



Future job openings for new entrants by industry and occupation — support document

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Contents

International practice in modelling labour demand	4
Quantitative modelling	4
United States	9
European Union	13
Canada	16
Labour market information in Australia	20
Australia	20
South Australia	22
Western Australia	23
New South Wales	24
Victoria	24
References	25

International practice in modelling labour demand

Quantitative modelling

Quantitative labour market forecasting for education and planning purposes dates back to the 1920s in the old Soviet Union (Spalletti 2008). After the Second World War, the Bureau of Labor Statistics (BLS) began to conceive the idea of producing labour market forecasts in order to offer career guidance to returning war veterans, with the first set of forecasts produced not until 1960 (Bureau of Labor Statistics 2012). Growing recognition of the role of human capital in economic development within the theoretical and empirical literature of the late 50s and early 60s further encouraged policy interest in models for education and labour force planning.

At the beginning, the development was characterised primarily by an emphasis on the labour demand side - 'manpower requirements'. Typically, the process involved calculating labour requirements by occupation and qualification to meet specific, pre-determined macro and/or sectoral targets. An important criticism of the approach was the use of fixed coefficients in moving from the macro to industrial, occupational and qualification-specific forecasts.

Advances in economic modelling over the past 25 years have attempted to address some of these criticisms. Most development has occurred in two areas:

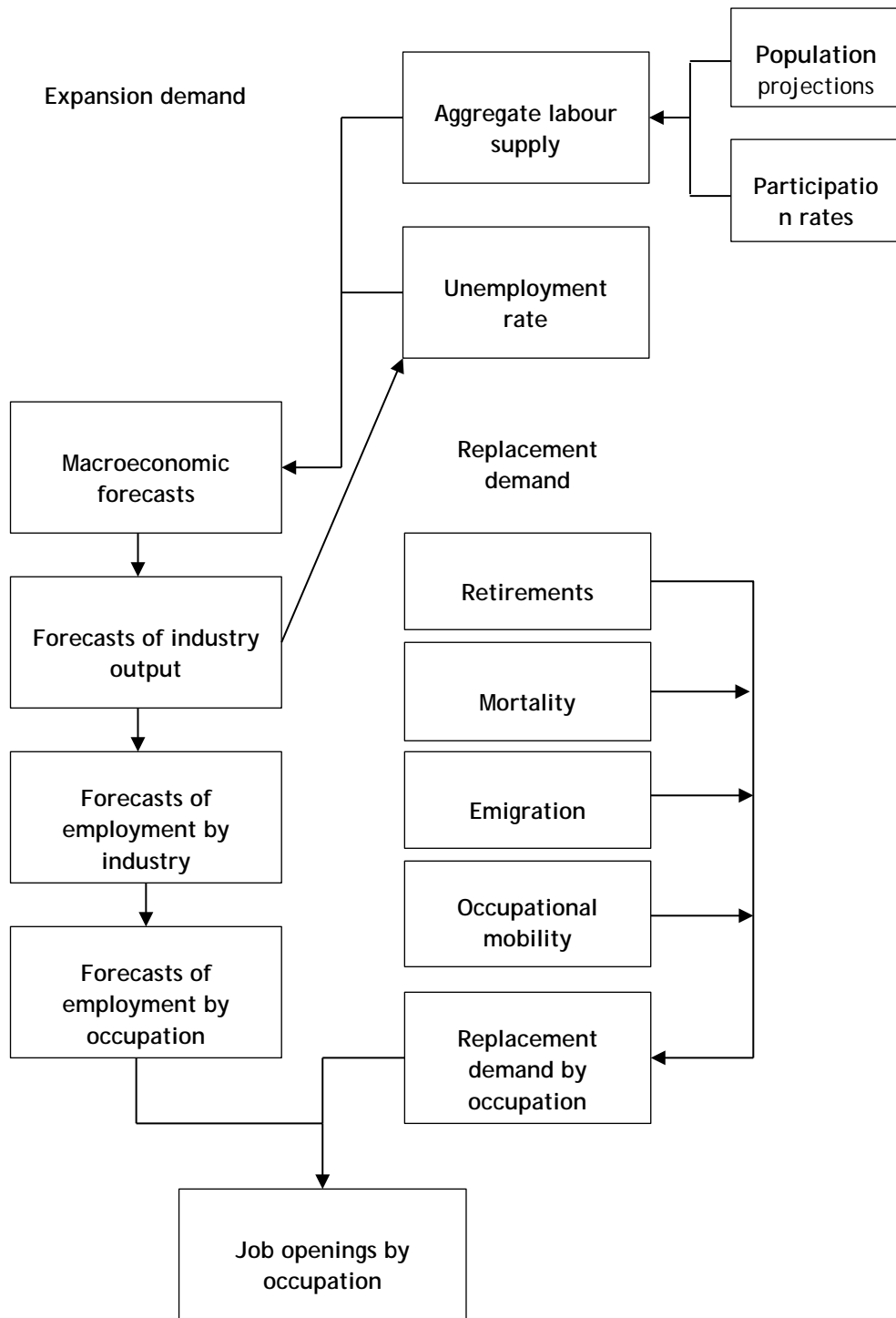
1. dynamic multi-sectoral macroeconomic models that extend basic input-output analysis with econometric relationships estimated using time series and panel data (Cedefop 2012; Wilson et al. 2016a; Lapointe et al. 2006; Bijlsma et al. 2016; Suzuki 2002)
2. dynamic computable general equilibrium models (Meagher, Adams and Horridge 2000; Dixon and Rimmer 2002; Dixon and Rimmer 2009; Giesecke et al. 2015).

Both these developments address the fixed coefficients problem of earlier methods. They use economic and social theories to model the behaviour of key actors in the economy, capturing trends in the past as well as factors that may influence future behaviour. The models are more suitable for medium- to long-term forecasting than models that extrapolate linear (or more complex) trends in individual variables. Bakule et al. (2016) notes that most trend patterns eventually end and, therefore, are not suitable for medium- to long-term forecasting.

Figure 1 shows the basic components for forecasting job openings for new entrants by occupation common to most systems, although the details may vary across countries depending on each country's access to expertise and data.¹

¹ Some systems have extensions that include forecasts of employment by qualification, supply of qualifications and some method for reconciling the supply with the demand.

Figure 1 System for forecasting job openings for new entrants



Expansion demand

A key input to forecasting expansion demand is macroeconomic forecasts, including forecasts of the national gross domestic product and the major categories of demand and income. They are derived from macroeconomic models, often developed by external organisations (e.g. in the U.S., Macroeconomic Advisers, in the European Union, Cambridge Econometrics and in Canada, Conference

Board of Canada). Many hundreds of behavioural equations and accounting identities relating changes in major categories of demand and income to changes in the external and domestic economic environment constitute a macroeconomic model. Economic theory underpins the formulation of these equations, which may include many feedback loops and interactions among the multitude of variables.² The external environment consists of the economic wellbeing of the country's major trading partners. The domestic economic environment includes such things as the country's fiscal and monetary policy, inflation rate, the exchange rate, productivity growth, energy supply and prices, unemployment rate, rate of adoption of technology and aggregate labour supply. The models are typically estimated using econometric methods. Output from the models includes forecasts for gross domestic product and its expenditure and income side components, and in some instances (e.g. U.S.), output forecasts for some broad industry sectors.

The next stage in figure 1 converts the forecasts of economic output from the macroeconomic model into forecasts of output by industry, with the link between the two stages generally made using multi-sectoral models of the input-output type. These models can vary in sophistication from the simple, as used in some developing countries using data from a single input-output table, to more complex, using econometric methods to estimate the model (Bakule et al. 2016). A number of countries model the two stages within a unified framework. For instance, the macro model for the European Union is a multi-sectoral dynamic model, combining econometric methods with input-output detail and structure (Cedefop 2012). It provides consistent macro and industry forecasts. The macro model for the U.S., on the other hand, produces forecasts for broad industry groups, which are subsequently decomposed into detailed industries using input-output methods (Bureau of Labor Statistics 2012). As we will show in the next chapter, in Australia too, a single framework (computable general equilibrium model) produces the macro and industry forecasts. The degree of disaggregation of the output by industry can vary from about a dozen in Japan (Suzuki 2002) to more than a hundred in the U.S. (Bureau of Labor Statistics 2012) and Australia (Meagher and Pang 2011).

The third step in determining expansion demand is deriving employment by industry. The simplest method is to extrapolate past trends in industry shares in total employment (Mane and Oliver-Alonso 2002; Australian Government 2017a). A slightly more complex method is to use industry output and labour productivity as is done in, for example, Korea (Korea Employment Information Service (KEIS) 2012) and New Zealand (SriRamaratnam and Zhao 2010). Some systems estimate it as a function of industry output, industry-specific real producer wages, average hours worked, and in some cases energy prices and interest rates, and use econometric methods for the estimation (Bureau of Labor Statistics 2012; Cedefop 2012; Suzuki 2002). The computable general equilibrium framework typically uses a nested production function linking employment by industry with output by industry (Meagher and Pang 2011; Giesecke et al. 2015).

The fourth step transforms employment by industry to employment by occupation, and most models do this by extrapolating past trends of the matrix of occupational shares by industry. Some systems make further adjustments to reflect anticipated changes in industry production mixes and technology (Bureau of Labor Statistics 2012; Cedefop 2012). Expert judgement is an important final input in some systems.

² The ability to estimate multiple relationships simultaneously with feedback loops and interactions in these models is a clear advantage over simpler methods such as univariate trend extrapolation.

Replacement demand

Forecasts of job growth provide an insight into where to expect future job openings. Additional job openings arise when workers permanently leave an occupation (e.g. to retire or for other reasons) and need replacing. Job openings resulting from replacement needs far exceed those due to growth in most developed countries. More than three quarters of all job openings for new entrants in the U.S. from 2014 to 2024 were a result of replacement demand, with the proportion much higher in occupations requiring low entry requirements (Bureau of Labor Statistics 2016).

There are two concepts of replacement demand: (1) total; and (2) net (Shah and Burke 2001; Bureau of Labor Statistics 2008). Total replacement demand measures the total number of job openings resulting from flows of workers out of an occupation irrespective of the numbers entering over the same period. Figure 1 shows the four components of occupational separation that leads to total replacement demand. As experienced workers seeking to re-enter the occupation will also fill some of the jobs, it is not a good indicator of opportunities for new entrants to an occupation. For this purpose, net replacement demand, which is net of these re-entrants, and expansion demand provides a more accurate measure of the number of new and generally younger workers required in an occupation. In figure 1, replacing occupational mobility by *net occupational mobility* provides an approximation for net replacement demand.

A lack of appropriate data to estimate the four components of replacement demand often means that countries often do not report total replacement demand. In the literature, replacement demand thus generally refers to net replacement demand and henceforth, we will follow this convention. Furthermore, for the purposes of education and training markets, net replacement is a more important measure because when added to job openings from expansion demand they approximate the minimum number of workers to train in occupations generally requiring entry-level training.

Most systems, apart from the one used in Canada³, use some variant of the cohort-component method to estimate replacement demand by occupation (Bureau of Labor Statistics 2012; Cedefop 2012; Wilson et al. 2016a; Sexton et al. 2001; Bijlsma et al. 2016; Shah and Burke 2001). The method, which has many applications in demography⁴, captures demographic but generally not behavioural changes. Most countries define cohorts by age, by 5-year groups, and gender, although the U.S. defines them by only age. The method calculates net separations by comparing the size of the same cohort at two points, five years apart, in each occupation. Net separations occur only when the size of the cohort declines. The sum of all net separations provides a measure of replacement demand. If employment in an occupation declines, then net separations would be greater not only because more workers leave, but also because fewer enter the occupation. Replacement needs in these circumstances are less by the decline in employment (Bureau of Labor Statistics 2012).⁵ Most systems then convert replacement demand estimates into rates and use these to project replacement demand for future periods.

This method provides a lower bound for the number of job openings from replacement demand. This is because in younger age groups, more workers are entering than leaving the occupation and, therefore, net separation for this age group will be zero. This means that replacement need estimates

³ For details about the Canadian method, the Support Document.

⁴ For applications of the method in demography, see ABS (1992); Davenport and O'Leary (1992); Kippen and McDonald (2000); Pollard, Yusuf and Pollard (1974); Shryock and Siegel (1980).

⁵ For an alternative method of adjusting for declining occupations, see the details of the European Union method in the support document.

do not include a person in these age groups who dies even though such an event creates a replacement need.

Job openings

Job openings in an occupation are a result of growth in the occupation and replacement demand. These are primarily job openings for new entrants. Many other job openings also arise, but experienced workers fill these openings. The measure provides a lower bound for training requirements in occupations generally requiring training. Some people who complete the specific training do not enter the occupation for which they qualify. As a result, more workers would need to train to ensure that the minimum number enter the occupation.

United States

The United States invests heavily, more than any other country, in producing labour market information. After the Second World War, the Bureau of Labor Statistics (BLS) began to conceive the idea of producing prospective information in order to offer career guidance to returning war veterans. The first set of projections were not produced until 1960 but since then the BLS has published projections about every two years (Bureau of Labor Statistics (2012)), with the most recent, for the 2014-24 decade, in 2015 (Hogan and Roberts (2015)).

The BLS information covers the future size and composition of the labour force, aggregate economic growth, detailed estimates of industry production, and industry and occupational employment and job openings. The BLS follows the following interrelated steps to produce the information:

- project the size and demographic composition of the labour force
- project aggregate economic growth
- project final demand (gross domestic product) by commodity and industry
- project employment by industry
- project employment by occupation
- project replacement demand by occupation
- project job openings for new entrants by occupation
- project education and training requirements (Bureau of Labor Statistics (2012)).

Labour force projections

The size of the labour force provides an upper bound on the supply of labour for the economy and, therefore, its projections are an important input for forecasting future economic growth. The BLS projects the size of the labour force for 136 different population cohorts defined by age, sex, race and ethnicity using time series methods. It does this by, first, projecting the labour force participation rates for each cohort and then multiplying the derived rates with the projections of the civilian population⁶ from the Census Bureau. Finally, it aggregates the cohort projections to obtain the total labour force.

The population in U.S. is getting older, as it is in many developed countries, with people 55 years and older projected to increase their share of the civilian population from 34.2 percent in 2014 to 38.2 percent in 2024.

Population ageing, and the fact that older people are less likely to participate in the labour force, means the overall labour force participation rates will decline from 62.9% in 2014 to 60.9% in 2024, although the size of the labour force will increase by 7.8 million, or 5.0 percent, over the same decade.

⁶ The civilian population excludes all children under 16 years of age, the Armed Forces and people in institutions (e.g. prisons, aged care homes, mental institutions, etc.).

Forecasts of aggregate economic growth

In the second stage, the BLS uses a macroeconomic model of the U.S. economy to produce projections of various macro variables, including gross domestic product (GDP) and the major categories of demand (consumption, private investment, government and foreign trade) and income (personal and business). Labour force projections, energy prices and assumptions about fiscal and monetary policies are included in the model but determined external to the model. The model produces aggregate measures that are consistent with each other and with various other assumptions and conditions relating to the macro economy.⁷

The BLS projected real gross domestic product to increase by 2.2% per year from 2014 to 2024, which is consistent with the economic growth in the recovery period following the global financial crisis but lower than in the decades from 1960 to 2000 (Byun and Nicholson (2015)).

Final demand (gross domestic product) by commodity and industry

At this stage, the BLS first disaggregates the projections of final demand (from the previous step) into detailed categories. It then distributes each category's demand across 195 commodity types.⁸ To achieve this it uses a bridge table, based on the historical relationships within the input output accounts, with adjustments for things such as external energy forecasts, global economic outlook, known trade agreements, government spending trend and expectations of government policy changes.

Second, it converts the data from purchaser value to producer value with margins for wholesale and retail mark-ups and transport costs. The result is a data matrix representing the inter-industry model of the U.S. economy, with 195 rows of commodity sectors and 191 columns of final demand and margin categories.

Third, it determines industry level output needed to produce final demand from step two. It uses input-output analysis for this, which is the quantitative analysis of inter-industry relations describing the allocation of resources in a multi-sectoral economy.⁹ Each industry within the economy relies on other industries to supply inputs, in terms of intermediate products or services for further processing.¹⁰ To do the analysis, the BLS has developed a consistent (iteratively scaled) set of

⁷ BLS currently uses the structural macro model of the U.S. economy developed by Macroeconomic Advisers, with some input for the model from Oxford Economics, both private forecasting agencies. The model has 744 endogenous and exogenous variables, describing 134 behavioural equations and 201 identities. They use time series econometric techniques to solve the system of equations. The model's foundations are: (1) consumption follows a life-cycle model; and (2) a neoclassical model for investment. By design, the model reaches a full employment solution in the forecast period, which is the BLS long-run view of the economy. Any unemployment is considered to be frictional and not a consequence of insufficient demand (Bureau of Labor Statistics 2012).

⁸ The categories and commodity types are up to the level supported in the National Income and Product Accounts and the Input Output Accounts, both published by the Bureau of Economic Analysis.

⁹ The BLS input-output model consists of two basic matrices for each year: a 'use' table and a "make" table. The 'use' table is the direct requirements table, showing the use of commodities by each industry as inputs into its production process. Each column of the table displays the pattern of commodity inputs per dollar of industry output. The 'make' table is the market share table, showing the commodity output of each industry as well as the industry distribution of production for each commodity. Historical relationships and the projected final demand tables provide a basis to project the input-output tables. The calculation of industry outputs uses two matrices, 'use' and 'make', and the vector of final demand.

¹⁰ The gross domestic product, which is a measure of the value of only the final goods and services, does not include intermediate products or services. For example, the gross domestic product estimates directly reflect the sale of computers to consumers for personal use or to businesses for equipment, but they do not reflect the copper used in the wiring of the computer as this is intermediate material input.

historical input-output tables for the 195 industry sectors (see previous step) using data from the Bureau of Economic Analysis (BEA).¹¹

Employment by industry

The BLS makes industry-level employment projections in terms of both numbers of jobs and hours worked.¹² The employment equations relate an industry's labour demand (total hours) to its output, its wage rate relative to its output price and a trend variable to capture technological change within the industry.¹³ Together with another set of equations that relate the average weekly hours for each industry with the unemployment rate and trend variable, the solutions of these equations provide predictions of average weekly hours over the forecast period. Finally, an identity relating average weekly hours, total hours and employment yields a count of jobs by industry.

Employment by occupation

For each projection cycle, the BLS develops a set of matrices to allocate industry employment to occupations. The set includes a base-year employment¹⁴ matrix and a projected-year employment matrix, collectively referred to as the National Employment Matrix. The National Employment Matrix provides a detailed breakdown of employment by industry in each occupation. Similarly, for each industry, the matrix provides a detailed breakdown of occupational employment.

Occupational employment within each industry, divided by total employment in each industry, for the base year yields the occupational distribution ratios (staffing patterns) used to project occupational employment. To derive projected-year staffing patterns, the BLS uses ancillary information (for example, product mix and changes in technology and business practices) that may affect occupational utilisation within industries during the projection period, to adjust base-year staffing patterns. It then multiplies each industry's projected employment by the projected-year occupational shares to obtain the industry's projected-year occupational employment.

Replacement demand by occupation

Projections of job growth provide an insight into where to expect future job openings for new entrants. Additional job openings for them also arise when workers permanently leave an occupation (e.g. to retire or for other reasons) and need replacing.

To project replacement demand in an occupation, the BLS first calculates age-specific net separations¹⁵ using a cohort-component method (Bureau of Labor Statistics (2015)).¹⁶ It uses

¹¹ Data from the BEA included the benchmark input-output table for 430 industries and annual input-output tables for 67 industries.

¹² BLS makes separate calculations for wage and salary workers, self-employed and unpaid family workers.

¹³ The aggregate of individual industry estimates must be consistent with the results from the macroeconomic modelling described earlier.

¹⁴ Base-year employment data come from a variety of sources and measure total employment as a count of jobs, and not as a count of individual workers.

¹⁵ In contrast, total separations identify the flow of all workers, irrespective of experience, leaving an occupation for any reason whatsoever and without regard to workers entering the occupation. Total separations are also the total replacement needs in an occupation and provide the broadest measure of job openings (Bureau of Labor Statistics 2008a). Recent BLS publications do not include estimates of total replacement demand (for example, see Bureau of

historical data on employment by age and occupation from the Current Population Survey (CPS) for the calculations. Net separations, which are generally higher from older cohorts, summarise the movements of workers into and out of an occupation over a specific period, in other words, they approximate the number of persons who permanently leave an occupation.¹⁷ When summed over all age cohorts, net separations provide an estimate of the replacement need in occupations experiencing growth. In occupations with negative growth, however, replacements are equal to the total numbers of separations less the decline in employment. The BLS converts these into rates and, together with occupational employment projections, projects replacement demand for future periods. Implicit in the projections is the assumption that workers continue to retire and otherwise permanently exit an occupation at ages similar to those in the recent past.

The BLS estimated the average annual replacement rate across all occupations at 2.35% from 2014 to 2024 (Bureau of Labor Statistics (2016d)).

Job openings for new entrants

Employment growth and replacement demand quantify the need for new entrants in an occupation, and if training is required, identify minimum training requirements. Putting it another way, they indicate the number of job openings or opportunities in the occupation for new entrants.

If employment change is non-negative, then the sum of employment increase and net replacement indicates the total number of job openings in the occupation. If employment change is negative, then job openings due to growth are zero and total job openings equal net replacements.

Measures of education and training

The BLS provides information about education and training requirements for all occupations in the National Employment Matrix. Information on three categories is included for each occupation: 1) typical education required for entry (eight categories¹⁸); 2) work experience in a related occupation (three categories)¹⁹; and 3) typical on-the-job training (six categories)²⁰ (Bureau of Labor Statistics (2016a)).

The BLS assigns occupations to categories based on analyses of qualitative and quantitative information. Sources of quantitative information include educational attainment data from the Census Bureau's American Community Survey (ACS), education, work experience and on-the-job training requirements data from the Occupational Information Network (O*NET) and data on post-secondary program completions from the National Centre for Education Statistics. Sources of qualitative

Labor Statistics (2016d)). However BLS produces monthly estimates of total separations (turnover), which includes quits, layoffs and discharges, and other separations based on data from an employer survey (Bureau of Labor Statistics 2017). The total separation rate for February 2017 was 3.5%. The annual rate is the average of the monthly rates.

¹⁶ This method captures demographic changes, but not behavioural changes. Beginning with 2016-26 projections, BLS is changing its method of calculating replacement needs (Bureau of Labor Statistics 2016b). The new method uses the longitudinal aspects of the monthly Current Population Survey (CPS) and its supplements. Bureau of Labor Statistics (2016c) provides answers to frequently asked questions about the new method in relation to the previous method.

¹⁷ Workers who change jobs but remain in the same occupation do not contribute to replacement needs.

¹⁸ 1) Doctoral or professional degree 2) master's degree 3) bachelor's degree; associate's degree 4) post-secondary non-degree award 5) some college (no degree) 6) high school diploma or equivalent 7) no formal educational credential.

¹⁹ Work experience categories are: 1) five years or more 2) less than five years 3) none.

²⁰ 1) internship/residency 2) apprenticeship 3) more than 12 months on-the-job training 4) one to 12 months on-the-job training 5) one month or less on-the-job training 6) none.

information include data from educators, employers, workers in the occupation, expert trainers and representatives of professional and trade associations and unions.

The typical entry-level educational requirement in an occupation does not necessarily reflect the educational attainment of workers already in the occupation. The latter can reflect a higher level of attainment. In the 2014-15 data, for instance, 50.1% of advertising sales agents had attained a bachelor's degree but the typical education required for *entry* into the occupation is 'high-school diploma or equivalent'.

European Union

Many countries in the European Union produce national labour market information, for example, the UK (Wilson et al. (2016b)), the Netherlands (Bijlsma et al. (2016)), Ireland (Behan (2014)) to name just a few. Rather than describing the practice in each European country, we describe the method that the European Centre for the Development of Vocational Training (Cedefop) uses for producing medium-term pan-European forecasts of the supply and demand for skills (Cedefop (2012)). The underlying method has parallels with the methods used in some member states, most notably the UK and the Netherlands.

In 2008, the European Centre for the Development of Vocational Training (Cedefop) (with the support of the European commission) began a project to produce medium-term pan-European forecasts of the supply and demand for skills (Cedefop 2008). The project's aim was not to substitute the work already undertaken at the national level, but rather to complement it. The latest forecasts from Cedefop are for 28 European Union member states and Iceland, Norway and Switzerland (EU-28+). A consolidated report is produced for EU-28+ (Cedefop 2016) as well as short reports for each country (for example, see Cedefop (2015) for a report for Austria). Cedefop's web portal provides much of this information online.

Four main modules make up the Cedefop forecasting system. Cedefop (2012) includes detailed descriptions of each module as well as three indicators to reconcile the supply and demand forecasts for qualifications. We briefly describe the four modules below.

Macroeconomic and sectoral forecasts

At the core of the Cedefop forecasting system is a pan-European macroeconomic model (E3ME²¹) for EU-28+ providing a set of consistent sectoral forecasts of employment for each country at a high level of disaggregation (41 industry sectors).²² The model treats Europe as a multiregional area, with each country treated as a region within it.

The model is the bedrock of the forecasting system and describes the interaction (two-way feedback) between the labour market and the wider economy, including linkages with energy supply and demand and environmental emissions. Interaction among economic sectors takes place through input-output relationships and links among countries through international trade relationships. The model includes assumptions relating to main external influences, such as technological change and global competition, on each country's economy. Its features allow for short-, medium- and long-term

²¹ Cambridge Econometrics in the UK developed the model.

²² According to Cedefop (2012), the model combines features from both time series econometric models and computable general equilibrium models.

forecasting as well as dynamic policy simulation. The outcomes from the model are a set of coherent, benchmark aggregate forecasts for sectoral labour demand and aggregate supply by age and gender.

A system of equations describes the relationships among employment, average wages, average hours worked and labour force participation rates for each industry and region. The model also includes interactions between these and other economic variables (unemployment, labour force participation rates, working age population, social benefit rates etc.). The equation for employment, for instance, is a function of industry output, wages, hours worked and energy prices. The model incorporates technological progress in two ways: (1) as a combination of gross investment in ICT and expenditure on research and development and (2) skills deepening or upgrading. For more details, see Cedefop (2012).

E3ME projects labour supply in each country by 5-year age groups and gender based on forecasts of participation rates and externally projected working age population. The model does not include a labour market clearing mechanism and thus unemployment arises when labour supply is greater than labour demand.

The models are estimated using European-wide, harmonised official data sources, including Eurostat (in particular Eurostat demographic data), national accounts of individual countries, the EU Labour Force Survey as well as additional data on qualifications (Cedefop 2012). Other aggregated international data from agencies such as the European Commission (annual macroeconomic (AMECO) database), OECD Stan database, World Bank and the International Monetary Fund are also incorporated in the modelling.²³

Cedefop shares the initial forecasts from the model with a group of national experts who provide their feedback on the methods used; the assumptions underpinning the model; and the plausibility of the preliminary results. They may also bring information on likely future trends not accounted for in the model.

According to Cedefop (2016), which includes the most recent set of forecasts, employment in EU-28+ is forecast to grow 0.3% per year from 2015 to 2025, with the highest growth (1.1% per year) in business and other services and negative growth (-1.4%) in primary sector and utilities.

Employment by occupation and qualification

E3ME produces forecasts of employment by industry in each country. Two other modules, EDMOD and QMOD, then translate these into forecasts of employment by occupation (27) and qualification (3). At the core of the EDMOD module are historical tables of occupation shares by industry estimated from EU Labour Force Surveys from 1993 to the most recent.²⁴ Similarly, historical tables of shares of qualifications by occupation form the core of the QMOD module. The projection of shares in each module uses a logistic function with a time trend.²⁵

Employment is forecast to increase in higher skilled occupations and, with some exceptions (service workers, shop and market sales workers and elementary occupations), decline in lower skilled occupations (Cedefop 2016). For example, the model forecasts employment growth of 1% per annum

²³ The most recent set of forecasts contained in Cedefop (2016) use Eurostat's population projections developed in 2013. The model uses the GDP growth projections from European Commission (2015) to update the long-run economic projections.

²⁴ It is unclear why Cedefop does not use recent data from the EU Labour Force Surveys.

²⁵ The projection uses an alternative specification (log-linear, linear or fixed shares) when the logistic specification produces implausible results.

for technicians and associate professionals from 2015 to 2025 and a negative growth of 1.3% per annum for skilled agricultural and fishery workers. It is thus unsurprising to find growth in jobs requiring high qualifications (2.3% per year) and negative growth in jobs requiring low skill qualifications (-1.7% per year).

Replacement demand

Cedefop also uses a cohort-component method (RDMOD), similar to that used by the BLS, to estimate replacement demand.²⁶ It uses data from the EU Labour Force Surveys to estimate the model. Unlike the BLS, which defines the cohorts by only age, Cedefop defines them by age and gender.²⁷ Cedefop estimates the average net replacement demand across EU 28+ countries at about 4% per annum (Cedefop 2016).²⁸ This means that 85% of the source of job openings in EU-28+ from 2015 to 2025 will be from replacement demand.

Job openings

The growth in employment together with replacement demand provides an estimate of job openings in occupations in which employment is increasing. In occupations experiencing contraction, job openings equal replacement demand less the contraction in employment.

Labour supply by qualifications

Cedefop uses a multinomial model with a time trend to estimate the probability that a person of a given age and gender in each country will attain a qualification in a given period. The model is estimated with data on (highest attained) qualifications from the EU Labour Force Surveys. The projected probabilities from the model, in conjunction with labour force projections from the E3ME model, provide a basis to forecast labour supply by qualification. Cedefop (2016) projects virtually no change in the size of the labour force in EU-28+ from 2015 to 2025, but forecasts its skills distribution to shift towards high skills and a corresponding shift away from low skills, not dissimilar to the pattern in demand.

Imbalance indicators

The co-existence of unemployment and unfilled vacancies is generally a normal feature of most labour markets. This is because of friction in the market from search costs and information asymmetry. Sometimes retraining and reallocation of existing workers can resolve short-term imbalances within particular occupations. However, when imbalances are substantial and persistent, then it is important to identify the source to develop appropriate policies to minimise their effects.

Simply comparing the forecasts of supply and demand is problematic because the results for the two are derived using distinct models without dynamic interaction between them and using different data. In reality, the supply and demand adjust through wage changes, the way firms deploy the available skills and the way workers accept jobs that are not matched with their current skills.

²⁶ See Cedefop (2012) for further details about the method.

²⁷ Cedefop does not adjust the net outflows for occupations with declining employment at this stage. The adjustment for declining occupations occurs when calculating job openings.

²⁸ The average replacement rates in the U.S., as well as in Australia (see, for example, Shah and Burke (2001)), are generally lower. Part of the difference may be due to treatment of occupations with declining employment in the different models and the assumption regarding the age at which workers are compulsorily retired.

Notwithstanding the limitations of the current method of producing forecasts of supply and demand, Cedefop developed a set of three indicators for assessing likely skills imbalance in the future. It uses the concept of unconstrained and constrained skill demand as a basis for constructing these indicators. Unconstrained demand assumes supply is unlimited. Constrained demand is also unconstrained demand but which is adjusted to be consistent with the available supply using 'RAS' (iterative scaling).

The three Cedefop indicators are:

Indicator of change (IC): measures the adjustment, by occupation, required to constrain the forecasts of demand for skills consistent with the adjustment just described. Higher values of IC are indications of greater adjustment.

Measure of constraint (MC): measures the adjustment, by occupation, of skills demand necessary from the base year to a given year of the forecast. Once again, higher values of the index are indications of greater adjustment relative to the base year.

Indicator of future imbalances of demand (IFIOD): this indicator summarises the overall supply-demand relationship of qualification levels. The closer the indicator is to one, the lower the difficulties to recruit the appropriate skill mix for the occupation.

Cedefop (2016) presents calculations for only IFIOD. The relatively lower values of the index for all intermediate and lower skilled occupations in a number of countries (for example, Scandinavia, Benelux and France) is interpreted as potential imbalance of qualifications over the forecast period. It could also be an indication of significant changes in the distribution of qualifications in these occupations.

Canada

Canada has more than a 30-year history of producing labour market information. It uses the models of the Canadian Occupational Projection System (COPS) to project medium-term trends in the major sources of job openings (growth and replacement demand) and job seekers (school leavers, immigrants and other entrants) by occupation and qualification.²⁹ By comparing the trends in the supply and demand sides of the labour market, the COPS system helps to identify where potential imbalances between the two may develop. A series of technical papers provides details about the construction of the models that make up COPS (Boothby, Roth and Roy 1995; Boothby 1995b; Boothby 1995a; Boydell, Gautier and Hughes 1995; Meltz 1996. El Achkar 2010 and Thomas 2015) provide reviews of COPS. Below we describe the major features of COPS.

Occupational demand

Macroeconomic reference scenario

At the core of COPS are medium-term, macroeconomic forecasts of the Canadian economy. The focus is on prediction of structural trends in demand and productivity, and not short-term business cycles. The likely economic scenario is developed jointly by Employment and Social Development Canada (ESDC) and the Conference Board of Canada using the most recent private and public forecasts of the Canadian economy from a variety of organisations (e.g. Consensus Economics, OECD, IMF Finance

²⁹ The calculations of job openings and job seekers are exclusive of full-time students. The calculations thus exclude all students working part-time while studying full-time.

Canada, Bank of Canada) (Lapointe et al. 2006; Ignaczak 2012). The latest projections show GDP growth of about 2% from 2015 to 2024 (Employment and Social Development Canada 2015c). They also show a slowing in the labour force participation rate of working age Canadians from 66% in 2014 to 64.3% in 2024.

Employment by industry

An input-output matrix translates the forecasts of final demand from the macroeconomic model into industry output. Forecasts of employment by industry are a function of forecasts of industry output, industry-level productivity, capital and technology.

Employment by occupation

COPS use time series method to project employment by occupation using an industry-occupation share matrix (33 industries by 140 occupations) (Lapointe et al. 2006). It later expands the projections to 500 occupations.

Replacement Demand

Unlike BLS and Cedefop models, the current COPS model for replacement demand captures only retirements, deaths and emigration from the occupation. Outflows to other occupations, net of inflows from other occupations, which can be substantial in some occupations, are not included in the estimates.³⁰

Lapointe et al. (2006) describes in detail the method for projecting retirements by occupation in COPS. The method³¹ first uses data from the Longitudinal Administrative Databank (LAD) to project retirement³² rates by age and gender. The next step is to multiply the rates to forecasts of employment by age and gender to obtain aggregate forecasts of retirements. In the final step, retirements by occupation are projected and then adjusted so that in aggregate they are consistent with the forecasts from the step before.³³

COPS uses death rates in the population by age (presumably derived from administrative data) and forecasts of employment by occupation and age to forecast the number of deaths³⁴ in each occupation.

Emigrants from an occupation are calculated by assuming that overall emigrants as a proportion of the Canadian population is constant (about 0.14%) and that the emigrants are a true reflection of the non-student Canadian labour force (Human Resources and Skills Development Canada 2008).

Replacement demand is then the sum of retirements, deaths and emigration. The model for projecting replacement demand regresses historical rates on time.

³⁰ Thomas (2015) suggests that these net outflows are included as net re-entrants on the supply side estimates.

³¹ The method uses an econometric model that takes into consideration determinants of retirement decisions, including education, wealth and labour demand.

³² Retirees are individuals aged 50 and over separating from a job and remaining non-employed for at least three consecutive years.

³³ COPS projects retirements in an occupation by ageing forward the occupation's age profile (as observed in the Labour Force Survey) and calculating the average annual number of workers within five years of that occupation's median retirement age, which is assumed to remain constant over the forecast period. The documentation is however unclear about the determination of the occupation's median retirement age.

³⁴ These calculations do not incorporate occupation-specific risk.

Job openings

Once again, job openings are the sum of expansion demand and replacement demand. Employment and Social Development Canada (2015a) projects three quarters of all job openings from 2015 to 2024 to be from replacement demand.³⁵

COPS forecasts about 5.95 million job openings from 2015 to 2024, with 65.9% expected in occupations usually requiring post-secondary education.

Labour supply

The projection of labour supply by occupation has three major elements: 1) school leaver entrants 2) immigrants and 3) other entrants.

The school leavers' model projects the number of people leaving the school system to enter the labour market by occupation. First, using administrative data from the education system and population demographic data, full-time enrolments and graduate completions (high school, trade and vocational, community college and university) are projected.³⁶ Second, based on the recent experience of school leavers entering the labour force, job leavers by occupation are projected.

The projection of the number of immigrants among job seekers assumes immigration into Canada will remain constant as a proportion of the population (about 0.75%). The labour market experience of recent immigrants as observed in the census data forms the basis for projecting occupational choices of immigrants into the future.

Other entrants, which include workers from other occupations³⁷, can be an important source of job seekers in some occupations. Mobility patterns observed in the Labour Force Survey provide the basis for projecting other entrants.

COPS projected 5.83 million job seekers entering the labour market from 2015 to 2024, with 64.8% in occupations usually requiring post-secondary education.

Imbalances between supply and demand

There are three steps in COPS for assessing the state of the projected labour market:

- Identify occupations recently showing signs of shortage or surplus conditions based on three primary labour market indicators (unemployment rate, wages and employment) as well as a range of other indicators such as job vacancies, overtime and employment insurance recipient information.
- Compare projections of job openings with job seekers over the projection period to identify projected gaps.

³⁵ The documentation is unclear about the treatment of occupations with negative growth in the calculation of new job openings.

³⁶ The calculations do not include foreign students; they enter through the immigration channel when they apply for permanent residency. Students who drop out of their course complete a qualification a step below the one they dropped out from, for example, a person who drops out of a trade apprenticeship completes high school.

³⁷ Net labour market re-entrants and other students (individuals working while undertaking study) can also be sources of job seekers, but according to Employment and Social Development Canada (2015b) their numbers are relatively small.

- Combine the results from the first two steps to assess prospective changes in both the demand and supply sides of the labour market, to identify occupations where potential labour market imbalances may persist or develop (Employment and Social Development Canada 2016).

Overall, there is no evidence of imbalance between supply and labour by skills level from 2015 to 2024 (Employment and Social Development Canada 2016). A handful of occupations however show imbalance. Four occupations, mostly in the health sector, which have recently experienced a shortage, will continue to experience shortage over the next decade. Similarly, three occupations in current surplus will continue to have a surplus. Another 13 (15) occupations recently in shortage (surplus) are projected to be in balance. On the other hand, of another 41 occupations currently in balance, 13 (28) are projected to be in shortage (surplus) over the next decade.

Labour market information in Australia

The intention of this review is not to provide an extensive critique of each jurisdiction's practice, but to document the main sources of the information and the purpose for producing it. The review mostly uses publicly available information and, therefore, there may be some omissions relating to the practices of some jurisdictions that we cover.

The production and processing of the information on the future labour market varies across jurisdictions in Australia. The Australian Government's purpose for producing labour market information is to inform those making decisions, or those helping others make decisions, about employment, education and training opportunities. One of the main uses of labour market information for state jurisdictions is for informing their policies on purchasing training and for the setting of levels of public subsidies for vocational courses for different population groups. Some states also use it for prioritising occupations for regional migration.

While most states provide links to the Australian Government websites for current or historical labour market information, they invariably assess future job prospects independently of the Australian Government and use different sources of information for this purpose. The Australian Government has an in-house method to project employment by industry, occupation and occupation skill level. The states generally buy employment forecasts from outside agencies, some of which use sophisticated dynamic computational general equilibrium models for producing these forecasts. Most countries that have a long tradition of producing labour market information also use more advanced models than the model the Australian Government uses. Finally, the Australian Government assesses future job prospects based all job opportunities in the labour market, which is the sum of employment growth and total replacement demand. For the states, who have to plan training provisions, net replacement demand is a preferred concept for assessing job prospects, which, together with job growth, also provides a more accurate assessment of job opportunities for new entrants to the labour market.

Australia

The Australian Government, through the Department of Employment, publishes information on where the jobs are for people helping others make decisions about employment and training and for people looking to develop career plans for themselves (Australian Government nd.). It provides the following types of information.

Australian jobs, an annual publication bringing together up-to-date information about jobs in Australia.³⁸ The topics include employment patterns by industry, occupation and regions; graduate outcomes; employers' skill needs and the linkages between education and employment. The publication does not include prospective information about jobs.

Industry information is about the key employment statistics for the 19 major industries.³⁹ For each industry, the information includes the education and gender profiles; the share of full-time employment; average full-time hours; median weekly earnings; and the projected employment growth

³⁸ <http://employment.gov.au/australian-jobs-publication>

³⁹ <http://lmip.gov.au/default.aspx?LMIP/IndustryInformation>

over the next five years. Interactive data tools allow one to drill down for similar information for the 10 largest occupations in each industry. Additional information at the occupation-level includes average weekly pay, the typical qualification level of workers and an indication of their unemployment rate.

Employment projections are derived using data from ABS Labour Force surveys and forecasts of total employment from either the most recent budget or Mid-Year Economic and Fiscal Outlook (MYEFO).⁴⁰ The forecasts provide a snapshot of employment patterns by industry, occupation, skill level and region at a point in time five years hence. It uses time series methods (univariate) to extrapolate employment in hundreds of industries at the national level and in 19 industry divisions at the regional level.⁴¹ It also projects employment by occupation and occupational skill level.⁴² It uses historical data from the Labour Force surveys for this purpose, but adjusts the final projections to conform to the aggregate employment growth forecasts produced by the Australian Treasury.⁴³ The latest set of projections, released in September 2017, is for 2022.

Job Outlook provides an overview (employment level, unemployment, average hours of work, proportion working full-time, average weekly pay, gender composition); prospects (expansion demand and job openings⁴⁴); pathways; skills and knowledge; and the work environment for 353 occupations.⁴⁵ The source of information for the last two items is the U.S. developed O*NET⁴⁶. Job Outlook information is available online.

Skills shortages portal provides qualitative assessment of skill shortage in each of more than a hundred large occupations at the national and regional levels using a three-level rating (shortage, recruitment difficulty or no shortage).⁴⁷ The method uses a range of data sources for assessing skills shortages, the key element being data from the Survey of Employers who have Recently Advertised (SERA) (Australian Government 2017b).

Labour Market Information Portal provides a range of historical data about the labour force by region. It includes participation, employment and unemployment rates as well as Centrelink and Job Services Australia data.

Small Area Labour Markets publication contains quarterly estimates of unemployment rates, unemployment levels and the labour force at a detailed regional level across Australia.⁴⁸ The

⁴⁰ <http://lmip.gov.au/employmentprojections>

⁴¹ It projects employment in 416 industry divisions, subdivisions and groups for Australia as a whole. The regions are states and territories, capital city, rest of state area, as well as sub-state regions (statistical area level 4 in the Australian Statistical Geography Standard classification).

⁴² It projects employment for 667, major, sub-major, minor and unit groups under ANZSCO and five occupational skill groups.

⁴³ For example, the projections released in 2017 were consistent with the growth forecasts in the 2017-18 Budget. The Department adjusts some projections to reflect outcomes from its internal research and known future industry, occupational and regional developments, but the method for doing this is undocumented.

⁴⁴ For example, the employment of butchers and small goods makers was projected to increase by 700, from 14 500 in 2017 to 15 200 2022. Total job openings, which are job opportunities resulting from expansion and *total* replacement demand are estimated to be between 7501 and 15 000. To measure total replacement demand, the Department considers the occupational status of individuals at two time points 12 months apart (in the ABS Survey of Participation, job search and mobility). Individuals whose occupation is not the same at the end of the period as at the end of the period are counted towards total replacement demand. Clearly, this is a lower bound for the total number of job openings, as it excludes those who leave the occupation and get another job in the same occupation within the 12-month period.

⁴⁵ <http://joboutlook.gov.au/>

⁴⁶ O*NET version 21.2.

⁴⁷ <https://www.employment.gov.au/skill-shortages>

⁴⁸ <https://www.employment.gov.au/small-area-labour-markets-publication>

estimates are derived using data from Centrelink (Youth Allowance and Newstart recipients), Labour Force surveys and the Census.

Regional Internet Vacancy Index is a monthly report with detailed data on online job advertising levels and trends by occupation for 37 regions across Australia.⁴⁹ The source of the data for the index are online job advertisements newly lodged on SEEK, CareerOne and Australian JobSearch websites during the month. As these websites cannot include all job vacancies advertised, the index underestimates the total job advertisements.

Regional Employer Surveys is the source of employers' views on a range of selected local recruitment issues, which help to identify local employment opportunities and ways that job seekers can improve their prospects of getting a job in the local area.⁵⁰

South Australia

The Training and Skills Commission (TASC) in South Australia undertakes labour market modelling and analysis to answer two main questions: (1) what will be the pattern of employment in South Australia over the next decade and (2) what skills (in terms of qualifications) will be required to meet industry demand? One of the most important purposes of the analyses is to inform the state's plan for purchasing training. Training and Skills Commission (2017) contains the results from the latest iteration of this work and contains forecasts for the 2015-25 period.

The Commission, in conjunction with the state treasury, develops its own forecasts of total employment using a macro model for the state. It uses the Australian Government's five-year projections of industry employment shares for South Australia to convert the forecasts of total employment into employment by industry. In this respect, there is consistency between the state and national projections. The Commission uses an industry by occupation shares matrix to convert industry forecasts to occupation forecasts.⁵¹ It then adds estimates of replacement demand⁵² to forecasts of employment growth to obtain forecasts of job openings for new entrants in each occupation.

Next, the Commission estimates new qualifications to meet industry demand and for creating a reserve capacity, or buffer. In deriving these estimates, it first projects the qualification profile of the future workforce, taking into consideration trends in skills deepening, the changing qualification profile of the workforce towards higher qualifications, which largely reflects technological change but may also have an element of credential creep. It then considers the:

- skills required by workers filling new job openings (expansion demand and replacement demand)
- higher level qualifications that existing workers are completing (upskilling)
- equivalent or lower level qualifications that existing workers are completing (skills broadening)
- lower level qualifications that individuals are completing in order to undertake higher level qualifications (pathways)
- skilling of people not employed (reserve capacity).

⁴⁹ <http://lmip.gov.au/default.aspx?LMIP/VacancyReport>

⁵⁰ <https://www.employment.gov.au/recruitment-conditions>

⁵¹ The Commission will source employment forecasts from the Centre of Policy studies (CoPS) for the next iteration of this work.

⁵² TASC sources these from the former Centre for the Economics of Education and Training (CEET), Monash University and now from the authors.

For many occupations, the link to a specific qualification is tenuous and the normal labour market adjustments can deal with any imbalances between the supply and the demand. However, for some other occupations, the link to specific qualifications is more direct, and where training is typically long and costly. The implication of persistent imbalances in these occupations can be costly. The Commission identifies these qualifications linked occupations (QLO) for advanced planning. This analysis informs policy development where government intervention is required.

The Commission employs four criteria to assess whether an occupation should be on the QLO list:

- close link between qualification and occupation
- qualifications include acquiring specialised skills requiring long periods of learning
- high opportunity cost from skills shortage
- existence of robust industry intelligence to support listing.

In the 2017 report, the Commission included 106 occupations on the QLO list. For each occupation, the report provides base period employment; median age of workers; ratings for historical job growth, future job openings and qualifications demand; the Department of Employment's assessment of skills shortage; inclusion on the Department of Immigration and Border Protection's eligible skilled occupation list; and a three-level risk assessment of impending shortage. The 'above average' risk assessment means that the Commission keeps a close watch on the demand and supply situation in the occupation.

The analyses for the report are subject to final adjustment in light of feedback from industry consultations. In all, the Commission employs a rigorous and transparent method to produce robust projections for the demand for qualifications.

Western Australia

Each year the Department of Training and Workforce Development produces the State Priority Occupation List (SPOL) to inform and guide workforce planning and development and other policy areas for Western Australia. The department consults key state stakeholders, including the state's industry training councils, in compiling the list. As in South Australia, the main purpose of the list is to inform the policy on purchasing training through the State Training Plan and Future Skills WA. It is also used for compiling the WA Skilled Migration Occupation List that guides the State Nomination migration program (Department of Training and Workforce Development (2017a); Department of Training and Workforce Development (2017b)).

The Department considers about 743 occupations for inclusion on SPOL. Inclusion on the list requires the occupation to be critically important for the state's economy in the sense that market failure could potentially have significant adverse effects. To be included on the list, an occupation:

- needs skills acquired through extended periods of education and training to work in the occupation
- has clear education and training pathways to enter the occupation
- does not require specialist, only employer-provided, training
- shortage could have broader economic implications.

The method also considers non-market factors, such as changes in licensing or registration requirements to practice in the occupation. Furthermore, the department undertakes significant

analysis to calculate an Occupational Priority Index (OPI) for each occupation using historical and prospective labour market information.⁵³

Finally, depending on its ranking on the OPI, as well as how well it meets the other assessment criteria discussed above, each occupation is rated on a five-star scale. The highest rating is Priority 1 followed by 2A and 2B. Priority 3 signifies that the assessment is relative to a specific industry or region, in the other words, the occupation does not have a state-level priority. Occupations without current supply or demand issues, but requiring close monitoring for potential future problems, are in the last category. The 2017 list includes 187 occupations on Priority 1, 2A and 2B, 59 on Priority 3 and 37 on the last category.

New South Wales

The New South Wales Government's Skills List identifies vocational education and training qualifications attracting public-subsidies under the Smart and Skilled program.⁵⁴ Developed through extensive, but targeted, consultations with peak industry bodies, the Skills List identifies a range of qualifications to support the diverse skills needs of employers. A Job Guide provides labour market information for each occupation requiring a vocational education and training qualification for entry.⁵⁵ It includes information on the current employment, average full-time wages, employers perspectives on skills shortage and recruitment difficulties⁵⁶ and job prospects (next four years), which is an assessment of the future growth prospects in the occupation.⁵⁷ The Smart and Skilled website also provides information on the level of subsidies for vocational qualifications.

Victoria

According to the Victorian Government website, extensive research and industry consultation on the state's current and forthcoming labour market needs is undertaken to identify the occupations suitable for visa nomination. This ensures that Victoria's industries have skills required to remain productive, and that skilled migrants who come to Victoria are employment-ready in their nominated occupation.⁵⁸

Limited amount of labour market information is available on the Jobs and Careers page of the Victorian Skills Gateway.⁵⁹ For each occupation in a list, it includes information on qualifications required for entry, average weekly wage, current employment and future prospects (strong, moderate or poor)⁶⁰. From the information available, it is unclear whether job prospects in an occupation is an indicator of growth prospects, as in the information provided in New South Wales, or some other method is used to assess this.

⁵³ The Centre of Policy Studies (CoPS) and the former Centre for the Economics of Education and Training (CEET) provide the department with labour market forecasts.

⁵⁴ <https://smartandskilled.nsw.gov.au/about/nsw-skills-list>

⁵⁵ <https://smartandskilled.nsw.gov.au/for-students/job-guides>

⁵⁶ This based on information from the Department of Employment website:
https://docs.employment.gov.au/system/files/doc/other/skillshortagelistnsw_6.pdf

⁵⁷ The Centre of Policy Studies (CoPS) provides the information on job prospects.

⁵⁸ <http://www.liveinvictoria.vic.gov.au/visas-and-immigrating/visa-nomination-occupation-lists#.WceFq0xL29Y>

⁵⁹ <http://www.skills.vic.gov.au/victorianskillsgateway/Students/Pages/jobs-and-careers.aspx>

⁶⁰ The information on this is sourced from the Department of Employment and training (DET), the ABS and Deloitte Access Economics: <http://www.skills.vic.gov.au/victorianskillsgateway/Pages/about.aspx#link20>

References

- Behan, J 2014, *Occupational employment projections 2020*, Skills and Labour Market Research Unit, Further Education and Training Authority (SOLAS), Dublin, viewed 8 May 2017, <<http://www.solas.ie/SolasPdfLibrary/OccupationalEmploymentForecasts2013.pdf>>.
- Bijlsma, I, Cörvers, F, Dijkman, S, Fouarge, D, Künn-Nelen, A & Poulissen, D 2016, *Methodiek arbeidsmarktprognoses en-indicatoren 2015-2020*, Technical report: ROA-TR-2016/4, Research Centre for Education and the Labour Market (ROA), Maastricht, viewed 8 May 2017, <http://roa.sbe.maastrichtuniversity.nl/roanew/wp-content/uploads/2016/06/ROA_TR_2016_4.pdf>.
- Boothby, D 1995a, 'The Canadian Occupational Modelling System (COPS): A revised supply side', Technical document No. T-95-5, Human Resources Development Canada, Applied Research Branch, Hull, Quebec.
- Boothby, D 1995b, 'COPS: A revised demand side', Technical document No. T-95-4 June, Human Resources Development Canada, Applied Research Branch, Hull, Quebec.
- Boothby, D, Roth, W & Roy, R 1995, 'The Canadian occupational projection system: A methodological enhancement', Research paper No. R-95-2, Human Resources Development Canada, Applied Research Branch, Hull, Quebec.
- Boydell, K, Gautier, J & Hughes, K 1995, 'The Canadian Occupational Projection System (COPS): A new model of occupational coefficients', Research paper No. R-95-6, Human Resources Development Canada, Applied Research Branch, Hull, Quebec.
- Bureau of Labor Statistics 2008a, *Occupational projections and training data*, Bulletin 2702, 2008-09 edn, viewed 5 May 2017, <<http://www.edeps.org/AppliedResearch/optd.pdf>>.
- Bureau of Labor Statistics 2008b, *Occupational Projections and Training Data, 2008-09 Edition*, Bulletin 2702, U.S. Department of Labor, Washington DC.
- Bureau of Labor Statistics 2012, *BLS Handbook of methods*, United States Department of Labor, Washington, DC, viewed 26 April 2017, <<https://www.bls.gov/opub/hom/>>.
- Bureau of Labor Statistics 2015, *Estimating occupational replacement needs*, viewed 4 May 2017, <https://www.bls.gov/emp/ep_replacements.htm>.
- Bureau of Labor Statistics 2016a, *Measures of education and training*, viewed 6 May 2017, <https://www.bls.gov/emp/ep_education_tech.htm>.
- Bureau of Labor Statistics 2016b, *New occupational separations methodology*, viewed 4 May 2017, <https://www.bls.gov/emp/ep_separations_methods.htm>.
- Bureau of Labor Statistics 2016c, *Occupational separations methodology frequently asked questions*, viewed 4 May 2017, <https://www.bls.gov/emp/ep_separations_faqs.htm>.
- Bureau of Labor Statistics 2016d, *Replacement needs*, viewed 5 May 2017, <https://www.bls.gov/emp/ep_table_110.htm>.
- Bureau of Labor Statistics 2017, *Job openings and labor turnover - February 2017*, viewed 5 May 2017, <<https://www.bls.gov/news.release/pdf/jolts.pdf>>.
- Byun, K & Nicholson, B 2015, 'The U.S. economy to 2024', *Monthly Labor Review*.
- Cedefop 2008, *Future skill needs in Europe: Synthesis report Medium-term forecast*, Office for Official Publications of the European Communities, Luxembourg, viewed 10 May 2017, <<http://www.cedefop.europa.eu/en/publications-and-resources/publications/4078>>.
- Cedefop 2012, *Skills supply and demand in Europe: methodological framework*, Cedefop research paper No 25, Publications Office of the European Union, Luxembourg, viewed 8 May 2017, <<http://www.cedefop.europa.eu/en/publications-and-resources/publications/5525>>.
- Cedefop 2015, *Skills forecasts country reports - Austria 2015 Edition*, viewed 12 May 2017, <<http://www.cedefop.europa.eu/printpdf/publications-and-resources/country-reports/austria-skills-forecasts-2025>>.
- Cedefop 2016, *Future skill needs in Europe: critical labour force trends*, Cedefop research paper No 59, Publications Office of European Union, Luxembourg, viewed 8 May 2017, <<http://dx.doi.org/10.2801/56396>>.
- El Achkar, S 2010, *A companion guide to analysing and projecting occupational trends*, Centre for the Study of Living Standards, Ottawa, Canada, viewed 15 May 2017, <<http://www.csls.ca/reports/csls2010-07.pdf>>.
- Employment and Social Development Canada 2015a, *The Canadian Occupational Projection System (COPS) 2015 Projections: Job openings 2015-2024*, viewed 15 May 2017, <<http://occupations.esdc.gc.ca/sppc-cops/l.3bd.2t.1ils@-eng.jsp>>.

- Employment and Social Development Canada 2015b, *The Canadian Occupational Projection System (COPS) 2015 Projections: Job seekers 2015-2024*, viewed 15 May 2017, <<http://occupations.esdc.gc.ca/sppc-cops/l.3bd.2t.1ils@-eng.jsp>>.
- Employment and Social Development Canada 2015c, *The Canadian Occupational Projection System (COPS) 2015 Projections: Macroeconomic scenarios 2015-2024*, viewed 15 May 2017, <<http://occupations.esdc.gc.ca/sppc-cops/l.3bd.2t.1ils@-eng.jsp>>.
- Employment and Social Development Canada 2016, *The Canadian Occupational Projection System (COPS) 2015 Projections: Imbalances between labour demand and supply 2015-2024*, viewed 15 May 2017, <<http://occupations.esdc.gc.ca/sppc-cops/l.3bd.2t.1ils@-eng.jsp>>.
- European Commission 2015, *The 2015 ageing report: economic and budgetary projections for the 28 EU Member States (2013-2060): European economy series, 3/2015*, Publications Office of the European Union, Luxembourg, viewed 13 May 2017, <http://europa.eu/epc/sites/epc/files/docs/pages/ageing_report_2015_en.pdf>.
- Hogan, A & Roberts, B 2015, 'Occupational employment projections to 2024', *Monthly Labor Review*.
- Human Resources and Skills Development Canada 2008, *Looking-ahead: A 10-year outlook for the Canadian labour market (2008-2017)*, Policy Research Directorate, Strategic Policy and Research Branch, Human Resources and Skills Development Canada, Gatineau, Quebec, viewed 16 May 2017, <<https://tinyurl.com/m5k37nf>>.
- Ignaczak, L 2012, 'Projecting Labour Market Needs in Canada: The COPS National Model after 30 Years', Human Resources and Skills Development Canada, Ottawa, viewed 27 August 2017, <http://www2.warwick.ac.uk/fac/soc/ier/research/forecast/forecastingsymposium/agenda/draft_luke_ignaczak_warwick_cops.pdf>.
- Lapointe, M, Dunn, K, Tremblay-Cote, N, Bergeron, L-P & Ignaczak, L 2006, *Looking-ahead: A 10-year outlook for the Canadian labour market (2006-2015)*, Policy Research Directorate, Labour Market and Skills Forecasting and Analysis Unit, Human Resources and Social Development Canada, Gatineau, Quebec, viewed 15 May 2017, <http://msdilalloscience.weebly.com/uploads/6/9/6/2/6962884/looking_ahead.pdf>.
- Meltz, NM 1996, 'Occupational forecasting in Canada: Back to the future', Technical document No. T-96-4, Human Resources Development Canada, Applied Research Branch, Hull, Quebec.
- Shah, C & Burke, G 2001, 'Occupational replacement demand in Australia', *International Journal of Manpower*, vol. 22:7, pp. 648-663.
- Thomas, J 2015, *Review of best practices in labour market forecasting with an application to the Canadian Aboriginal population*, Centre for the Study of Living Standards, Ottawa, Canada, viewed 15 May 2017, <<http://www.csls.ca/reports/csls2015-16.pdf>>.
- Wilson, R, Sofroniou, N, Beaven, R, May-Gillings, M, Perkins, S, Lee, M, Glover, P, Limmer, H & Leach, A 2016b, *Working futures 2014-2024*, Evidence Report 100, UK Commission for Employment and Skills, London, viewed 8 May 2016, <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/513801/Working_Futures_final_evidence_report.pdf>.