FORECASTING REGIONAL LABOUR MARKET DEVELOPMENTS BY OCCUPATION AND EDUCATION
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Introduction

Analyses of expected labour market developments in view of particular policy issues in the Netherlands are included in the biennial report *The labour market by education and occupation to 200x*,[1] published by the Research Centre for Education and the Labour Market (ROA). As the problems of matching labour supply and demand can be regional in nature, the ROA makes forecasts for three Dutch provinces (Limburg, Gelderland and Overijssel), which are published in reports that are largely comparable to the national report. Regional labour market forecasting by occupation and education is based on the methodology used to forecast trends in the national labour market. An advantage of this approach is that the forecasts of regional supply and demand are consistent with the national forecasts.

The general forecasting model for the labour market as a whole and data from national and regional sources are combined to serve two main functions of labour market forecasting, policy-making and information (see Van Eijs 1994). As regards the former, labour market forecasts are useful to policy-makers at ministries, job centres and employment agencies, employers' organizations, unions and educational organizations. These are able to propose or carry out changes in the educational infrastructure by taking account of future employment trends in broadly defined educational categories (in terms of both level and subject) and occupational classes. National and regional forecasts that focus on the macroeconomic or industry level – as is usually the case – do not detect changes in the occupational mix in particular industries or the continuous upgrading of skill levels in many occupations. Also, since the forecasting model covers the labour market as a whole, it can account for interactions between different segments of the labour market, which partial analyses of the labour market often fail to include.[2]

The information function originally focused on education and career guidance. This improves the functioning of the labour market, since individuals are better able to adjust their human capital investment decisions to the labour market prospects of particular types of education (see Borghans 1993). Also, firms and labour market agencies can use labour market forecasts as 'early warnings' of future recruitment problems to outline human resources policies or design training programmes. The labour market information thus provides detailed information on the current and future labour market position of 104 types of education and 127 occupational groups. Comparable occupational forecasts are published in other countries, by e.g. the Bureau of Labor Statistics in the USA and the ESRI in Ireland (for an overview of the OECD countries see Neugart and Schömann 2002). All these models assume that labour market imbalances can exist due to market imperfections. Providing

1. See e.g. ROA (1995, 2001, 2003abcd) and Cörvers, De Grip and Heijke (2002).
2. For example, an analysis of the labour market for engineers should include trends in manufacturing industry as well as other sectors.

individuals with information on future trends in labour supply and demand for different occupational groups and types of education may reduce cobweb-type ups and downs.

This chapter deals with the forecasting model for the Dutch national and regional labour markets developed by the ROA. It is organized as follows. We first discuss the basic principles underlying the ROA's labour market forecasting, then looks at the most important parts of the forecasting model, i.e. expansion demand, replacement demand, the inflow of school-leavers onto the labour market, and the 'labour market gap indicator'. Then we present an application of regional labour market forecasts to the Province of Gelderland. Finally, we draw some conclusions.

Basic principles and structure of the forecasting model[3]

It used to be thought that the problem of coordinating the education system and the labour market could be solved by planning. One well-known approach is the 'manpower requirements model' as applied e.g. by Parnes (1962), who developed a manpower planning model based on the input/output structure of the economy. Various methodological and fundamental objections have been made to the manpower requirements approach. The methodological objections relate mainly to the fixed coefficients used in the forecasting models to translate economic development into changes in employment differentiated by training and occupation, and the mechanical concept of labour market functioning, which leaves no room for the operation of substitution and other adjustment processes (Blaug 1967). The fundamental objections are that future trends are in fact not sufficiently predictable, and that an exclusive relationship between job requirements and training is assumed without adequate justification.

These objections, and lack of statistical data for estimating the forecasting models, led to the rejection of the planning concept. A flexible approach to education was advocated, one which would enable people to respond adequately to uncertain future trends. This concept involved broadening initial training courses so that each could lead to a broad range of occupations. Any discrepancies that might arise between specific, and mutable, job demands and the qualifications of workers would be dealt with by means of short training courses and on-the-job training.

Also, it was no longer thought that a policy of direct intervention was required to ensure that the education system corresponded to the labour market; instead, adequate information would make the labour market more transparent for those choosing a course of study and others investing in education. This transparency would enable the supply of labour to be more responsive to changes on the labour market. On top of this, the labour market forecasts give firms an indication of future risks of labour recruitment problems in the various skill categories, enabling them to anticipate shortages, e.g. by means of internal training and outflow reduction policies for categories of workers where shortages are forecast. This development is evident in the way the role of manpower forecasting has completely changed in the various

3. Parts of this paragraph are taken from Cörvers, De Grip and Heijke (2002). For the regional dimension of the ROA forecasting model see also Berendsen et al. (1993).

countries where occupational and/or educational forecasts are still made.[4] A number of basic principles are taken into account when compiling these highly differentiated forecasts so as to counter the fundamental and methodological criticisms of initial manpower planning approaches. These principles are set out below. The same methodological issues apply to the regional forecasting models of labour supply and demand. Forecasting regional labour supply and demand involves some additional issues and constraints, however.

· The forecasts are limited to the *medium term,* i.e. a five-year period. Within this horizon the changes on the labour market are less uncertain than in the long term,[5] where the uncertain results of substitution, geographical mobility and other adjustment processes can be decisive, in particular where discrepancies between supply and demand may be extremely large. On a smaller scale, e.g. in the case of the twelve provinces of the Netherlands, the uncertainties are greater, owing to the relatively large impact of incidents such as the closure or location of a big firm in the region.

· Instead of fixed coefficients for the occupational and training structure of employment, *explanatory models* are used to describe the changes in both structures over time. Some preliminary analyses show that the national occupational and educational structure of employment in particular industries is very similar to the employment structure in many regions.[6] We can therefore also expect trends in the employment structure in particular industries to be similar, and these can be used to forecast regional employment growth. The regional employment structure cannot be differentiated in terms of occupation and education in all segments of the labour market, however, owing to the relatively small size of the regional samples in the Labour Force Survey.

· The theoretical framework underlying the forecasting models incorporates both ex ante and ex post *substitution processes* in the forecasts of the labour market situations for the various types of education. Ex ante substitution refers to demand-led substitution between types of education due e.g. to the upgrading of skill requirements for a particular occupation; ex post substitution, on the other hand, refers to shifts in the educational structure of employment in an occupation as a result of the initial gaps between supply and demand for the various types of education (see e.g. Borghans and Heijke 1996; Cörvers and Heijke 2003). In the regional forecasting model we assume that interaction between regional labour markets is also important (perhaps more important), especially when forecasts are made for administrative areas such as provinces:[7] both substitution processes between types of education within regions and changes in commuting (or migration) flows between regions can solve the discrepancies between supply and demand to some extent. These adjustments between supply and demand are not without cost, however.

· No detailed comparisons of supply and demand are made for each forecasting year: the forecasts themselves are limited to a *general*

4. See Hughes (1993), Heijke (1994), OECD (1994), Heijke and Borghans (eds, 1998) and Neugart and Schömann (eds, 2002).
5. Cf. pupils and students that participate in educational courses with a maximum duration of five years: this enables their inflow onto the labour market in the medium term to be predicted relatively easily (although predictions of drop out and flows within the educational system are also important).
6. These analyses are hampered, however, by the relatively small sample sizes at regional level in the Labour Force Survey.
7. On this point see e.g. Hensen and Cörvers (2003).

characterization of the relationship between supply and demand for particular categories of education over the whole forecast period. Information intended as guidance for students is limited to a qualitative description of the labour market prospects of these training categories, on a scale from 'good' to 'poor'. The education categories therefore need to be constructed carefully so as to minimize the variation in labour market prospects within each category.[8] The same classifications of occupation and education and the same characterizations of labour market prospects are used at regional and national level.

· It is important to make maximum use of any information already available on future growth in employment, flows between work and inactivity, and flows from the education system onto the labour market. In the Netherlands this applies in particular to data on changes in employment in the various industries, which are taken from the CPB (Netherlands Bureau for Economic Policy Analysis), and those on flows from the education system onto the labour market, which are taken from forecasts made by the Ministry of Education, Culture and Science. By using these we ensure that the labour market forecasts are consistent with the authoritative forecasts that provide the basis for policy decisions on important social and economic issues.[9]

· The uncertainties associated with labour market forecasts are countered to some extent by *mapping the labour market risks* that a particular choice of training could entail. Statistical indicators have been developed to complement forecasts of the probability of finding an attractive job. These give insight into e.g. the opportunities that a particular type of education offers for switching between occupations, and the sensitivity of the occupations relevant to a particular type of education to cyclical fluctuations (see Dekker, De Grip and Heijke 1990). Preliminary analyses show that these indicators do not differ very much between regions.

· The national forecasts are evaluated periodically at the end of the forecasting period (see e.g. Borghans, Van Eijs and De Grip 1994; Smits and Diephuis 2001). This includes an empirical evaluation of the forecasts made by all the submodels and the resulting labour market signals provided for students and firms, and a survey of the methodology, describing the strong and weak points of the models and possible improvements and extensions. The regional labour market forecasts have not been evaluated so far.

Structure of the labour market forecasting model

Figure 1 gives a general picture of flows on the labour market. On the demand side it distinguishes between (a) demand resulting from future changes in employment levels – *expansion demand* – and (b) demand due to retirement and occupational mobility – *replacement demand*. The sum of expansion and replacement demand equals the expected number of *job openings*. On the supply side it distinguishes between (a) supply due to the inflow of school-

Figure 1. The general forecasting model
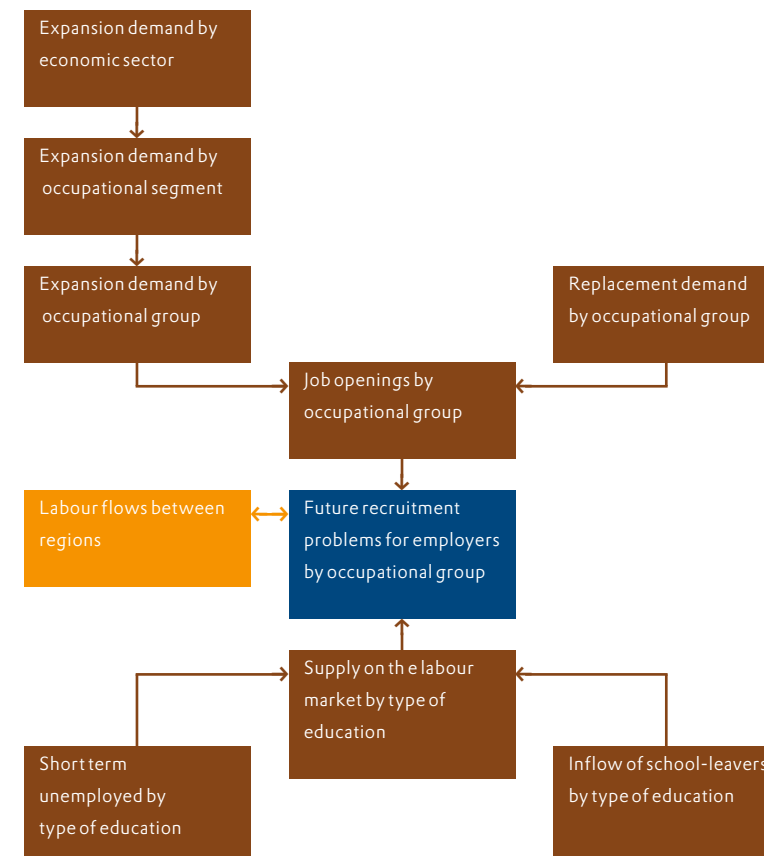
leavers onto the labour market and (b) the supply of short-term unemployed. Comparing the expected future labour demand with the supply gives us an indication of the discrepancies on the labour market by occupation or education. These discrepancies can be expressed as an Indicator of the *Future Labour Market situation* (IFLM), which indicates the future labour market prospects of school-leavers with a particular type of education or the future recruitment problems of employers in a particular occupation. The figure compares supply and demand for the occupational groups. Using the IFLM, employers can foresee to what extent it will be possible to achieve the desired educational structure in particular occupations.

Expansion demand
The forecasts are based on the national employment projections by sector, which are in turn based on the CPB's Athena model. Athena is a multi-sector model of the Dutch economy (CPB 1990) which identifies 15 sectors.[10] The CPB does not make regional forecasts of employment growth by sector, however, so an alternative source of forecasts is required from which to compile national and regional forecasts by sector using a similar methodology. The regional forecasts of employment growth by sector are derived from forecasts made by the provinces themselves or other institutions (Ecorys NEI, TNO). The national CPB employment forecasts are often used as input when compiling these regional employment forecasts, however. We translate the forecast employment growth in economic sectors into expansion demand by occupational class, allowing for the fact that some occupational classes in economic sectors may grow more rapidly than others.[11] We then determine the implications of the predicted growth in the various occupational classes for expansion demand as regards each type of education. The regional forecasts of expansion demand are based on these national forecasts. The expected national changes in the occupational and educational structure of employment are projected onto the professional and training structure of employment in the region concerned.[12]

Data on the regional employment structure are drawn from the Statistics Netherlands Labour Force Survey. Forecasts are only made for occupational groups or types of education with at least 2,500 persons (averaged over two years) employed in the region in question. This restriction is set by Statistics Netherlands to prevent the publication of figures from the Labour Force Survey with confidence intervals that are too broad. Thus this number can be regarded as the minimum size of an occupational group or type of education for which reliable regional labour market forecasts can be made.

Figure 2 illustrates the expansion demand model. The boxes are of various colours: brown indicates the results (or interim results) from estimating the national forecasting model; additional data required for forecasting regional expansion demand are shown in orange; the results of the regional model are designated in blue rectangles; and white rectangles with a blue frame represent the final forecasting results of changes in provincial employment by occupational group and type of education.

10. The classification and number of sectors identified in the Athena model of CPB varied over time.
11. For more information see Cörvers, De Grip and Heijke (2002) and Cörvers et al. (2004).
12. A similar approach has been followed with regard to regional occupational forecasts in the United Kingdom (Lindley and Wilson, 1991).

Figure 2. Methodology of the regional expansion demand
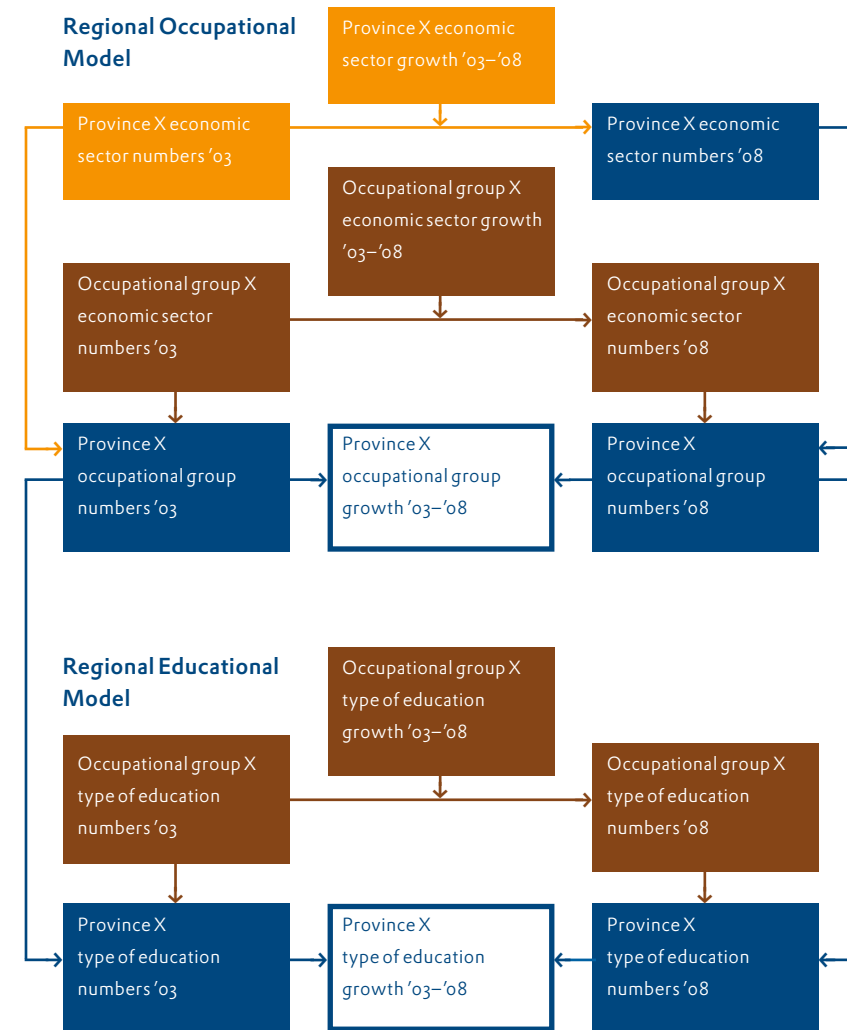
The national employment forecasts by occupational group are produced as follows.[13] Based on the CPB forecasts of employment by sector, a two-step model is estimated to explain the occupational structure of the sectors. The changes in employment levels by economic sector are first translated into employment changes for 43 occupational segments using a model with explanatory variables.[14] Changes in the employment structure are estimated on the basis of the Labour Force Survey data from 1988 to 2002. As the available time series is rather short, a random coefficient model (RCM) has been used. [15]

Replacement demand
The demand for labour also includes *replacement demand*, which arises when workers retire, leave the labour force under an early retirement scheme or owing to disability, withdraw from the labour market temporarily, switch to another occupation etc. Replacement demand only arises, however, if the departure of an employee actually leads to a vacancy for a new entrant; if it is taken as an opportunity to cut employment levels, no replacement demand results. There is also an important difference between replacement demand by occupational class and by type of education, as occupational mobility affects replacement demand by occupational class but not by type of education. Switching occupations has no effect on the educational structure of employment. On the other hand, when workers complete part-time studies that raise them to a higher level or give them different qualifications, this in fact amounts to outflow to another educational category (type of education). In this case replacement demand does arise in the educational category in which the worker's previous education was classified.

The first step in modelling future replacement demand by occupational group is describing the inflow and outflow patterns by occupational group[16] over a historical period. As suitable data on mobility flows on the labour market is not available, stock data is used. Using the 'cohort components' method we calculate cohort change rates based on the number of persons in the same birth cohort who were employed at two different times (see Shryock and Siegel 1980).

The second step is to translate these inflow and outflow percentages into replacement demand by occupational group. In the case of occupational groups with an increase in employment in the period (t-1,t), replacement demand equals total net outflow over this period. In the case of occupational groups that suffered a decrease in employment, on the other hand, not all vacancies due to outflow will have been filled, hence replacement demand in these groups equals the number of vacancies that were actually refilled, i.e. the total inflow of workers into the group. A random coefficient model is estimated, explaining the net inflow or outflow ratios on the basis of (a) average inflow or outflow from the total working population and (b) occupation-specific deviations by age-sex group (see Willems 1999). This approach guarantees that the sum of the net flows among the occupations corresponds to the total inflow or outflow.

The third step is to project the historically measured net replacement demand rates by age-sex group for a particular occupational group onto the

13. The national forecasts of expansion demand by type of education are not discussed here. The methodology of these forecasts includes shifts in the employment structure of skill categories ('upgrading') within an occupational group due to technological and organizational developments, as well as the substitution processes that result from discrepancies between labour supply and demand and cause additional shifts in demand as employers adjust their desires in accordance with the availability of workers (see e.g. Borghans and Heijke, 1996; Cörvers and Heijke, 2003).
14. In the latest occupational model of expansion demand (see Dupuy and Cörvers, 2003) the relevance of explanatory sector variables such as added valued, capital investment and R&D expenditure follows directly from a microeconomic model for the occupational structure of sectors. This occupational model takes account of capital-skill complementaries and skill-biased technological change.
15. Borghans and Heijke (1994) provide a detailed description of this model.
16. A similar method is used to determine the replacement demand by type of education.

age-sex structure of the workers at the beginning of the forecasting period. The historically observed cohort change rates are also corrected for business cycle effects and expected changes in participation rates (for details see Willems and De Grip 1993). Future replacement demand is determined in the same way as historical replacement demand. In the case of occupational groups with an expected increase in employment, replacement demand equals net outflow. In the case of occupational groups where a decrease in employment is expected, replacement demand equals total net inflow.

The replacement demand for Gelderland (see next paragraph) is calculated using Province of Gelderland official sources on the structure of the labour force by gender and age. The corrections for changes in the participation rate are also determined using these regional data. To forecast replacement demand we use the same inflow and outflow rates (by gender and age group, and by occupation and education) as those estimated for the country as a whole. Here we assume that these rates do not differ very much from one region to another, as retirement schemes for industries or occupations, for example, are often agreed at national level. The occupational structure of the working population is again drawn from the Labour Force Survey. A RAS procedure (proportional fitting of a table to given marginal totals) is used to estimate the matrix of occupation by age-sex group. Total regional replacement demand by occupational group can be calculated by projecting the corrected net inflow and outflow ratios onto this matrix.

Inflow of school-leavers onto the labour market
Forecasts of the flows of school-leavers entering the labour market match the Reference Forecasts ('*Referentieramingen*': see Ministry of Education, Culture and Science 2001) compiled by the Ministry of Education, Culture and Science for courses in the 'regular' (full-time initial) education system. The ROA disaggregates these forecasts using supplementary data from Statistics Netherlands education matrices and its own information on school-leavers. Supplementary data from Statistics Netherlands are used to estimate the effects of continuous (vocational) education on the flows entering the labour market. The Reference Forecasts cover not only pupils who leave school with qualifications but also those who end their studies without a school-leaving certificate. With the aid of education transition matrices these preliminary school leavers are given the qualification of the previous school from which they left.

A forecast is also made of the flow from post-initial education onto the labour market. This flow indicates the effects of lifelong learning on the educational structure of the labour supply. Data on the inflow of 'newcomers' to the labour market from post-initial education are taken from the Labour Force Survey. Owing to data restrictions we assume that, in the forecasting period, the proportion of workers with a particular educational background who complete a post-initial training course that gives them another educational background is the same as in latest year for which data on participation in post-initial training are available.

The national inflow of school-leavers with a particular type of education onto the labour market is distributed among the regions based on the shares of working youngsters (under the age of 30) living in the various regions (provinces of the Netherlands). By implicitly allowing for historical migration flows of young workers between regions, we are able to forecast the inflow of school-leavers onto the regional labour markets. Gaps between supply and demand in particular labour segments within regions may change the direction of these migration flows, however.

Labour market gap indicator
By matching labour demand with labour supply we can construct an *Indicator of the Future Labour Market situation* (IFLM). This indicator of labour market prospects is constructed for each of the occupational groups and types of education. If the indicator of future labour market recruitment problems for employers is 1, employers are not constrained by a limited supply of particular types of education in their recruitment. The indicator represents the extent to which labour supply meets labour demand in each occupational group, in particular the likelihood that employers will be able to achieve the desired educational mix of workforce in the occupational groups at the end of the forecasting period (see Cörvers et al. 2004). The smaller the indicator, the larger the recruitment problems for employers. The indicator of the future labour market situation is translated into a 'qualitative characterization' of expected future recruitment problems for employers on a 5-point scale: *none, almost none, some, serious and very serious* recruitment problems. A broad qualitative characterization of this kind is adequate for various purposes, including recruitment policies, labour market exchange, training policies and vocational and educational counselling. It also obviates the problem of too much significance being attached to exact numbers of shortages or surpluses.

The forecasts and the labour market gap indicator (IFLM) give an indication of which way labour flows between regions need to change so as smooth out the discrepancies between labour supply and demand. Although the basic regional labour market model does not take potential changes in interregional mobility flows into account, these may be important as a labour market adjustment mechanism. Local labour markets may be isolated, on the other hand, by the presence of infrastructural barriers that prevent the free movement of labour between regions: shortages of specific types of workers in a local labour market can persist if these barriers are too high.

The regional labour market forecasting model applied
This paragraph presents the forecasting results for the Province of Gelderland, one of the twelve provinces of the Netherlands. Gelderland is situated in the central and eastern part of the Netherlands, between the centre of the Netherlands (the Province of Utrecht) and Germany. The capital city of Gelderland is Arnhem and other important towns are Nijmegen and Apeldoorn. The Gelderland labour force numbers about 845,000, 12% of the Dutch working population. Relative to the country as a whole, a high

proportion of people in Gelderland work in the food and beverage industry, the metal and electronics industry, the rubber and plastics industry and the construction industry. A relatively small number of people are employed in energy, chemicals and transport, storage and communications.

Forecasting results for the Province of Gelderland
Table 1 shows the forecasting results for eleven occupational classes over the 2003–2008 period (see ROA 2004). These eleven occupational classes are aggregates of 127 occupational groups for which the most detailed forecasts are available. The classification of occupational groups is based on the 3-digit International Standard Classification of Occupations (ISCO). The forecasts can vary significantly for different occupational groups within one occupational class, in particular between occupational groups with (a) high and (b) low job levels.

The total percentage of job openings during the five-year period from 2003 to 2008 is expected to be 20% of the total number of employed in 2002. Note that total replacement demand is much higher than total expansion demand.[17] The largest number of job openings as a percentage of occupational employment in 2002 is to be found in public security and safety occupations, educational occupations and cultural occupations (e.g. interpreters, library assistants, artists, clergymen and journalists). These last two occupational classes also exhibit the largest replacement demand, whereas very low replacement demand is expected in ICT occupations. These differences in replacement demand relate strongly to differences in age composition between occupations. Rapidly growing employment in ICT occupations has been attracting large numbers of young people, and expansion demand in these occupations is expected to be the largest of all the occupational classes. Employment in agricultural occupations is expected to decrease even further in the years to come, and expansion demand is also expected to be negative in technical and industrial occupations, transport occupations, socio-cultural occupations (e.g. personnel officers, personnel managers, welfare workers, researchers) and commercial and administrative occupations.

The comparison between labour supply and demand is reflected in the Indicator of the Future Labour Market situation (IFLM). As already mentioned, the indicator is set to its maximum value of 1 if employers are not constrained by limited supply of school-leavers with particular types of education. The smaller the indicator, the larger the recruitment problems. It follows from Table 1 that employers looking for graduates qualified to work as teachers in the educational sector will be confronted with very serious recruitment problems. The number of job openings in these occupations, caused mainly by replacement demand, cannot easily be refilled, as the inflow of school-leavers into educational occupations is too low. In spite of the relatively large number of job openings in public security and safety occupations, the inflow of school-leavers is large enough to prevent serious recruitment problems for employers. Employers may expect serious recruitment problems in cultural occupations and technical and industrial occupations, how-

17. The outflow of workers from a particular occupational group only contributes to the number of job openings when these workers are actually replaced. Thus the replacement demand model accounts for job openings foregone owing to an expected decline in employment. In our model, therefore, negative expansion demand does not reduce the number of job openings (see Cörvers et al. 2004). As a result the number of job openings only equals the sum of expansion and replacement demand in a particular occupational class if expansion demand is positive for all the occupational groups within that class.

ever: in the case of the former, the number of job openings as a percentage of occupational employment is relatively large, as against average in the case of the latter. The recruitment problems in the technical and industrial occupations in Gelderland are due mainly to the relatively low inflow of technically trained school-leavers onto the labour market, and these problems are much greater, on average, than in other parts of the country. In the case of socio-cultural occupations, on the other hand, the recruitment problems are much smaller in Gelderland than in the country as a whole.

Commuting flows and the inflow of school-leavers onto the regional labour market

One way to reduce the mismatch between supply and demand in Gelderland would be to change the commuting and migration flows. The supply of labour from other (neighbouring) regional labour markets with fewer mismatches between supply and demand could reduce the mismatches in specific occupational groups in Gelderland, e.g. the technical and industrial occupations mentioned above. Table 2 gives some idea of the changes in commuting flows and flows of school-leavers onto the regional labour market that would be required to bridge the gap between labour supply and demand for the eleven occupational classes. As the table shows, to solve the shortages in educational occupations in Gelderland, incoming commuting flow would have to increase by about 170%. This does not seem very realistic, in particular given that employers are expected to have serious recruitment problems in other parts of the country. In the case of technical and industry occupations, on the other hand, an increase of only 1% in the incoming commuting flow would meet the expected excess demand in Gelderland. Furthermore, a 14% decrease in in-commuters in socio-cultural occupations would help to solve the serious recruitment problems expected in other parts of the country.

Changes in the inflow of school-leavers onto the labour market could also reduce the mismatches between supply and demand on the regional labour market. School-leavers could choose to work in other occupations, as school-leavers in earlier cohorts used to, or could decide to work (and live) in other regions with better labour market prospects. As the last column of Table 2 shows, the changes required in the inflow of school-leavers are smaller than those required in incoming-commuting flows in the case of some occupations. In cultural occupations a 22% increase in the inflow of school-leavers from other regions would solve the recruitment problems of employers in this occupational class, whereas in-commuting flows would have to increase by 40% to get the same result.

Final remarks

The previous paragraph discussed the labour market forecasting model developed by the ROA, which goes beyond the scope of the traditional manpower requirements approach. The model predicts mismatches between labour supply and demand at regional level in the medium term. It covers the regional labour market as a whole with regard to detailed occupational

Table 1. Expected future expansion demand, replacement demand, job openings, and Indicator of Future Labour situation (IFLM) by occupational class for employers in 2008, as percentage of occupational employment in 2002

Occupational class	Expansion demand %	Replacement demand %	Job openings %	IFLM	Characteristic of expected recruitment problems in 2008	
	Gelderland	Gelderland	Gelderland	Gelderland	Gelderland	Netherlands
Educational occupations	10	21	32	0.89	Very serious	Serious
Cultural occupations	9	18	28	0.90	Serious	Some
Agricultural occupations	−8	18	18	0.96	Almost none	None
Technical and industrial occupations	−3	18	20	0.91	Serious	Almost none
Transport occupations	−3	13	15	0.96	Almost none	None
Medical and paramedical occupations	5	17	23	0.92	Some	Serious
Commercial and admin. occupations	0	14	16	0.95	Almost none	Some
ICT occupations	11	9	21	0.93	Some	Some
Socio-cultural occupations	−1	15	18	0.95	Almost none	Serious
Care and service occupations	6	16	23	0.97	Almost none	None
Public security and safety occupations	7	25	34	0.92	Some	Serious
TOTAL	**1**	**16**	**20**			

Source: ROA/Province of Gelderland/CPB

Table 2 Changes in commuting flows (average 2000–2001) required to solve discrepancies between demand and supply by occupational class, as a percentage of the forecast excess demand (2003-2008) by occupational class, Gelderland

Occupational class	Incommuters Inflow of school-leavers %	Required change
Educational occupations	172	169
Cultural occupations	40	22
Agricultural occupations	−16	−3
Technical and industrial occupations	1	1
Transport occupations	n.a.	n.a.
Medical and paramedical occupations	n.a.	n.a.
Commercial and administrative occupations	−48	−26
ICT occupations	41	42
Socio-cultural occupations	−14	−9
Care and service occupations	29	10
	58	123

n.a.= not available due to too small numbers

Source: ROA/CBS

groups and types of education. When drawing up the regional labour market forecasts an approach was chosen in which regional forecasts of employment growth by sector, age composition and participation rates at regional level and the regional distribution of working youngsters with a particular type of education are important inputs. One advantage of this approach is that it makes national and regional forecasting of the labour market consistent. Another advantage is that, in spite of the data constraints, a fairly high level of disaggregation by occupation and education can be achieved at regional level. The forecasts by occupation and education can therefore be useful both to policy-makers, who can use the regional forecasts at a more aggregate level; individual employers, who may be interested in the future labour market situation in particular occupational groups; and schools or youngsters who may want to know the labour market prospects for particular types of education.

On the other hand, the region-specific dimensions in the labour market forecasting model of provinces are limited, as the forecasting draws heavily on national employment trends by occupation and education, and on national flow ratios of workers in and out of the labour force. We do not expect trends in the occupational and skill mix in particular sectors, e.g. the increase in white-collar jobs at the expense of blue collar jobs, and the upgrading of skills, to differ very much between similar sectors across regions. Nor are inflow- and outflow-rates by age group and gender due to e.g. retirement, motherhood or job mobility expected to differ much in similar occupational groups across regions. Finally, the regional model does not really deal with changes in the geographical mobility of workers resulting from regional mismatches between supply and demand on the labour market in the province concerned and the neighbouring regions: how relevant these mobility flows are depends on whether similar labour market segments in neighbouring provinces are interrelated, and thus to what extent labour market developments in the particular region respond to mismatches between occupation and education ('gaps') in other regions. Further research is required to incorporate these adjustment processes into the regional forecasting model.

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