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Will we run out of young men? Implications of the ageing of the population for the trades in Australia

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NATIONAL CENTRE FOR VOCATIONAL EDUCATION RESEARCH

The ageing of the population has been attracting the attention of policy-makers in Australia and many other countries. One of the concerns is that labour shortages could occur because of inadequate growth in labour supply. The particular aspect picked up in this paper is the trades sector of the labour market. The distinct feature of the trades is that the apprenticeship model is the dominant method of training, and almost all apprentices in the traditional trades (excluding hairdressing) are young men. This paper considers the labour market for the traditional trades in Australia over the next 30 to 40 years and investigates whether the ageing of the population will pose particular problems for this labour market. The broad conclusion is that the ageing of the population will significantly impact on the size of the potential trades workforce, but this is unlikely to result in shortages. Rather, any shortage is more likely to occur if the trades lose their attractiveness relative to other occupations Moreover, the age distribution of the trades workforce will remain largely unaltered.

PLEASE NOTE:
The graphs in this document have been produced in colour. For clarity, please print in colour.

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Introduction

Current skill shortages and the knowledge that our population is ageing have given rise to concerns that we will face severe skill shortages in coming decades (see, for example, the Australian Council of Trade Unions 2004]). This paper looks at one area of particular interest, that of the trades.[1] The reason we single out the trades is that they draw their new entrants from a narrow demographic group, young men, and therefore *prima facie* this labour market will be particularly vulnerable to the ageing of the population.[2] This dependence on young men can be seen from figure 1 which shows the age and gender distribution of those commencing an apprenticeship in the trades.[3]

The paper seeks to explore the implications of the ageing of the population on the trades over the next 30 to 40 years.

The approach we take is quite straightforward. We build a workforce model with a labour supply flavour, and compare the projections with those obtained from a demand-driven approach. Any shortfall will be taken as evidence that we have a particular problem.

The structure of the paper is as follows.[4] In section 1 we set up the supply workforce model. We then use the model to provide a set of projections of the overall number of tradespersons up to 2040. Section 3 then extends the projections to the eight two-digit Australian Standard Classification of Occupations (ASCO) trade occupations. In section 4 we construct a set of projections with a more demand flavour. Section 5 brings the two approaches together in order to elaborate on the extent to which we will have shortages in the trades. We end with some final comments. Specifically, we conclude that, while the ageing of the population will affect the potential supply of tradespersons, in general it does not have any serious implications for the trades, neither in terms of numbers nor the age distribution of the trades workforce.

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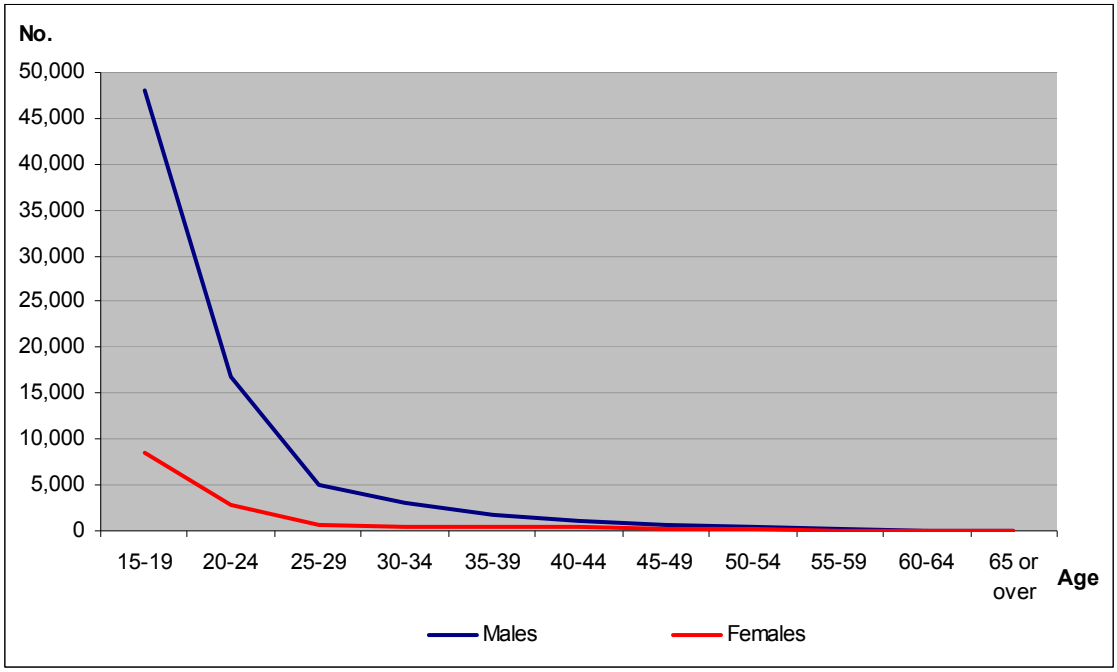
1 By traditional trades we cover the following occupations based on the Australian Standard Classification of Occupations (ASCO) (further details are provided in appendix 6):
- ✧ Tradespersons and related workers—not further defined (ASCO 40)
- ✧ Mechanical and fabrication engineering tradespersons (ASCO 41)
- ✧ Automotive tradespersons (ASCO 42)
- ✧ Electrical and electronics engineering tradespersons (ASCO 43)
- ✧ Construction tradespersons (ASCO 44)
- ✧ Food tradespersons (ASCO 45)
- ✧ Skilled agriculture and horticulture workers (ASCO 46)
- ✧ Other tradespersons and related workers (ASCO 49). The largest occupations in this category are hairdressing, cabinetmaking and printing.

2 Men dominate the trades except for hairdressing and, to a lesser extent, the food trades. We concentrate on young men because of their dominance and also to aid exposition. However, the modelling covers all ages and both sexes.

3 By apprenticeship we actually mean a contract of training. In the Australian context this covers both apprenticeships and traineeships.

4 For our calculations we use data from the Australian Bureau of Statistics, *Population by age and sex, Australian states and territories*, the ABS Labour Force Survey and NCVER's National Apprentice and Trainee Collection.

Figure 1 Commencements by age and sex, 2006



1 The supply model

In economic parlance, supply refers to the number of people offering their labour at given wages (and working conditions). However, this is not really possible to observe because people change occupations and so there are many people who could work in the trades but who are not. Our 'supply' model, although not purporting to model the unknown potential supply, does contain the elements we associate with supply: the numbers of people entering and leaving the occupation. This contrasts with a demand approach, which would focus on the level of economic activity and the implied level of employment to underpin this.

The basis of the model is that the number of people in a trade at a point in time is determined by the number at the previous point in time plus commencing apprentices less withdrawals from apprenticeships and those who leave the trade. While we have data on commencements and withdrawals of apprentices, we do not have data on those people in the trade who leave. So in practice we model net attrition rather than actual attrition. More formally,

$$X_t = X_{t-1} + C_t - W_t - D_t \qquad (1)$$

Where X_t is the number of people in the trades at the end of year t, C_t is the number of apprentice commencements during the year, W_t is the number of apprentices who have their contract cancelled during the year, and D_t is the net departures during the year. We reparameterise the model, by expressing C, W, and D as rates.

Define w as the withdrawal rate, that is, $w = W/C$

d as the net departure rate, i.e. $d = D/X$

c as the commencing rate (proportion of the population), that is, $c = C/N$ where N is the population size.

Then we have

$$X_t = X_{t-1}(1-d_t) + c_t(1-w_t)N_{t-1} \qquad (2)$$

We use historical data to estimate the parameters of the model *d*, *c* and *w* and then project forward using demographic projections of *N*.

Now the model as in (1) and (2) is highly stylised and has no demographic dimension to it, apart from the total population. In order to make the model more interesting, we introduce a demographic dimension through the index *i*, as follows:

$$X_t = \sum_i X_{i,t}$$

and

$$X_{i,t} = X_{i-1,t-1}\left(1 - d_{i,t}\right) + c_{i,t}\left(1 - w_{i,t}\right)N_{i-1,t-1} \qquad (3)$$

So now the commencement, withdrawal and net attrition rates all depend on the demographic age group. It is this dimension that is at the heart of the paper.

2 The aggregated supply projections

Before getting into the actual projections we present the components: the commencement rates, the cancellation rates and the net attrition rates. We concentrate on males because of their dominance in the trade occupations (although the model has an analogous set for females). One of the points apparent from the construction of our model is that the parameters that drive employment have changed during the last ten years. So rather than produce one set of projections we produce three, corresponding to *average*, *best* and *worst* scenarios. The differences between these scenarios are of some importance, as we will see later. In the Australian context, the labour market for the trades has been very buoyant in recent years and we have seen increasing numbers of apprenticeship commencements in the trades.

Figure 2 shows the commencement rates we use for the model. They have been derived from historical data.[5] These represent the proportion of the age cohort who commenced an apprenticeship or traineeship in the trades. There are a couple of points worth making about this figure. First, as we already have seen from figure 1, the only age groups with sizable numbers entering an apprenticeship or traineeship in the trades are young men, up to the age of 24 years. While older people do undertake them, the numbers are small. The other point to note is how large these commencement rates are: over 25% for men aged 15–19 years and around 9% for men aged 20–24 years. If we add the rates over all age groups, we get an implied commencement rate of around 40% (although this is includes those who commence more than once). Thus trade apprenticeships and traineeships are really important for men.

[5] We have smoothed the historical rates in order to ensure that the model is well behaved.

Figure 2 Apprenticeship and traineeship commencement rates for tradesmen (proportion of age cohort)

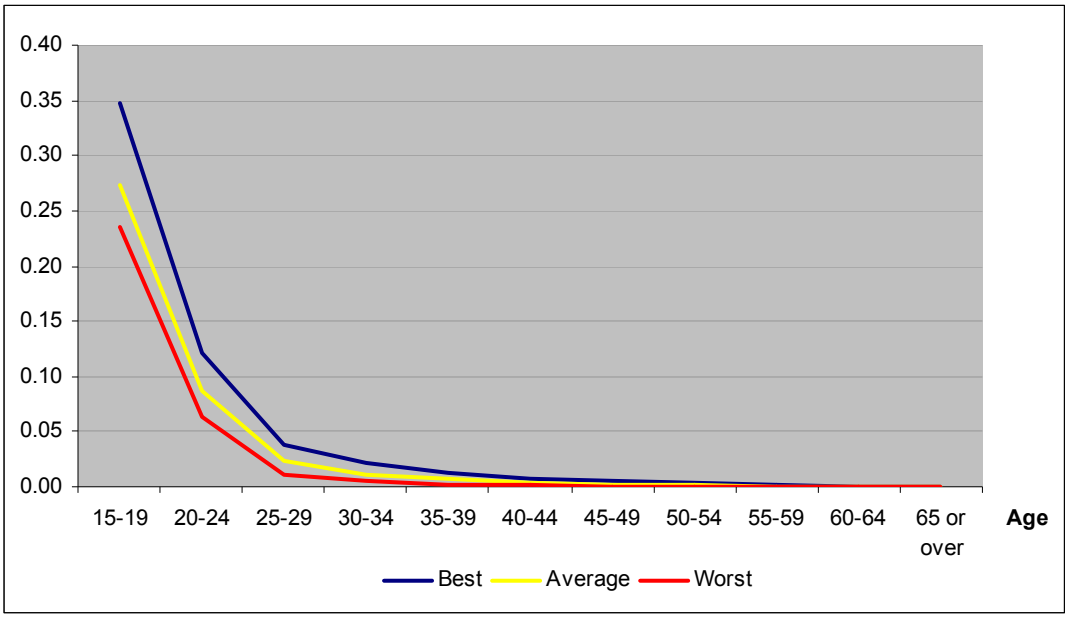
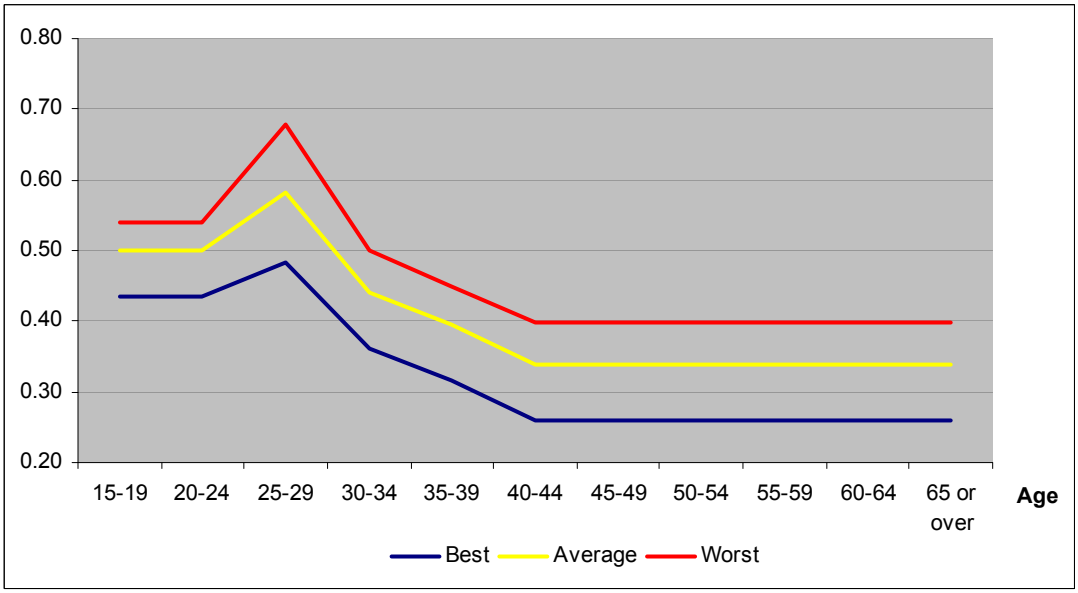


Figure 3 Apprenticeship and traineeship cancellation rates for tradesmen (proportion of commencements)

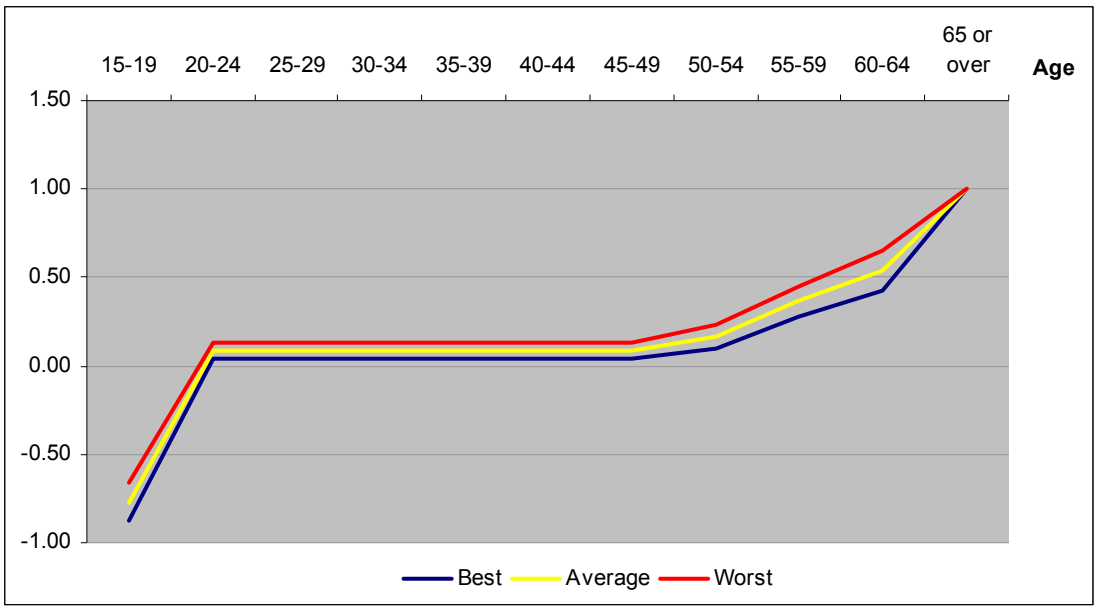


The cancellation rates in our model (figure 3) are rather salutary. Again these are based on historical data. They indicate that for young men around 50% of apprenticeships are not completed—a rather high level of wastage. The cancellation rates for older males (over the age of 30 years) are lower. However, this is not very helpful because very few older males enter an apprenticeship or traineeship in the trades.

Finally, we present the net attrition rates (figure 4). While they are very important for our projections, they are really the least satisfactory part of our model for reasons we will try to explain. The net attrition rates are obtained by solving equation (3) using historical data. The intuition is that they represent the attrition within cohorts over a five-year period (the number of 30 to 34-year-olds in 2006 in the trades compared with the number of 25 to 29-year-olds in 2001, for example) but accounting for actual commencements and withdrawals in apprenticeships. The reasons they are not overly satisfactory are two-fold. First, the trades are not totally regulated: there are people who

are employed in the trades who have not formally completed an apprenticeship or traineeship.[6] Putting it another way, there are substantial numbers of people working as a tradesperson who do not have actual qualifications. Second, our model has not explicitly taken account of immigration, which has been of some importance for the trades. Thus our net attrition rates capture a number of flows, which ideally one would prefer to model individually.

Figure 4 Five-year net attrition rates for tradesmen (proportion of employment)[7]



Before getting to the projections, we should comment on the negative attrition rate for males aged 20 to 24 years. The interpretation of this is that there are considerable numbers of young men who enter a trade without undertaking an apprenticeship or traineeship.

Now a major point of the paper is to examine the effect of demographics on labour supply. To do this we calculate a counterfactual in which the population is assumed to grow at a constant rate within each demographic group at the population rate from the Australian Bureau of Statistics (ABS) projections over the period. This is a world in which population growth is as in the ABS demographic series, but there is no ageing. The difference between the projection based on the ABS demographic series and the projection based on the 'no ageing' counterfactual shows the impact of the ageing of the population over the next 40 years on the supply.

[6] It should be noted that our employment data come from the ABS Labour Force Survey, which relies on information from any responsible adult in the household. No doubt there is some noise in the response to questions about occupation.

[7] The attrition rates are derived by comparing the numbers of an age group at a point in time with the numbers of the younger (by five years) age group five years earlier. The attrition rate for 15 to 19-year-olds is zero by definition. It is also assumed that all 65 to 69-year-olds retire within the next five years.

Figure 5 Impact of demographics on the supply of tradespeople

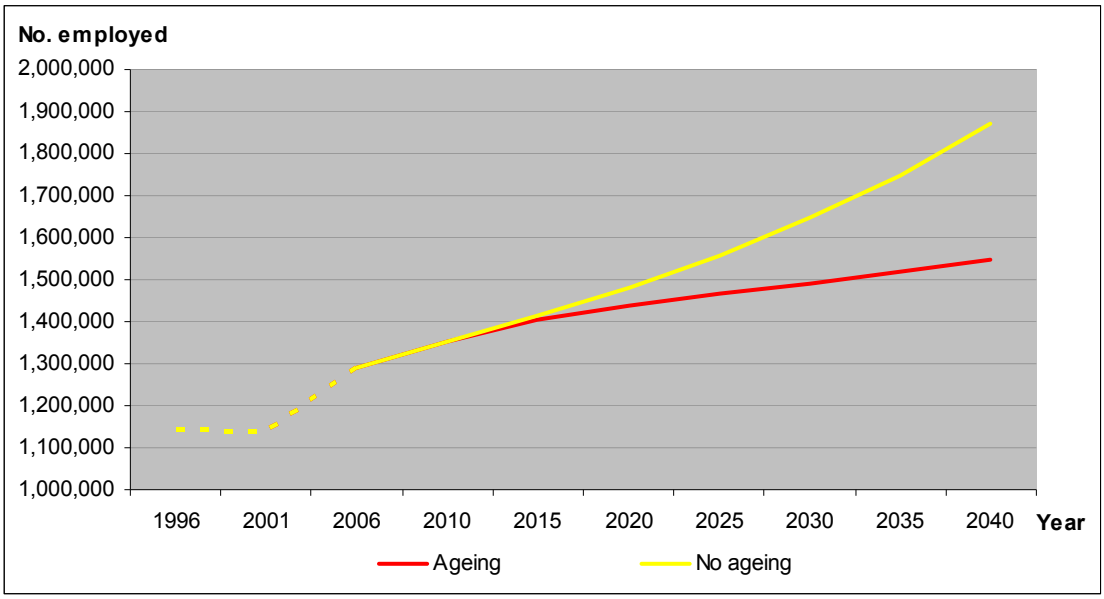
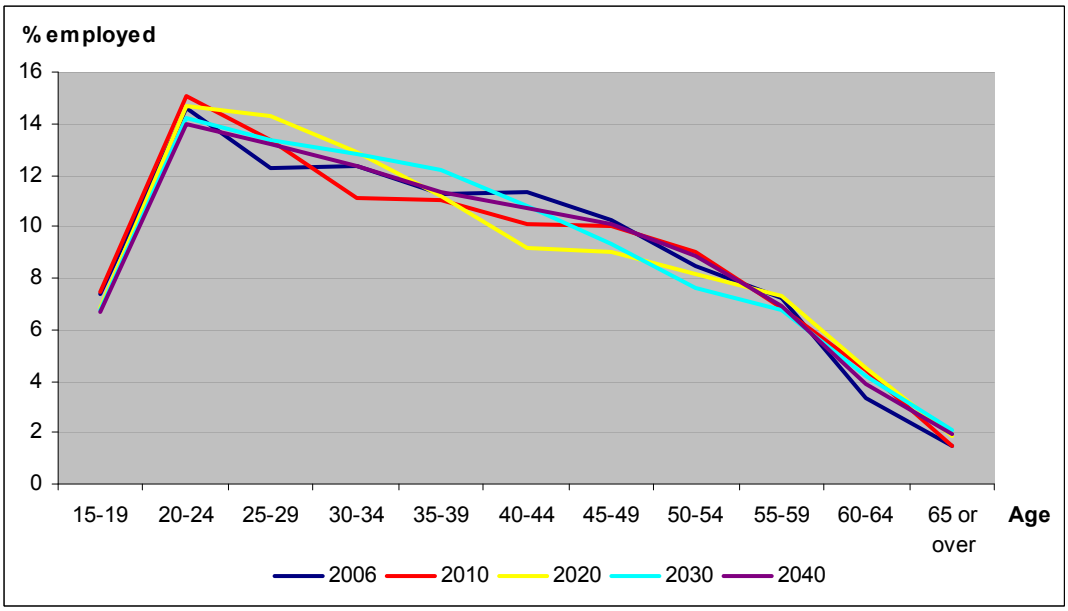


Figure 5 shows that the difference between the ageing and no ageing scenarios grows from 12 000 in 2015 to 43 000 in 2020 and 320 000 in 2040. So the ageing of the population has a real kick in terms of the impact on total labour supply for the trades. It appears that we should answer the question posed in the title in the affirmative; we return to this in section 5.

Up to this point we have concentrated on the impact of ageing on the overall numbers of tradespersons. The ageing may have another impact; one would posit that it will alter the distribution of demographic groups within the trades, and this would have an impact on workplace dynamics and work organisation. Figure 6 plots the evolution of the age distribution of people in the trades.

Figure 6 Age distribution of tradesmen, various years



The projections put paid to our supposition; there is little change to the age distribution. The reason for this is that entry to the trades consists almost entirely of young people, and thus the age distribution depends on the rate of attrition rather than the demographics of the population.

3 The disaggregated supply projections

We now turn to the individual trades. As can be seen from table 1, the overwhelming majority of people commencing an apprenticeship are young men (24 years or less), although there is some variation across the trades. Automotive and construction have the highest proportion of young men, with over 90% of commencements. Young women dominate the 'other' group (hairdressing is the largest occupation within this group) and also contribute substantially to food tradespersons.

Table 1 Percentage of average commencements by occupation, age and sex

Occupation	Aged 15–24		Aged 25–34	
	Males	Females	Males	Females
Mechanical and fabrication engineering tradespersons	83.7%	1.1%	9.3%	0.3%
Automotive tradespersons	90.6%	1.6%	5.6%	0.3%
Electrical and electronics engineering tradespersons	84.6%	1.4%	10.1%	0.4%
Construction tradespersons	90.5%	1.0%	6.7%	0.2%
Food tradespersons	60.4%	22.1%	7.1%	2.7%
Skilled agriculture and horticulture workers	65.1%	8.8%	10.7%	2.4%
Other tradespersons and related workers	34.6%	55.4%	3.4%	2.8%
All tradespersons and related workers	73.2%	14.2%	7.0%	1.2%

Occupation	Aged 35–44		Aged 45 or over	
	Males	Females	Males	Females
Mechanical and fabrication engineering tradespersons	3.6%	0.1%	1.7%	0.1%
Automotive tradespersons	1.4%	0.1%	0.3%	0.0%
Electrical and electronics engineering tradespersons	2.8%	0.1%	0.6%	0.0%
Construction tradespersons	1.3%	0.0%	0.3%	0.0%
Food tradespersons	2.7%	1.7%	1.9%	1.4%
Skilled agriculture and horticulture workers	5.7%	1.4%	4.8%	1.1%
Other tradespersons and related workers	1.2%	1.2%	0.6%	0.6%
All tradespersons and related workers	2.2%	0.6%	1.1%	0.4%

Table 2 presents the average rates at which apprenticeships are cancelled by men. These cancellation rates are particularly high for the food trades and are lowest for the electrical and electronics engineering trades and the mechanical and fabrication engineering trades.

Table 2 Average male cancellation rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–29	Aged 30–34	Aged 35–39	Aged 40 or over
Mechanical and fabrication engineering tradespersons	0.38	0.38	0.39	0.34	0.32	0.27
Automotive tradespersons	0.48	0.48	0.69	0.54	0.52	0.47
Electrical and electronics engineering tradespersons	0.36	0.36	0.41	0.33	0.34	0.32
Construction tradespersons	0.56	0.56	0.72	0.60	0.61	0.53
Food tradespersons	0.65	0.65	0.78	0.61	0.49	0.51
Skilled agriculture and horticulture workers	0.47	0.47	0.51	0.55	0.42	0.30
Other tradespersons and related workers	0.55	0.55	0.56	0.42	0.34	0.35

The cancellation rates for women are at table 12 in appendix 2. While the cancellation rates for men are high, the rates for women tend to be even higher. Consistent with the previous section we found that there are many young men aged 20 to 24 years who enter a trade without using the

vocational pathway (table 3). This is particularly the case for electricians and construction workers. The skilled agriculture and horticulture trades stand out, with negative attrition for a range of ages. The pathway in this trade is rather different from the others, with more older men entering it (and this is also evident from table 1), and many are not doing so through an apprenticeship.

Table 3 Average male five-year net attrition rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–54	Aged 55–59	Aged 60–64	Aged 65 or over
Mechanical and fabrication engineering tradespersons	0.00	-0.69	0.06	0.15	0.37	0.52
Automotive tradespersons	0.00	-0.36	0.11	0.01	0.55	0.43
Electrical and electronics engineering tradespersons	0.00	-1.77	0.09	0.38	0.11	0.23
Construction tradespersons	0.00	-1.23	0.04	0.12	0.44	0.62
Food tradespersons	0.00	-0.07	0.24	0.56	0.30	0.46
Skilled agriculture and horticulture workers	0.00	-0.83	-0.07	-0.47	0.15	0.50
Other tradespersons and related workers	0.00	-0.49	0.08	0.19	0.37	0.39

Note: The rates for women are in table 14 in appendix 2.

Figure 7 contains our projections for each of the trades. As can be see, there is considerable variation in projected growth rates. The growth in supply for each trade is positive over time, apart from 'other'. Skilled agriculture and horticulture trades and, to a slightly lesser degree, electrical and electronics engineering trades are projected to grow relatively quickly. The variation in growth rates is explained by the variation in the individual components. So the reason for the decline in 'other' tradespersons is simply that that the outflows are larger than the inflows, as can be seen from table 4.

Figure 7 Average supply projections for all tradespeople (indexed)

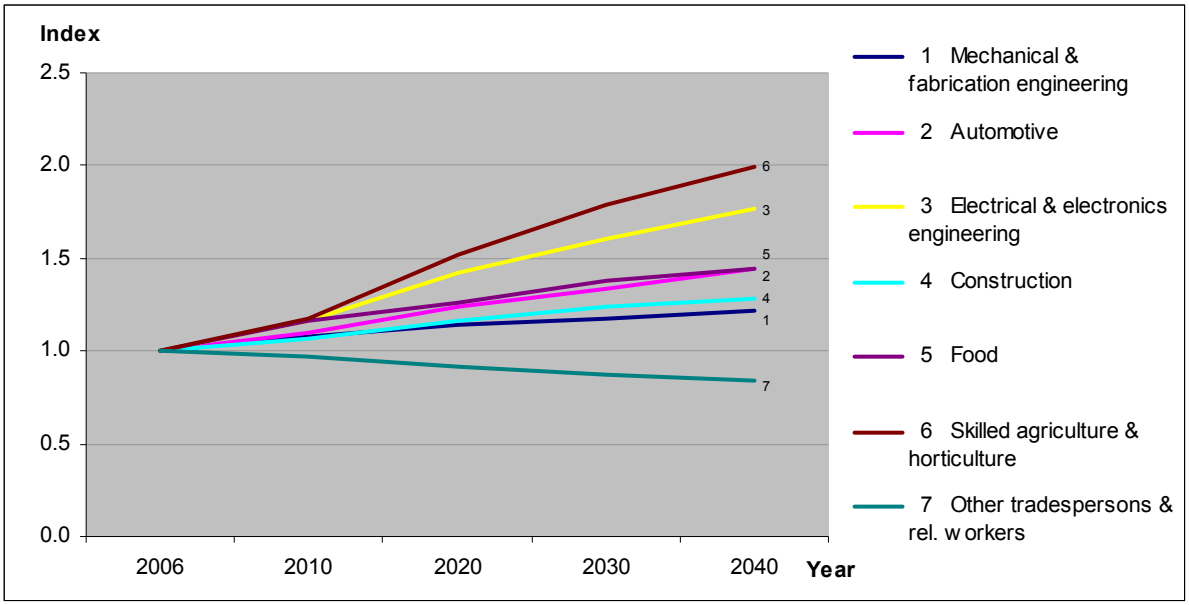


Table 4 Total employed, commencements, cancellations and net attrition for 'other tradespersons and related workers', 2010–40[1]

Year	Employed	Commencements over 5 years	Cancellations over 5 years	Net attrition over 5 years[2]
2010	201 670	56 265	32 682	24 239
2015	196 938	56 152	32 601	28 283
2020	191 301	55 663	32 307	28 993
2025	188 115	56 278	32 648	26 816
2030	182 680	56 777	32 927	29 284
2035	177 596	57 441	33 314	29 212
2040	175 201	58 342	33 839	26 898

Note: 1 The flows for all trades groups are at appendix 4.
2 Derived by solving equation 1 on page 2.

Analogous to the calculations for the trades at an aggregate level (see figure 5) we isolate the impact on labour supply of the demographic movements the ABS projects. Table 5 shows the difference for various years, with a positive sign on the difference indicating that the counterfactual 'no ageing' projection is higher than our projections that incorporate the ageing demographic.

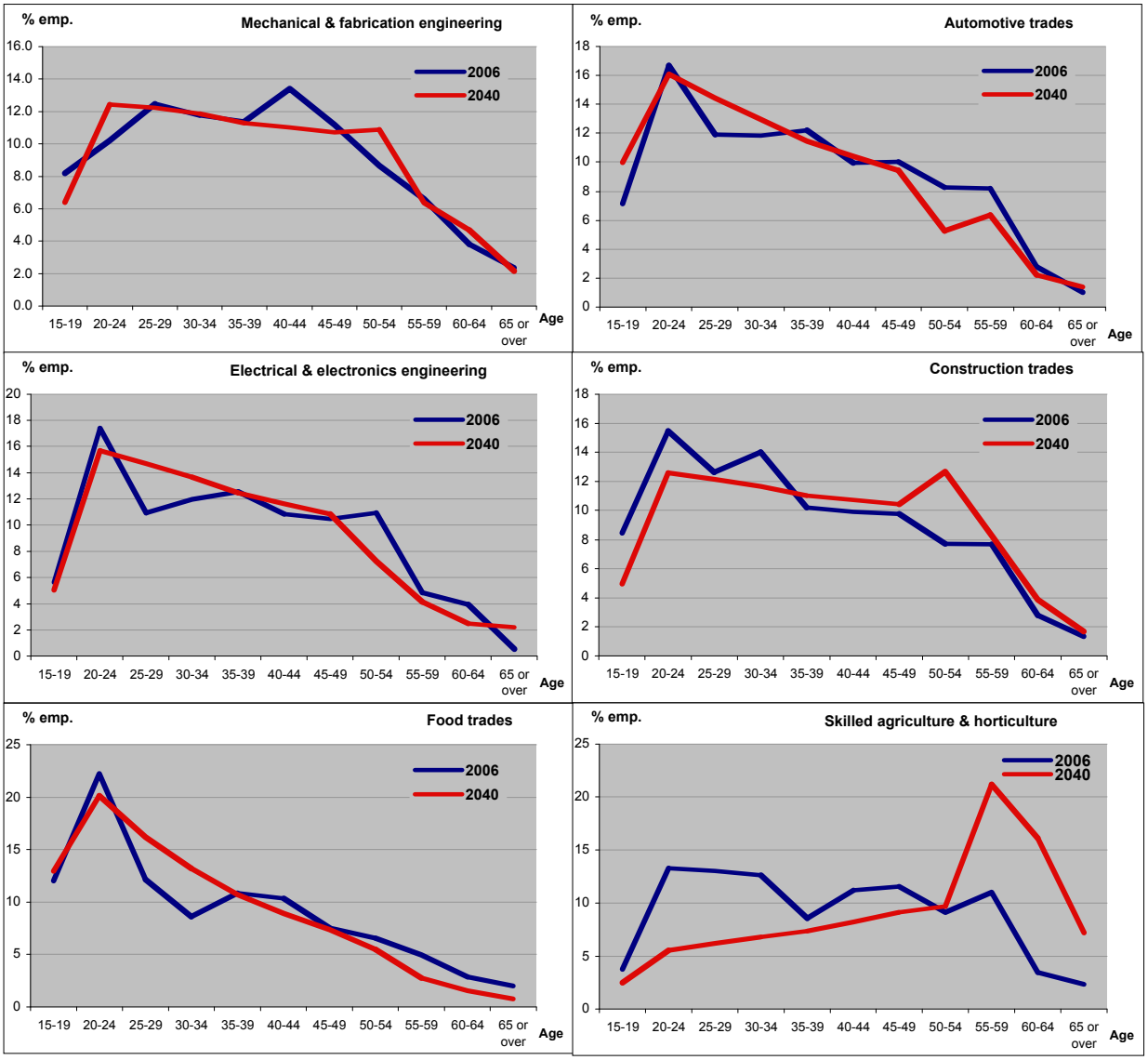
Table 5 Difference between ageing and no ageing (percentage), 2020–40

Occupation	2020 (%)	2030 (%)	2040 (%)
Mechanical & fabrication engineering tradespersons	2.75	9.65	19.88
Automotive tradespersons	4.08	12.54	23.63
Electrical & electronics engineering tradespersons	3.22	11.15	21.71
Construction tradespersons	2.42	8.75	18.32
Food tradespersons	4.22	12.22	23.10
Skilled agriculture & horticulture workers	1.24	4.24	9.12
Other tradespersons & related workers	2.91	10.01	21.19

Two comments are in order. The first is that the impact of ageing is very small in the short to medium term. By 2020 the changes in the demographics result in, at most, 4% fewer tradespersons; we need to go out many more years before the demographics have a sizable impact. The second point is that there is little variation across the trades, with the exception of the skilled agriculture and horticulture trades, for which the ageing has a smaller impact on labour supply. This is because these trades are less reliant on the entry of young people.

Finally, we look at the projected age distributions of the workforces for the eight trades groups. Figure 8 compares the age distribution of 2006 with the projected 2040 distribution. Our earlier conclusion, that the ageing of the population has no implications for the age distribution of the workforce, stands up reasonably well. Not surprisingly, there is some variation at the more disaggregated level. The trade that stands out as being different is skilled agriculture and horticulture, for which our projections suggest a marked spike in tradespeople over the age of 55 years. The projections for the construction trades also show some change in the age profile, with fewer workers under the age of 35 years and more over (and noticeably more in the 50 to 54 year age group.

Figure 8 Age distribution of tradesmen by individual trades, 2006



4 Demand projections

Our first response to the projections in figure 5 was to go out and buy shares in labour hire companies that specialise in the trades. However, the projections we have constructed have a supply focus because of the focus on new entrants and attrition rates, and we need to compare those with demand projections. The essential difference is that the supply projections concentrate on demographics and historical flow rates, while the demand projections are based on a view of the economy in which employment is constrained, and product markets and labour markets adjust to a set of economic forces. This is a world in which economic activity adjusts, not a world in which fixed proportions are assumed to continue. The demand for labour in a particular occupation will depend on how fast the economy grows (and this will be constrained by the size of labour supply), how labour productivity changes in that occupation and others, and how product markets adjust.

It is beyond our competence to build a model of the economy in which all these forces play their way out.[8] The approach we take is to simply project changes in employment shares and then apply them to an assumed overall level of employment. The intuition is that the changes in employment shares that we have observed over the last ten years reflect some fundamental changes in the economy (technology changes, overseas trade, capital flows, changes in consumers tastes and so on), and that these trends will continue. This is pretty naive but has more face validity than a fixed coefficients view of the world, in which occupational shares remain constant (although we include this as a benchmark).

This is a fancy way of saying that the share of total employment in the trades has dropped over the past and we expect it to drop in the future. For our projection we also need total employment. Here, the key assumption is that the total employment will be constrained by the projected population, with the age-specific employment-to-population ratios a little higher than they are now for the 15 to 64-year-old population. The reason for this is that age-specific employment-to-population rates will increase because of higher educational levels (better qualified people tend to have high employment rates), as argued by Karmel and Woods (2004).

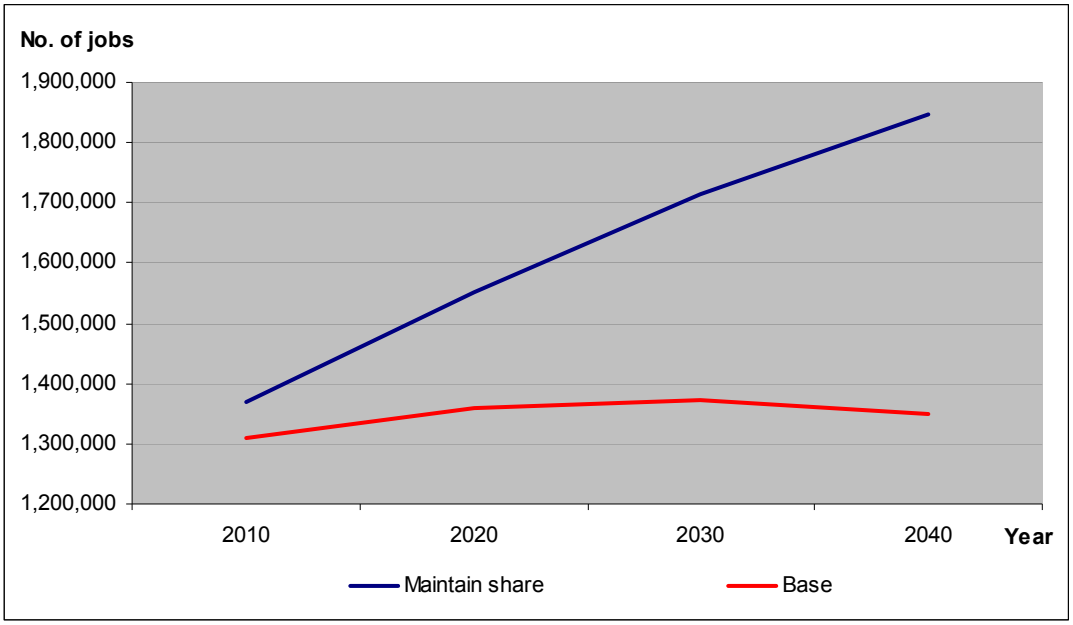
The trades employment projection (which we label as the *base* scenario) and the benchmark projection (assuming no decline in the share of employment held by the trades, and labelled as *maintain share* scenario) are shown in figure 9. The *base* scenario assumes that the trades share of employment declines from 12.7% of total employment in 2005–06 to 9.3% in 2040 (a projection of the trend between 1996 and 1997 and 2005 and 2006). For the individual trades we assume that they maintain their relative shares of total trades employment. While this is overly simplistic, we are not sufficiently confident in projecting changes in shares at the two-digit Australian Standard Classification of Occupations level.

[8] A potential model is the Monash model, a general equilibrium model of the Australian economy (Dixon & Rimmer 2002).

Table 6 Projected occupational shares for base scenario and 'maintain share' scenario

Occupation/Year	Maintain share	Base			
	2005–06	2010	2020	2030	2040
4 Tradespersons & related workers	*0.127*	*0.121*	*0.111*	*0.102*	*0.093*
41 Mechanical & fabrication engineering	0.022	0.021	0.019	0.017	0.016
42 Automotive	0.014	0.013	0.012	0.011	0.010
43 Electrical & electronics	0.019	0.018	0.017	0.015	0.014
44 Construction	0.034	0.032	0.030	0.027	0.025
45 Food	0.009	0.008	0.007	0.007	0.006
46 Skilled agricultural & horticultural	0.009	0.009	0.008	0.008	0.007
49 Other tradespersons & rel. workers	0.021	0.020	0.018	0.017	0.015
All other occupations	*0.873*	*0.879*	*0.889*	*0.898*	*0.907*
Total all occupations	***1.000***	***1.000***	***1.000***	***1.000***	***1.000***

Figure 9 Projections of employment in the trades



As can be seen in figure 9, the overall projections are quite sensitive to employment shares. If the share of employment in the trades were maintained, then in 2040 we would be looking at around half a million additional jobs compared with the base scenario. However, our base scenario is pretty much in line with scenarios developed by other modellers. For example, Access Economics (2006) projects very modest growth in the trades up to 2020,[9] and Shah et al. (2005), using the Monash model, project almost no growth for total trades to 2016.

Figure 9, of course, is for all trades. We do not present similar figures for the eight two-digit Australian Standard Classification of Occupations groupings because we are assuming that the relativities are unchanged; that is, analogous figures would be identical except for a change in scale.

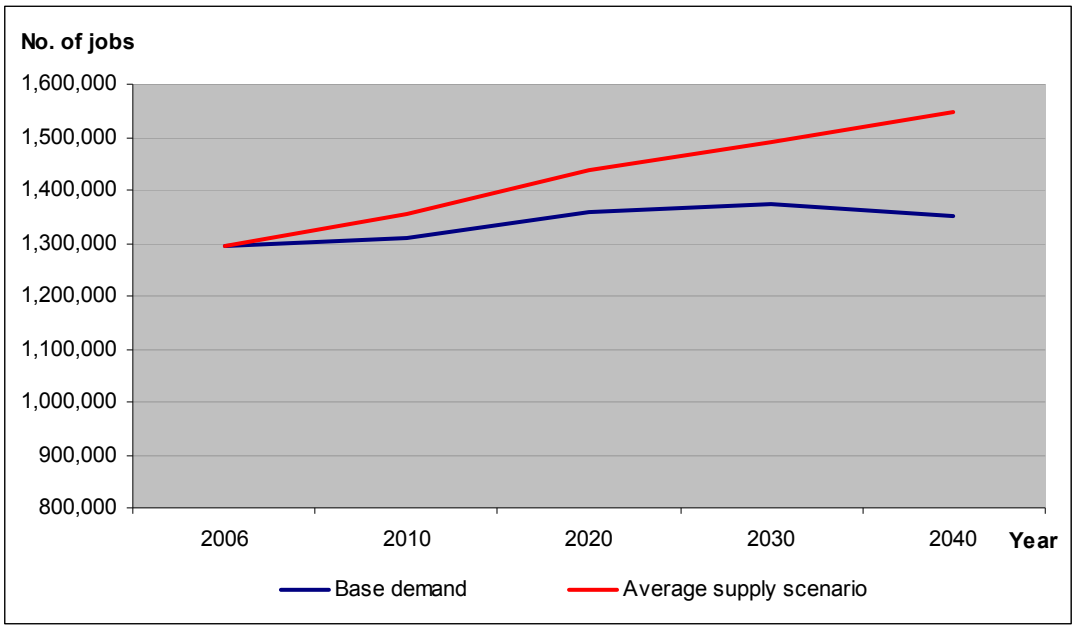
[9] The Access Economics model does not line exactly with ours in terms of coverage (Access Economics 2004). However, if we aggregate their categories *mechanical engineering & automotive, fabrication engineering, electrical, plumbing & construction, food, printing, wood, hairdressers, textile and miscellaneous*, then the aggregate can be directly compared with our projections for total trades (acknowledging that the Access Economics does not cover horticultural workers). If we do this, the Access Economics project average growth of 1.9% per annum, slightly higher than our rather simplistic demand projection for all of trades (0.5% per annum).

5 Comparison of demand and supply

We now compare the supply and demand projections.

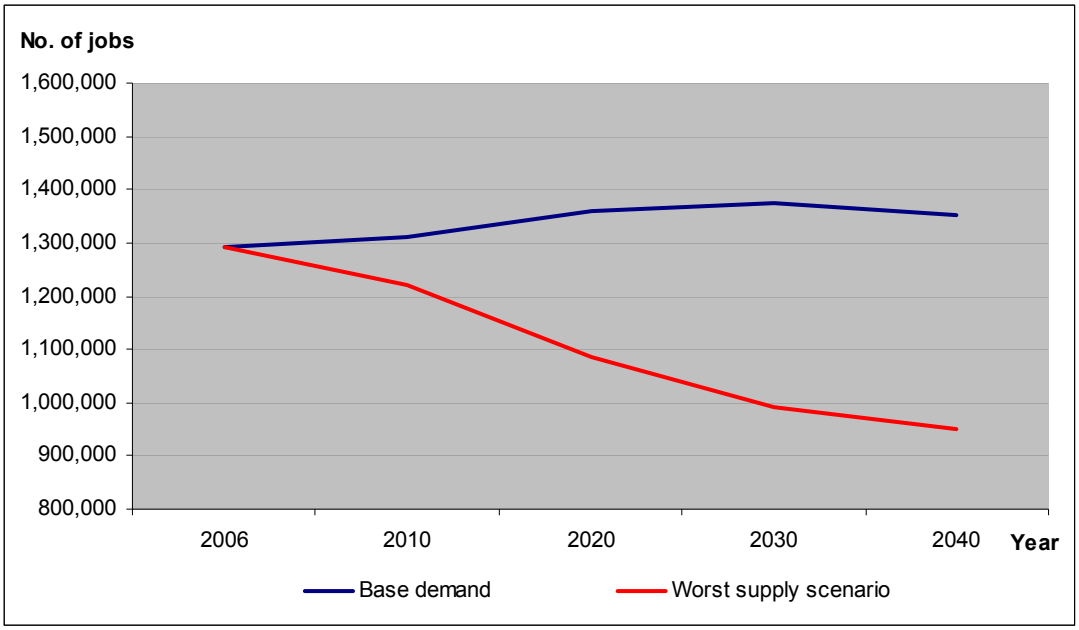
First, consider the aggregate projections. We have a bewildering array, and so we start with what we consider to be the most middle-of-the-road projections: the *average* scenario for the supply model and the *base* scenario for the demand projections (figure 10).

Figure 10 Comparison of the *average* supply scenario and the *base* demand scenario



The point that jumps out from this figure is that, according to these projections, there is a potential over-supply of tradespersons. We would therefore answer the hypothetical question embedded in the paper with a resounding no! However, perhaps this is a little hasty. Recall that commencement rates have been high in recent years, and attrition rates have been lower than in earlier times, reflecting a very strong labour market. If we look at a second scenario (the worst scenario), then the picture is very different, as can be seen in figure 11.

Figure 11 Comparison of the *worst* supply scenario and the *base* demand scenario



In this case, we would be looking at a decline in the trades workforce and very serious labour shortfalls. To complete the results we also compare the supply and demand projections under the other combinations of scenarios. These results are tabulated in table 7.

Table 7 Difference between demand and supply projections for the trades, 2040 (+ indicates potential surplus, - potential shortage, '000 people)

	***Base* demand scenario**	***Maintain* share demand scenario**
Worst supply projection	-400	-900
Average supply projection	+200	-300
Best supply projection	+1400	+900

Table 7 shows that the extent to which we project skill shortages or surpluses is quite sensitive to the assumptions. The conclusion, on the assumption that our demand projections are not grossly understated, is that there is no reason to be overly concerned about the supply of tradespersons *if the trades can maintain their attractiveness relative to other occupations*. That is, commencement rates must be kept at reasonably high levels and attrition rates at reasonably low levels. Otherwise, skill shortages are likely to emerge. If they do, however, do not blame demographics. Another way of expressing these results is that the potential supply is more than sufficient to underpin any reasonable projection of employment demand in the trades.

However, this is at the aggregate level, and in table 8 we consider the individual trades.

Projected shortfalls or surpluses do vary somewhat by individual trades. If the base demand scenario eventuates, then there will be shortages in only one trade—the rather unhelpful 'other tradespersons and related workers'. The issue here, as discussed earlier, is that our supply projection is downwards (see figure 7), driven by the high attrition rate. Again any shortfall cannot be blamed on the demographics. So our conclusion, that the ageing of the population has little implication for the trades workforce, remains.

Table 8 Difference between demand and average supply projections for individual trades, 2040 (+ indicates potential surplus, - potential shortage, '000 people)

Occupation	Base demand scenario	Maintain share demand scenario
Mechanical and fabrication engineering tradespersons	+34	-50
Automotive tradespersons	+52	-1
Electrical and electronics engineering tradespersons	+135	+61
Construction tradespersons	+76	-56
Food tradespersons	+33	0
Skilled agriculture and horticulture workers	+88	+51
Other tradespersons and related workers	-46	-128

6 Final comments

It is worth noting again that this conclusion is contingent on the demand projection and that our assumption is that employment demand in the trades is primarily related to total employment. Essentially, we are arguing that demand in the trades will be related to the overall level of economic activity, which will be constrained by the labour force, and not driven by the population size. This approach is quite different from that employed in some manpower models, especially in service industries. For example, planning in health and community services commonly assumes that demand is related to population numbers, not employment numbers. However, the demand for the trades primarily depends on the level of economic activity in industries such as construction and manufacturing, and these industries are clearly driven by levels of economic activity.

To sum up:

- The trades workforce is going to be directly affected by the ageing of the population because of its reliance on young men as entrants.
- The ageing of the population will make a very significant difference to the size of the trades workforce—some 320 000 people by 2040.
- Despite this impact on the size of the workforce, moderate scenarios suggest that there will be no overall imbalance between supply and demand over coming decades, because the slowing in employment growth caused by the ageing of the population will dampen the demand for tradespersons.
- This conclusion presupposes that the trades retain their attractiveness and that we do not see significant declines in commencement rates among young men or significant increases in attrition.
- Unless patterns of commencements and attrition change, the age distribution within the trades will be largely unchanged; demographics do not play a big role here, with the exception of skilled agricultural and horticultural workers, which will comprise many more older people, and the construction trades where the balance between younger and older workers will shift a little toward the latter.
- While patterns of apprenticeship commencements, cancellations and attrition rates significantly vary across individual trades, our conclusions are not significantly changed by considering individual trades. If there are skill shortages, they will be driven by the relative unattractiveness of the occupation, not the demographics.

References

Access Economics 2004, *Future demand for vocational education and training*, DEST, Canberra.

Australian Council of Trades Unions 2004, *Australia's looming skills shortage*, ACTU Background Paper, July, ACTU, Melbourne.

Ball, K & John, D 2005, *Apprentice and trainee completion rates*, NCVER, Adelaide.

Dixon, P & Rimmer M 2002, *Dynamic, general equilibrium modelling for forecasting and policy: A practical guide and documentation of MONASH,* North-Holland, Amsterdam.

Karmel, T & Woods, D 2004, *Lifelong learning and older workers*, NCVER, Adelaide.

Shah, C, Cooney, R, Long, M & Burke, G 2005, *Availability of skilled labour in selected occupations in Western Australia*, Centre for the Economics of Education and Training, Melbourne.

Appendix 1: The supply model

Data

For this paper, we define the trades by the ASCO 4: trades and related workers occupational group. Our initial intention was to define demographic groups by gender and individual age groups. However, the employment data in trades are constrained to five-year age groups (that is, aged 15–19, 20–24 years etc.). Therefore, we employ equation (3) with a time unit of five years. For instance, those aged 30–34 years will be aged 35–39, five years later.

As such, we focus on five-year time periods starting from 1996 to 2006 (that is, t = 1996, 2001 and 2006). The ABS Labour Force Survey provides us with number of employed tradesmen by age group as at August in each time period ($X_{i,t}$). The number of contract commencements, cancellations and withdrawals[10] in trades for the year ending in March are obtained from the NCVER New Apprenticeship Collection 48. These numbers are then multiplied by five to approximate the total five-year commencements and cancellations ($C_{i,t}$ and $W_{i,t}$ respectively). Finally, ABS Estimated Resident Population (1991, 1996 and 2001) and ABS Population Projections (2006–40) give us the total population in each relevant time period ($N_{i,t}$).

Calculations of rates

Commencement and cancellation rates are calculated directly from the data. Commencement rates are derived as percentages of age cohorts, while cancellation rates are expressed as a percentage of commencements. We then adjust the cancellation rates following these assumptions:

- Cancellation rate is calculated based on ten-year age group for those aged 15–19 and 20–24 years, that is, cancellation rate equals to total cancellations for age group 15–24 years, divided by total commencements for age group 15–24 years.
- Cancellation rates are assumed to level off after age 45.

These rates then give the ingredients to obtain the net attrition or departure rate by solving equation (3). These attrition rates are smoothed using the following guidelines.

- We assume no attrition for those aged 15–19 years since all tradespersons in this group are new entrants at time t. Those aged 65 years and above will move towards retirement (100% attrition).
- For males, those aged 25–54 years share the same aggregate attrition rates for age groups 25–29, 30–34, ..., 50–54 years.
- For females, those aged 50–59 years share the same aggregate attrition rate for age groups 50–54 and 55–59 years.

The calculated rates are shown in appendix 2.

[10] According to Ball & John (2005), approximately 55% of expired contracts are actual cancellations and thus total cancellations have been adjusted to include this proportion of expired contracts.

Best, average and worst scenarios

Various case scenarios can be identified using these rates. For the best scenario, we use the highest contract commencement rate but the lowest contract cancellation and tradespersons attrition rates. On the other hand, the lowest commencement rate but highest cancellation and attrition rates provide input to the worst scenario possible. Finally, the average rates depict the middle scenario.

Under these three scenarios in mind, we then project the number of employed tradespersons for years 2010, 2020, 2030 and 2040 using equation (3) for all age groups except for the youngest group. For this group, we use the modified version of equation (1) to tackle the unique situation where the employed group consists of all new entrants and there is no attrition. Here, we assume the number of tradespersons employed to be 96.5% of total commencements minus the overall cancellations. This assumption is needed to calibrate the NCVER apprentice and trainee data with the ABS employment data.

These projections are based on ABS Series B projected population. The counterfactual, which assumes no ageing, is derived by considering a constant growth rate within each demographic group at the population rate from the ABS projections over the period between 2006 and 2010. The results of these projections for the best, average and worst case scenarios are presented in appendix 3.

Appendix 2: Projected commencement, cancellation and net attrition rates

Table 9 Average male commencement rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–29	Aged 30–34	Aged 35–39	Aged 40–44	Aged 45–49	Aged 50–54	Aged 55–59	Aged 60–64	Aged 65 or over
Mechanical and fabrication engineering tradespersons	0.0390	0.0102	0.0035	0.0019	0.0013	0.0009	0.0005	0.0003	0.0001	0.0001	0.0000
Automotive tradespersons	0.0549	0.0139	0.0029	0.0013	0.0007	0.0003	0.0002	0.0001	0.0000	0.0000	0.0000
Electrical and electronics engineering tradespersons	0.0380	0.0138	0.0041	0.0021	0.0012	0.0006	0.0003	0.0001	0.0000	0.0000	0.0000
Construction tradespersons	0.0730	0.0226	0.0049	0.0021	0.0009	0.0004	0.0002	0.0001	0.0000	0.0000	0.0000
Food tradespersons	0.0372	0.0169	0.0043	0.0021	0.0014	0.0010	0.0007	0.0005	0.0003	0.0001	0.0000
Skilled agriculture and horticulture workers	0.0091	0.0035	0.0012	0.0009	0.0006	0.0005	0.0004	0.0003	0.0002	0.0001	0.0000
Other tradespersons and related workers	0.0217	0.0064	0.0017	0.0011	0.0006	0.0004	0.0003	0.0001	0.0001	0.0000	0.0000

Table 10 Average female commencement rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–29	Aged 30–34	Aged 35–39	Aged 40–44	Aged 45–49	Aged 50–54	Aged 55–59	Aged 60–64	Aged 65 or over
Mechanical and fabrication engineering tradespersons	0.0004	0.0003	0.0001	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Automotive tradespersons	0.0008	0.0004	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electrical and electronics engineering tradespersons	0.0005	0.0003	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Construction tradespersons	0.0007	0.0004	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Food tradespersons	0.0130	0.0068	0.0016	0.0008	0.0007	0.0008	0.0006	0.0004	0.0002	0.0001	0.0000
Skilled agriculture and horticulture workers	0.0009	0.0008	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
Other tradespersons and related workers	0.0357	0.0092	0.0015	0.0008	0.0005	0.0005	0.0003	0.0001	0.0001	0.0000	0.0000

Table 11 Average male cancellation rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–29	Aged 30–34	Aged 35–39	Aged 40 or over
Mechanical and fabrication engineering tradespersons	0.3822	0.3822	0.3864	0.3376	0.3184	0.2682
Automotive tradespersons	0.4842	0.4842	0.6916	0.5373	0.5185	0.4667
Electrical and electronics engineering tradespersons	0.3592	0.3592	0.4116	0.3281	0.3377	0.3200
Construction tradespersons	0.5616	0.5616	0.7188	0.5951	0.6131	0.5339
Food tradespersons	0.6489	0.6489	0.7824	0.6072	0.4871	0.5053
Skilled agriculture and horticulture workers	0.4729	0.4729	0.5140	0.5464	0.4225	0.3020
Other tradespersons and related workers	0.5519	0.5519	0.5623	0.4182	0.3356	0.3500

Table 12 Average female cancellation rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–29	Aged 30–34	Aged 35–39	Aged 40 or over
Mechanical and fabrication engineering tradespersons	0.5098	0.5098	0.8341	0.6439	0.8861	0.6705
Automotive tradespersons	0.4937	0.4937	1.0073	0.7643	2.8143	0.5306
Electrical and electronics engineering tradespersons	0.3563	0.3563	0.4655	0.3464	0.2426	0.1292
Construction tradespersons	0.6838	0.6838	0.7417	0.6611	0.8722	0.0476
Food tradespersons	0.6940	0.6940	0.7238	0.7427	0.3751	0.2373
Skilled agriculture and horticulture workers	0.4849	0.4849	0.7379	0.2231	0.3828	0.1695
Other tradespersons and related workers	0.6117	0.6117	0.7815	0.5860	0.5675	0.3674

Table 13 Average male five-year net attrition rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–54	Aged 55–59	Aged 60–64	Aged 65 or over
Mechanical and fabrication engineering tradespersons	0.0000	-0.6908	0.0551	0.1492	0.3746	0.5233
Automotive tradespersons	0.0000	-0.3595	0.1126	0.0089	0.5543	0.4289
Electrical and electronics engineering tradespersons	0.0000	-1.7656	0.0866	0.3843	0.1072	0.2279
Construction tradespersons	0.0000	-1.2312	0.0446	0.1196	0.4424	0.6249
Food tradespersons	0.0000	-0.0666	0.2408	0.5569	0.3018	0.4558
Skilled agriculture and horticulture workers	0.0000	-0.8344	-0.0708	-0.4707	0.1480	0.5009
Other tradespersons and related workers	0.0000	-0.4902	0.0849	0.1865	0.3715	0.3900

Table 14 Average female five-year net attrition rates by occupation and age

Occupation	Aged 15–19	Aged 20–24	Aged 25–29	Aged 30–34	Aged 35–39	Aged 40–44	Aged 45–49	Aged 50–59	Aged 60–64	Aged 65 or over
Mechanical and fabrication engineering tradespersons	0.0000	0.0494	-1.5897	-0.3382	0.4362	0.5000	-0.6125	0.1114	1.0000	0.7436
Automotive tradespersons	0.0000	0.6890	0.0000	-0.7521	-0.1558	0.0000	0.0000	0.5000	0.0000	0.6556
Electrical and electronics engineering tradespersons	0.0000	0.0000	-0.3655	0.4967	0.6656	0.5222	0.1722	-0.8250	0.0000	-0.3099
Construction tradespersons	0.0000	-1.1872	-1.0008	0.2792	0.5818	-0.1750	-0.2500	-0.2383	-0.7896	0.7730
Food tradespersons	0.0000	-0.0778	0.1850	-0.7813	0.2945	-0.0321	-0.7693	0.3109	0.0072	0.6748
Skilled agriculture and horticulture workers	0.0000	-0.7757	-0.6871	0.3754	-0.8946	-1.1689	-0.1041	-0.7438	-0.0365	0.6619
Other tradespersons and related workers	0.0000	-0.4155	0.2367	0.2935	-0.1887	0.2268	0.2671	0.1020	0.6660	0.4585

Appendix 3: Projected supply of tradespersons and related workers

Table 15 Best case scenario of tradespersons supply in Australia, 2010–40

Year	Ageing	No ageing
2010	1 521 605	1 521 605
2015	1 768 956	1 786 447
2020	1 985 499	2 051 990
2025	2 187 281	2 330 663
2030	2 373 769	2 619 632
2035	2 546 904	2 923 479
2040	2 712 983	3 247 853

Table 16 Average case scenario of tradespersons supply in Australia, 2010–40

Year	Ageing	No ageing
2010	1 352 839	1 352 839
2015	1 403 080	1 414 705
2020	1 436 531	1 479 876
2025	1 465 587	1 557 120
2030	1 491 450	1 645 276
2035	1 517 814	1 748 878
2040	1 546 876	1 869 291

Table 17 Worst case scenario of tradespersons supply in Australia, 2010–40

Year	Ageing	No ageing
2010	1 221 961	1 221 961
2015	1 150 447	1 158 863
2020	1 084 222	1 115 101
2025	1 031 466	1 095 309
2030	991 671	1 096 850
2035	965 051	1 120 139
2040	949 606	1 162 409

Table 18 Impact of demographics on the supply of individual tradespersons

Year	Mechanical and fabrication engineering tradespersons			Automotive tradespersons			Electrical and electronics engineering tradespersons		
	Ageing	No ageing	Difference	Ageing	No ageing	Difference	Ageing	No ageing	Difference
2010	232 637	232 637	0	150 390	150 390	0	220 722	220 722	0
2015	241 584	243 434	1 850	160 728	162 722	1 993	247 445	249 375	1 930
2020	247 744	254 546	6 802	168 264	175 127	6 863	270 713	279 441	8 728
2025	251 271	265 708	14 437	175 818	189 707	13 890	288 163	307 888	19 725
2030	254 352	278 894	24 542	182 190	205 038	22 848	305 250	339 271	34 021
2035	258 038	295 249	37 212	189 178	222 938	33 759	322 224	374 099	51 875
2040	263 336	315 695	52 359	196 560	243 014	46 454	336 599	409 689	73 090

Year	Construction tradespersons			Food tradespersons			Skilled agriculture and horticulture workers		
	Ageing	No ageing	Difference	Ageing	No ageing	Difference	Ageing	No ageing	Difference
2010	365 162	365 162	0	99 572	99 572	0	112 287	112 287	0
2015	383 112	385 396	2 283	104 352	105 753	1 402	129 850	130 321	471
2020	397 132	406 738	9 606	107 267	111 793	4 526	144 855	146 655	1 800
2025	410 199	431 552	21 353	113 250	122 146	8 896	156 825	160 863	4 038
2030	421 740	458 633	36 893	117 796	132 191	14 395	170 365	177 583	7 218
2035	430 119	486 680	56 561	120 439	141 396	20 957	183 023	194 583	11 560
2040	438 043	518 308	80 265	123 339	151 830	28 492	189 359	206 624	17 265

Year	Other tradespersons and related workers		
	Ageing	No ageing	Difference
2010	201 670	201 670	0
2015	196 938	198 522	1 584
2020	191 301	196 861	5 560
2025	188 115	199 363	11 248
2030	182 680	200 971	18 290
2035	177 596	204 579	26 983
2040	175 201	212 323	37 122

Appendix 4: Total employed, commencements, cancellations and net attrition

Table 19 Mechanical and fabrication engineering tradespersons, 2010–40

Year	Employed	Commencements	Cancellations	Attrition
2010	232 637	42 102	15 957	14 880
2015	241 584	42 044	15 928	17 169
2020	247 744	41 799	15 829	19 810
2025	251 271	42 275	16 000	22 747
2030	254 352	42 641	16 135	23 424
2035	258 038	43 138	16 322	23 130
2040	263 336	43 794	16 572	21 924

Table 20 Automotive tradespersons, 2010–40

Year	Employed	Commencements	Cancellations	Attrition
2010	150 390	54 285	26 960	18 798
2015	160 728	54 060	26 858	16 863
2020	168 264	53 550	26 642	19 372
2025	175 818	54 124	26 916	19 655
2030	182 190	54 585	27 136	21 076
2035	189 178	55 226	27 452	20 785
2040	196 560	56 105	27 881	20 842

Table 21 Electrical and electronics engineering tradespersons, 2010–40

Year	Employed	Commencements	Cancellations	Attrition
2010	220 722	43 739	15 775	5 982
2015	247 445	43 774	15 786	1 266
2020	270 713	43 493	15 689	4 535
2025	288 163	43 894	15 826	10 618
2030	305 250	44 263	15 956	11 220
2035	322 224	44 749	16 133	11 642
2040	336 599	45 420	16 374	14 671

Table 22 Construction tradespersons, 2010–40

Year	Employed	Commencements	Cancellations	Attrition
2010	365 162	75 482	43 129	2 139
2015	383 112	75 309	43 042	14 316
2020	397 132	74 614	42 681	17 914
2025	410 199	75 333	43 077	19 189
2030	421 740	75 971	43 429	21 001
2035	430 119	76 848	43 930	24 539
2040	438 043	78 060	44 617	25 519

Table 23 Food tradespersons, 2010–40

Year	Employed	Commencements	Cancellations	Attrition
2010	99 572	63 428	41 025	15 873
2015	104 352	63 678	41 174	17 725
2020	107 267	63 327	40 927	19 485
2025	113 250	63 865	41 241	16 641
2030	117 796	64 488	41 609	18 333
2035	120 439	65 219	42 076	20 499
2040	123 339	66 187	42 706	20 582

Table 24 Skilled agriculture and horticulture workers, 2010–40

Year	Employed	Commencements	Cancellations	Attrition
2010	112 287	13 827	6 361	-9 419
2015	129 850	13 909	6 395	-10 050
2020	144 855	13 888	6 384	-7 500
2025	156 825	14 046	6 447	-4 372
2030	170 365	14 186	6 503	-5 857
2035	183 023	14 352	6 574	-4 881
2040	189 359	14 558	6 669	1 552

Table 25 Other tradespersons and related workers, 2010–40

Year	Employed	Commencements	Cancellations	Attrition
2010	201 670	56 265	32 682	24 239
2015	196 938	56 152	32 601	28 283
2020	191 301	55 663	32 307	28 993
2025	188 115	56 278	32 648	26 816
2030	182 680	56 777	32 927	29 284
2035	177 596	57 441	33 314	29 212
2040	175 201	58 342	33 839	26 898

Appendix 5: The demand model

Let $E_{t,i}$ be employment in occupation i and time t.

Then we can write $E_{t,i} = \frac{E_{t,i}}{E_t} E_t = s_{t,i} E_t$ where s denotes the share. (1)

Then our unadjusted projection is $\hat{E}_{t,i} = \hat{s}_{t,i} E_t$ (2)

And our adjusted projection is $\hat{E}'_{t,i} = \frac{\hat{E}_{t,i}}{\sum_i \hat{E}_{t,i}} E_t$ (3)

We start off by calculating the projected occupational shares ($\hat{s}_{t,i}$). The projected shares are obtained by annualising observed change in shares between 1996 and 1997 and 2005 and 2006 ($s_{0,i}$) as depicted in table 26. In other words: $\hat{s}_{t,i} = s_{0,i}(1 + r_i)^t$.

These shares are then further adjusted so that shares sum up to 1 for all occupations (table 27).

Subsequently, we compute the unadjusted employment projection as in (2). Here, we assume that the total employment will be constrained by the population total and so we use the employment-to-population (E/Pop) ratios to project forward. However, future E/Pop ratios will be slightly higher than they are now for the current population (Karmel & Woods 2004). This is because E/Pop rates will increase due to higher education levels, that is, better qualified people will tend to have higher employment rates. As such, we adjust the projection using the ratios as shown in table 28. In addition to this base scenario, we also consider what the projected demand is if the current occupational share in 2005–06 is maintained.

Table 26 Projected occupational shares, 2010–40

Occupation/year	1996–97		2005–06		% change in share	'Annual-ised'	2010	2020	2030	2040
	Employed ('000)	Share	Employed ('000)	Share						
4 Tradespersons and related workers	1 145.4	0.137	1 273.0	0.127	-0.075	0.991	0.121	0.111	0.102	0.093
41 Mechanical and fabrication engineering tradespersons	205.8	0.025	216.0	0.022			0.021	0.019	0.017	0.016
42 Automotive tradespersons	138.1	0.017	136.3	0.014			0.013	0.012	0.011	0.010
43 Electrical and electronics tradespersons	181.0	0.022	190.2	0.019			0.018	0.017	0.015	0.014
44 Construction tradespersons	259.8	0.031	340.9	0.034			0.032	0.030	0.027	0.025
45 Food tradespersons	88.9	0.011	85.4	0.009			0.008	0.007	0.007	0.006
46 Skilled agricultural and horticultural workers	69.1	0.008	95.2	0.009			0.009	0.008	0.008	0.007
49 Other tradespersons and related workers	202.8	0.024	209.0	0.021			0.020	0.018	0.017	0.015
All other occupations	7 209.4	0.863	8 769.1	0.873	0.012	1.001	0.879	0.891	0.903	0.915
Total all occupations	**8 354.7**	**1.000**	**10 042.1**	**1.000**	**0.000**	**1.000**	**1.000**	**1.002**	**1.005**	**1.008**

Table 27 Adjusted projected occupational shares, 2010–40 (base demand)

Occupation/year	2005–06	2010	2020	2030	2040
4 Tradespersons and related workers	0.127	0.121	0.111	0.102	0.093
41 Mechanical and fabrication engineering tradespersons	0.022	0.021	0.019	0.017	0.016
42 Automotive tradespersons	0.014	0.013	0.012	0.011	0.010
43 Electrical and electronics tradespersons	0.019	0.018	0.017	0.015	0.014
44 Construction tradespersons	0.034	0.032	0.030	0.027	0.025
45 Food tradespersons	0.009	0.008	0.007	0.007	0.006
46 Skilled agricultural and horticultural workers	0.009	0.009	0.008	0.008	0.007
49 Other tradespersons and related workers	0.021	0.020	0.018	0.017	0.015
All other occupations	0.873	0.879	0.889	0.898	0.907
Total all occupations	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Table 28 Ratios used to adjust future employment-to-population ratios

Gender	2010	2020	2030	2040
Males	1.005	1.010	1.015	1.020
Females	1.018	1.036	1.054	1.073

Appendix 6: Trades occupation distribution

Table 29 2001 census occupation count by gender, Australia

ASCO	Occupation	Male	Female	All people	Male %	Female %
41	*Mechanical and fabrication engineering tradespersons*	*165 108*	*2 062*	*167 170*	*98.8*	*1.2*
4111	General Mechanical Engineering Tradespersons	4 131	52	4 183	98.8	1.2
4112	Metal Fitters and Machinists	72 458	534	72 992	99.3	0.7
4113	Toolmakers	7 653	96	7 749	98.8	1.2
4114	Aircraft Maintenance Engineers	13 142	220	13 362	98.4	1.6
4115	Precision Metal Tradespersons	7 105	602	7 707	92.2	7.8
4121	General Fabrication Engineering Tradespersons	1 345	30	1 375	97.8	2.2
4122	Structural Steel and Welding Tradespersons	48 389	317	48 706	99.3	0.7
4123	Forging Tradespersons	1 324	66	1 390	95.3	4.7
4124	Sheetmetal Tradespersons	7 227	52	7 279	99.3	0.7
4125	Metal Casting Tradespersons	834	26	860	97.0	3.0
4126	Metal Finishing Tradespersons	1 500	67	1 567	95.7	4.3
42	*Automotive tradespersons*	*112 502*	*1 194*	*113 696*	*98.9*	*1.1*
4211	Motor Mechanics	78 677	691	79 368	99.1	0.9
4212	Automotive Electricians	6 048	40	6 088	99.3	0.7
4213	Panel Beaters	14 218	171	14 389	98.8	1.2
4214	Vehicle Painters	9 092	130	9 222	98.6	1.4
4215	Vehicle Body Makers	2 887	42	2 929	98.6	1.4
4216	Vehicle Trimmers	1 580	120	1 700	92.9	7.1
43	*Electrical and electronics engineering*	*136 051*	*3 522*	*139 573*	*97.5*	*2.5*
4311	Electricians	75 458	1 054	76 512	98.6	1.4
4312	Refrigeration and Airconditioning Mechanics	12 058	103	12 161	99.2	0.8
4313	Electrical Distribution Tradespersons	5 027	24	5 051	99.5	0.5
4314	Electronic Instrument Tradespersons	803	44	847	94.8	5.2
4315	Electronic and Office Equipment Tradespersons	22 923	1 345	24 268	94.5	5.5
4316	Communications Tradespersons	19 782	952	20 734	95.4	4.6
44	*Construction tradespersons*	*225 087*	*4 557*	*229 644*	*98.0*	*2.0*
4411	Carpentry and Joinery Tradespersons	72 920	606	73 526	99.2	0.8
4412	Fibrous Plasterers	17 259	352	17 611	98.0	2.0
4413	Roof Slaters and Tilers	5 993	98	6 091	98.4	1.6
4414	Bricklayers	19 770	227	19 997	98.9	1.1
4415	Solid Plasterers	2 686	22	2 708	99.2	0.8
4416	Wall and Floor Tilers and Stonemasons	13 498	416	13 914	97.0	3.0
4421	Painters and Decorators	33 849	1 287	35 136	96.3	3.7
4422	Signwriters	4 758	766	5 524	86.1	13.9
4423	Floor Finishers	7 085	229	7 314	96.9	3.1
4431	Plumbers	47 269	554	47 823	98.8	1.2

ASCO	Occupation	Male	Female	All people	Male %	Female %
45	*Food tradespersons*	*57 015*	*27 933*	*84 948*	*67.1*	*32.9*
4511	Meat Tradespersons	21 308	718	22 026	96.7	3.3
4512	Bakers and Pastrycooks	17 838	4 871	22 709	78.6	21.4
4513	Cooks	16 293	21 699	37 992	42.9	57.1
4519	Other Food Tradespersons	1 576	645	2 221	71.0	29.0
46	*Skilled agriculture and horticulture workers*	*60 572*	*8 965*	*69 537*	*87.1*	*12.9*
4611	Farm Overseers	1 657	218	1 875	88.4	11.6
4612	Shearers	5 362	101	5 463	98.2	1.8
4613	Wool, Hide and Skin Classers	1 028	253	1 281	80.2	19.8
4614	Animal Trainers	2 251	875	3 126	72.0	28.0
4621	Nurserypersons	3 997	2 423	6 420	62.3	37.7
4622	Greenkeepers	11 637	291	11 928	97.6	2.4
4623	Gardeners	34 640	4 804	39 444	87.8	12.2
49	*Other tradespersons and related workers*	*126 540*	*62 508*	*189 048*	*66.9*	*33.1*
4911	Graphic Pre-Press Tradespersons	3 344	1 600	4 944	67.6	32.4
4912	Printing Machinists and Small Offset Printers	15 440	1 652	17 092	90.3	9.7
4913	Binders and Finishers	1 983	921	2 904	68.3	31.7
4914	Screen Printers	1 883	476	2 359	79.8	20.2
4921	Wood Machinists and Turners	3 525	73	3 598	98.0	2.0
4922	Cabinetmakers	21 279	507	21 786	97.7	2.3
4929	Other Wood Tradespersons	3 725	892	4 617	80.7	19.3
4931	Hairdressers	7 018	35 705	42 723	16.4	83.6
4941	Clothing Tradespersons	2 428	6 673	9 101	26.7	73.3
4942	Upholsterers and Bedding Tradespersons	4 036	384	4 420	91.3	8.7
4943	Footwear Tradespersons	1 566	270	1 836	85.3	14.7
4944	Leather Goods, Canvas Goods and Sail Makers	1 372	719	2 091	65.6	34.4
4981	Marine Construction Tradespersons	4 370	76	4 446	98.3	1.7
4982	Glass Tradespersons	6 204	154	6 358	97.6	2.4
4983	Jewellers and Related Tradespersons	3 170	1 060	4 230	74.9	25.1
4984	Florists	666	5 299	5 965	11.2	88.8
4985	Fire Fighters	9 003	204	9 207	97.8	2.2
4986	Drillers	4 014	72	4 086	98.2	1.8
4987	Chemical, Petroleum and Gas Plant Operators	5 884	177	6 061	97.1	2.9
4988	Power Generation Plant Operators	2 690	33	2 723	98.8	1.2
4991	Defence Force Members Not Elsewhere Included	9 928	875	10 803	91.9	8.1
4992	Performing Arts Support Workers	7 622	2 506	10 128	75.3	24.7
4999	Other Miscellaneous Tradespersons and Related Workers	5 390	2 180	7 570	71.2	28.8