



VET and the changing labour market

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Executive Summary

This paper takes a descriptive approach to changes in the labour market over the ten years 2011 to 2021, exploiting granular data from the Census of Population and Housing. Our primary interest is in the relationship between what is happening to occupational employment on one hand and qualifications on the other. We look at the occupational distribution in a number of ways. In addition to using the broad ANZSCO classification (for example, professionals, managers) we rank jobs (more specifically four digit ANZSCO occupations) by average income and also according to the five Australian Bureau of Statistics skill levels categories. We group qualifications into six categories: higher degrees, bachelor degrees and equivalent, diplomas and advance diplomas, certificates III/IV and two residual categories comprising 'other certificates' and no post-school qualification. Under current institutional arrangements the first two are the purview of Higher Education and the second two of Vocational Education and Training. We should also note that the data refers to the highest qualification, so individuals who upgrade their qualifications are counted under their highest qualification. We also make use of the field of study which is collected in the Census.

The stylised factors to emerge are the following:

Between 2011 and 2021 occupational change has been significant. In terms of full-time employment growth has been strongest in community and personal service workers, professionals and managers. All remaining broad occupational groups had less than average growth, with lowest growth being among clerical and administrative workers, sales and technicians and trades workers.

If we rank occupations by average income (the occupation with the highest average income in 2011 was surgeons and anaesthetists) then it is clear that employment growth has been biased. Sorting the occupations into income deciles defined in terms of full-time employment in 2011, we see that growth in full-time employment has been strongest in the top four income deciles (and especially in the top two), while growth in total employment was strongest in the top four income deciles and the bottom two. That is, full-time jobs have been strongly biased toward the better paid jobs, while growth in all jobs has shown a hollowing out of the occupation distribution with growth at the top and bottom at the expense of the middle. It is clear that the growth in part-time jobs has tended to be in the poorer paying jobs.

Our analysis, however, has another element, and this is the rapid increase in credentials. It is the intersection of the increase in credentials with the significant occupational structure change which will impact on the employment prospects of individuals. In respect of qualifications, the period 2011 to 2021 was one of growth in credentials, particularly in higher degrees and bachelor degrees. The strongest growth was in higher degrees where the proportion of employed persons with a higher degree increased from 5.1% to 9.1%, while the proportion with a bachelor degree increased from 20.8% to 26.3%. Diplomas increased a little while the proportion of employed persons with a certificate III/IV remained constant (at 19.5%). There are now more people with a degree than with a certificate III/IV. The groups which have seen a decline are those with an 'other certificate' (which include certificates I and II and those qualifications that fall outside the Australian Qualification framework) and those with no non-school qualification. The decline has been very significant in respect of the latter, declining 8.7% points from 37.4% to 28.7%.

The very large increase in persons with qualifications is much larger than can be accommodated by the changes in the occupational structure. That is, having a qualification does not automatically imply that the individuals will gain a job commensurate with the qualification. So, for example, if we look at the 'new' jobs (the net increase in employment between 2011 and 2021) for persons with a higher degree, over 12% of them are in the two lowest income deciles. Similarly, over 20% of new jobs for those with a bachelor degree are in the two lowest income deciles. A university degree may be a gateway into a well-paid job but provides no guarantee. In terms of diplomas, new jobs have occurred across the income distribution but with relatively high numbers in the bottom three income deciles for all employment and at the top and bottom of the distribution for full-time jobs. If we look at persons with a certificate III/IV we see over 50% of new jobs (full-time and part-time) have occurred in jobs in the lowest two income deciles. The new full-time jobs are more widely spread but large increases were seen in the second, sixth and ninth deciles. Finally, the decline in employment in persons with no post-school qualification is concentrated in the lowest two income deciles, while the decline in full-time jobs has mostly been in the lower half of the jobs. The obvious conclusion is that persons with no post-school qualification are being displaced by people with credentials, predominantly in the poorer paid jobs. Credentials are becoming increasingly important even in lower paid jobs.

The interplay between increases in qualification levels and the changing occupational structure is illuminated through a shift share analysis. This analysis decomposes, in an accounting sense, the change in number of persons in jobs into three components: a qualification share effect reflecting changes in the share of jobs within occupations of persons with a certain qualification; an occupational share effect, reflecting the change associated with differential growth in occupations; and an overall growth effect which reflects the overall increase in the total number of jobs. A simple interpretation of the qualification share effect is that it reflects an increase in the number of persons with that qualification over and above that needed to maintain the proportion of people in an occupation with that qualification.

The results of the shift share analysis show clearly two important structural changes. First, the change in the occupation structure clearly favour those with higher degrees and degrees (especially those with higher degrees), is relatively neutral for those with diplomas and is unfavourable for those with a certificate III/IV. It is also very unfriendly to those with no post-school qualification. Second, the qualification share effect shows that it is the increase in supply of persons with qualifications that is dominant for those with higher degrees, and to a lesser extent for those with bachelor degrees. The shares of those with diplomas and certificates have also increased but to a much more modest extent.

If we put both of these effects together the group that was disadvantaged on both counts was those with no post-school qualification. This group has faced both an unfriendly change in the occupational structure, and an increase in competition from those with qualifications.

In the analysis, we have also dug a little deeper for two qualification levels associated with vocational education and training; diplomas and certificates III/IV. In particular we can see where the groups have been losing or gaining share of the jobs within occupations. At the aggregate level, we saw that those with diplomas had gained share, but we see that this gain overall is actually reflecting an increase in the share in the lower paying jobs (bottom half of the distribution) and losing share in the higher paying jobs. The same pattern is observed for those with a certificate III/IV.

These results are at the total qualification level, and we can further disaggregate the analysis by field of study. If we do this, we find that there have been some declines in the share of qualifications for a number of fields of study, notably engineering and related technologies (both diplomas and certificates III/IV) and education (diplomas). This is despite the share of qualifications increasing for the overall qualification. We can also see how this plays out across the jobs distribution. The general finding is that there has been a loss in qualification share among the better paid jobs.

The overall lesson that emerges is that the labour market has become increasingly unfriendly for persons with a diploma or a certificate III/IV. First, the growth in occupations has not been in those occupations associated with the VET qualifications. Technicians and trades workers are growing much more slowly than the overall labour market. Second, these qualifications are being pushed aside by higher degrees and bachelor degrees and have only maintained their position by pushing out those with no post-school qualifications. This has tended to occur in the lower paying jobs.

The discussion would not be complete without a reference to the role of regulation. Clearly, increased output by education institutions will impact on the shares of employment held by persons with different qualification levels. But changes to regulatory structures are likely to be an important driver. In the professions, a degree is the entry level qualification almost universally (a masters degree to be a clinical psychologist). In childcare, we see that a certificate III is the mandatory qualification, and diplomas are becoming more common (hence the rapid increase in education diplomas in recent years). In aged care we have seen a push for more credentialed staff. These changes to regulatory regimes are both an opportunity for VET but also a possible threat. The opportunity tends to be at lower level jobs where persons with no post-school qualification are being channelled into certificates, while the threat is at higher level jobs. For example, one would have thought that it is almost inevitable that childcare/education degrees will supplant diplomas. We also note that community and personal service workers is the one occupational group with a strong relationship with VET qualifications which is likely to continue with strong employment growth. But in this occupational group we have seen higher growth in persons with degrees compared to persons with certificates III/IV.

The point is that the outlook is less than benign for VET. The occupational structure is changing in a way not sympathetic to diplomas and certificates, and the supply of persons with degrees is only going to increase, making the lower level qualifications less competitive.

1. Introduction

The labour market has had a series of shocks in recent years, with COVID-19 impacting significantly directly on the way individuals work and businesses having to reassess their supply chains. At the same time, technology continues to challenge the way we work, with artificial intelligence being applied to an increasing number of tasks. Commentators such as Richard Baldwin (2019) observe that we are seeing a 'great transformation' which is leading to deindustrialisation as technology renders traditional manufacturing obsolete and allows an increasing number of roles to be outsourced to low wage countries. He points to implications for large numbers of skilled and semi-skilled workers.

The issue we wish to focus on in this paper is the implications of changes in the labour market on tertiary education in general and Vocational Education and Training (VET) in particular. The recent

release of 2021 Census data provides an opportunity to analyse at a highly granular level the way the labour market is changing, and the implications for workers with different types of qualifications.

We wish to focus on occupation and qualifications. The period we are looking at is 2011 to 2021, building on similar work on earlier censuses (Karmel *et al.* 2015, Karmel 2015). Essentially, we wish to look at the way the labour market is changing in respect of the distribution of jobs across occupations and the distribution of type of qualifications. By type of qualification, we refer to the level of the qualification and its field of education. In order to keep the analysis tractable, we categorise qualifications into higher degrees, bachelor degrees, diplomas and advanced diplomas, certificates III and IV, other certificates, and no post school qualification. We also touch on income by using it as a way of ranking jobs which enables us to comment on the extent to which changes in the labour market have impacted on jobs at different parts of the job distribution. That is, we can investigate whether for example changes have impacted more on highly paid jobs relative to jobs that are lowly paid. By interacting these changes with individuals' qualifications, we can see which groups of people are benefiting from the changes and which groups are being negatively affected. Our particular interest is the impact of these changes on individuals with VET qualifications, relative to those with higher education qualifications.

In the next section we undertake some broadly descriptive analysis, looking at changes in employment by occupations, and changes in qualification levels. This is followed by an analysis of changes (Section 3) in the occupational distribution, where the distribution is based on average incomes within occupations. This allows us to see where structural change is having its greatest effect at the top of the distribution (high income jobs) or the middle of the distribution (middle income jobs) and the bottom of the distribution (low income jobs). In Section 4 we apply a shift share decomposition to the change in employment levels by qualification, which allows us to differentiate between changes in the share of employment within occupations held by specific qualifications, change in employment levels of specific qualifications reflecting changes in the occupational structure, and change due to the overall growth of employment. We do this both overall, and across the distribution of jobs where jobs are ranked according to average income and according to the skill level assigned by the Australian Bureau of Statistics to each four digit (ANZSCO) occupation. We conclude with a discussion.

2. Broad description¹

Table 1 shows the change in the proportion of employed persons by highest qualification. The qualification levels we use are higher degree, bachelor degree, diplomas (including advanced diploma, certificates III and IV, other certificates and no non-school qualification.

¹ This paper is based on the 2011 and 2021 Censuses. A possible issue is the extent to which change over this period was impacted by COVID-19. There was a downturn in the labour market in 2020 but this was largely reversed by August 2021. However, any change in the occupational distribution due to COVID-19 is marginal relative to the change over the 10 year period.

Table 1 Proportion of employed persons by highest qualification, 2011 and 2021

	2011	2021	Change (% points)
Higher degree	5.1	9.1	4.0
Bachelor degree	20.8	26.3	5.6
Diploma/advanced diploma	10.0	11.1	1.1
Certificate III/IV	19.5	19.5	0.1
Other certificates	7.2	5.3	-2.0
No non-school qualification	37.4	28.7	-8.7
Total	100	100	

Notes: Higher degree includes doctorates, masters and postgraduate degree level (not further defined); bachelor degrees include bachelor degrees and graduate diploma/graduate certificates; other certificates include certificates I/II, certificates not further defined, and level inadequately described or not stated.

Source: Dataset: Census of Population and Housing, 2021, TableBuilder; 2-digit level QALLP by LFHRP, counting persons

We see that the proportion of persons with a degree or a higher degree has increased substantially, offset by declines in those with a lower level certificate or no non-school qualification. Interestingly, the proportion with a certificate III or IV has remained constant, while the proportion with a diploma or advanced diploma has grown a little.

We now look at employment growth at a broad level.

Table 2: Employment growth by occupation, 2011 and 2021 (persons employed)

	2011	2021	Change (%)
Managers	1293970	1645769	27.2
Professionals	2145442	2886921	34.6
Technicians and Trades Workers	1425145	1554313	9.1
Community and Personal Service Workers	971901	1382205	42.2
Clerical and Administrative Workers	1483558	1525311	2.8
Sales Workers	942154	986433	4.7
Machinery Operators and Drivers	659551	755863	14.6
Labourers	947614	1086120	14.6
Inadequately described	109153	133815	22.6
Not stated	79861	92659	16.0
Total	10058349	12049410	19.8

Source: Dataset: Census of Population and Housing, 2021, TableBuilder; 1-digit level OCCP Occupation by LFHRP Labour Force Status and Hours Worked Not Stated

We see that employment growth has been very variable. The occupational group with the fastest employment growth is community and personal service workers, followed by professionals and managers. All other groups have had less than the overall growth. The two occupational groups with the lowest growth rates are clerical and administrative workers, sales workers and technicians and trades workers. It is clear that employment growth has been far from neutral across different types of jobs, and this phenomenon is one we will now explore.

Our primary interest is in the interaction between changing qualification levels and occupations. In Table 3 we show the share of employment in each occupational group held by persons with

different types of qualifications, while in Table 4 we look at the changes in the proportion of the various qualification groups within the broad occupation groups.

Table 3: Proportion of occupation groups with qualifications, 2021 (percentage)

	Higher degree	Bachelor degree	Diploma, advanced diploma	Certificate III/IV	Other certs	No non-school qual	Total
Managers	12.3	30.9	13.6	15.9	4.5	22.8	100
Professionals	21.9	56.8	8.3	4.1	2.5	6.4	100
Technicians and Trades Workers Community and Personal Service Workers	2.1	8.8	9.6	52.3	3.9	23.4	100
Clerical and Administrative Workers	3.6	18.3	19.5	24.1	6.8	27.7	100
Sales Workers	5.8	21.4	14.7	17.4	7.2	33.5	100
Machinery Operators and Drivers	3.3	12.7	9.1	13.9	6.6	54.5	100
Labourers	2.4	7.4	7.0	24.2	6.2	52.7	100
Total	2.1	8.4	6.5	18.9	7.0	57.2	100
Total	9.1	26.5	11.1	19.6	5.1	28.5	100

Note: The occupation total covers those with an occupation code and excludes those whose occupation is labelled those not adequately described or not applicable.

Source: Dataset: Census of Population and Housing, 2021, TableBuilder; 1-digit level OCCP Occupation by 2-digit level QALLP

We see that the VET qualifications of diploma and certificate III/IV are the most common qualifications among technicians and trades workers, community and personal workers, sales workers, machinery operators and drivers, and labourers. However, it is worth noting that degrees are important in a number of these occupational groups, namely community and personal service workers, clerical and administrative workers. In the same vein the proportion of technicians and trades workers with a diploma is only marginally larger than the proportion with a degree. We also note that degrees have become quite prevalent in occupation groups which on the face of it do not have a requirement for such a qualification. So, we see that 16 % of sales workers have a bachelor or higher degree, 9.8% of machinery operators and drivers and 10.5% of labourers.

Table 4 Changes in the proportion of occupation groups with qualifications, 2011 to 2021, percentage points²

	Higher degree	Bachelor degree	Diploma/advanced diploma	Certificate III/IV	Other certificates	No non-school qualification
Managers	4.8	7.1	1.2	-0.9	-1.5	-10.6
Professionals	7.4	1.3	-3.3	-1.1	-1.3	-3.0
Technicians and Trades Workers Community and Personal Service Workers	1.2	3.4	2.1	-2.0	-1.1	-3.7
Clerical and Administrative Workers	2.1	6.3	3.3	2.4	-4.0	-10.2
Sales Workers	2.9	6.2	2.7	3.5	-2.5	-12.8
Machinery Operators and Drivers	1.9	4.2	1.5	2.0	-2.0	-7.6
Labourers	1.7	3.8	3.0	2.2	-1.7	-9.0
Inadequately described	1.3	3.7	2.0	2.6	-1.9	-7.8
Not stated	1.6	1.7	0.3	1.7	-1.8	-3.5
Total	2.6	3.2	0.2	0.2	4.1	-10.2
	4.0	5.6	1.1	0.1	-2.0	-8.7

Source: Dataset: Census of Population and Housing, 2021, TableBuilder; 1-digit level OCCP Occupation by 2-digit level QALLP

We see that the change in qualification levels has been far from neutral across different occupations. However, all occupations increased their qualification levels, even in occupations where particular qualifications are unlikely to be required. For example, we see increases in the number of persons with a higher degree even in low skilled occupations such as sales workers, machinery operators and drivers, and labourers. The changes in the proportion with a diploma or advanced diploma were positive in all occupations except professional, where clearly degrees are displacing diplomas. While the overall proportion of employed persons with a certificate III/IV has remained largely unchanged declines were seen among managers, professional and trades and technicians.

It is clear that changes in the labour market are impacting differentially across persons with different sorts of qualifications.

3. Changes in the occupational distribution

We continue our analysis by looking further at the structure of employment growth. The idea is to rank occupations so that we can distinguish between ‘better’ and ‘worse’ jobs. In this case we define ‘better’ and ‘worse’ using an income metric. To begin with we construct an index of jobs (at the four digit ANZSCO level) based on the average weekly income of full-time workers. Occupations are ranked by an estimated weekly income for full-time workers. This index is given in the Appendix I. The ranking provided by the index is pretty much as expected. The occupations with the highest incomes are dominated by medical professionals. The occupation with the highest income is surgeons and anaesthetists.

² This table encompasses employed persons, as in tables 1 and 2; Occupation is only coded for employed persons.

By contrast the occupations with the lowest incomes are occupations such as fast food cooks, food preparation assistants nfd, cafe workers, sewing machinists, pharmacy sales assistants, sports and personal service workers nfd, and bricklayers, and carpenters and joiners nfd.³

We now present the growth in employment using the income index lens. Initially, we look at employment growth across deciles (the first decile contains those occupations which have the highest incomes). We then focus on individuals with different levels of qualification. Table 5 shows the distribution of full-time jobs for 2011 and 2021, while Table 6 is the analogous table for total employment.

Table 5: Distribution of full-time employment based on income deciles.

Income decile	Full-time employment (%)		
	2011	2021	Distribution of new jobs (%) ⁴
1	10.0	12.5	34.7
2	10.0	12.6	35.8
3	9.9	10.9	19.3
4	9.6	10.2	15.5
5	10.3	9.7	4.7
6	10.1	9.4	3.4
7	10.1	8.3	-7.2
8	10.3	8.5	-7.4
9	9.8	9.4	6.0
10	9.9	8.4	-4.8
Total	100.0	100.0	100.0

Note: Income deciles are based on full-time employment in 2011. The shares in 2011 are not exactly 10% because of occupations straddling the boundaries.

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

We see that the growth in full-time employment is very uneven. The majority of the new full-time jobs is in the top two deciles, with substantial growth in deciles 3 and 4. By contrast there is little or negative growth in the bottom six deciles.

³ We note that the index is affected by the way the ABS undertakes its classification. For example, the income of bricklayers and stone masons and carpenters and joiners are in the seventh decile while bricklayers, and carpenters and joiners nfd is the occupation with the lowest income. It is most likely the case that the classification is impacted by the ability to define occupation precisely - no doubt the ABS is less confident with the occupations of those assigned to the not further defined (nfd) category.

⁴ The distribution of 'new' jobs is based on the net employment change over 2011 to 2021.

Table 6: Distribution of all jobs based on income deciles

Income decile	Employment (%)		Distribution of new jobs (%)
	2011	2021	
1	7.7	9.2	16.7
2	7.7	9.3	17.5
3	8.1	8.5	10.6
4	8.7	8.8	9.7
5	9.2	8.9	7.3
6	8.9	8.3	5.3
7	9.7	8.3	1.2
8	10.4	8.7	0.1
9	11.2	11.8	14.9
10	18.4	18.1	16.7
Total	100.0	100.0	100.0

Note: the deciles were created using full-time employment in 2011

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

The first thing to notice about this table is that part-time jobs are less likely to be in the top paying occupations. By far the largest group is in the 10th decile, i.e. the worst paying jobs. However, there have been changes between 2011 and 2021. If we look at overall employment there has been growth in the occupations in the top 4 deciles (best paying jobs) and in the lowest paying jobs (bottom two deciles). In terms of overall employment there has been a hollowing out of the distribution, and this is particularly noticeable in the 6th, 7th and 8th deciles. So in terms of full-time employment we see growth at the top of the distribution, but in terms of overall employment growth has occurred at the top and the bottom.

We have seen that there have indeed been significant structural change in the labour market in terms of the distribution of occupations. We now look at how this has interacted with the increasing levels of qualifications which we noted earlier. We look at each qualification level in turn, beginning with higher degrees.

Table 7: Distribution across occupation income deciles of those with a higher degree, 2011 and 2021

Income decile	Full-time employment			Total employment		
	2011 (%)	2021 (%)	Distribution of new jobs (%)	2011 (%)	2021 (%)	Distribution of new jobs (%)
1	30.6	28.0	25.5	27.9	24.5	21.5
2	22.4	22.0	21.6	20.6	19.6	18.7
3	16.5	16.7	17.0	15.7	15.5	15.2
4	12.3	13.0	13.8	13.6	13.6	13.6
5	4.8	5.7	6.6	5.4	6.6	7.6
6	3.6	3.6	3.6	3.6	3.8	3.9
7	3.1	3.0	2.8	3.6	3.6	3.6
8	3.0	2.8	2.6	3.5	3.4	3.4
9	1.6	2.6	3.5	2.3	4.1	5.6
10	2.1	2.5	3.0	3.8	5.4	6.9
Total	100	100	100	100	100	100
Total number	376733	763937	387204	503871	1078496	574625

Note: The total number refers to employed persons with an ANZSCO occupation code.

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

We see that the labour market has on the whole been favourable for those with higher degrees, with a half of those in full-time employment in the top two deciles in both periods (but only 40% in terms of total employment). On the other hand, it seems that the rapid increase in those with higher degrees has had some impact on the distribution. In particular, there has been a decrease in those with a job in the upper two deciles and an increase in those with a job at the bottom of the distribution. For example, 12.5% of the new jobs (total employment) were in the bottom two deciles compared to 9.5% of jobs in 2011. This phenomenon has been more pronounced for all jobs relative to full-time jobs.

Table 8: Distribution across occupation income deciles of those with a bachelor degree, 2011 and 2021

Income decile	Full-time employment (%)			Total employment (%)		
	2011	2021	Distribution of new jobs (%)	2011	2021	Distribution of new jobs (%)
1	19.7	20.1	21.0	16.5	16.1	15.5
2	16.2	17.9	21.9	13.5	14.3	16.0
3	19.5	17.4	12.7	17.5	15.1	10.4
4	15.0	14.0	11.5	16.1	14.1	10.4
5	9.3	9.4	9.5	10.9	11.2	11.7
6	5.8	5.8	5.9	5.9	6.0	6.3
7	4.3	3.9	3.1	4.9	4.7	4.3
8	4.3	4.0	3.2	5.0	4.8	4.5
9	2.6	3.5	5.5	3.7	5.4	8.6
10	3.2	3.9	5.7	6.0	8.2	12.4
Total	100	100	100	100	100	100
Total number	1410103	2024704	614601	2064006	3137290	1073284

Note: The total number refers to employed persons with an ANZSCO occupation code.

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

We see that those with bachelor degrees have fared well in the top two deciles, with the percentage increasing over the 10 year period for full-time jobs. However, this is not true for the third and fourth top deciles where the percentage of new jobs was considerably lower than the shares in 2011 (and this is true for both full-time and total employment). Another feature that is noticeable is that the distributions differ significantly between full-time and total employment. Those in full-time employment with a degree are employed in better paid jobs than those in part-time employment. It is also clear that having a degree does not guarantee a good job. For example, 21% of the new jobs were in the bottom two deciles, compared to 9.7% in 2011.

Table 9: Distribution across occupation income deciles of those with a diploma or advanced diploma, 2011 and 2021

Income decile	Full-time employment			Total employment		Distribution of new jobs (%)
	2011 (%)	2021 (%)	Distribution of new jobs (%)	2011 (%)	2021 (%)	
1	10.0	9.9	9.7	7.7	7.1	5.6
2	12.4	13.6	19.7	9.6	9.8	10.6
3	13.0	12.2	8.3	10.6	9.3	5.2
4	10.1	9.0	4.0	9.5	7.6	1.6
5	11.3	9.8	2.7	11.1	9.1	3.0
6	10.1	10.2	10.9	9.5	9.4	9.0
7	8.3	7.8	5.2	8.5	8.0	6.4
8	9.0	9.3	11.0	9.9	10.8	13.4
9	6.6	8.8	19.4	8.5	12.0	22.5
10	9.3	9.3	9.2	15.0	16.9	22.7
Total	100	100	100	100	100	100
Total number	636502	767918	131416	991207	1317937	326730

Note: The total number refers to employed persons with an ANZSCO occupation code.

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

The distribution of jobs of persons with a diploma is very even across the deciles for both full-time and total employment, and this feature has changed little between the two censuses.

Table 10: Distribution across occupation income deciles of those with a certificate III/IV, 2011 and 2021

Income decile	Full-time employment			Total employment		
	2011 (%)	2021 (%)	Distribution of new jobs (%)	2011(%)	2021(%)	Distribution of new jobs (%)
1	4.2	4.8	16.5	3.5	3.7	5.0
2	6.8	7.6	21.6	5.7	5.9	6.6
3	5.7	5.9	9.5	4.9	4.7	3.7
4	9.6	9.5	8.1	8.3	7.6	4.0
5	14.3	13.6	-0.4	12.7	11.3	4.0
6	11.3	11.9	22.9	10.5	10.6	11.2
7	14.1	12.9	-8.1	13.4	12.1	5.3
8	12.6	12.0	1.2	12.4	11.5	7.3
9	12.5	12.9	19.6	14.0	15.7	24.4
10	8.9	8.9	9.1	14.6	16.9	28.6
Grand Total	100	100	100	100	100	100
Total number	1399307	1478486	79179	1931003	2316730	385727

Note: The total number refers to employed persons with an ANZSCO occupation code.

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

Overall, those with a certificate III/IV are over represented in the 5th to 9th deciles for full-time employment and in the 5th to 10th deciles for total employment, although there are considerable numbers of persons with a certificate III/IV in the top two deciles (but proportionately less than those with higher level qualifications). The growth over the period is a bit lumpy, with large numbers of those in full-time employment going to occupations in the 1st, 2nd, 6th and 9th deciles. By contrast the largest growth in terms of total employment occurred in the bottom two deciles.

Table 11: distribution across occupation income deciles of those with an ‘other certificate’, 2011 and 2021

Income decile	Full-time employment			Total employment		
	2011	2021	Distribution of new jobs	2011	2021	Distribution of new jobs
1	5.0	6.1	24.1	3.4	3.9	7.2
2	6.7	8.1	30.9	4.7	5.4	9.7
3	6.1	6.1	5.0	4.6	4.3	2.6
4	6.4	6.9	15.1	5.0	5.1	5.3
5	10.4	10.4	10.1	7.9	7.8	6.8
6	11.3	11.0	6.1	9.7	9.1	5.3
7	12.1	11.3	-2.0	11.2	10.6	6.7
8	13.6	12.2	-11.0	13.7	11.9	0.8
9	11.6	13.7	47.3	13.5	16.2	32.9
10	16.8	14.3	-25.6	26.2	25.8	22.7
Total	100	100	100	100	100	100
Total number	173493	184128	10635	309390	358629	49239

Note: The total number refers to employed persons with an ANZSCO occupation code.

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

Table 12: Distribution across occupation income deciles of those with no post-school qualification, 2011 and 2021

Income decile	Full-time employment			Total employment		
	2011 (%)	2021 (%)	Distribution of new jobs (%)	2011 (%)	2021 (%)	Distribution of new jobs (%)
1	4.6	5.5	-1.6	3.2	3.5	-7.2
2	5.6	6.7	-1.6	3.8	4.2	-9.7
3	4.8	4.8	-4.9	3.5	3.3	-2.6
4	5.9	6.1	-5.1	4.5	4.5	-5.3
5	9.1	8.6	-10.7	6.8	6.1	-6.8
6	12.9	13.2	-11.6	10.1	9.7	-5.3
7	12.6	11.6	-16.1	11.3	10.3	-6.7
8	14.0	12.5	-19.2	12.9	10.7	-0.8
9	14.7	16.1	-10.0	15.3	16.7	-32.9
10	15.7	14.7	-19.2	28.5	30.9	-22.7
Total	100	100	-100	100	100	-100
Total number	2280349	1773322	-507027	4069592	3613755	-455837

Note: The total number refers to employed persons with an ANZSCO occupation code.

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

The patterns for those with some other certificate or no qualification are similar. While there are considerable numbers of individuals in the top two income deciles the weight of the distributions is in the lower half of the income distribution. We see that credentials are becoming more important across the board, with the biggest change occurring in the lower deciles. For example, in terms of total employment 55.6% of the loss of jobs for those with no post-school qualification has occurred in the bottom two deciles, indicating that credentials are becoming important even in the lowest paid jobs.

4. A shift share analysis

We now undertake a further piece of analysis in order to understand what is going on. The technique we employ is a shift-share analysis in which we endeavour to uncover the main drivers of changes in the number of persons with a particular qualification. In particular, we decompose the change in employment levels of persons with a particular qualification in terms of growth in the occupations where those persons work, the change in the share of employment of persons with that qualification within each occupation, and the overall growth of the workforce.

The derivation is given in Appendix II.

The first term in the decomposition we label the qualification share effect (the impact of the qualification changing its share of jobs within occupations), the second term the occupation share effect (reflecting the change in importance of each occupation) and the third term the overall growth effect (reflecting the overall growth in the workforce).⁵

We now present a series of tables presenting the shift share decomposition. The first table looks at full-time employment while the second at total employment.

We explain the intuition of the shift share analysis by way of the first row in Table 13. We see that the number of persons in full-time employment with a higher degree increased by 68.8% between 2011 and 2021. If the structure of the workforce had remained the same over this period (that is, no change in the occupational structure and no change in the proportion of persons in an occupation holding a higher degree) we would have expected the number of persons in a full-time job with a higher degree to have increased by 10.8%. This gives us the overall growth effect. If we take into account that some occupations grew faster than others, and abstract from the overall growth, then the number of persons in full-time employment with a higher degree would have had to increase by 15.0% in order to keep the proportion of persons in each occupation with a higher degree constant. This is labelled the occupational share effect. Finally, the remaining component (68.8% less 10.8% and 15.0%) reflects the growth which is represents an increase in the proportion of jobs held within an occupation by persons with a higher degree.⁶

⁵ The attribution of growth to the occupation share effect and the qualification share effect does depend on the level of the occupation classification. If the occupation classification is coarse then one would expect the occupational share effect to be less important and the qualification share effect to be more important. The occupational classification used in the analysis is 4 digit ANZSCO, a very fine classification. This means that the occupational share effect captures changes in the distribution of jobs within one, two and three digit ANZSCO occupations.

⁶ In the shift share analysis we calculate the percentage change based on the mid-point between the two time periods rather than the conventional approach of calculating change as a percentage of the base period. This approach improves the accuracy of the decomposition, especially when the changes are large.

Table 13: Decomposition of the percentage change (evaluated at the mid-point) in full-time employment by qualification level

	Qualification share effect	Occupational share effect	Overall growth effect	Total
Higher degree	43.1	15.0	10.8	68.8
Bachelor degree	13.5	11.4	10.8	35.7
Diploma or advanced diploma	5.8	2.1	10.8	18.7
Certificates III and IV	1.6	-6.8	10.8	5.6
Other certificates	1.0	-5.8	10.8	6.0
No post school qualification	-26.5	-9.1	10.8	-24.7

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

Table 14: Decomposition of the percentage change (evaluated at the mid-point) in total employment by qualification level

	Qualification share effect	Occupational share effect	Overall growth effect	Total
Higher degree	45.6	10.5	18.0	74.1
Bachelor degree	15.9	7.6	18.0	41.5
Diploma/advanced diploma	7.8	2.6	18.0	28.4
Certificates III and IV	3.7	-3.5	18.0	18.3
Other certificates	-0.4	-2.9	18.0	14.8
No post school qualification	-23.9	-5.7	18.0	-11.6

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

From this table we see from the occupational share effect that changes in the occupational structure of the labour market have been particularly favourable to those with a higher degree, reasonably favourable for those with a bachelor degree, relatively neutral for those with a diploma and unfavourable for those with a certificate. The changes in the occupational structure of the labour market has not been kind to those with the VET qualifications.

The qualification share effect essentially shows the level of changes in the number of qualifications over and above those needed to 'satisfy' the demands of the labour market as reflected by the occupational structure of the labour market. Thus we see that the increase in the number of those with a higher degree is driven by the increase in supply of those with the qualification, leading to a very significant increase in the share of qualifications. Similarly, there was a large qualification effect for those with bachelor degrees and more modest effects for those with a diploma or a certificate III/IV. Not surprisingly, these positive qualification share effects are balanced by a very significant and negative effect for those with no post-school qualification. This large shift toward credentials can be interpreted as either credentialism (if one believes that the jobs do not really require this level of qualification) or skills deepening (if one believes that changes in the nature of jobs leads to an increase in qualification levels). No doubt there is truth in both of these interpretations, but it is clear that the expectations concerning the sort of job a person is likely to get with a certain type of qualification will have to be revised.

We can go an extra step in our analysis by analysing in which occupations the qualification effect is being concentrated. We do this in two ways: first we group by the income deciles we have created earlier; second we group by the skill levels defined by the Australian Bureau of Statistics⁷.

Because the paper is focused on vocational education and training we present here only those tables for persons with a diploma and those with a certificate; however, the full set is provided in Appendix III.

Table 15: Decomposition of the percentage change (evaluated at the mid-point) in full-time employment for those with a diploma, by income decile

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.5	2.2	1.1	1.8
2	-0.6	2.8	1.4	3.7
3	-0.9	1.1	1.4	1.6
4	-0.7	0.4	1.0	0.7
5	-0.5	-0.2	1.1	0.5
6	1.3	-0.4	1.1	2.0
7	1.8	-1.7	0.9	1.0
8	2.6	-1.5	1.0	2.1
9	2.7	0.1	0.8	3.6
10	1.6	-0.9	1.0	1.7
Total	5.8	2.1	10.8	18.7
ABS Skill level				
1	-6.8	5.9	4.0	3.0
2	3.0	0.1	2.7	5.8
3	2.2	-1.4	1.5	2.3
4	5.6	-1.3	2.0	6.3
5	1.8	-1.2	0.6	1.2
Total	5.8	2.1	10.8	18.7

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

⁷ANZSCO assigns occupations to one of five skill levels. The determination of boundaries between skill levels is based on the following definitions. Skill Level 1: a level of skill commensurate with a bachelor degree or higher qualification. At least five years of relevant experience may substitute for the formal qualification. Skill Level 2: a level of skill commensurate with an AQF Associate Degree, Advanced Diploma or Diploma. At least three years of relevant experience may substitute for the formal qualifications. Skill Level 3: a level of skill commensurate with Certificate IV or Certificate III including at least two years of on-the-job training. At least three years of relevant experience may substitute for the formal qualifications listed above. Skill Level 4: a level of skill commensurate with a Certificate II or III. At least one year of relevant experience may substitute for the formal qualifications listed above. Skill Level 5: Occupations at Skill Level 5 have a level of skill commensurate with Certificate I or compulsory secondary education.

Table 16: Decomposition of the percentage change (evaluated at the mid-point) in total employment for those with a diploma, by income decile

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.0	1.3	1.3	1.6
2	-0.4	1.7	1.7	3.0
3	-0.7	0.4	1.8	1.5
4	-1.1	-0.1	1.5	0.4
5	-1.1	0.1	1.8	0.8
6	1.2	-0.3	1.7	2.6
7	1.7	-1.4	1.5	1.8
8	3.0	-1.0	1.9	3.9
9	3.4	1.2	1.9	6.5
10	2.9	0.7	2.9	6.5
Total	7.8	2.6	18.0	28.4
ABS skill level				
1	-6.7	3.4	5.8	2.5
2	3.2	0.9	4.0	8.1
3	2.4	-0.7	2.6	4.3
4	6.2	0.0	4.0	10.1
5	2.7	-1.0	1.7	3.4
Total	7.8	2.6	18.0	28.4

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

We see a very definite pattern emerge. For persons with diploma the favourable change in labour market structure has occurred in the high income deciles but this has been offset by losses in share in the occupations. Diplomas have gained share only in the bottom half of the distribution of jobs by income. Exactly the same pattern is observed if we use the ABS skills classification, with diplomas losing share in the highest skill jobs (category 1) and gaining share in the lower skill level jobs.

We now present the same data for those with a certificate III/IV.

Table 17: Decomposition of the percentage change (evaluated at the mid-point) in full-time employment for those with a certificate III/IV, by income decile

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-0.2	0.6	0.5	0.9
2	-0.9	1.4	0.8	1.2
3	-0.3	0.2	0.6	0.5
4	0.0	-0.6	1.0	0.4
5	-0.1	-1.4	1.5	0.0
6	0.7	-0.6	1.3	1.3
7	0.5	-2.4	1.5	-0.4
8	0.7	-2.0	1.3	0.1
9	0.3	-0.5	1.4	1.1
10	1.0	-1.4	1.0	0.5
Total	1.6	-6.8	10.8	5.6
ABS skill level				
1	-1.7	1.8	1.6	1.6
2	-0.4	-0.4	1.4	0.7
3	-0.4	-5.6	4.5	-1.6
4	2.9	-1.2	2.4	4.2
5	1.3	-1.4	0.9	0.7
Total	1.6	-6.8	10.8	5.6

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

Table 18: Decomposition of the percentage change (evaluated at the mid-point) in total employment for those with a certificate III/IV, by income decile

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-0.1	0.4	0.7	0.9
2	-0.7	0.9	1.0	1.2
3	-0.2	0.0	0.9	0.7
4	0.1	-0.8	1.4	0.7
5	-0.3	-1.1	2.2	0.7
6	0.7	-0.6	1.9	2.0
7	0.6	-2.0	2.3	1.0
8	0.9	-1.7	2.2	1.4
9	0.6	1.2	2.7	4.5
10	2.2	0.2	2.8	5.2
Total	3.7	-3.5	18.0	18.3
ABS Skill level				
1	-1.5	1.0	2.3	1.8
2	-0.4	0.2	2.2	2.1
3	-0.4	-4.2	6.7	2.1
4	3.8	0.6	4.7	9.1
5	2.3	-1.1	2.1	3.2
Total	3.7	-3.5	18.0	18.3

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

We see that those with a certificate III/IV have lost share in the higher income and higher skill jobs. The qualification share effect is only positive for the 6th to 10th income deciles (with the exception of a value of 0.1% for total employment in the fourth decile) and skill levels 4 and 5 – the two lowest skill categories. Thus the overall modest positive qualification effect masks a compositional shift with certificate III/IV holders losing share in the better jobs and gaining share in the lower paid and lower skill level jobs. It seems that persons with a certificate III/IV are displacing those with no post school qualification in the bottom part of the labour market.

5. Fields of study

As a final piece of analysis we add an extra layer to our decomposition by looking at fields of study within each qualification. The derivation is provided in Appendix II. While we could identify an effect corresponding to the change in the share of a field of study within a qualification level on top of the change in the share of the qualification level, we choose to aggregate these effects. Thus the effect we present is the qualification effect for each field of study. This represents the growth attributable to the share of jobs within an occupation held by individuals with a specific field of study and qualification level. It is essentially the qualification share effect for a field of study.

In order to keep the number of tables manageable we present the results for the decomposition of total employment for the two VET qualification groups we are primarily interested in: diplomas/advanced diplomas and certificates III/IV.

Table 19: Qualification share effect for certificates III/IV and diplomas/advanced diplomas, by field of study, 2011 to 2021, total employment

	Certificate III/IV		Diplomas and advanced diplomas	
	Field of study share 2011	Qualification share effect	Field of study share 2011	Qualification share effect
Natural and Physical Sciences	0.2	20.8	1.4	-4.5
Information Technology	1.1	13.4	4.5	7.0
Engineering and Related Technologies	39.2	-12.7	11.2	-4.1
Architecture and Building	16.9	7.3	3.0	18.0
Agriculture, Environmental and Related Studies	3.3	-4.7	2.9	-8.1
Health	4.1	7.6	11.8	12.1
Education	1.3	77.2	7.4	-13.4
Management and Commerce	12.2	16.9	31.9	8.5
Society and Culture	7.2	39.9	12.9	13.2
Creative Arts	1.5	18.9	6.4	15.6
Food, Hospitality and Personal Services	12.9	-3.7	6.6	18.4
Mixed Field Programmes	0.0	23.7	0.0	48.1
Total	100	3.7	100	7.8

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

We see that the overall effect is very variable across the various fields of study. For certificates III/IV overall there has been an increase in the share of the qualification, but there were decreases in two sizeable fields -engineering and related technologies and food, hospitality and personal services. The increase in shares were substantial for management and commerce, society and culture, and architecture and building. We also saw very large percentage increases in a number of fields but on very small bases (for example, natural and physical sciences, education, creative arts). For diplomas overall the qualification share effect was larger than for certificates III/IV, with sizeable positive effects for a number of fields with substantial numbers, including health, and society and culture and management and commerce. There were, however, a number of fields which the qualification share effect was negative. The largest of these fields was engineering and related technologies and education.

The analysis does not isolate the causal factors behind these changes in share. However, there is little doubt that changes in regulatory regimes in childcare and community care more generally are a key driver. The negative share effect for education diplomas is likely to reflect the adoption of a degree as the minimum qualification needed to be a teacher. A similar driver is most likely behind the negative qualification share effect for diplomas in engineering and related technologies. The very large increase in education certificates III/IV no doubt reflects the credentialing that has occurred in childcare. In this respect we have seen the VET system produce large numbers of diplomas in the field of education in recent years, but this increase has not been reflected in an overall increase in the share of education diplomas (noting that a diploma in education was a very common qualification for many years).

We complete our analysis by showing how these overall changes have been reflected across jobs, using the income deciles and ABS skill levels as before. In the following tables, we present the results restricted to those fields where there are large numbers of individuals.

Table 20: Qualification share effect for certificates III/IV, by selected fields of study, 2011 to 2021, total employment

Income decile	Engineering and Related Technologies	Architecture and Building	Management and Commerce	Food, Hospitality and Personal Services	Society and Culture
1	-0.7	-0.1	0.1	0.1	1.2
2	-0.6	-1.1	-0.3	-0.6	1.4
3	-1.1	-0.2	-0.3	-0.2	1.5
4	-0.7	0.0	-0.7	-0.6	2.1
5	-1.2	-0.2	0.7	-0.2	3.7
6	-2.7	0.6	1.5	0.7	5.5
7	-4.9	0.3	1.8	0.4	5.2
8	-0.8	1.1	1.4	0.1	4.0
9	-1.2	5.5	8.7	-0.3	7.6
10	1.2	1.3	3.9	-3.0	7.8
Total	-12.7	7.3	16.9	-3.7	39.9
ABS skill level					
1	-2.4	-1.9	-1.3	-1.8	6.8
2	-2.1	-0.9	0.2	0.0	4.4
3	-8.5	5.9	1.4	-1.8	6.2
4	0.4	2.9	12.2	0.6	13.3
5	0.0	1.3	4.4	-0.7	9.3
Total	-12.7	7.3	16.9	-3.7	39.9

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

We see that on the whole the pattern of losses or gains in shares has a negative flavour. In engineering and related technologies the qualification share has decreased except in respect of jobs in the lowest income decile and the lowest two ABS skill levels. For architecture and building the overall share effect is positive but the effect is negative for the top five income deciles and the top two ABS skill levels. Similarly, management and commerce certificates III/IV have increased their share overall (16.9%) but we see negative share effects in the top income deciles and the top ABS skill level. The picture is a little more mixed for food, hospitality and personal service with negative effects for the 2nd, 3rd, 4th, 5th, 9th and 10th income deciles, and the 1st, 3rd and 5th ABS skill levels. Finally, the qualification share effect is positive in every part of the jobs distribution for society and culture certificates, but the largest gains are in the lower half of the income distribution and 4th and 5th ABS skill levels.

Table 21: Qualification share effect for diplomas and advanced diplomas, by selected fields of study, 2011 to 2021, total employment

Income decile	Engineering and Related Technologies				
	Management and Commerce	Society and Culture	Health	Technologies	Education
1	-1.0	-0.3	-0.7	-2.9	-2.0
2	0.0	0.6	-0.4	-3.4	-1.9
3	-0.9	0.2	-0.6	-2.9	-2.2
4	-1.0	-0.2	-0.7	-2.3	-5.0
5	-1.0	-0.7	-0.8	-2.4	-2.7
6	0.9	1.7	1.5	0.8	-0.5
7	1.7	2.4	1.9	1.1	-2.0
8	2.8	4.0	3.5	2.7	-0.7
9	3.9	3.6	4.1	2.8	-0.3
10	3.0	1.8	4.4	2.4	4.0
Total	8.5	13.2	12.1	-4.1	-13.4
ABS skill level					
1	-6.1	-4.6	-6.1	-11.8	-15.5
2	3.0	5.4	3.7	0.0	-1.0
3	2.9	0.9	2.6	0.8	5.9
4	5.9	7.9	8.0	5.0	-1.6
5	2.7	3.6	3.9	1.9	-1.1
Total	8.5	13.2	12.1	-4.1	-13.4

Source: Census of Population and Housing, 2011, Census of Population and Housing, 2021, TableBuilder

The overwhelming feature of the table is that diplomas and advanced diplomas are losing share in the top half of jobs sorted by income and in the top ABS skills level. Where there are gains in share they tend to be in the bottom half of the distribution (by income) and the lower two ABS skill levels. Education is interesting with an overall decrease in the qualification share of 13.4%. In the income distribution the qualification share effect is negative in every decile except the bottom decile. This most likely reflects the impact of an expansion in degrees at the expense of diplomas, with a degree now necessary to become a teacher, and an explosion in diplomas in childcare following regulation of the child care industry. We seem to be witnessing a long-term change in which degrees are pushing out diplomas, but diplomas in some cases are now pushing out certificates.

6. Discussion

This paper has taken a descriptive approach to changes in the labour market over the ten years 2011 to 2021, exploiting the very granular data produced from the Census of Population and Housing by the Australian Bureau of Statistics. Our primary interest is in the relationship between what is happening in the occupational distribution of jobs and the qualification profile of the workforce. We look at the occupational distribution in a number of ways. In addition to using the aggregate ABS classification (for example, professionals, managers) we rank jobs (more specifically four digit ANZSCO occupations) by average income and also according to the five ABS skill levels categories. In terms of qualifications we group qualifications into six categories: higher degrees, bachelor degrees

and equivalent, diplomas and advance diplomas, certificates III/IV and two residual categories comprising 'other certificates' and no post-school qualification. Under current institutional arrangements the first two are the purview of Higher Education and the second two of Vocational Education and Training. We should also note that the data refers to the highest qualification, so individuals who upgrade their qualifications are counted under their highest qualification. We also make use of the field of study which is collected in the Census.

The stylised factors to emerge are the following:

Between 2011 and 2021 occupational change has been significant. It is certainly not the case that the workforce in 2021 is just a larger version of 2011. In terms of full-time employment growth has been strongest in community and personal service workers, professionals and managers. All remaining broad occupational groups had less than average growth, with lowest growth among clerical and administrative workers, sales and technicians and trades workers.

If we rank occupations by average income (the occupation with the highest average income in 2011 was surgeons and anaesthetists) then it is clear that employment growth has been biased in a number of ways. Sorting the occupations into income deciles defined in terms of full-time employment, we see that growth in full-time employment has been strongest in the top four income deciles (and especially in the top two), while growth in total employment was strongest in the top four income deciles and the bottom two. That is, full-time jobs have been strongly biased toward the better paid jobs, while growth in all jobs has shown a hollowing out of the occupation distribution with growth at the top and bottom at the expense of the middle. It is clear that the growth in part-time jobs has tended to be in the poorer paying jobs.

This pattern is consistent with Baldwin's 'grand transformation' in which skilled and semiskilled jobs are disappearing. There is no evidence, however, that professional jobs have been impacted yet, although commentators suggest that artificial intelligence (and professionals in low wage countries) may make many professional roles redundant.

Our analysis, however, has another wrinkle which is an important part of the story, and this is the rapid increase in credentials. It is the intersection of the increase in credentials with the significant occupational structure change which will impact on the employment prospects of individuals. In respect of qualifications, the period 2011 to 2021 was one of growth in credentials, particularly in higher degrees and bachelor degrees. The strongest growth was in higher degrees where the proportion of employed persons with a higher degree increased from 5.1% to 9.1%, while the proportion with a bachelor degree increased from 20.8% to 26.3%. Diplomas increased a little while the proportion of employed persons with a certificate III/IV remained constant (at 19.5%). There are now more people with a degree than with a certificate III/IV. The groups which have seen a decline are those with an 'other certificate' (which include certificates I and II and those qualifications that fall outside the AQF) and those with no non-school qualification. The decline has been very significant in respect of the latter, declining 8.7% points from 37.4% to 28.7%.

The very large increase in persons with qualifications is much larger than can be accommodated by the changes in the occupational structure. That is, having a qualification does not automatically imply that the individuals will gain a job commensurate with the qualification. So, for example, if we look at the 'new' jobs (the net increase in employment between 2011 and 2021) for persons with a higher degree, over 12% of them are in the two lowest income deciles. Similarly, over 20% of new jobs for those with a bachelor degree are in the two lowest income deciles. It seems that a university degree may be a gateway into a well paid job but provides no guarantee. In terms of diplomas, new

jobs have occurred across the income distribution but with relatively high numbers in the bottom three income deciles for all employment and at the top and bottom of the distribution for full-time jobs. Interestingly, the largest increase for full-time jobs is in the second highest decile. If we look at persons with a certificate III/IV we see in terms of all jobs over 50% of new jobs have occurred in jobs in the lowest two income deciles. The new full-time jobs are more widely spread but large increases were seen in the 2nd, 6th and 9th deciles. Finally, the decline in employment in persons with no post-school qualification is concentrated in the lowest two income deciles, while the decline in full-time jobs has mostly been in the lower half of the jobs. The obvious conclusion is that persons with no post-school qualification are being displaced by people with credentials, predominantly in the poorer paid jobs. Credentials are becoming increasingly important even in lower paid jobs.

The interplay between increases in qualification levels and the changing occupational structure is illuminated through a shift share analysis. What this analysis does is to decompose, in an accounting sense, the change in number of persons in jobs into three components: a qualification share effect which captures changes in the share of jobs within occupations; an occupational share effect, reflecting the change associated with differential growth in occupations; and an overall growth effect which reflects the overall increase in the total number of jobs. While this is an accounting identity, a simple interpretation of the qualification share effect is that it reflects an increase in the supply of persons with that qualification over and above that needed to maintain the proportion of people in an occupation with that qualification. This supply interpretation is consistent with the idea of credentialism or alternatively changes in demand at the occupational level so that particular jobs increasingly require a qualification. Unfortunately, the data do not allow us to differentiate between what is driving the increase in qualification share.

The results of the shift share analysis show clearly two important structural changes. First, the change in the occupation structure clearly favour those with higher degrees and degrees (especially those with higher degrees), is relatively neutral for those with diplomas and is unfavourable for those with a certificate III/IV. It is also very unfriendly to those with no post-school qualification. Second, the qualification share effect shows that it is the increase in supply of persons with qualifications that is dominant for those with higher degrees, and to a lesser extent for those with bachelor degrees. The shares of those with diplomas and certificates have also increased but to a much more modest extent.

If we put both of these effects together the group that was disadvantaged on both counts was those with no post-school qualification. This group has faced both an unfriendly change in the occupational structure, and an increase in competition from those with qualifications.

In the analysis, we have also dug a little deeper for two qualification levels associated with vocational education and training; diplomas and certificates III/IV. In particular we can see where the groups have been losing or gaining share of the jobs within occupations. At the aggregate level, we saw that those with diplomas had gained share, but we see that this gain overall is actually reflecting an increase in the share in the lower paying jobs (bottom half of the distribution) and losing share in the higher paying jobs. The same pattern is observed for those with a certificate III/IV.

These results are at the total qualification level, and we can further disaggregate the analysis by field of study. If we do this, we find that there have been some declines in the share of qualifications for a number of fields of study, notably engineering and related technologies (both diplomas and certificates III/IV) and education (diplomas). This is despite the share of qualifications increasing for

the overall qualification. We can also see how this plays out across the jobs distribution. The general finding is that there has been a loss in qualification share among the better paid jobs.

The overall lesson that emerges is that the labour market has become increasingly unfriendly for persons with a diploma or a certificate III/IV. First the growth in occupations has not been in those occupations associated with the VET qualifications. Technicians and trades workers are growing much more slowly than the overall labour market. Second, these qualifications are being pushed aside by higher degrees and bachelor degrees and have only maintained their position by pushing out those with no post-school qualifications. This has tended to occur in the lower paying jobs. Thus VET appears to be caught in a pincer movement.

The discussion would not be complete without a reference to the role of regulation. Clearly, increased output by education institutions will impact on the shares of employment held by persons with different qualification levels. But changes to regulatory structures are likely to be an important driver. In the professions, a degree is the entry level qualification almost universally (a masters degree to be a clinical psychologist) and a diploma will not be sufficient. In childcare, we see that a certificate III is the mandatory qualification, and diplomas are becoming more common (hence the rapid increase in education diplomas in recent years). In aged care we have seen a push for more credentialed staff. These changes to regulatory regimes are both an opportunity for VET but also a possible threat. The opportunity tends to be at lower level jobs where persons with no post-school qualification are being channelled into certificates, while the threat is at higher level jobs. For example, one would have thought that it is almost inevitable that childcare/education degrees will supplant diplomas at some stage. We also note that community and personal service workers is the one occupational group with a strong relationship with VET qualifications which is likely to continue with strong employment growth. But in this occupational group we have seen higher growth in persons with degrees compared to persons with certificates III/IV.

The point is that the outlook is less than benign for VET if we define it in terms of qualifications (that is, diplomas and certificates). The occupational structure is changing in a way not sympathetic to these qualifications, and the supply of persons with degrees is only going to increase, making the lower level qualifications less competitive. In earlier work (Karmel 2022), an analysis of trends in the numbers undertaking diplomas and degrees concluded that degrees have supplanted diplomas in the majority of fields of study, including the natural and physical sciences, information technology, engineering and related technologies, agriculture, environmental and related studies, health, society and culture and the creative arts. Education is the one field where we have seen very strong growth in diplomas, and this is associated with changes to the regulatory framework in childcare and early education. Health has also seen some growth in the provision of diplomas associated with enrolled nursing and some non-mainstream health therapies including massage. We also noted that the ATAR scores needed to enter higher education have been declining over the last 20 years.

This earlier work pointed out to the difficulty of VET competing with higher education. The results of the current analysis paints an even grimmer picture for VET, and strengthen the argument for radical reform if we want VET to be a more important player in the post-school education firmament than a residual provider of lower level training to meet short term industry needs. The sort of reform I am talking about is the idea of a high level vocational approach as a genuine alternative to the more academic approach of universities (with its emphasis on research), as spelt out in Karmel and Mackenzie 2022. We envisaged a tertiary institution – which we labelled a ‘professional university’, focused on teaching and practice, delivering VET certificates, diplomas and bachelor degrees (and

may be course work masters degrees). Ideally, there would be pathways from certificates to diplomas and degrees.

Unless there is radical reform of this nature, the future of VET will be restricted to lower level industry training. This would be a great pity for those who believe we benefit from having a number of educational approaches including high quality training based on a practical approach. Surely, we all benefit from having a range of educational approaches rather than that provided by large comprehensive research (actual or aspiring) universities.

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Appendix I: Derivation of occupational income index

To construct this index we estimated the average weekly income of persons employed full-time. The average was estimated by:

- Excluding those whose income was less than \$400 per week. This figure was chosen as the income range that was less than the legal minimum wage of \$589.30 per week (Hamilton 2022, page 74). Those with negative incomes were included in the exclusions.
- Estimating an upper bound for the top income interval of more than \$2000 per week. This was done by assuming that the distribution in the top two intervals (i.e. \$1500-\$2000 and \$2000 plus) was uniform. For example if there were 1000 persons in the 1500-2000 interval and 1500 in the 2000+ interval the upper bound was estimated by $\$2000 + 1500 / 1000 * 500 = \2750
- The deciles were determined using the total number of full-time employed persons in an occupation (irrespective of whether they were excluded or not from the estimation of average income).

Table A1: Estimated average weekly income from the 2011 Census, by 4 digit ANZSCO

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
2535 Surgeons	4700	1
2532 Anaesthetists	4153	1
1110 Chief Executives, General Managers and Legislators nfd	3365	1
2534 Psychiatrists	3363	1
2533 Specialist Physicians	3302	1
2539 Other Medical Practitioners	2910	1
2336 Mining Engineers	2853	1
2523 Dental Practitioners	2743	1
2711 Barristers	2498	1
2530 Medical Practitioners nfd	2450	1
1332 Engineering Managers	2419	1
1113 Legislators	2418	1
2531 Generalist Medical Practitioners	2349	1
1111 Chief Executives and Managing Directors	2344	1
1351 ICT Managers	2196	1
1112 General Managers	2167	1
2712 Judicial and Other Legal Professionals	2164	1
2344 Geologists and Geophysicists	2153	1
1322 Finance Managers	2148	1
3992 Chemical, Gas, Petroleum and Power Generation Plant Operators	2062	1
1343 School Principals	2060	1
2713 Solicitors	2045	1
1325 Research and Development Managers	2044	1
1324 Policy and Planning Managers	2013	1
2222 Financial Dealers	2007	1
2311 Air Transport Professionals	1960	1
2252 ICT Sales Professionals	1947	1
1323 Human Resource Managers	1933	1
1320 Business Administration Managers nfd	1931	1
2243 Economists	1926	1
3129 Other Building and Engineering Technicians	1920	1
2331 Chemical and Materials Engineers	1916	1
1300 Specialist Managers nfd	1907	1
2611 ICT Business and Systems Analysts	1906	1
2333 Electrical Engineers	1895	1
2220 Financial Brokers and Dealers, and Investment Advisers nfd	1892	1
7122 Drillers, Miners and Shot Firers	1890	1
2223 Financial Investment Advisers and Managers	1859	1

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
2600 ICT Professionals nfd	1857	1
2332 Civil Engineering Professionals	1852	1
1330 Construction, Distribution and Production Managers nfd	1830	1
2421 University Lecturers and Tutors	1823	1
2710 Legal Professionals nfd	1819	1
2245 Land Economists and Valuers	1819	1
1311 Advertising, Public Relations and Sales Managers	1798	2
2330 Engineering Professionals nfd	1796	2
2312 Marine Transport Professionals	1795	2
2247 Management and Organisation Analysts	1791	2
2610 Business and Systems Analysts, and Programmers nfd	1774	2
1344 Other Education Managers	1767	2
2241 Actuaries, Mathematicians and Statisticians	1740	2
1391 Commissioned Officers (Management)	1737	2
2514 Optometrists and Orthoptists	1734	2
2633 Telecommunications Engineering Professionals	1724	2
2335 Industrial, Mechanical and Production Engineers	1722	2
1390 Miscellaneous Specialist Managers nfd	1715	2
2300 Design, Engineering, Science and Transport Professionals nfd	1708	2
1000 Managers nfd	1701	2
1399 Other Specialist Managers	1700	2
2613 Software and Applications Programmers	1695	2
1336 Supply and Distribution Managers	1689	2
2200 Business, Human Resource and Marketing Professionals nfd	1686	2
1340 Education, Health and Welfare Services Managers nfd	1680	2
2339 Other Engineering Professionals	1677	2
2240 Information and Organisation Professionals nfd	1670	2
2349 Other Natural and Physical Science Professionals	1661	2
2212 Auditors, Company Secretaries and Corporate Treasurers	1652	2
1321 Corporate Services Managers	1646	2
2340 Natural and Physical Science Professionals nfd	1646	2
1342 Health and Welfare Services Managers	1634	2
2244 Intelligence and Policy Analysts	1625	2
1335 Production Managers	1624	2
2630 ICT Network and Support Professionals nfd	1623	2
2631 Computer Network Professionals	1622	2
2700 Legal, Social and Welfare Professionals nfd	1621	2
3126 Safety Inspectors	1620	2
2543 Nurse Managers	1620	2
1392 Senior Non-commissioned Defence Force Members	1614	2
2210 Accountants, Auditors and Company Secretaries nfd	1608	2

ANZSCO 4 digit		Estimated average weekly income (\$, 2011)	Decile
	Database and Systems Administrators, and ICT Security Specialists	1602	2
2621	Specialists	1600	2
2334	Electronics Engineers	1589	2
2326	Urban and Regional Planners	1588	2
2512	Medical Imaging Professionals	1581	2
3123	Electrical Engineering Draftspersons and Technicians	1579	2
2723	Psychologists	1577	2
7313	Train and Tram Drivers	1563	2
2221	Financial Brokers	1559	2
2491	Education Advisers and Reviewers	1559	2
1331	Construction Managers	1557	2
2211	Accountants	1555	3
2513	Occupational and Environmental Health Professionals	1553	3
2322	Surveyors and Spatial Scientists	1549	3
2347	Veterinarians	1546	3
1499	Other Hospitality, Retail and Service Managers	1542	3
2521	Chiropractors and Osteopaths	1535	3
2121	Artistic Directors, and Media Producers and Presenters	1533	3
2510	Health Diagnostic and Promotion Professionals nfd	1533	3
4410	Defence Force Members, Fire Fighters and Police nfd	1527	3
5100	Office Managers and Program Administrators nfd	1522	3
4413	Police	1521	3
2515	Pharmacists	1517	3
3400	Electrotechnology and Telecommunications Trades Workers nfd	1517	3
5111	Contract, Program and Project Administrators	1512	3
3121	Architectural, Building and Surveying Technicians	1510	3
2500	Health Professionals nfd	1507	3
2321	Architects and Landscape Architects	1502	3
3125	Mechanical Engineering Draftspersons and Technicians	1500	3
2632	ICT Support and Test Engineers	1499	3
4412	Fire and Emergency Workers	1493	3
3132	Telecommunications Technical Specialists	1492	3
2000	Professionals nfd	1490	3
2526	Podiatrists	1490	3
2414	Secondary School Teachers	1489	3
2542	Nurse Educators and Researchers	1486	3
7121	Crane, Hoist and Lift Operators	1484	3
2251	Advertising and Marketing Professionals	1481	3
2250	Sales, Marketing and Public Relations Professionals nfd	1481	3
6392	Retail and Wool Buyers	1481	3
3231	Aircraft Maintenance Engineers	1481	3

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
4111 Ambulance Officers and Paramedics	1481	3
2254 Technical Sales Representatives	1478	3
2346 Medical Laboratory Scientists	1471	4
2540 Midwifery and Nursing Professionals nfd	1470	4
2490 Miscellaneous Education Professionals nfd	1469	4
2343 Environmental Scientists	1465	4
1492 Call or Contact Centre and Customer Service Managers	1457	4
7120 Stationary Plant Operators nfd	1456	4
4400 Protective Service Workers nfd	1456	4
2249 Other Information and Organisation Professionals	1453	4
1333 Importers, Exporters and Wholesalers	1451	4
2415 Special Education Teachers	1449	4
2420 Tertiary Education Teachers nfd	1448	4
2341 Agricultural and Forestry Scientists	1447	4
2232 ICT Trainers	1446	4
8217 Structural Steel Construction Workers	1443	4
2345 Life Scientists	1443	4
6100 Sales Representatives and Agents nfd	1442	4
Middle School Teachers (Aus) / Intermediate School Teachers (NZ)	1442	4
2413 (NZ)	1442	4
2310 Air and Marine Transport Professionals nfd	1442	4
2525 Physiotherapists	1442	4
1490 Miscellaneous Hospitality, Retail and Service Managers nfd	1441	4
2253 Public Relations Professionals	1439	4
3422 Electrical Distribution Trades Workers	1438	4
5996 Insurance Investigators, Loss Adjusters and Risk Surveyors	1429	4
2233 Training and Development Professionals	1424	4
4420 Prison and Security Officers nfd	1418	4
3232 Metal Fitters and Machinists	1416	4
2320 Architects, Designers, Planners and Surveyors nfd	1414	4
2342 Chemists, and Food and Wine Scientists	1409	4
2422 Vocational Education Teachers (Aus) / Polytechnic Teachers (NZ)	1403	4
2124 Journalists and Other Writers	1396	4
2412 Primary School Teachers	1395	4
3120 Building and Engineering Technicians nfd	1390	4
2410 School Teachers nfd	1388	4
3122 Civil Engineering Draftspersons and Technicians	1387	4
6112 Insurance Agents	1386	4
2541 Midwives	1385	4
2242 Archivists, Curators and Records Managers	1384	4
2120 Media Professionals nfd	1377	4

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
2527 Speech Professionals and Audiologists	1372	4
2231 Human Resource Professionals	1359	4
2400 Education Professionals nfd	1358	4
6111 Auctioneers, and Stock and Station Agents	1357	4
2123 Film, Television, Radio and Stage Directors	1354	4
7129 Other Stationary Plant Operators	1351	4
2524 Occupational Therapists	1345	4
1494 Transport Services Managers	1341	4
2519 Other Health Diagnostic and Promotion Professionals	1340	4
2520 Health Therapy Professionals nfd	1337	4
8219 Other Construction and Mining Labourers	1333	4
2511 Dietitians	1323	4
2246 Librarians	1323	4
2493 Teachers of English to Speakers of Other Languages	1317	4
2724 Social Professionals	1315	4
2612 Multimedia Specialists and Web Developers	1314	4
8992 Deck and Fishing Hands	1314	4
8216 Railway Track Workers	1313	4
3130 ICT and Telecommunications Technicians nfd	1311	4
4112 Dental Hygienists, Technicians and Therapists	1309	4
4421 Prison Officers	1309	4
3124 Electronic Engineering Draftspersons and Technicians	1308	4
5522 Credit and Loans Officers (Aus) / Finance Clerks (NZ)	1308	4
5995 Inspectors and Regulatory Officers	1308	4
4524 Sportspeople	1302	4
5120 Office and Practice Managers nfd	1302	4
3411 Electricians	1302	5
3200 Automotive and Engineering Trades Workers nfd	1299	5
6121 Real Estate Sales Agents	1297	5
5122 Practice Managers	1292	5
3230 Mechanical Engineering Trades Workers nfd	1288	5
2725 Social Workers	1282	5
6212 ICT Sales Assistants	1278	5
6113 Sales Representatives	1274	5
3113 Primary Products Inspectors	1269	5
2721 Counsellors	1268	5
3131 ICT Support Technicians	1266	5
2544 Registered Nurses	1261	5
2100 Arts and Media Professionals nfd	1260	5
3000 Technicians and Trades Workers nfd	1250	5
2323 Fashion, Industrial and Jewellery Designers	1248	5

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
3110 Agricultural, Medical and Science Technicians nfd	1247	5
2230 Human Resource and Training Professionals nfd	1245	5
2122 Authors, and Book and Script Editors	1243	5
1334 Manufacturers	1241	5
7212 Earthmoving Plant Operators	1237	5
6000 Sales Workers nfd	1233	5
2325 Interior Designers	1224	5
6300 Sales Support Workers nfd	1224	5
2720 Social and Welfare Professionals nfd	1221	5
3100 Engineering, ICT and Science Technicians nfd	1218	5
3990 Miscellaneous Technicians and Trades Workers nfd	1216	5
3424 Telecommunications Trades Workers	1216	5
1400 Hospitality, Retail and Service Managers nfd	1208	5
4411 Defence Force Members - Other Ranks	1203	5
1414 Licensed Club Managers	1199	5
5910 Logistics Clerks nfd	1196	5
5211 Personal Assistants	1186	5
6399 Other Sales Support Workers	1185	5
2726 Welfare, Recreation and Community Arts Workers	1184	5
5990 Miscellaneous Clerical and Administrative Workers nfd	1183	5
1410 Accommodation and Hospitality Managers nfd	1183	5
7123 Engineering Production Workers	1178	5
5520 Financial and Insurance Clerks nfd	1178	5
3223 Structural Steel and Welding Trades Workers	1177	5
3510 Food Trades Workers nfd	1176	5
5521 Bank Workers	1175	6
1419 Other Accommodation and Hospitality Managers	1172	6
8210 Construction and Mining Labourers nfd	1171	6
2112 Music Professionals	1162	6
3420 Electronics and Telecommunications Trades Workers nfd	1161	6
7219 Other Mobile Plant Operators	1160	6
3211 Automotive Electricians	1159	6
2324 Graphic and Web Designers, and Illustrators	1157	6
7000 Machinery Operators and Drivers nfd	1155	6
5000 Clerical and Administrative Workers nfd	1154	6
1491 Amusement, Fitness and Sports Centre Managers	1154	6
5994 Human Resource Clerks	1153	6
1493 Conference and Event Organisers	1153	6
5912 Transport and Despatch Clerks	1152	6
3210 Automotive Electricians and Mechanics nfd	1152	6
5121 Office Managers	1151	6

ANZSCO 4 digit		Estimated average weekly income (\$, 2011)	Decile
1341	Child Care Centre Managers	1150	6
5900	Other Clerical and Administrative Workers nfd	1149	6
3995	Performing Arts Technicians	1147	6
3421	Airconditioning and Refrigeration Mechanics	1146	6
5513	Payroll Clerks	1144	6
4110	Health and Welfare Support Workers nfd	1144	6
8212	Concreters	1143	6
3341	Plumbers	1143	6
3220	Fabrication Engineering Trades Workers nfd	1137	6
3114	Science Technicians	1136	6
4517	Travel Attendants	1135	6
7210	Mobile Plant Operators nfd	1135	6
3321	Floor Finishers	1134	6
2411	Early Childhood (Pre-primary School) Teachers	1133	6
5500	Numerical Clerks nfd	1130	6
8911	Freight and Furniture Handlers	1130	6
5210	Personal Assistants and Secretaries nfd	1128	6
7111	Clay, Concrete, Glass and Stone Processing Machine Operators	1125	6
5911	Purchasing and Supply Logistics Clerks	1123	6
3922	Graphic Pre-press Trades Workers	1122	6
1413	Hotel and Motel Managers	1121	6
7331	Truck Drivers	1120	6
5523	Insurance, Money Market and Statistical Clerks	1118	6
3600	Skilled Animal and Horticultural Workers nfd	1117	6
2111	Actors, Dancers and Other Entertainers	1115	6
4117	Welfare Support Workers	1113	6
4512	Driving Instructors	1112	6
5510	Accounting Clerks and Bookkeepers nfd	1112	6
5991	Conveyancers and Legal Executives	1110	6
3423	Electronics Trades Workers	1109	7
3312	Carpenters and Joiners	1109	7
2492	Private Tutors and Teachers	1107	7
4523	Sports Coaches, Instructors and Officials	1105	7
8211	Building and Plumbing Labourers	1103	7
5999	Other Miscellaneous Clerical and Administrative Workers Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	1101	7
3240	nfd	1099	7
6210	Sales Assistants and Salespersons nfd	1098	7
3332	Plasterers	1096	7
3999	Other Miscellaneous Technicians and Trades Workers	1095	7
5992	Court and Legal Clerks	1094	7

ANZSCO 4 digit		Estimated average weekly income (\$, 2011)	Decile
3300	Construction Trades Workers nfd	1093	7
3234	Toolmakers and Engineering Patternmakers	1084	7
3923	Printers	1076	7
4513	Funeral Workers	1074	7
5512	Bookkeepers	1072	7
1211	Aquaculture Farmers	1069	7
3111	Agricultural Technicians	1068	7
4000	Community and Personal Service Workers nfd	1065	7
8214	Insulation and Home Improvement Installers	1065	7
3991	Boat Builders and Shipwrights	1064	7
6213	Motor Vehicle and Vehicle Parts Salespersons	1063	7
2113	Photographers	1062	7
3311	Bricklayers and Stonemasons	1062	7
1421	Retail Managers	1060	7
4313	Gaming Workers	1059	7
5511	Accounting Clerks	1057	7
4422	Security Officers and Guards	1048	7
5300	General Clerical Workers nfd	1047	7
4522	Outdoor Adventure Guides	1047	7
3320	Floor Finishers and Painting Trades Workers nfd	1044	7
3334	Wall and Floor Tilers	1043	7
3233	Precision Metal Trades Workers	1040	7
3222	Sheetmetal Trades Workers	1037	7
5611	Betting Clerks	1037	7
4510	Personal Service and Travel Workers nfd	1036	7
1210	Farmers and Farm Managers nfd	1035	7
5613	Filing and Registry Clerks	1033	7
7312	Bus and Coach Drivers	1033	7
3330	Glaziers, Plasterers and Tilers nfd	1032	7
8215	Paving and Surfacing Labourers	1031	7
6217	Street Vendors and Related Salespersons	1028	8
7112	Industrial Spraypainters	1026	8
1213	Livestock Farmers	1026	8
8999	Other Miscellaneous Labourers	1026	8
3322	Painting Trades Workers	1024	8
6394	Ticket Salespersons	1022	8
1212	Crop Farmers	1022	8
5993	Debt Collectors	1020	8
5610	Clerical and Office Support Workers nfd	1016	8
8393	Product Quality Controllers	1015	8
7110	Machine Operators nfd	1014	8

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
5212 Secretaries	1013	8
3612 Shearers	1013	8
3920 Printing Trades Workers nfd	1009	8
3333 Roof Tilers	1009	8
2522 Complementary Health Therapists	1009	8
1214 Mixed Crop and Livestock Farmers	998	8
3900 Other Technicians and Trades Workers nfd	996	8
4115 Indigenous Health Workers	993	8
8996 Recycling and Rubbish Collectors	991	8
4234 Special Care Workers	991	8
2722 Ministers of Religion	990	8
5311 General Clerks	990	8
8900 Other Labourers nfd	990	8
4516 Tourism and Travel Advisers	989	8
3241 Panelbeaters	988	8
1411 Cafe and Restaurant Managers	987	8
4518 Other Personal Service Workers	987	8
3331 Glaziers	987	8
8419 Other Farm, Forestry and Garden Workers	983	8
5615 Survey Interviewers	983	8
4114 Enrolled and Mothercraft Nurses	983	8
5412 Inquiry Clerks	983	8
8311 Food and Drink Factory Workers	982	8
6390 Miscellaneous Sales Support Workers nfd	982	8
8213 Fencers	978	8
5410 Call or Contact Centre Information Clerks nfd	978	8
8413 Forestry and Logging Workers	977	8
6219 Other Sales Assistants and Salespersons	976	8
7115 Plastics and Rubber Production Machine Operators	976	8
2110 Arts Professionals nfd	976	8
7119 Other Machine Operators	976	8
3993 Gallery, Library and Museum Technicians	971	8
4521 Fitness Instructors	970	8
8391 Metal Engineering Process Workers	968	8
3212 Motor Mechanics	967	8
3243 Vehicle Painters	967	9
8116 Other Cleaners	962	9
6215 Retail Supervisors	962	9
3994 Jewellers	961	9
5612 Couriers and Postal Deliverers	960	9
5400 Inquiry Clerks and Receptionists nfd	960	9

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
3242 Vehicle Body Builders and Trimmers	956	9
1412 Caravan Park and Camping Ground Managers	955	9
3112 Medical Technicians	952	9
6110 Insurance Agents and Sales Representatives nfd	952	9
5411 Call or Contact Centre Workers	951	9
7211 Agricultural, Forestry and Horticultural Plant Operators	950	9
2114 Visual Arts and Crafts Professionals	949	9
6395 Visual Merchandisers	948	9
7113 Paper and Wood Processing Machine Operators	947	9
3620 Horticultural Trades Workers nfd	946	9
5614 Mail Sorters	940	9
3221 Metal Casting, Forging and Finishing Trades Workers	940	9
3513 Chefs	938	9
8993 Handypersons	938	9
7300 Road and Rail Drivers nfd	938	9
3996 Signwriters	929	9
3622 Gardeners	927	9
4200 Carers and Aides nfd	924	9
7310 Automobile, Bus and Rail Drivers nfd	922	9
8910 Freight Handlers and Shelf Fillers nfd	918	9
7100 Machine and Stationary Plant Operators nfd	914	9
5321 Keyboard Operators	912	9
7213 Forklift Drivers	912	9
8991 Caretakers	908	9
3941 Cabinetmakers	906	9
6391 Models and Sales Demonstrators	904	9
4514 Gallery, Museum and Tour Guides	899	9
8990 Miscellaneous Labourers nfd	896	9
8000 Labourers nfd	893	9
3921 Print Finishers and Screen Printers	893	9
8312 Meat Boners and Slicers, and Slaughterers	889	9
3611 Animal Attendants and Trainers	885	9
4116 Massage Therapists	880	9
5616 Switchboard Operators	880	9
4230 Personal Carers and Assistants nfd	879	9
4314 Hotel Service Managers	877	9
5997 Library Assistants	874	9
7411 Storepersons	874	9
3623 Greenkeepers	874	9
7321 Delivery Drivers	872	9
3940 Wood Trades Workers nfd	872	9

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
3512 Butchers and Smallgoods Makers	870	9
8994 Motor Vehicle Parts and Accessories Fitters	868	9
4520 Sports and Fitness Workers nfd	866	9
8310 Food Process Workers nfd	859	9
6393 Telemarketers	859	9
8110 Cleaners and Laundry Workers nfd	856	9
3624 Nurserypersons	855	9
4231 Aged and Disabled Carers	855	9
4515 Personal Care Consultants	854	9
5619 Other Clerical and Office Support Workers	852	9
8399 Other Factory Process Workers	849	9
8390 Miscellaneous Factory Process Workers nfd	847	9
7117 Textile and Footwear Production Machine Operators	843	9
3931 Canvas and Leather Goods Makers	842	9
3942 Wood Machinists and Other Wood Trades Workers	838	9
8113 Domestic Cleaners	838	9
8411 Aquaculture Workers	835	9
3511 Bakers and Pastrycooks	835	9
8997 Vending Machine Attendants	832	9
3932 Clothing Trades Workers	832	9
8995 Printing Assistants and Table Workers	831	9
8112 Commercial Cleaners	831	9
7114 Photographic Developers and Printers	830	10
8322 Product Assemblers	825	10
8414 Garden and Nursery Labourers	824	10
8416 Mixed Crop and Livestock Farm Workers	821	10
4319 Other Hospitality Workers	819	10
8394 Timber and Wood Process Workers	817	10
3933 Upholsterers	817	10
4221 Education Aides	808	10
8300 Factory Process Workers nfd	805	10
4233 Nursing Support and Personal Care Workers	804	10
6211 Sales Assistants (General)	804	10
8410 Farm, Forestry and Garden Workers nfd	802	10
4310 Hospitality Workers nfd	800	10
4113 Diversional Therapists	798	10
8313 Meat, Poultry and Seafood Process Workers	795	10
4232 Dental Assistants	793	10
5421 Receptionists	793	10
8392 Plastics and Rubber Factory Workers	784	10
3930 Textile, Clothing and Footwear Trades Workers nfd	783	10

ANZSCO 4 digit	Estimated average weekly income (\$, 2011)	Decile
6216 Service Station Attendants	775	10
4511 Beauty Therapists	770	10
8415 Livestock Farm Workers	768	10
3514 Cooks	766	10
4311 Bar Attendants and Baristas	766	10
8912 Shelf Fillers	764	10
3621 Florists	762	10
8321 Packers	762	10
3911 Hairdressers	755	10
8412 Crop Farm Workers	754	10
7311 Automobile Drivers	754	10
3610 Animal Attendants and Trainers, and Shearers nfd	754	10
4211 Child Carers	753	10
8513 Kitchenhands	746	10
8114 Housekeepers	742	10
8111 Car Detailers	738	10
8115 Laundry Workers	733	10
3613 Veterinary Nurses	732	10
6311 Checkout Operators and Office Cashiers	731	10
8512 Food Trades Assistants	725	10
8320 Packers and Product Assemblers nfd	725	10
4315 Waiters	723	10
8511 Fast Food Cooks	718	10
8510 Food Preparation Assistants nfd	715	10
4312 Cafe Workers	713	10
7116 Sewing Machinists	700	10
6214 Pharmacy Sales Assistants	692	10
4500 Sports and Personal Service Workers nfd	663	10
3310 Bricklayers, and Carpenters and Joiners nfd	641	10

Appendix II: Formal derivation of shift share analysis

Let n_{ij} be the number of persons with qualification i in occupation j . Then we can write $n_{ij} = (n_{ij}/n_{.j})(n_{.j}/n_{..})n_{..}$ where the dot represents the summation over the relevant index. Taking percentage changes we have (approximately⁸)

$$\% \Delta n_{i.} = \sum_j w_{ij} \left(\% \Delta \frac{n_{ij}}{n_{.j}} + \% \Delta \frac{n_{.j}}{n_{..}} + \% \Delta n_{..} \right) \text{ where } w_{ij} = \frac{n_{ij}}{n_{i.}}$$

The first term in the summation we label the qualification share effect (the impact of the qualification changing its share of jobs within occupations), the second term the occupation share effect (reflecting the change in importance of each occupation) and the third term the overall growth effect (reflecting the overall growth in the workforce).

We can extend the shift share analysis to distinguish between different fields of study.

More formally, let n_{ijk} be the number of persons with field of study k in qualification i and occupation j . Then we can write $n_{ijk} = (n_{ijk}/n_{ij.})(n_{ij.}/n_{.j})(n_{.j}/n_{...})n_{...}$ where the dot represents the summation over the relevant index. Taking percentage changes we have (approximately⁹)

$$\% \Delta n_{i.k} = \sum_j w_{ijk} \left(\% \Delta \frac{n_{ijk}}{n_{ij.}} + \% \Delta \frac{n_{ij.}}{n_{.j}} + \% \Delta \frac{n_{.j}}{n_{...}} + \% \Delta n_{...} \right) \text{ where } w_{ijk} = \frac{n_{ijk}}{n_{i.k}}$$

The first term in the summation we label the field of study effect within the qualification share effect. If we add the first two effects together we have a qualification share effect for each field of study within that qualification, and it is this statistic that is presented in the tables in the body of the paper.

⁸ In order to maximise the level of accuracy we evaluate the changes using the mid-point as the base rather than the first time point.

⁹ In order to maximise the level of accuracy we evaluate the changes using the mid-point as the base rather than the first time point.

Appendix III: Decomposition of the percentage change in employment, by qualification level and income decile

Table A2: decomposition of the percentage change (evaluated at the midpoint) in total employment, by qualification level, by income decile

Higher degree

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	7.0	4.5	4.7	16.2
2	6.3	4.2	3.6	14.1
3	7.6	1.0	2.8	11.4
4	6.3	1.4	2.4	10.1
5	3.9	0.5	1.1	5.5
6	2.5	-0.3	0.7	2.8
7	2.5	-0.6	0.6	2.6
8	2.3	-0.5	0.6	2.5
9	3.1	0.3	0.6	4.0
10	4.1	0.0	0.8	4.9
Total	45.6	10.5	18.0	74.1

Bachelor degree

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	0.3	3.2	2.9	6.4
2	1.2	2.9	2.5	6.6
3	0.4	1.0	2.9	4.3
4	0.6	0.9	2.7	4.3
5	2.2	0.7	2.0	4.9
6	1.7	-0.1	1.1	2.6
7	1.7	-0.7	0.9	1.8
8	1.8	-0.8	0.9	1.8
9	2.4	0.4	0.8	3.6
10	3.7	0.1	1.3	5.1
Total	15.9	7.6	18.0	41.5

Diploma/advanced diploma

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.0	1.3	1.3	1.6
2	-0.4	1.7	1.7	3.0
3	-0.7	0.4	1.8	1.5
4	-1.1	-0.1	1.5	0.4
5	-1.1	0.1	1.8	0.8
6	1.2	-0.3	1.7	2.6
7	1.7	-1.4	1.5	1.8
8	3.0	-1.0	1.9	3.9
9	3.4	1.2	1.9	6.5
10	2.9	0.7	2.9	6.5
Total	7.8	2.6	18.0	28.4

Certificates III and IV

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-0.1	0.4	0.7	0.9
2	-0.7	0.9	1.0	1.2
3	-0.2	0.0	0.9	0.7
4	0.1	-0.8	1.4	0.7
5	-0.3	-1.1	2.2	0.7
6	0.7	-0.6	1.9	2.0
7	0.6	-2.0	2.3	1.0
8	0.9	-1.7	2.2	1.4
9	0.6	1.2	2.7	4.5
10	2.2	0.2	2.8	5.2
Total	3.7	-3.5	18.0	18.3

Other certificates

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-0.2	0.6	0.7	1.1
2	-0.2	0.8	0.9	1.4
3	-0.6	0.2	0.8	0.4
4	-0.1	0.0	0.9	0.8
5	0.0	-0.4	1.4	1.0
6	0.0	-0.9	1.7	0.8
7	0.7	-1.7	2.0	1.0
8	0.8	-2.9	2.3	0.1
9	0.8	1.4	2.7	4.8
10	-1.5	0.2	4.7	3.4
Total	-0.4	-2.9	18.0	14.8

No post school qualification

Income deciles	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.1	0.4	0.6	-0.1
2	-1.4	0.7	0.7	0.0
3	-1.3	0.1	0.6	-0.6
4	-1.3	-0.1	0.8	-0.6
5	-1.8	-0.8	1.2	-1.4
6	-2.4	-1.0	1.8	-1.6
7	-2.6	-1.6	1.9	-2.3
8	-3.1	-2.6	2.1	-3.5
9	-3.6	0.3	2.9	-0.4
10	-5.3	-1.1	5.3	-1.0
Total	-23.9	-5.7	18.0	-11.6

Table A3: decomposition of the percentage change (evaluated at the mid-point) in total employment, by qualification level, by ABS skills level

Higher degree

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	28.1	11.4	13.8	53.3
2	4.8	0.0	1.4	6.2
3	2.8	-0.4	0.6	3.0
4	6.7	-0.1	1.5	8.0
5	3.3	-0.5	0.7	3.5
Total	45.6	10.5	18.0	74.1

Bachelor degree

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	2.8	8.7	12.1	23.6
2	2.9	0.1	1.9	4.9
3	2.8	-0.5	1.0	3.3
4	4.9	-0.2	2.1	6.8
5	2.5	-0.6	1.0	2.8
Total	15.9	7.6	18.0	41.5

Diploma/advanced diploma

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-6.7	3.4	5.8	2.5
2	3.2	0.9	4.0	8.1
3	2.4	-0.7	2.6	4.3
4	6.2	0.0	4.0	10.1
5	2.7	-1.0	1.7	3.4
Total	7.8	2.6	18.0	28.4

Certificates III and IV

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.5	1.0	2.3	1.8
2	-0.4	0.2	2.2	2.1
3	-0.4	-4.2	6.7	2.1
4	3.8	0.6	4.7	9.1
5	2.3	-1.1	2.1	3.2
Total	3.7	-3.5	18.0	18.3

Other certificates

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.5	1.3	2.5	2.3
2	-1.0	-1.4	2.8	0.4
3	0.2	-1.2	2.5	1.5
4	-0.2	0.2	6.5	6.5
5	2.2	-1.8	3.7	4.1
Total	-0.4	-2.9	18.0	14.8

No post school qualification

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-4.3	0.7	2.3	-1.3
2	-3.5	-1.0	2.0	-2.5
3	-2.9	-1.7	2.4	-2.2
4	-8.5	-1.2	5.9	-3.8
5	-4.7	-2.5	5.4	-1.7
Total	-23.9	-5.7	18.0	11.6

Table A4: decomposition of the percentage change (evaluated at the mid-point) in full-time employment, by qualification level, by income decile

Higher degree

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	7.8	6.9	3.2	17.9
2	7.1	5.5	2.4	15.0
3	8.1	1.8	1.8	11.7
4	6.0	2.1	1.4	9.5
5	3.5	0.4	0.6	4.5
6	2.3	-0.3	0.4	2.4
7	2.2	-0.6	0.3	1.9
8	1.9	-0.5	0.3	1.7
9	2.0	0.1	0.2	2.3
10	2.1	-0.4	0.2	2.0
Total	43.1	15.0	10.8	68.8

Bachelor degree

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	0.5	4.9	2.1	7.5
2	1.6	4.4	1.8	7.8
3	0.5	2.1	2.0	4.6
4	0.7	1.8	1.6	4.1
5	1.9	0.5	1.0	3.4
6	1.7	-0.2	0.6	2.1
7	1.5	-0.9	0.4	1.1
8	1.6	-0.9	0.4	1.1
9	1.6	0.0	0.3	1.9
10	2.0	-0.4	0.4	2.0
Total	13.5	11.4	10.8	35.7

Diploma or advanced diploma

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.5	2.2	1.1	1.8
2	-0.6	2.8	1.4	3.7
3	-0.9	1.1	1.4	1.6
4	-0.7	0.4	1.0	0.7
5	-0.5	-0.2	1.1	0.5
6	1.3	-0.4	1.1	2.0
7	1.8	-1.7	0.9	1.0
8	2.6	-1.5	1.0	2.1
9	2.7	0.1	0.8	3.6
10	1.6	-0.9	1.0	1.7
Total	5.8	2.1	10.8	18.7

Certificates III and IV

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-0.2	0.6	0.5	0.9
2	-0.9	1.4	0.8	1.2
3	-0.3	0.2	0.6	0.5
4	0.0	-0.6	1.0	0.4
5	-0.1	-1.4	1.5	0.0
6	0.7	-0.6	1.3	1.3
7	0.5	-2.4	1.5	-0.4
8	0.7	-2.0	1.3	0.1
9	0.3	-0.5	1.4	1.1
10	1.0	-1.4	1.0	0.5
Total	1.6	-6.8	10.8	5.6

Other certificates

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-0.3	1.2	0.6	1.4
2	-0.4	1.5	0.8	1.8
3	-0.8	0.5	0.7	0.3
4	0.0	0.2	0.7	0.9
5	0.3	-0.8	1.1	0.6
6	0.2	-1.1	1.2	0.4
7	0.8	-2.2	1.3	-0.1
8	1.1	-3.1	1.4	-0.7
9	1.4	0.1	1.4	2.8
10	-1.3	-1.9	1.7	-1.5
Total	1.0	-5.8	10.8	6.0

No post school qualification

Income decile	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.8	0.9	0.5	-0.4
2	-2.3	1.3	0.7	-0.4
3	-2.0	0.3	0.5	-1.2
4	-2.0	0.0	0.6	-1.3
5	-2.3	-1.3	1.0	-2.6
6	-3.0	-1.3	1.4	-2.9
7	-3.0	-2.3	1.3	-4.0
8	-3.4	-2.8	1.4	-4.8
9	-3.2	-0.9	1.7	-2.5
10	-3.4	-2.9	1.6	-4.7
Total	-26.5	-9.1	10.8	-24.7

Table A5: decomposition of the percentage change (evaluated at the mid-point) in full-time employment, by qualification level, by ABS skills level

Higher degree

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	29.0	16.2	8.6	53.9
2	4.7	0.0	0.9	5.6
3	2.2	-0.3	0.3	2.3
4	5.2	-0.5	0.7	5.4
5	1.9	-0.5	0.2	1.6
Total	43.1	15.0	10.8	68.8

Bachelor degree

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	2.8	13.3	7.7	23.8
2	3.0	0.0	1.2	4.2
3	2.3	-0.5	0.5	2.4
4	3.9	-0.8	1.0	4.1
5	1.5	-0.6	0.3	1.2
Total	13.5	11.4	10.8	35.7

Diploma or advanced diploma

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-6.8	5.9	4.0	3.0
2	3.0	0.1	2.7	5.8
3	2.2	-1.4	1.5	2.3
4	5.6	-1.3	2.0	6.3
5	1.8	-1.2	0.6	1.2
Total	5.8	2.1	10.8	18.7

Certificates III and IV

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-1.7	1.8	1.6	1.6
2	-0.4	-0.4	1.4	0.7
3	-0.4	-5.6	4.5	-1.6
4	2.9	-1.2	2.4	4.2
5	1.3	-1.4	0.9	0.7
Total	1.6	-6.8	10.8	5.6

Other certificates

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	2.6	2.0	-1.8	2.8
2	-1.9	2.0	-1.5	-1.4
3	-1.6	1.6	1.0	1.0
4	-2.3	3.7	1.8	3.2
5	-2.5	1.4	1.5	0.4
Total	-5.8	10.8	1.0	6.0

No post school qualification

ABS Skills level	Qualification share effect	Occupational share effect	Overall growth effect	Total
1	-6.3	1.7	1.9	-2.7
2	-4.5	-1.7	1.5	-4.7
3	-3.2	-2.4	1.7	-3.9
4	-9.0	-3.5	3.8	-8.7
5	-3.5	-3.2	2.0	-4.8
Total	-26.5	-9.1	10.8	-24.7