



# Forecasting Labour Shortages in the Australian Economy

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# Forecasting labour shortages in the Australian economy

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Labour shortages have the potential to hamper the ability of the economy to produce the combination of goods and services desired by population. Labour shortages are typically quantified through analysis of the number and duration of job vacancies, and surveys of employers. Here we use an economy-wide model of the Australian economy to forecast labour shortages over the next two years. Labour shortages are indicated in the model results by occupations with strong wage growth, which suggests that shortages would develop in these occupations at the current wage. Most occupations anticipated by the model results to be in shortage by 2024 require vocational education, while occupations in strong supply tend to require higher education. Leading up to the 2022 Australian Jobs and Skills Summit this suggests an important role for the VET sector in training the workers required to avoid labour shortages.

JEL Codes: J21, J23, J24, J11

Keywords: Labour shortage, Skills shortage, Dynamic CGE modelling, Australian labour market

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# 1 Introduction

The Australian government's 2022 Jobs and Skills Summit will seek to address many challenges, including *addressing skills shortages and getting our skills mix right over the long term.*

-- The Treasury, Jobs and Skills Summit 2022

Yet Richardson (2007) defines shortage as a “surprisingly slippery concept” that is difficult to measure for several reasons. She suggests a hierarchy of shortages ranging from an absolute shortage in people with essential skills, to a situation where people have the skills but are not willing to apply for vacancies under current conditions (remuneration and non-wage conditions). Trendle (2008) refers specifically to wages, finding that a skills shortage is defined as a situation where the number of workers required with a particular skill exceeds the number available at current wages or levels of remuneration. These are static definitions that can be quantified at a point in time by surveying employers or analysing job vacancies and the length of time taken to fill them.

Here we use a modelling approach to attempt to anticipate where skills shortages may emerge in the near future. We use an economy-wide model of the Australian economy to simulate changes in demand and supply for labour classified by educational attainment over the next two years. Using occupation wages as an indicator of shortages, we conclude that if occupation wages increase relative to the economy-wide average, that a shortage would exist “at current wages” – or in fact, current wage relativities – so we conclude that these are occupations with potential shortages.

We use a Dynamic Computable General Equilibrium (CGE) model, which provides a framework in which demand and supply schedules are estimated and simulated through time. As populations grow, the demand and supply schedules for most goods and services gradually shift to the right. Production volumes increase and prices may rise or fall, depending on scarcity of resources, technical change, and many other factors, which are summarised in the relative magnitudes of the shifts in the supply and demand schedules.

We find that the occupations most likely to experience shortages are those associated with Vocational Education and Training (VET) qualifications, such as Personal Carers and Assistants, Education Aides, and some construction-related occupations. On the other hand, supply to white collar occupations requiring Higher Education such as Accounting, Law and Engineering will be relatively strong.

To some extent, shortages can be alleviated by increasing aggregate labour input, or the total hours worked across the economy. With the unemployment rate currently at generational lows, scope to do so is limited, and policies would need to focus on increasing hours worked rather than the number of persons working. Providing quality, free or low-cost child care is an effective way of increasing labour force participation of parents with caring responsibilities (Dixon, 2020).

However, in the present tight labour market, to address the shortages in some occupations will also require individuals to be diverted from other occupations and undertake training, particularly in the VET sector. We suggest that some occupations should be partially replaced by automation, freeing up individuals to train and supply labour to other occupations in shortage. Time lost to training should be minimised by careful design of courses tailored to the required skills.

The following section describes the modelling approach, while section 3 describes the main results from the modelling. Section 4 goes through some of the limitations of this study, and Section 5 gives some policy recommendations and conclusions.

## 2 Modelling

The simulations are run in the Victoria University Employment Forecasting (VUEF) Computable General Equilibrium (CGE) model of the Australian economy, described in Dixon (2017). VUEF provides a dynamic CGE framework in which linkages between all major sectors of the economy are represented. The CGE framework of VUEF mainly draws on Dixon and Rimmer (2002). VUEF is unique in its very detailed representation of the labour market. Following from Meagher and Pang (2011), VUEF identifies 97 occupations and incorporates a constrained supply-side in which the labour market is disaggregated into cohorts based on field and level of highest educational attainment.

A dynamic simulation is run in which each simulation updates the model from one quarter to the next. As illustrated in Figure 1 below, final demand determines industry output, and industry output determines demand for labour by occupation, which is the standard CGE approach. In VUEF, on the supply side, population and demographics determine supply of labour by educational attainment. The labour cohorts, defined by their highest educational attainment, supply labour to the occupations, seeking to maximize revenue (wage income) subject to an occupation transformation frontier. Industries choose employment by occupation to minimize wage costs subject to a production function. The price, or wage, for each occupation is set by a market clearing mechanism. For occupations where wages increase (decrease) relative to the economy-wide average wage, labour shortages (surpluses) may be developing. The market-clearing wage is the basis of the skills shortage analysis in Section 3.

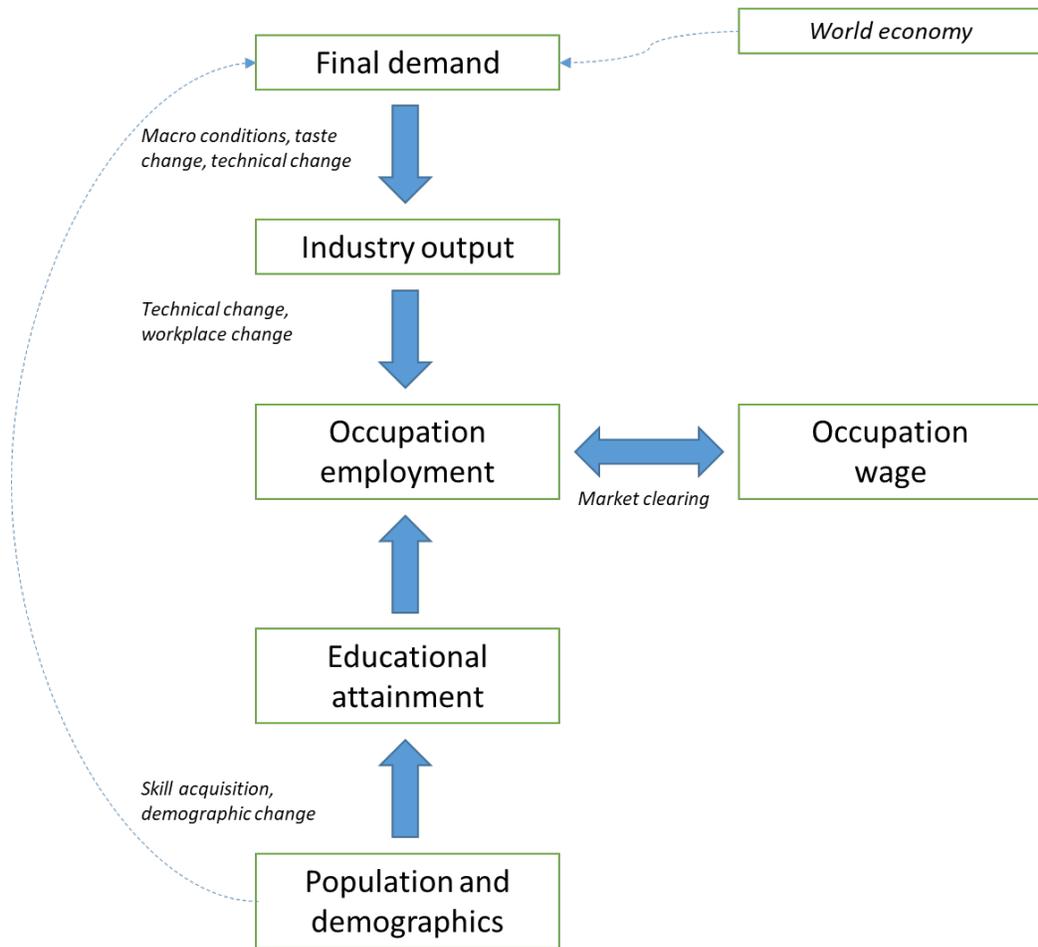


Figure 1: Labour market in the VUEF model

The VUEF forecast simulation is run from 2022q1 to 2024q2. Before running the VUEF forecast simulation, two processes are used to determine historical trends which form inputs to the forecast simulation. An historical CGE simulation (Dixon and Rimmer, 2002), in which observed data are reproduced by the model over the period 2010 to 2019, uncovers trends in tastes and technological change (including use of intermediate inputs, use of labour and the occupational composition of labour). These trends are carried forward into the VU forecast simulation. The years 2020 and 2021 are not included in the historical simulation as the economic disruption due to COVID-19 concealed any underlying structural change taking place during these years.

The macroeconomic environment for the VUEF forecast simulation is set by the Central Scenario of the Reserve Bank of Australia’s February 2022 economic statement (RBA, 2022).

A cohort model is used to determine trends in educational attainment, which are also carried forward into the VU forecast simulation. The basis of the cohort model is to track educational attainment by age and sex, and to use patterns of attainment to determine labour supply by educational attainment in the forecast period. The main result from the cohort model is that younger people are far more likely than their older counterparts to attain qualifications at the level of Bachelor Degree or higher. As natural

turnover takes place and the older workers retire, this underpins a strong increase in the supply of workers with Bachelor Degree or higher level qualifications. The corollary of this is that supply is growing relatively slowly in other areas, notably Vocational qualifications (VET). Overall, the proportion of the labour force with any level of post-school qualification is growing.

All CGE simulations in VUEF are solved using the Runge Kutta method for solving large systems of non-linear equations in the GEMPACK software (Horridge et al, 2019).

### 3 Results and discussion

Over time, aggregate employment broadly grows along with population growth, and average wage growth broadly aligns with productivity growth. Growth in occupational wages and employment relative to average indicates where pressures may be likely to appear in the labour market. If wage growth for an occupation is well above average wage growth, this indicates potential shortages of this occupation, and vice versa if wage growth is well below average.

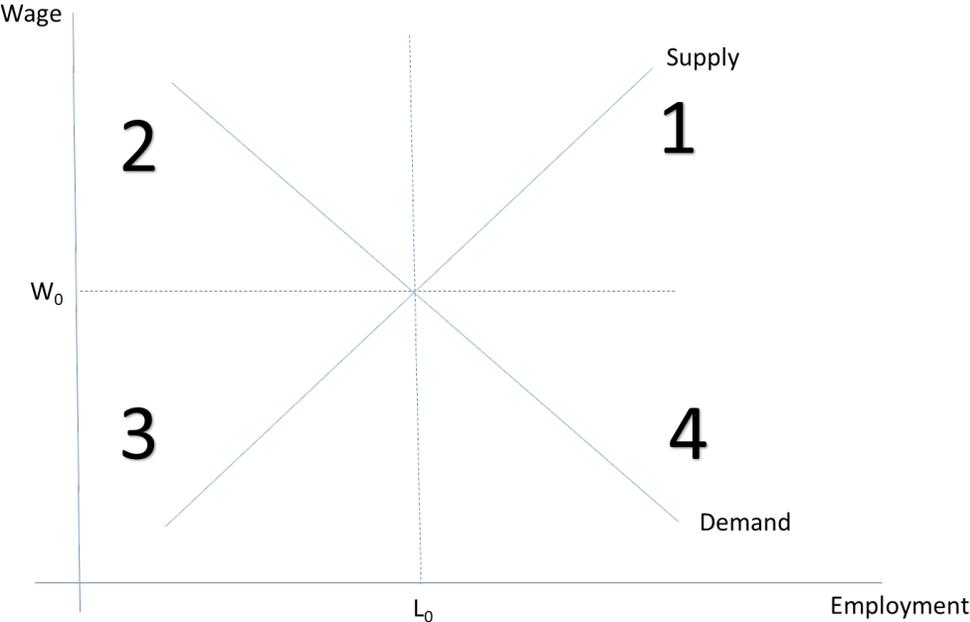


Figure 2: Supply and demand for occupations

Figure 2 illustrates a supply and demand framework for an occupation. Initial levels of wages and employment vary across occupations, so we use  $W_0$  and  $L_0$  to represent economy-wide average forecast wage and employment indexes respectively. An occupation with wage index forecast to be greater than  $W_0$  may be forecast to experience supply pressures, or a shortage of workers. These are the occupations with wage and employment forecasts in quadrants 1 or 2 of Figure 2. Occupations in quadrant 1 experience above-average growth in both employment and wages, indicating unambiguously that growth

in demand for these occupations, as indicated by a rightward shift of the demand curve, is stronger than the economy-wide average. Supply, as indicated by a rightward shift of the supply curve, may be growing faster or slower than the economy-wide average, but it is not growing fast enough to prevent wages from growing faster than average. Supply of occupations in quadrant 2 is unambiguously growing slower than the economy average (or declining), while it is not clear how demand is shifting relative to average. Tight supply is responsible for pushing up wages in these occupations.

Occupations in quadrants 3 or 4 have below-average growth in wages, indicating that supply to these occupations is strong relative to demand. Growth in demand for occupations in quadrant 3 is low relative to average, meaning that wage growth is low. Wage growth in occupations in quadrant 4 is low because of strong growth in supply to these occupations.

Potential shortages in the occupations in quadrants 1 and 2 could be addressed by encouraging workers out of the occupations in quadrants 3 and 4.

Table 1 below lists occupations with wage growth forecast to be well above or well below the economy wide average. These are occupations for which accumulated wage growth over the 2.5 years to the June quarter 2024 is simulated to be more than 1.5 percentage points above or below the economy-wide average.

Quadrant 1 indicates occupations in high demand, for which supply is not keeping up. In general these are occupations requiring VET level qualifications at most, with the exception of Midwifery and Nursing Professionals which usually requires a Bachelor degree. Strong demand from the Health Care and Social Assistance sector coupled with relatively slow growth in VET qualifications is evident in Quadrant 1, with Personal Carers and Assistants also in this quadrant. Quadrant 1 also contains several other occupations for which VET qualifications are required, including construction-related occupations, Education Aides, General Clerks and Sports and Fitness Workers. Strong demand for Education Aides and Sports and Fitness Workers is explained by a combination of a strong post-pandemic recovery forecast for household demand and tastes shifting in favour of these occupations. Similarly, strong demand for construction-related occupations is related to recovery in the household sector. Strong demand for General Clerks is explained by workplace changes in favour of this occupation and away from more specific clerical occupations such as Personal Assistants and Secretaries and Keyboard Operators (see Quadrant 3).

Quadrant 1 also contains occupations in which many workers have no post-school qualification, including Delivery Drivers, Checkout Operators, Sales Assistants and Storepersons. As the workforce becomes more educated, these occupations become less desirable, yet they will continue to be in strong demand.

Table 1: Occupations with wage growth well below or well above the economy-wide average. 3 digit codes indicate ANZSCO.

<b>Quadrant 2</b>	<b>Quadrant 1</b>
<i>Low demand, supply not keeping up</i>	<i>High demand, supply not keeping up</i>
O851 Food Preparation Assistants O331 Bricklayers, and Carpenters and Joiners O442 Prison and Security Officers O721 Mobile Plant Operators O733 Truck Drivers O841 Farm, Forestry and Garden Workers	O732 Delivery Drivers O631 Checkout Operators and Office Cashiers O422 Education Aides O423 Personal Carers and Assistants O333 Glaziers, Plasterers and Tilers O531 General Clerks O452 Sports and Fitness Workers O821 Construction and Mining Labourers O332 Floor Finishers and Painting Trades Workers O431 Hospitality Workers O334 Plumbers O621 Sales Assistants and Salespersons O741 Storepersons O254 Midwifery and Nursing Professionals
<b>Quadrant 3</b>	<b>Quadrant 4</b>
<i>Low demand, potential excess supply</i>	<i>High demand, potential excess supply</i>
O111 Chief Executives, General Managers and Legislators O521 Personal Assistants and Secretaries O231 Air and Marine Transport Professionals O532 Keyboard Operators O611 Insurance Agents and Sales Representatives	O221 Accountants, Auditors and Company Secretaries O271 Legal Professionals O233 Engineering Professionals O132 Business Administration Managers O222 Financial Brokers and Dealers, and Investment Advisers O232 Architects, Designers, Planners and Surveyors O223 Human Resource and Training Professionals O234 Natural and Physical Science Professionals O131 Advertising, Public Relations and Sales Managers O212 Media Professionals

Occupations in quadrant 2 experience below-average growth in employment. Although these are not fast-growing occupations, labour shortages may still emerge due to slow growth in supply. These include occupations requiring low educational attainment in such as Farm, Forestry and Garden Workers, Food Preparation Assistants and Prison and Security Officers.

In quadrant 3 are occupations for which wage growth is below average because growth in demand is below average. Growth in demand is weak because of workplace change. For example, slow growth in Chief Executives, General Managers and Legislators reflects the continuation of a decade of slow growth in this occupation despite strong growth in industries that use this occupation. Similarly, Personal

Assistants and Secretaries and Keyboard Operators (typists) are occupations that have gradually been replaced by automation and broader roles such as General Clerk, which appears in Quadrant 1. The presence of Air and Marine Transport Professionals in Quadrant 3 reflects slow recovery of the airline industry post-pandemic and is not necessarily part of a longer-term trend.

Finally, Quadrant 4 contains occupations that have strong forecast growth in employment, and weaker-than-average growth in wages. These are generally professional occupations, for which there is an ongoing increase in supply reflecting the trend towards earning a bachelor degree or higher level qualification. While wages in these occupations remain higher than average, wage growth is below average as the wage premium associated with these qualifications is gradually diminished.

## 4 Limitations

The modelling provides an effective and straightforward method for identifying occupational labour shortages but is subject to some limitations. The main limitations are outlined below.

The analysis is based on wage movements, relative to average, simulated from March 2022 to June 2024. According to relative wage movements, the criteria used in this analysis, a result in which all occupation wages had moved in line with the economy-wide average would have indicated no labour shortages or surpluses. However, they may have been existing labour shortages or surpluses in March 2022 that were simply carried forward through the simulation period. Where the simulation results show above-average wage growth, we have interpreted this to mean that a shortage is emerging, because we implicitly assume that the “ideal” labour market exists in March 2022. However, above-average wage growth could indicate correction of an existing surplus, rather than emergence of a new shortage.

The market-clearing mechanism for determining wages is an abstraction from the real world in which wage negotiations tend to be complicated by centralised wage fixing, collective bargaining power, and employers with monopsony power. Where the simulation finds an increase in wage for an occupation, this may manifest in the real world as a shortage of this occupation, which may be temporary or long running. Labour shortages can create supply bottlenecks with wider implications, which are not picked up by the modelling.

The supply shifts are based on the cohort model, in which the composition of educational attainment in the population is simply a function of age and gender. No attempt is made to estimate educational attainment more directly, for example, through analysis of domestic tertiary education completions and net overseas migration. Such analysis would be complicated by issues including difficulty identifying the highest qualification held by individuals, leakage of domestic students from the labour market (through non-participation or emigration), and difficulty forecasting the educational composition of inward migrants. As a baseline or counterfactual, the cohort model provides a satisfactory method for determining labour supply by educational attainment. Having simulated this base case, the model could be used to simulate departures from the base case, for example, a scenario in which 20,000 additional Bachelor and sub-Bachelor places were offered could be simulated (Chalmers and Clare, 2022).

We implicitly assume that individuals use their highest educational qualification through their lifetime of employment. However, labour shortages are as much to do with retaining workers in an occupation as they are about training new workers. For example, retaining existing teachers in the workforce will play an important role in addressing the current teacher shortage in Australian schools (Davies and Watterston, 2022). The VUEF simulation does not identify Teachers as being in short supply because there are sufficient numbers of suitably qualified workers forecast by the cohort model.

An important assumption in the simulation reported here is that population growth is determined exogenously, with the model taking on population growth rates from the Commonwealth Intergeneration Report. These forecasts include estimates for net overseas migration. In this model-based analysis we are not equipped to comment on whether labour shortages should be addressed by increasing migration. Without accounting for nuances such as the participation rates and consumption patterns of recent migrants relative to incumbents, increasing the population simply creates a scaling effect in the model, increasing demand as well as labour supply.

Finally, the modelling becomes out of date almost as quickly as it is produced. The current analysis is based in part on the RBA's February 2022 statement on monetary policy, which predicted moderate inflation and strong growth in household consumption. In the six months since the release of this statement, inflation has been high and cash rates have been increased four times. Some of the conclusions, particularly about shortages developing in response to strong household demand, may be revised when the analysis is next updated.

Despite these limitations, the modelling provides a valuable economy-wide view of occupational shortages and surpluses which is difficult to achieve via other methods such as job vacancy analysis. The forecasting capability of the model enables policy-makers to anticipate and plan for occupational shortages. Multiple scenarios may be simulated to gain deeper insight into possible futures including adoption of new technologies, changes in world economic conditions, demographic change and the impact of changes in educational attainment.

## 5 Conclusions and policy implications

Establishing where labour shortages exist is complex. Methods for doing so include surveying employers or counting the number and duration of job vacancies. In this paper we present a model-based analysis in which likely paths for supply and demand of occupations are forecast and wage movements are used to indicate where shortages and surpluses may emerge.

This approach provides a comprehensive analysis that is consistent with a plausible macroeconomic scenario for the next two years (provided by the RBA). The modelling shows the occupations in which shortages are most likely to occur, while accepting the total size of the labour market as a constraint. This is because the analysis is based on occupation wage movements relative to average.

The simulation shows shortages likely to emerge in areas requiring VET qualifications or no post-school qualifications, while strong growth in the supply of workers with Bachelor degrees and above will lead to

below-average wage growth in many professional occupations. These results lead to several policy recommendations, as follows.

Primarily we recommend a light touch, allowing these patterns to continue. In general, wage growth is below average in areas where wages are above average, so the wage gap between high and low wage jobs may be diminishing. Bachelor degree jobs, for which supply is strong, tend to be highly productive and well remunerated, and also provide non-wage benefits as these jobs can be intellectually stimulating and physically less demanding.

However, it is clear that there will be shortages in VET-qualified workers that need to be addressed. The solution has two aspects: labour hours need to be shifted into these occupations from elsewhere, and appropriate training needs to be delivered. The issue of hours may to some extent be addressed by increasing overall hours, particularly through provision of child care to enable greater labour market participation by parents and others with caring responsibilities. However, in the current tight labour market, this will have limited effectiveness. Therefore workers will need to be diverted from other activities. This may take the form of encouraging new entrants to the labour market into the shortage occupations, encouraging established workers to shift occupations, and adjusting the skill mix of new migrants. Making these changes will divert workers from other occupations, that is, they will be diverted from the occupations forecast by the model, which becomes the counterfactual.

In order not to create a shortage elsewhere, the temptation may be to divert workers from the occupations experiencing surplus. However, these are mostly high-wage, highly productive occupations and it would not make sense to divert people away from them. Instead, we suggest allowing shortages to continue or even worsen in some shortage occupations such as Checkout Operators, Sales Assistants, and Storepersons. This will naturally accelerate the pace of automation, freeing up workers to move to other shortage occupations such as Hospitality, or with a small amount of training, to Personal Carers or Education Aides.

With the exception of Nursing, training for the shortage occupations mainly needs to be delivered through the VET system. Training times should be kept to a minimum, to minimise time spent away from the workforce and to ensure labour shortages are filled quickly. This will require appropriate design of courses and there will be role for on-the-job training, apprenticeships or cadetships. Bean and Dawkins (2021) also recommend development of quality micro-credentials in which training is tightly targeted to particular roles.

The shortage of Nurses requires more people to undertake Nursing qualifications at the Bachelor degree level. This may be addressed by diverting people from other Bachelor degree courses, through incentives such as lower fees and favourable conditions for study.

Model-based analysis of labour shortages over the near future allows policy-makers to prepare and avoid potentially damaging shortages, which can create bottlenecks and frustrate the ability of the economy to produce the goods and services desired by the population. This analysis should be repeated at regular intervals, perhaps twice yearly, to enable policy-makers to anticipate and counteract labour shortages on a regular basis.

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