and 2000 are based on the assumption that the demand stimulus from both Norway and abroad will be weaker than in previous years. This will result in modest employment growth. Information concerning employment changes in 1999 based on Statistics Norway's Labour Force Surveys (LFS) also indicate a noticeably slower growth in employment compared to the recent years.

The turnaround in the Norwegian economy is partly due to more sluggish growth in traditional merchandise exports and a weaker development in mainland investments in 1998 and the beginning of 1999. Petroleum investments have also fallen sharply in 1999 after the peak level recorded in 1998. Along with increasing costs in 1998 and 1999, the weaker development in investments and slower growth in merchandise exports will contribute to a slow trend in Norwegian manufacturing industry, with a fall in employment. The turnaround will also gradually affect construction, and probably contribute to lower employment in this industry. Developments in household consumption also slowed down during 1999. This will contribute to lower employment growth in wholesale and retail trade and other private services. Employment in the public sector is also assumed to show only a moderate increase as a result of a relatively tight fiscal policy. However, employment may grow in e.g. the health and social sector as a consequence of reforms that have already been approved. As a result of this and the possibility of decisions on further reforms, public sector employment is assumed to show a slightly stronger growth than in the baseline projection in the previous Government's Long Term Programme (Ministry of Finance 1997).

Regarding total employment the projections show only a modest growth in the period to 2002. Inasmuch as the labour force is expected to increase slightly due to demographic factors, unemployment may increase. In the calculations, unemployment is estimated to reach about 4.4 per cent in 2002,

Table 2. Projection of the labour force, unemployment and employment. 1997-2010. 1 000 persons

	1997	2000	2005	2010
Labour force*	2 306	2 365	2 424	2 509
Unemployment	93	90	109	104
Employed*	2 213	2 274	2 314	2 405
- Primary industries	101	103	97	91
- Manufacturing	319	308	283	263
- Oil and ocean transport	64	66	58	50
- Construction, power supply	135	138	140	148
- Wholesale and retail trade	315	319	322	328
- Domestic transport	151	151	142	156
- Other private services	448	479	504	537
- Public sector	680	710	769	832

* Including conscripts and foreigners in ocean transport.
Source: Statistics Norway

measured by the LFS definition. However, this is considerably lower than the previous unemployment peak recorded in 1993. The development after 2002 is estimated more uncertain, but the Norwegian economy may exhibit a more positive trend, with a moderate growth in employment. As this may stimulate labour force participation, growth in the labour force also may pick up, and unemployment is expected to decline only moderately up to 2010.

Estimates for changes in the labour force, unemployment and employment by industry from 1997 to 2010 are shown in table 2. As a result of the cyclical downturn and technical progress, manufacturing employment is expected to fall considerably. A negative employment trend will probably also be seen in the primary industries and ocean transport. Over a longer period a greater number of people may be employed in construction, domestic transport, wholesale and retail trade and other private services. However, the sharpest growth in employment in the period to 2010 is expected to take place in the public sector, which is less affected by a sluggish economic development in 2000 and 2001 than other sectors. On the assumption of a moderate improvement in standards and coverage, the health and social sector, and to some extent the education sector, are expected to account for most of the increase in public sector employment. Employment growth is assumed to be very modest in public administration, and in the defence sector the number employed may decline.

Demand by different categories of education

Employment in various sectors of the economy consists of persons with different kinds of education, and the composition differs across industries. As noted earlier, a shift in the composition of industries will therefore in itself contribute to changes in the need for different kinds of labour. In addition, shifts in the composition within each sector may occur.

The projections are based on the educational distribution of the employed from 1997. During the last 20

Table 3. Demand for different kinds of education 1997-2010. 1 000 persons

	1997	2000	2005	2010
Primary school/first year upper secondary school	774	714	621	581
Secondary school, 2-3 years	761	825	880	922
University/college level (four year programme)	461	508	575	646
University/college level over four years	112	123	138	155
Unspecified	62	64	66	69
Total*	2 170	2 234	2 279	2 374

*Excluding conscripts and foreigners in ocean transport
Source: Statistics Norway

years the shares of persons employed with secondary school and higher education have been rising considerably in most industries. It is assumed that the growth in these shares will continue, but there is considerable uncertainty associated with the magnitude of this growth. In several sectors many of the tasks can be performed by educational categories that are closely related, and there is thus a tendency for the composition of employment to be influenced by the composition of supply.

On the basis of the assumptions above, the demand for most kinds of labour with secondary or higher education is likely to increase in the period to 2010. Table 3 shows that the increase, both relatively and absolutely, will be greatest for those with college education and university level of lower degree (up to four years). This particularly applies to different types of health personnel due to the assumption of continued growth in the health and social sector, and the likelihood that trained personnel will perform an increasing number of tasks at the expense of the unskilled. Among other labour groups with university or college education, growth in demand is also expected to be considerable for those who have studied economics and administration, social sciences, humanities and for teachers. There will also be a substantial need for more engineers and graduate engineers, although the projected sluggish development in some manufacturing sectors and construction the next few years imply that demand will not increase to the same extent as for the groups mentioned above. A modest growth in public administration is one of the reasons for a more sluggish increase in the need for lawyers, but the share of this educational category will expand in most sectors.

Even though the need for persons with different types of secondary education also may increase, the clear shift towards university and college education implies slower growth for this group. The projected weak developments in manufacturing and construction the next few years may naturally contribute to limiting the growth in demand for persons with secondary vocational education in these sectors. The need to replace unskilled labour nevertheless indicates an appreciable increase in demand. For similar reasons the need for persons with only primary school will fall. Growth in some service sectors with a high proportion of tasks that do not strictly require a formal education nevertheless may weaken the decreasing demand for this educational group.

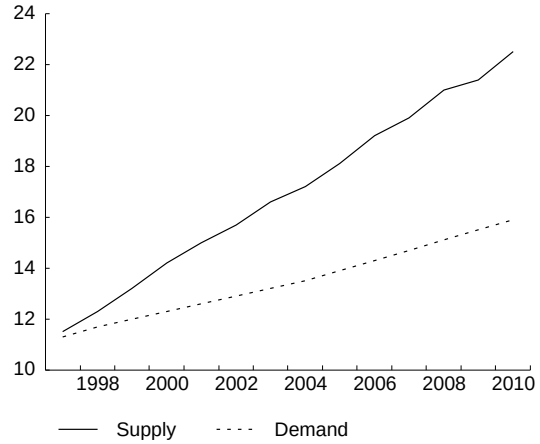
Possible imbalances in the labour market in the years ahead

By comparing the projections for supply and demand for various kinds of labour it is possible to obtain an indication of possible imbalances that may arise in the future. However, the results must be interpreted in the light of the underlying assumptions, and a considerable uncertainty may exist. If imbalances arise in the labour market for an educational category, counteracting mechanisms will in practice take effect. With a shortage of one category of labour, persons with a closely related education will often be hired. Conversely, if there is an excess supply of one category of trained labour, such persons may enter related areas or areas that do not necessarily require such a lengthy education. Young people's choice of education may be influenced by the prospect of possible imbalances and, as noted earlier, one of the purposes of the projections is to assist the authorities in determining educational capacity in various areas. As the mechanisms mentioned above are not incorporated in the model, the calculations may provide an exaggerated picture of the imbalances.

A comparison of tables 1 and 3 shows that there may be an excess supply of some groups with higher education. As shown in figure 1, this primarily relates to persons who have studied social sciences, both with a lower and higher degree. Even though it is likely that the demand for this group may show a clear increase, the high number of students choosing this area at the beginning of the 1990s means that supply may increase faster than demand. The propensity to study social sciences at a higher level also appears to have continued to increase from 1993 to 1997. Even though there may be too many social scientists in relation to requirements, it is unlikely that many persons in this category will be unemployed since most of them may find employment in areas where lower educational attainment levels would probably have been sufficient. The same applies to those who have studied the humanities, but not to the same extent as for social scientists. The projected weak increase in the number employed in public administration also contributes to limiting the growth in demand for lawyers. Despite lower propensities to study in the last years, there may thus be an excess supply for this category of education. As with social scientists, it is however unlikely that many persons with this education will be unemployed.

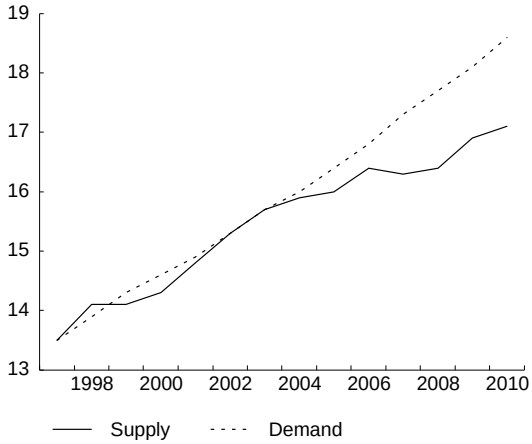
Figure 1. Developments in supply and demand for different kinds of labour 1997-2010. 1 000 persons

Social sciences (higher degree)
Supply and demand. 1 000 persons



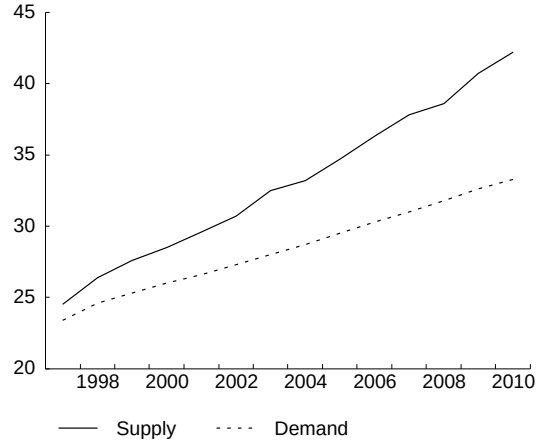
Source: Statistics Norway.

Physicians
Supply and demand. 1 000 persons



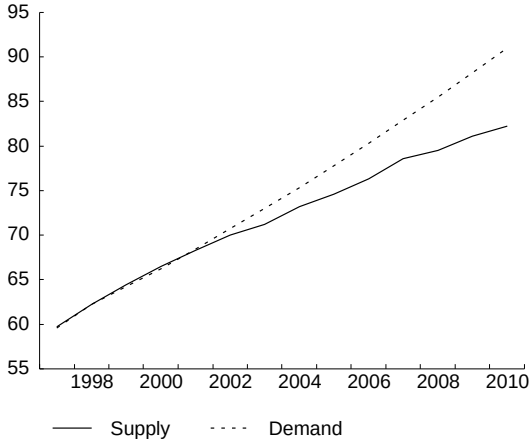
Source: Statistics Norway.

Social sciences (lower degree)
Supply and demand. 1 000 persons



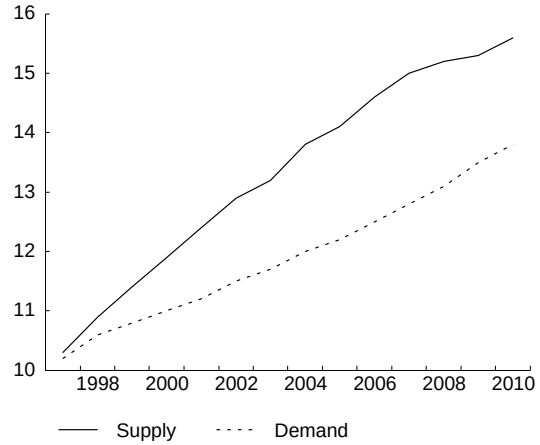
Source: Statistics Norway.

Nurses
Supply and demand. 1 000 persons



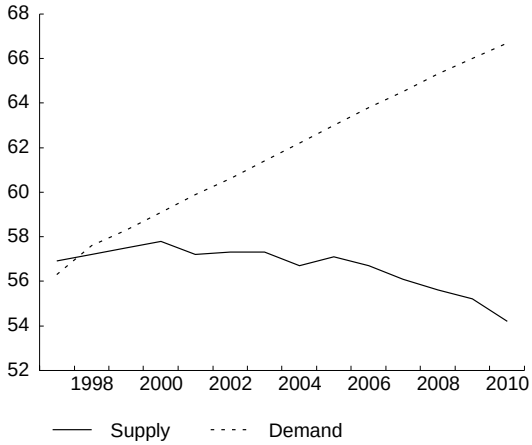
Source: Statistics Norway.

Lawyers (higher degree)
Supply and demand. 1 000 persons



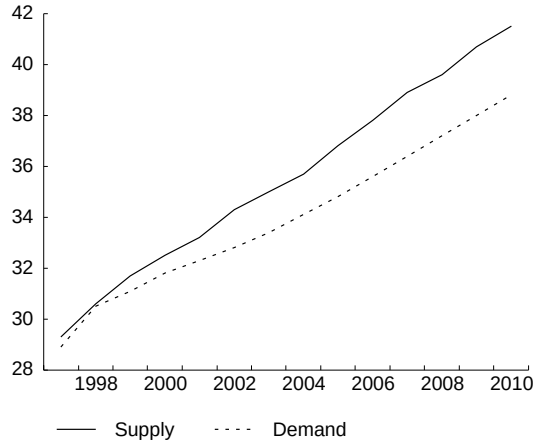
Source: Statistics Norway.

Auxiliary nurses
Supply and demand. 1 000 persons



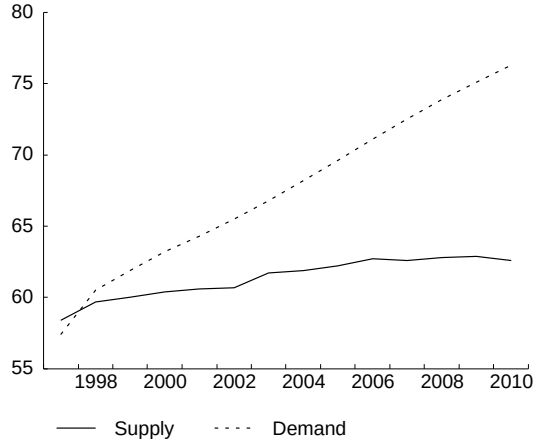
Source: Statistics Norway.

Graduate engineers
Supply and demand. 1 000 persons



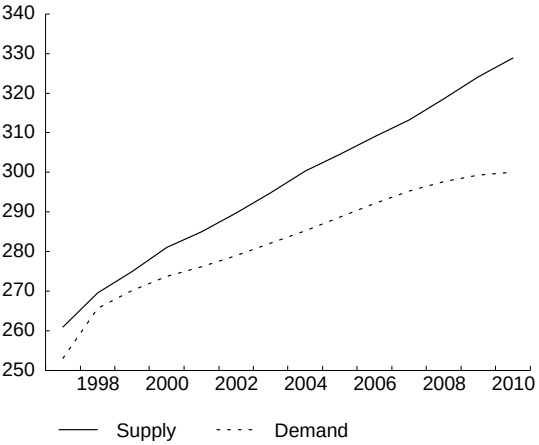
Source: Statistics Norway.

Engineers
Supply and demand. 1 000 persons



Source: Statistics Norway.

Manufacturing and crafts (secondary school)
Supply and demand. 1 000 persons



Source: Statistics Norway.

As a result of an appreciable growth in the health sector and the replacement of unskilled personnel by labour with higher education, the results presented in figure 1 indicate a persistent shortage of physicians, nurses and auxiliary nurses. A decline in the number of persons applying for education as auxiliary nurses in recent years along with a fairly high percentage of older auxiliary nurses also imply that supply of this kind of personnel will remain virtually unchanged in the years ahead. On the other hand the results from a more detailed projection drawn up for this sector, published in Rogdaberg and Stølen (1999), indicate excess supply for physiotherapists, child welfare workers and social workers. The projected excess supply for these groups is caused by a sharp rise in educational capacity in the last years.

The projections of the supply of engineers only show a modest increase in the years ahead. This is related to fewer numbers graduating each year compared with a few years ago. At the same time, the number of engineers reaching retirement age is fairly high. A trend towards a further decline in the number of students after 1993 may imply that the current supply projections are somewhat overoptimistic if the number of students does not pick up again. The economic downturn for manufacturing industries and construction in 1999 and 2000 contributes to slow down the increase in demand for engineers. Based on the assumption of a steadily higher share of engineers in most sectors, a noticeable growth in demand is still expected. With the modest rise in supply, this may imply a persistent shortage of this kind of labour. The need for graduate engineers is also influenced by the projected decline in petroleum investments and the general economic downturn. With the propensities to study from 1993, the calculations show an excess supply for this category. It has been claimed that the decline in the number of pupils from secondary school specialising in science may gradually reduce the number who want to become graduate engineers, but up to 1998 it does not appear that this has been of great importance.

The cyclical upturn in the Norwegian economy from 1993 to 1998 contributed to an appreciable increase in the demand for labour with secondary vocational training for manufacturing and construction, and a shortage of some kinds of this education was registered. In view of the downturn affecting these industries, this situation is somewhat reversed. On the supply side the propensity to educate in this area has been somewhat adjusted upwards compared with earlier presentations. The total effect of these factors shown in the projections in figure 1 is an excess supply for this category of education the next few years. The calculations for persons with secondary vocational training (as well as for engineers and graduate engineers) imply that there is greater uncertainty associated with attempts to estimate future imbalances for

groups where demand is clearly dependent on the cyclical situation. Inasmuch as the timing and amplitude of cyclical movements are not known in advance, the calculations will have a tendency to underestimate demand in periods of expansion and overestimate demand in periods of contraction. In addition, there is considerable uncertainty on the supply side for groups with fairly sizeable variations in propensities to study.

A comparison of table 3 with table 1 may misleadingly give the impression that there will be a shortage of people with primary school education. This must, however, be seen in connection with excess supply for groups with a general education from secondary school, which most certainly can perform the same tasks. The sharp rise in the number of persons with unspecified education in the supply projections must also be taken into account.

Conclusion

On the basis of the assumptions underlying the projections, there may be a persistent shortage of physicians, nurses and auxiliary nurses. Low recruitment to engineering studies in relation to higher demand and a substantial withdrawal when many reach retirement age also entail a possible shortage for this group. The increased number of students who choose social sciences may imply excess supply for social scientists, even with an assumption that demand will show a considerable rise. The same may to some extent also be the case for lawyers and those who have studied humanities. The projected decline in petroleum investments and the general cyclical downturn will in particular curb the growth in demand for persons with secondary vocational education, engineers and graduate engineers. For persons with secondary vocational education and graduate engineers this may result in excess supply the next few years. Lower propensity to study may cause a shortage of engineers.

The results might have been different if other assumptions had been applied. In addition to the clear impact on the need for various kinds of labour as a result of the cyclical downturn, the greatest uncertainty is associated with the assumptions concerning unchanged propensities to study in various fields and changes in the composition of demand. The projections can therefore not be interpreted as forecasts of imbalances in the labour market. When imbalances arise, this may also lead to political measures and the activation of mechanisms that contribute to restoring balance. Indeed, one of the aims of presenting projections is to contribute to this. At the same time, a critical evaluation of the assumptions underlying the calculations is important.

References

Cappelen, Å. (1992): "MODAG: A Medium Term Macroeconometric Model of the Norwegian Economy" in L. Bergman and Ø. Olsen (eds.): *Nordic Macroeconometric Models*, North Holland.

Cappelen, Å. and N.M. Stølen (1994): Forecasting labour market imbalances, *Economic Survey 4/94*, 21-29, Statistics Norway.

Drzwi, W., L. Lerskau, Ø. Olsen and N.M. Stølen (1994): *Tilbud og etterspørsel etter ulike typer arbeidskraft* (Supply and demand for different kinds of labour), Reports 94/2, Statistics Norway.

Fredriksen, D. (1998): *Projections of Population, Education, Labour Supply and Public Pension Benefits. Analyses with the Dynamic Microsimulation Model MOSART.* Social and Economic Studies **101**, Statistics Norway.

Ministry of Finance (1997): *Long-Term Programme 1998-2001*. Report no. 4 to the Parliament (1996-97).

Rogdaberg, G. and N.M. Stølen (1999): Tilbud og etterspørsel for ulike typer helsepersonell. (Supply and demand for different kinds of health personnel). *Økonomiske analyser 2/99*, 16-22. Statistics Norway.

Statistics Norway (1998): Økonomisk Utsyn over året 1997 (Economic Survey 1997), *Økonomiske analyser 1/98*, 59-64.