OCCASIONAL PAPER

NCVER

Modelling the trades: An empirical analysis of trade apprenticeships in Australia, 1967–2006

TOM KARMEL

PETER MLOTKOWSKI

NATIONAL CENTRE FOR VOCATIONAL EDUCATION RESEARCH

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

ISBN 978 1 921412 16 5 web edition

TD/TNC 92.38

Published by NCVER
ABN 87 007 967 311

Level 11, 33 King William Street, Adelaide, SA 5000
PO Box 8288 Station Arcade, Adelaide SA 5000, Australia

ph +61 8 8230 8400 fax +61 8 8212 3436
email ncver@ncver.edu.au
<http://www.ncver.edu.au>
<http://www.ncver.edu.au/publications/2003.html>

About the research

Modelling the trades: An empirical analysis of trade apprenticeships in Australia, 1967–2006 by Tom Karmel and Peter Mlotkowski

The idea that apprenticeship numbers in the trades may be affected by labour market conditions seems fairly obvious. But just as obvious is the idea that government policy may be able to promote the take-up of trade apprenticeships. The significant increases in trade apprenticeship numbers in recent years have occurred as the Australian economy has boomed. At the same time government policy has been active in the area of apprenticeships; the introduction of incentives to employers, the removal of age restrictions to apprenticeships and the extension of the apprenticeship model to existing workers are of particular note. *Modelling the trades: An empirical analysis of trade apprenticeships in Australia, 1967–2006*, by Tom Karmel and Peter Mlotkowski, looks at the relationship between trade apprenticeships and the labour market. The authors seek to address the following issues: which trade apprenticeships are more affected by labour market conditions than others, and have government policies been successful in increasing the number of trade apprenticeships?

This paper presents a rudimentary econometric analysis of trade apprenticeships within each traditional area of apprentice training (metal and vehicle, electrical, building, printing, and food trades). These models are used to understand how apprentice numbers in the trades respond to changes in labour market conditions. The method of evaluating the impact of recent government policy changes is to replicate the counterfactual or no policy change scenario, and then compare this with the actual level of apprentice activity.

Key messages

- Metal and vehicle, electrical, and building apprenticeship numbers are particularly sensitive to labour market conditions.
- Printing apprenticeship numbers have declined due to structural change in the industry.
- Historical relationships between apprenticeship numbers and the labour market in the majority of industries have broken down over the last 10 years such that apprentice numbers are lower than would otherwise have been the case.
- Government initiatives have been unable to completely counteract this trend, with the possible exception of electrical and food apprenticeships.
- The removal of restrictions on age and allowing existing workers to take up apprenticeships has made a significant but modest contribution to the number of trade apprenticeships.

Tom Karmel
Managing Director, NCVER

Contents

Tables and figures

Tables

Figures

Modelling trade apprenticeships

The idea that apprenticeship numbers may be affected by the state of the economy seems fairly obvious.[1] Much like any employee, an apprentice signs a contract with an employer and is paid a wage, the difference for apprentices being the emphasis on training. The recession of the early 1990s resulted in a sharp decline in trade apprenticeships in Australia, while the large increases of recent years have occurred as the economy has boomed. What remains unclear is which apprenticeships are more affected by labour market conditions than others, and which labour market variables are significant. In addition, apprentices exist within an institutional framework, which is likely to affect their numbers. In particular, governments provide a legislative basis for the training contract and have, from time to time, provided incentives to promote the take-up of apprenticeships. The question is how successful have government policies been in increasing the number of trade apprenticeships?

This paper attempts to answer these questions through an empirical analysis of trade apprenticeships in Australia from 1967 to 2006. Previous research has pointed to the significant impact of business cycles on total apprentice and trainee numbers (Kapuscinski 2001). However, we wish to test whether each traditional area of apprentice training (metal and vehicle trades, electrical, building, printing, and food) tells the same story. Our dependent variables will be the in-training numbers of apprentices in the traditional trades. These will be modelled on a set of labour market variables: total employment and unemployment, and construction and manufacturing employment.

The paper commences with an examination of the data. Next we outline our methodology. We then present the results of the regression models. An analysis of the impact of recent government policy changes on trade apprentices precedes some final comments.

The results from the models suggest that apprentice numbers in the different trades respond differently to changes in labour market conditions. Food apprenticeships closely follow changes in total employment and have grown in a remarkably steady manner. The number of unemployed persons is significant in explaining changes in metal and vehicle, electrical, and building apprenticeships. Printing apprenticeships are in a long-term decline.

The importance of the business cycle can be seen from our estimates of the effect of the buoyant economy over the period 2000–06, with numbers up by 9300 (compared with the counterfactual of a flat economy) for metal and vehicle apprenticeships, up by 11 400 for electrical apprenticeships, up by 18 800 for building apprenticeships, and up by 3800 for food apprenticeships.

Our results also indicate that recent government policy initiatives, such as subsidies to employers, the removal of the age bar, and allowing existing workers to take up apprenticeships, have not managed to maintain trade apprentice numbers at levels predicted by historical relationships. Structural change—that is, change in the labour market due to technological change and other economic forces—has an obvious effect on trade apprenticeships. This is not to say that the policy initiatives have not had any effect. An examination of two policies in particular—the removal of the age bar and allowing existing workers to take up apprenticeships—suggests that these initiatives

[1] In this paper, for simplicity we use the term trade 'apprenticeship' to describe a contract of training in a trade occupation. Technically, contracts of training refer to both apprenticeships and traineeships, with the former having a legal definition in some states.

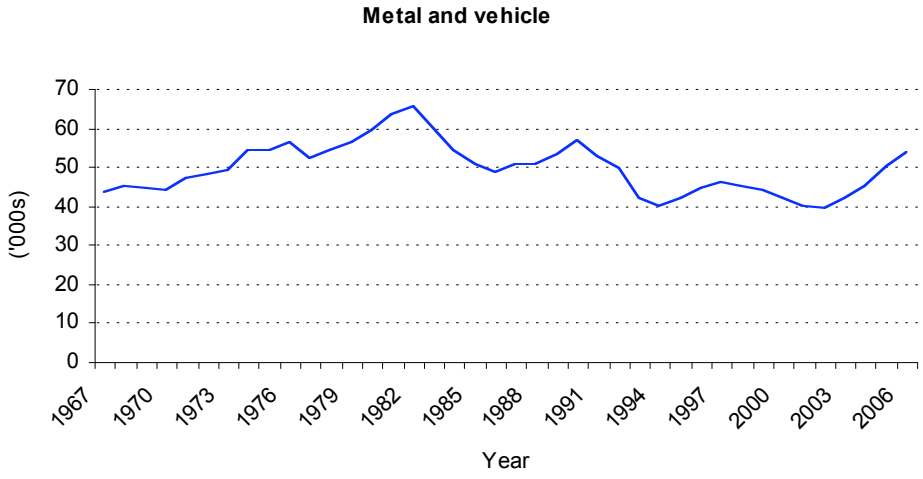
potentially have had some effect. We tentatively suggest that these initiatives have led to an additional 20 000 trade apprenticeships in 2006, but we have no direct evidence on additionality—there is a possibility that older and existing worker apprentices have taken up positions that otherwise would have gone to young, newly commencing apprentices. This number of 20 000 could well be smaller if the number of apprenticeships is constrained by employers.

Examining the data

We first give the particulars of the data. Pre-NCVER data come from *Apprenticeship statistics* publications compiled for the Australian Apprenticeship Advisory Committee (AAAC) and the Commonwealth/State Training Advisory Committee (COSTAC). The data are the administrative data reported uniformly by states and territories only after the introduction of a national statistical standard (Australian Vocational Education and Training Management Information Standard—AVETMISS) in 1994. All figures are in-training as at 30 June of each year.[2] Finally, metal and vehicle trades have been added together to overcome breaks in series caused by changes in occupational classifications.

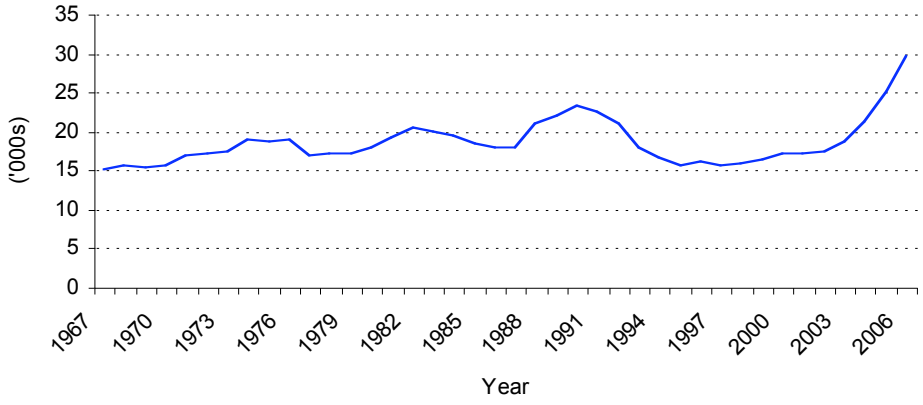
A quick look at the data reveals the following. Metal and vehicle, electrical, and building apprentice numbers have not grown steadily since the 1960s, but rather have experienced distinctive peaks and troughs. Printing apprentices have been on an erratic decline since the early 1970s. By comparison, the graph of food apprentices appears unremarkable, exhibiting steady growth punctuated by (relatively) minor corrections.

Figure 1 Apprentices in-training by trade occupation, 1967–2006

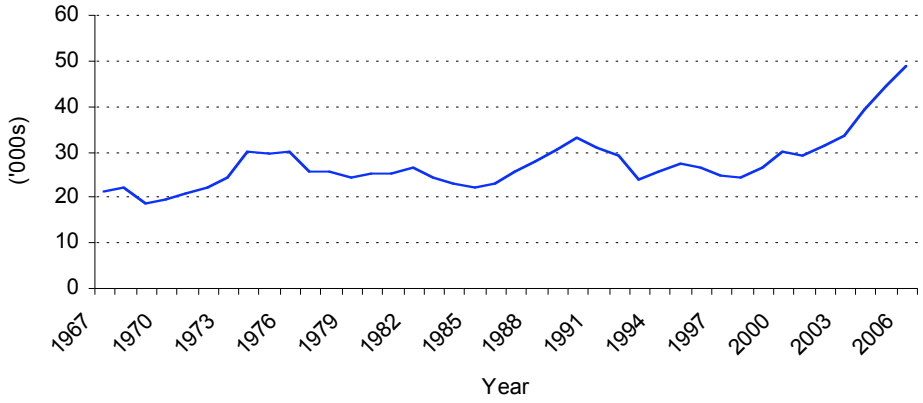


[2] While theoretically it would have been better to model the flows—commencements and completions—separately, only apprentice in-training figures are available for the full span of years.

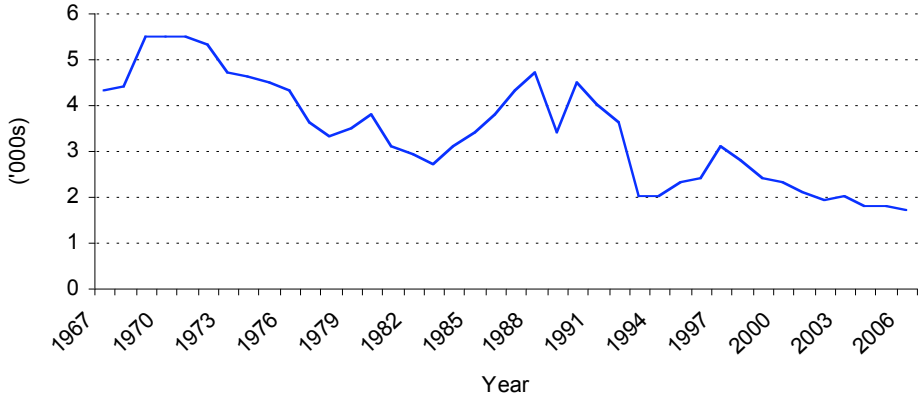
Electrical

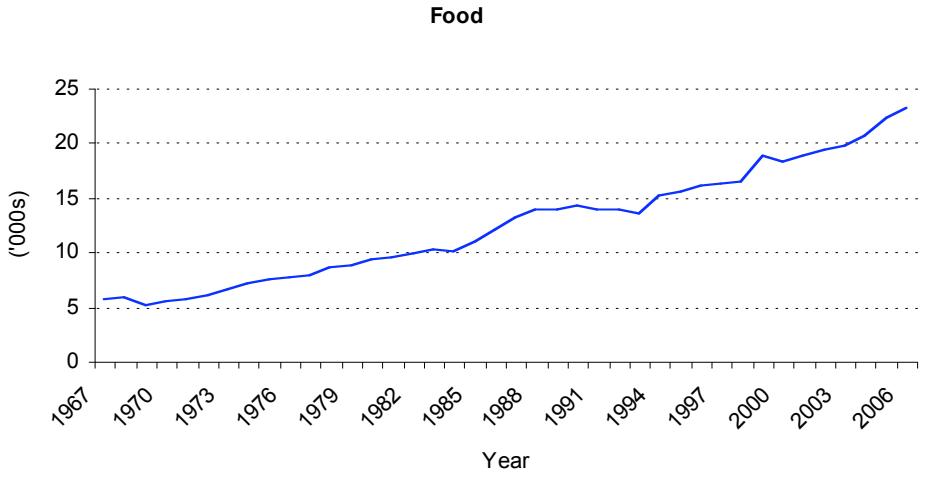


Building



Printing

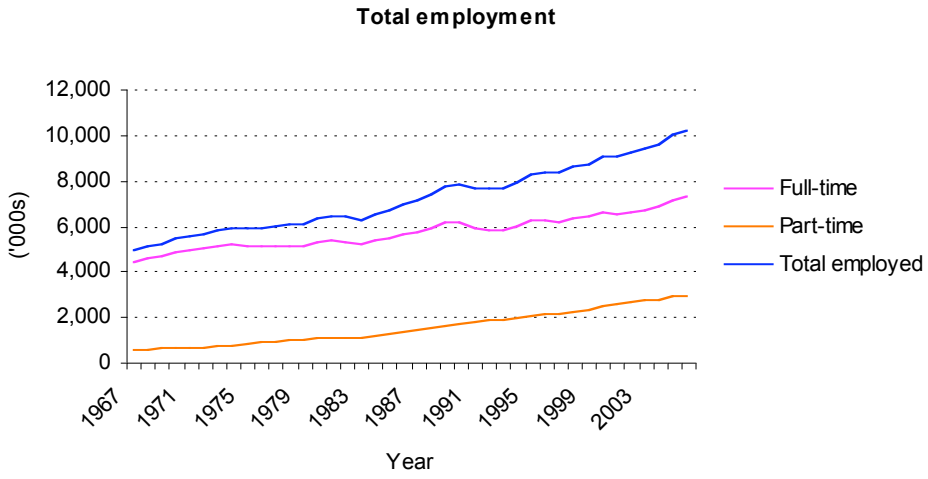




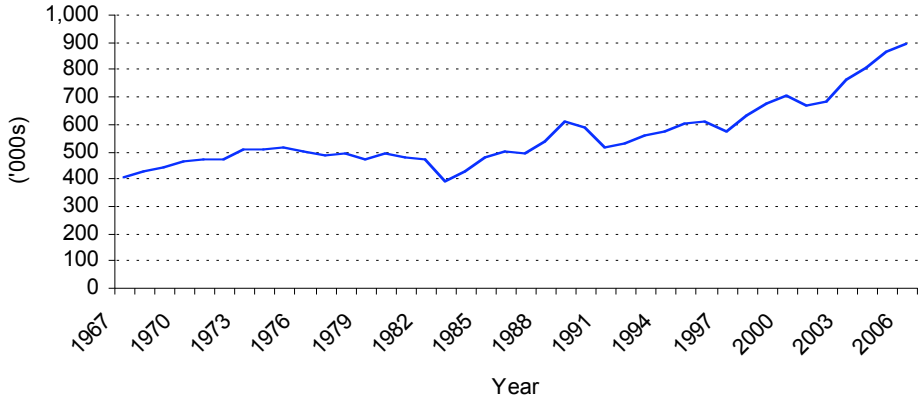
Source: Australian Apprenticeship Advisory Committee/Commonwealth/State Training Advisory Committee, Apprenticeship statistics (1967–1994); NCVER, Apprentice and Trainee Collection 52 (1995–2006).

We now present some labour market variables to illustrate the economic cycle. The graph of total employment mirrors that of food apprentices, showing steady growth punctuated by minor corrections. The graph also shows the correlation of full-time and total employment, as well as the steady growth of part-time employment. Construction and manufacturing employment displays more cyclical behaviour, with construction trending up and manufacturing down. Unemployed persons most clearly illustrate the economic cycle, with sharp increases evident in the 1970s (the oil shocks), 1984 and 1991–93. The last 15 years have seen a significant decline in the number of unemployed, although with aberrations in 1995–96 and 2001.

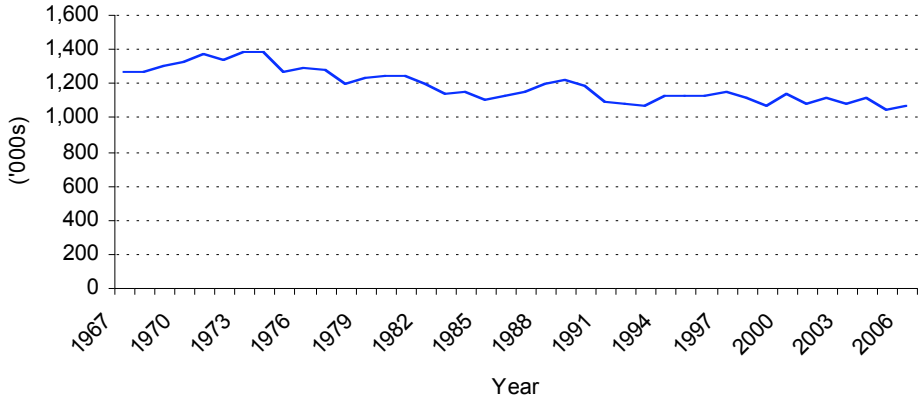
Figure 2 Labour market variables, 1967–2006



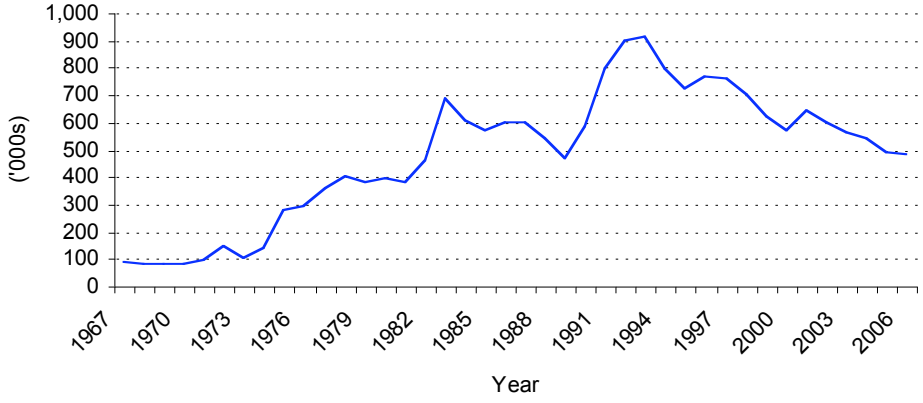
Construction employment



Manufacturing employment



Unemployed persons

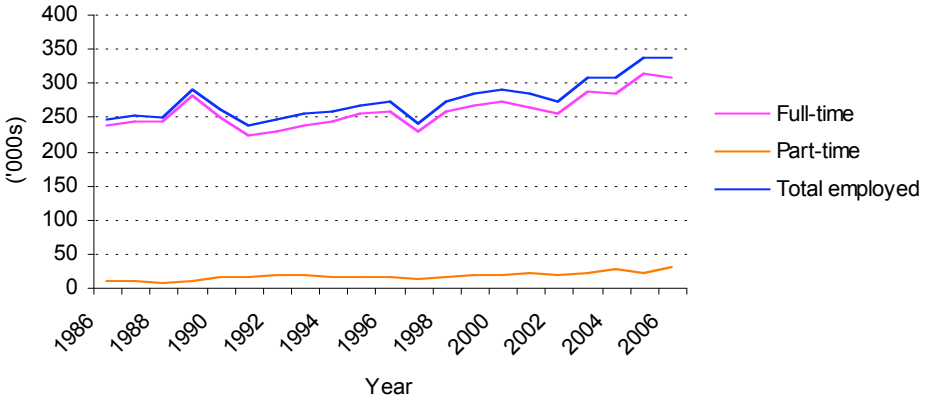


Source: Total employment and unemployment: ABS (2007a [1967–77], 2007b); Construction and manufacturing: ABS (2007a [1967–84], 2007c).

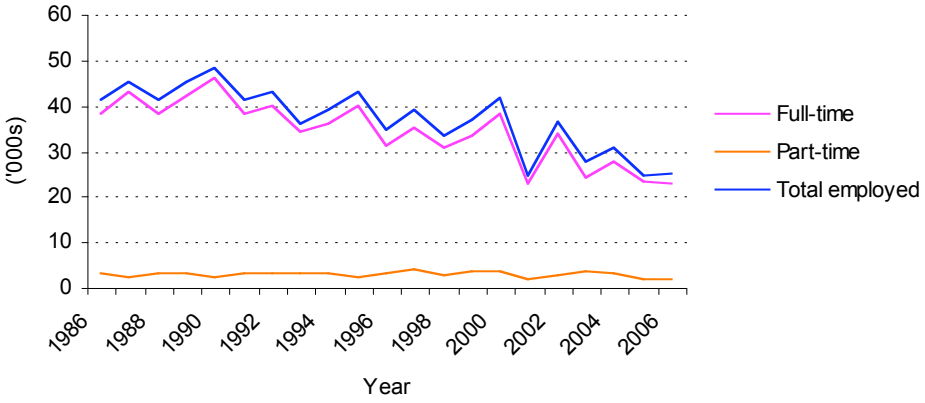
Finally, we present recent employment data on tradespersons. All of the graphs show a dip in employment following the recession of the early 1990s. Metal and vehicle tradespersons have been flat ever since. Building tradespersons exhibit customary peaks and troughs, while trending up. Printing tradespersons show another erratic decline, while food tradespersons climb again after 2004. Figure 3 also shows that full-time and total employment are highly correlated, and that part-time employment in the trades is relatively unimportant.

Figure 3 Employment of tradespersons, 1986–2006

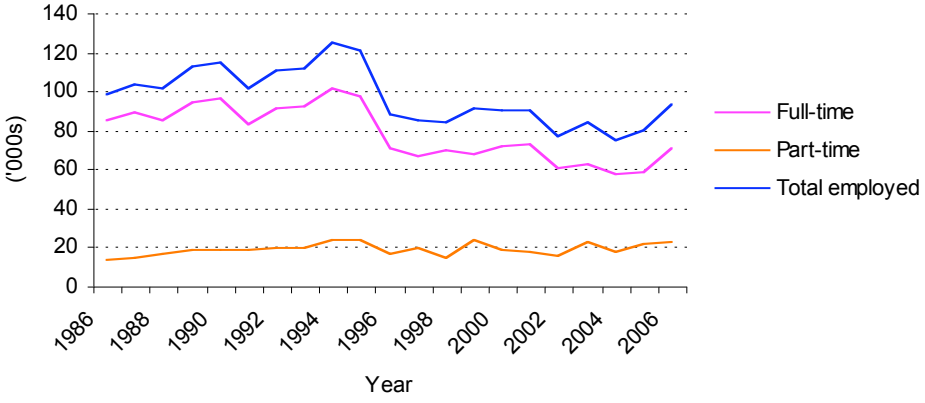
Building



Printing



Food



Source: ABS (2007d).

Methodology

The approach we take is to fit simple linear regression models to each trade from a set of labour market variables. We construct the models from our understanding of the data and economic theory.

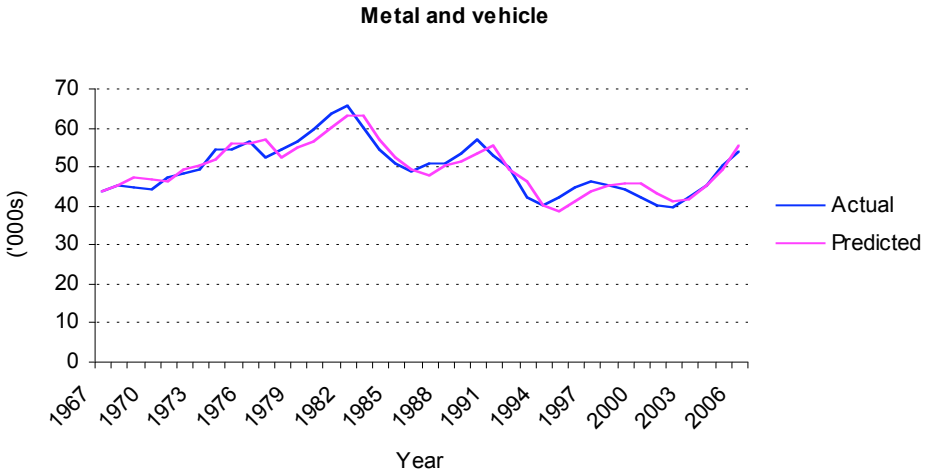
First, we understand apprentices at time t to be most influenced by labour market conditions at time t and t-1. Therefore, the explanation of trade apprenticeships at time t in our models will be in terms of variables measured contemporaneously and at one period past. All variables are entered as levels (rather than rates). We include total employment and total unemployment as broad measures of economic activity. We also include, where appropriate, employment in the traditional apprentice-employing industries of manufacturing and construction. Finally, the number of in-training apprentices in any given year is primarily determined by the in-training number one year before. For this reason we include a lagged dependent variable in each model.

Our choice of explanatory variables is, in part, the result of data availability constraints. Employment data on tradespersons in the respective occupations are not available back to the 1960s. This predominantly accounts for our use of aggregated explanatory variables, such as total employment and unemployment, rather than occupation-specific employment variables (as in figure 3). The same is true of disaggregated wage data.[3] Full-time employment is not considered as an explanatory variable, due to its high correlation with total employment (figures 2 and 3). Part-time employment is not included in the models because it fails to show any cyclical behaviour, rather growing in a remarkably steady manner since the 1960s (figure 2).

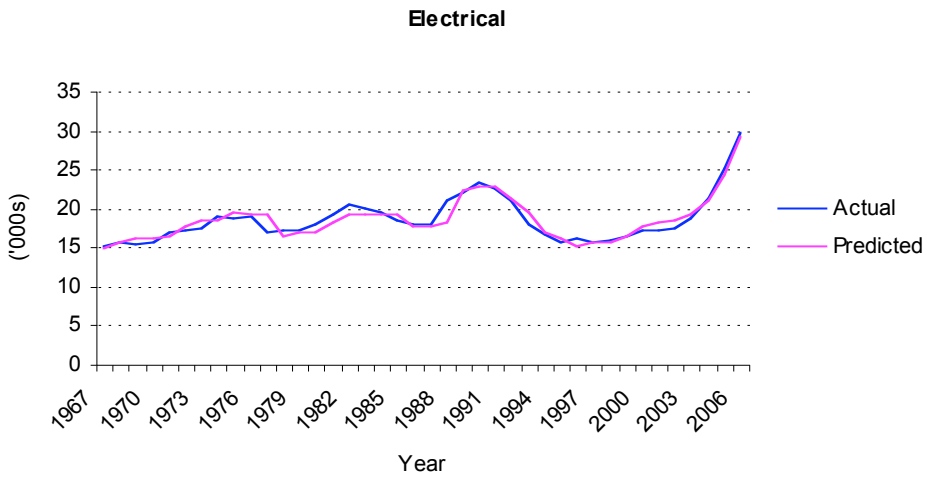
Results

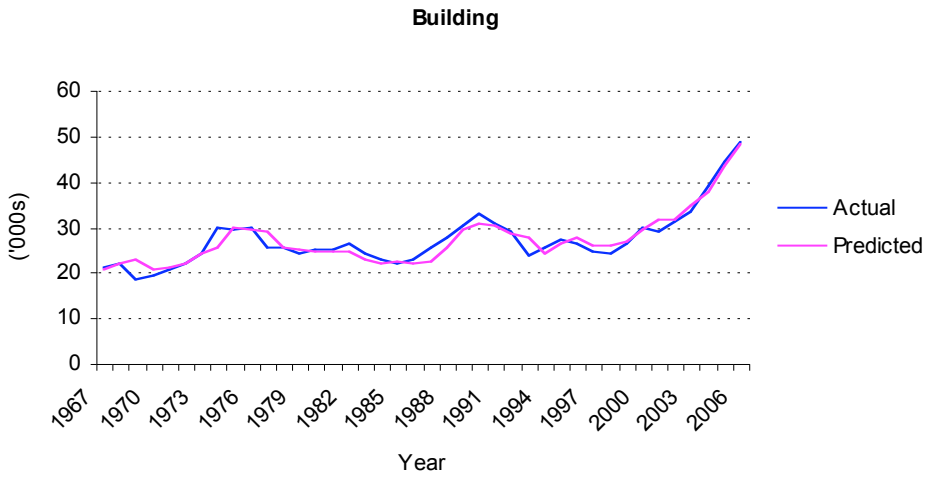
Perhaps the best way to initially present our models is to graph them by plotting the actual data with the predictions.

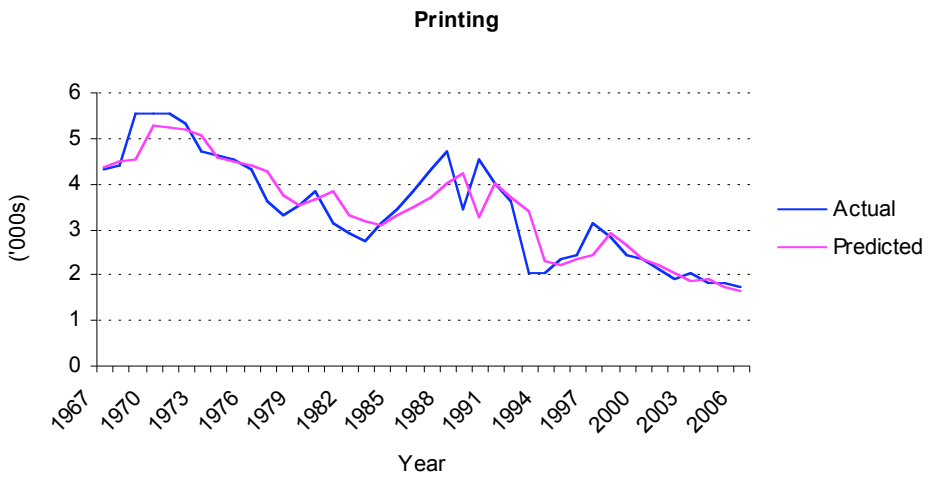
Figure 4 Actual and predicted apprentices in-training by trade occupation, 1967–2006

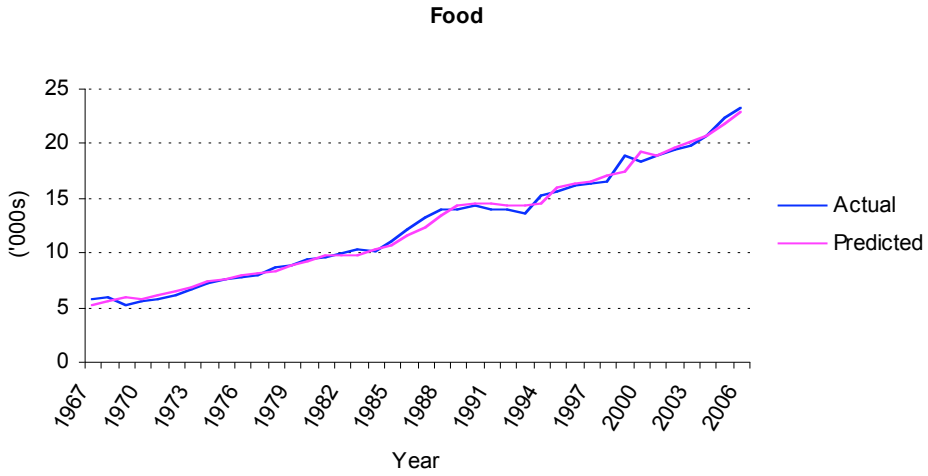


[3] Also, previous research on the effectiveness of employer apprentice subsidies, summarised by Toner, Cully and Koon (unpublished), finds that movements in real apprentice wages and apprentice wages relative to presumed substitutes have a minor effect on apprenticeship numbers. By contrast, demand variables, such as the current or expected level of output and unemployment, are major factors influencing the decisions of employers to recruit apprentices.


Electrical
('000s)
35
30
25
20
15
10
5
0
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
Actual
Predicted


Building
('000s)
60
50
40
30
20
10
0
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
Actual
Predicted


Printing
('000s)
6
5
4
3
2
1
0
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
Actual
Predicted



Source: Australian Apprenticeship Advisory Committee/Commonwealth/State Training Advisory Committee, Apprenticeship statistics (1967–1994); NCVER, Apprentice and Trainee Collection 52 (1995–2006); authors' calculations.

The models apparently fit the data well, but have a number of features suggesting that they should be viewed with some caution. First, the predictions follow the actual data with a slight lag, indicating some shortcomings in our lag structure. Second, the coefficients on some lagged dependent variables are either very close to 1 (metal and vehicle) or greater than 1 (electrical). The long-term stability of such models is likely to be problematic. Finally, the negative coefficient on the total employment variable in the printing model is counter-intuitive. It is likely that total employment, which increased from 4 933 000 in 1967 to 10 168 000 in 2006, is acting as a proxy for the long-term structural change in the printing industry.

The coefficients of the final models are shown in table 1. Since all variables are measured in thousands, the interpretation of the coefficients is as follows: an increase in, for example, construction employment at time t by 1000 workers results in an increase in building apprentices at time t by 19.3. Unless otherwise indicated, all coefficients are significant at the 1% confidence level. The results of the models are more thoroughly detailed in the appendix.

The first thing to note about table 1 is that manufacturing employment is not significant in any model, and hence is excluded from the table.[4] Likewise, the lagged value of unemployed persons is not significant at all, whereas the contemporaneous value is highly significant to metal and vehicle, electrical, and building apprentices. Surprisingly, construction employment is not significant to electrical apprentices. Although the coefficients of total employment are small, they represent a considerable effect on electrical, printing and food apprentices, due to the large base value involved.

[4] Manufacturing employment was not included in the models for building and food apprentices, whereas construction employment was not included in the models for printing and food apprentices.

Table 1 Coefficients of regression models for trade apprentices, 1967–2006

		Response variables				
		Metal and vehicle (t)	Electrical (t)	Building (t)	Printing (t)	Food (t)
Explanatory variables	Intercept	-2.8098†	-5.6961	-3.4097*	2.4919*	-6.0288
	Lagged dependent	0.9868	1.1315	0.8254	0.7042	0.5424
	Total employment (t)	-	0.0009	-	-	0.0017
	Total employment (t-1)	-	-	-	-0.0002*	-
	Unemployed persons (t)	-0.0080	-0.0060	-0.0041	-	-
	Construction employment (t)	-	-	0.0193	n/a	n/a
	Construction employment (t-1)	0.0141	-	-	n/a	n/a

Notes: * Significant at the 5% confidence level.
† Coefficient is not significant (see appendix for further detail).
n/a Explanatory variable was not included in model.

Source: Authors' calculation.

We can explain the results more intuitively than in table 1. Let us look at two periods of time, 2000–06 and 1980–83. The former saw strong economic growth (total employment up 1 177 700, construction employment up 190 700, and unemployed persons down 86 300). This, according to our models, translates to: metal and vehicle apprentices up 9300; electrical apprentices up 11 400; building apprentices up 18 800; printing apprentices down 700; and food apprentices up 3800. By contrast, 1980–83 saw an economic downturn (total employment down 40 200, construction employment down 97 800, and unemployed persons up 292 300). Understanding that our models follow the data with a slight lag, we translate this downturn by looking at predicted apprentices in the period 1982–85. This period saw: metal and vehicle apprentices down 10 400; electrical apprentices down 100; building apprentices down 2200, printing apprentices steady, and food apprentices up 800.

Effect of government policies

Having estimated the impact of labour market variables on trade apprentices, we now wish to do the same for government policy initiatives. In particular, we wish to determine the impact of recent initiatives, such as the introduction of New Apprenticeships in 1998 and its accompanying incentives program, which now includes commencement and completion incentives for employers, Commonwealth trade learning scholarships, as well as other incentives, like the living away from home allowance (Woyzbun forthcoming).

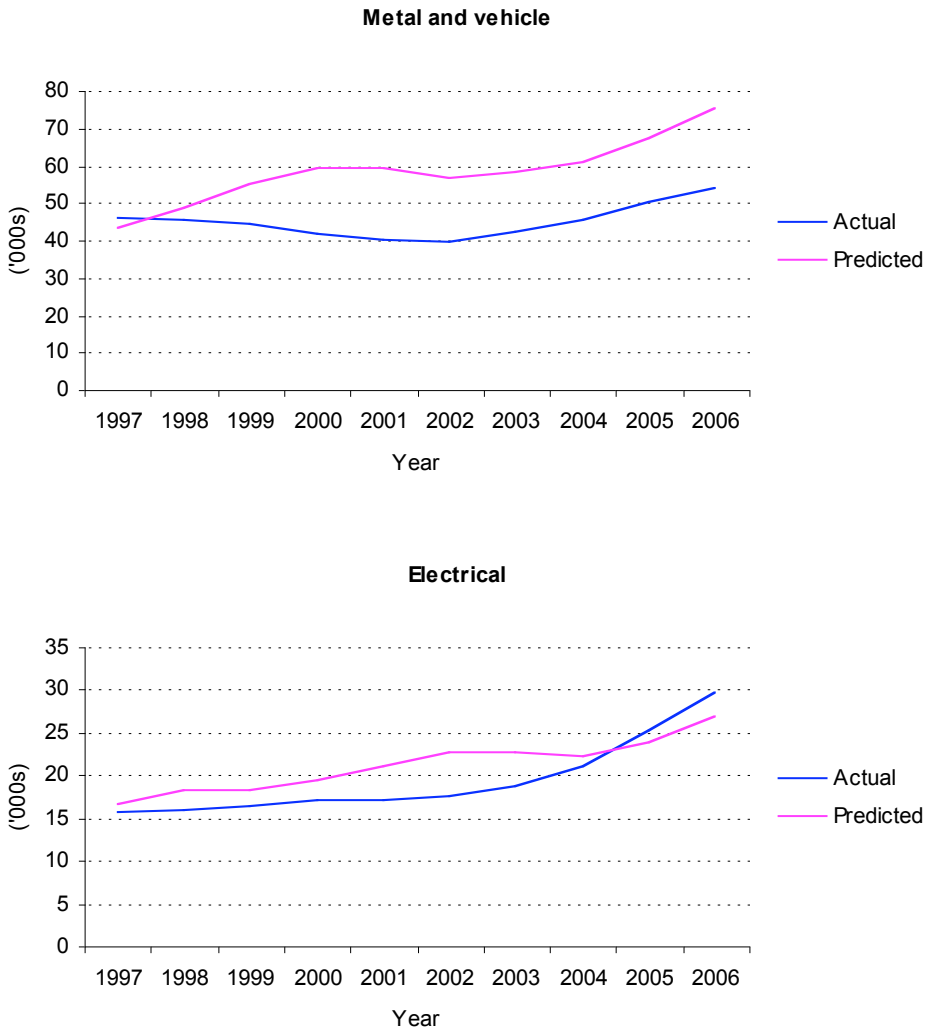
Our method of evaluating the impact of recent government policy initiatives on trade apprenticeships is to replicate the counterfactual or no policy initiative scenario, and then compare this with the actual level of activity. We first re-estimate our models on a restricted sample up to 1996. The results of these 'restricted' models are then used to predict apprentice numbers for 1997–2006. This approach replicates the no policy change scenario for the period 1997–2006 only. The effect of government policy on pre-1997 apprenticeship numbers, which are the basis for the predictions, has not been removed or 'stripped out'. Also, this approach is based on the assumption that, in the absence of government intervention, the relationships between apprentices and the labour market are robust over the period 1967–2006. If this is the case, then deviations between actual and predicted numbers could be attributed to government intervention. If this assumption does not hold, then the deviation would point to a change in the relationships. Previous research by Toner (2003) confirms the existence of a sustained break in the apprentice training rate following the recession of the early 1990s.[5] By using 1996 as the endpoint of our restricted sample we do not

[5] The training rate is the ratio of apprentices in-training to employed tradespersons.

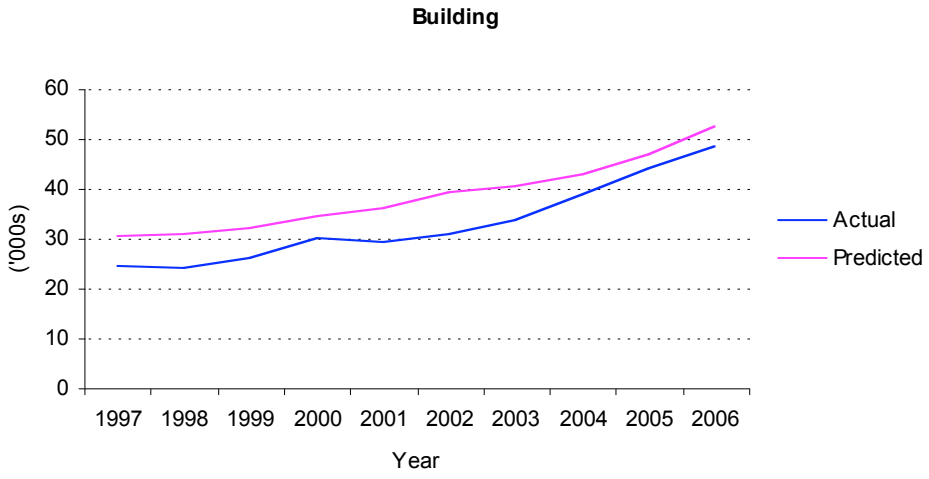
suggest that any break in the relationships between apprentices and the labour market occurred here. Rather we use this particular year to enhance statistical integrity.[6]

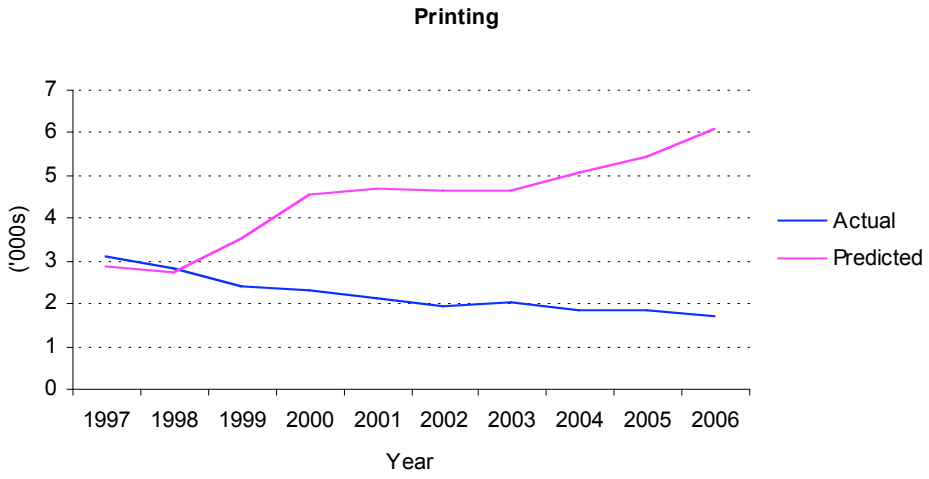
The predictions are dynamic in the sense that we use the predicted values for the lagged dependent variables. The results of this exercise are presented in figure 5.

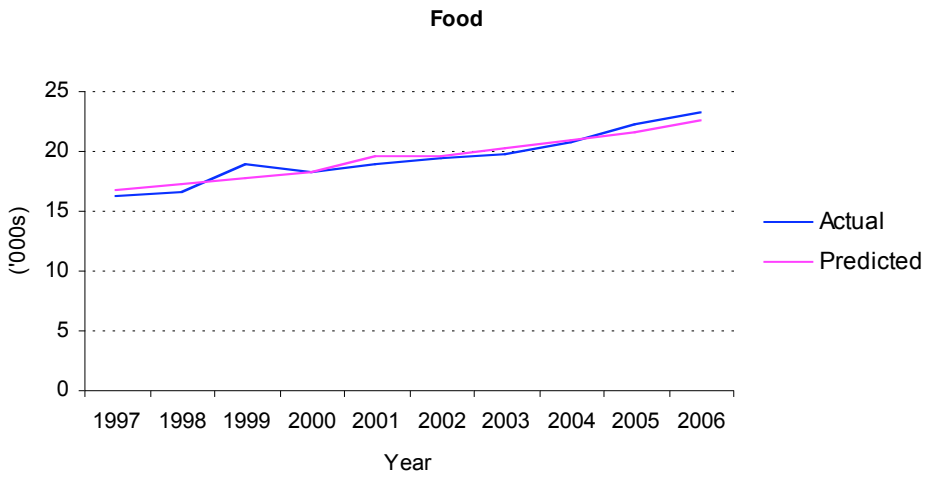
Figure 5 Actual and predicted apprentices in-training by trade occupation, 1997–2006



[6] Using 1996 as the endpoint ensures 30 observations in the restricted sample which, according to the central limit theorem, should see the distribution of the sample means approach normality.







Source: NCVER, Apprentice and Trainee Collection 52, and author's calculations.

It is quite apparent that overall the actual values are not greater than the model predictions and therefore recent government policy initiatives have not led to increases in apprenticeship numbers relative to the 'no change in historical relationships' counterfactual. This does not mean that the government initiatives have had no impact on apprenticeship numbers. A more sensible

interpretation is that the initiatives, which no doubt were motivated by relatively low apprenticeship numbers, have not been able to counteract completely a change in historical relationships.

There is considerable variation by trade: the actual and predicted values are virtually the same for food apprentices, and the actual numbers are greater than the predicted for electrical apprentices since 2005. So for these trades the government could perhaps claim success for its initiatives. By contrast, the predicted values exceed actual values significantly for metal and vehicle, and building apprenticeships. The starkest finding is reserved for printing apprentices, where the number was predicted to increase but in fact decreased by a third in 1997–2006. This is further evidence of structural change in the industry and it seems unlikely that printing apprenticeship numbers will ever get back to the level of the 'good old days'. Although outside the scope of this paper, the fact that some types of apprenticeships respond better to government initiatives than others has important public policy implications in a time of skills shortages. It suggests that government policy cannot be applied with a broad brush, but rather needs to be tailored to each industry. The technological changes affecting the printing industry, which have seen employed printing tradespersons decrease from 41 000 in 1986 to 24 800 in 2006, are very different to what has been happening in the food industry, where food apprentices have grown steadily for many years due, possibly, to changing consumption patterns and the growth of tourism and hospitality.

As a way of expanding on the above results, we now analyse the impact on trade apprentices of two key government policy initiatives: the removal of age restrictions to apprenticeships and traineeships (1992–94), and the introduction of incentives relating to existing worker apprentices and trainees (late 1990s).[7]

As shown in table 2, the removal of age restrictions has had some impact on trade apprenticeships. The number of older persons taking up trade apprenticeships has increased in the period 1995–2006. Significant growth has occurred in 25 to 44-year-olds, up from 9100 in 1995 to 29 100 apprentices in 2006.[8]

Table 2 Trade apprentices in-training at 30 December by age, 1995 and 2006

	1995		2006	
	Number	%	Number	%
Age 19 and under	57 742	46.9	78 082	42.5
Age 20–24	55 808	45.3	72 595	39.5
Age 25–44	9 145	7.4	29 060	15.8
Age 45 and over	369	0.3	3 895	2.1
Total	**123 064**	**100.0**	**183 631**	**100.0**

Note: Trade apprentices represent ASCO 4 Tradespersons and Related Workers.
Source: NCVER, Apprentice and Trainee Collection 52.

Both state and federal government policies have promoted existing worker apprenticeships. Employers now attract a standard commencement incentive of $1500 for existing workers starting an apprenticeship, in addition to the standard $2500 completion incentive. Legislation has also ensured that, in most states, the wages of existing workers are not reduced when they take up an apprenticeship. As with the lifting of age barriers, this initiative has had a modest impact, with existing worker apprentices up from 9500 in 2001 to 16 900 in 2006.

[7] An existing worker is defined as a person who has been employed by the employer, who is party to the training contract, continuously for more than three months full-time or twelve months casual or part-time or a combination of both, immediately prior to the commencement of the training contract.

[8] However, when compared with the non-trade or 'new' occupations, this growth is dwarfed (the number of 25 to 44-year-old apprentices in non-trade occupations increased from 3400 in 1995 to 84 300 in 2006).

Table 3 Trade apprentices in-training at 30 December by existing worker status, 2001 and 2006

	2001		2006	
	Number	%	Number	%
Existing worker	9 479	7.3	16 851	9.2
Not an existing worker	101 743	78.8	166 741	90.8
Status unknown	17 909	13.9	39	0.0
Total	**129 131**	**100.0**	**183 631**	**100.0**

Note: Trade apprentices represent ASCO 4 Tradespersons and Related Workers.
Source: NCVER, Apprentice and Trainee Collection 52.

It is interesting to note how much the above policy initiatives intersect one another. As table 4 shows, the majority of existing worker trade apprentices are older persons. Those in the 25 to 44-year-old age group make up the largest proportion in 2006 (45.4% or 7700 trade apprentices).

Table 4 Existing worker trade apprentices in-training at 30 December by age, 2006

	Number	%
Age 19 and under	2 258	13.4
Age 20–24	4 572	27.1
Age 25–44	7 656	45.4
Age 45 and over	2 365	14.0
Total	**16 851**	**100.0**

Note: Trade apprentices represent ASCO 4 Tradespersons and Related Workers.
Source: NCVER, Apprentice and Trainee Collection 52.

If we take tables 2, 3 and 4 together we get the number of trade apprentices in 2006 who are either 25 years and over or an existing worker to be 39 785 (29 060+3895+16 851-7656-2365), representing just over 20% of trade apprentices. However, we cannot conclude that these initiatives have increased the number of trade apprentices by this number. It all depends on the interaction of supply and demand. If the number of trade apprentices is supply constrained; that is, constrained by the number of potential apprentices, then these initiatives would have made a substantial contribution. On the other hand, if the number is demand constrained; that is, constrained by the number of employers who are willing to take on apprentices, then the initiatives would have had little effect on the number because the older or existing worker apprentices would have substituted for young, newly commencing apprentices. If we assume the true picture is half way in between these polar positions we would conclude that these initiatives have led to an increase in the number of trade apprentices by around 20 000 apprentices in 2006—a significant but modest proportion of the total of 183 600.

Assuming the middle ground when it comes to the interaction of apprentice supply and demand may not be as arbitrary as it first appears. Kapuscinski (2004) finds that economic cycles have a significant effect on both the propensity of employers to take on apprentices (demand) and for apprentices to cancel apprenticeships before their completion (supply). The growth of apprenticeships depends both on the profitability of employers who employ apprentices as well as the job opportunities available to potential apprentices, and not merely one or the other. An important question only posed here is to what extent have government initiatives aimed at increasing apprenticeship numbers been offset by the propensity of apprentices in a buoyant labour market to leave their training before completing?

Finally, we break down existing worker or older apprentices by trade (table 5). There is considerable variation in the importance of older and existing workers across the trades. They are least important in the building trades and most important in printing trades.

Table 5 Older or existing worker apprentices in-training at 30 December by trade occupation, 2006

	Older or existing worker apprentices	Total	Proportion (%)
Metal and vehicle	11 535	52 442	22.0
Electrical	7 102	30 172	23.5
Building	7 703	48 650	15.8
Printing	605	1 586	38.1
Food	7 386	22 900	32.3
Total[(a)]	**39 784**	**183 631**	**21.7**

Note: (a) represents ASCO 4 Tradespersons and Related Workers.
Source: NCVER, Apprentice and Trainee Collection 52.

Final comments

This short paper focused on the relationships between trade apprentices and the labour market. Our conclusion is that it is necessary to drill down in order to understand what is going on with trade apprentices. Some apprenticeships (for example, construction) are quite sensitive to the state of the labour market while others are declining for structural reasons (notably, printing). What is also clear is that historical relationships are not robust. The relationships that once held between the numbers of trade apprentices and various labour market variables no longer universally hold. Structural change in the labour market is a fact of life and trade apprenticeships are right in the middle of it. Government initiatives aimed at increasing the number of trade apprenticeships may well have been successful, but for the majority of the trades the initiatives have been unable to maintain apprenticeships at the levels implied by historical relationships with labour market variables.

In a similar exercise as used in this paper, Kapuscinski (2001) finds government policy had a major influence on total apprentice and trainee numbers in the period 1991–2000. His conclusion regarding traditional apprenticeships is more reserved, suggesting that actual numbers over the period are what would have been expected on the basis of previous experience. Toner's (2003) view is that government incentive payments have not, at least in the past, fully recognised the much greater investment of time and effort on the part of apprentice employers relative to trainee employers (traineeships may be completed in much less time—in some cases one year—compared with the traditional four years for a trade apprenticeship). Although critical of how government incentives are targeted, the author ultimately concludes that explanations focusing on structural and institutional changes which constrain employer investment in apprenticeships are best able to explain the sustained break in training rates following the recession of the early 1990s. These structural changes include: the privatisation of public utilities, the growth of casual and part-time employment, and the growth of outsourcing and labour hire in traditional apprentice-employing industries.

Acknowledgements

The authors would like to acknowledge Philip Toner and Mark Cully for their work in reviewing this paper. Thank you for your insightful comments.

References

ABS (Australian Bureau of Statistics) 2007a, *Labour force historical time series*, cat.no.6204.0.55.001 (1967–77, 1967–84).

——2007b, *Labour force, Detailed, Electronic delivery, November 2007*, cat.no.6291.0.55.001 (1978–2006).

——2007c, *Labour force, Detailed, Quarterly, August 2007*, cat.no.6291.0.55.003 (1985–2006).

Kapuscinski, C 2001, *Apprenticeships and traineeships in Australia in the last three decades: An empirical overview of the evidence*, Department of Education, Training and Youth Affairs, Canberra.

——2004, *Dynamics of apprenticeship and traineeship training in Australia: An historical analysis*, Research Analysis and Evaluation Group, Department of Education, Science and Training, Canberra.

Toner, P 2003, 'Supply-side and demand-side explanations of declining apprentice training rates: a critical overview', *Journal of Industrial Relations*, vol.45, no.4, pp.457–84.

Toner P, Cully, M & Koon, O (unpublished), 'Review of Australian apprenticeship incentives and assistance: Analysis of incentive payments', NCVER, Adelaide.

Woyzbun, K (forthcoming), *Did you know: A guide to national apprentice and trainee policy and training activity*, NCVER, Adelaide.

Appendix

Table A1 Regression results for metal and vehicle, 1967–2006

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-2.80982	4.52039	-0.62	0.5381	0
Lagged dependent	0.98682	0.06615	14.92	<.0001	1.2414
Construction employment (t-1)	0.01409	0.00433	3.25	0.0025	1.4736
Unemployed persons (t)	-0.00801	0.00182	-4.39	<.0001	1.2612

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	3	1 473.1	491.0	80.81	<.0001
Error	36	218.7	6.1		
Total	39	1 691.8			

R-square	0.8707
Adjusted R-square	0.8599

Table A2 Regression results for metal and vehicle, 1967–1996

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-23.06475	7.48724	-3.08	0.0048	0
Lagged dependent	1.06781	0.07269	14.69	<.0001	1.3610
Total employment (t)	0.00444	0.00101	4.42	0.0002	5.8477
Unemployed persons (t)	-0.02099	0.00382	-5.49	<.0001	6.1694

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	3	1 091.8	363.9	74.73	<.0001
Error	26	126.6	4.9		
Total	29	1 218.4			

R-square	0.8961
Adjusted R-square	0.8841

Table A3 Regression results for electrical, 1967–2006

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-5.69606	1.32956	-4.28	0.0001	0
Lagged dependent	1.13147	0.06946	16.29	<.0001	1.2189
Total employment (t)	0.00091	0.00014	6.60	<.0001	1.8156
Unemployed persons (t)	-0.00598	0.00087	-6.86	<.0001	1.9556

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	3	306.5	102.2	114.31	<.0001
Error	36	32.2	0.9		
Total	39	338.7			

R-square	0.9050
Adjusted R-square	0.8971

Table A4 Regression results for electrical, 1967–1996

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-6.13058	2.60982	-2.35	0.0270	0
Lagged dependent	1.02204	0.09956	10.27	<.0001	1.7879
Total employment (t)	0.00323	0.00085	3.81	0.0008	24.7936
Construction employment (t)	-0.02156	0.00799	-2.70	0.0123	7.3322
Unemployed persons (t)	-0.01042	0.00225	-4.64	<.0001	12.7128

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	4	118.0	29.5	36.09	<.0001
Error	25	20.4	0.8		
Total	29	138.4			

R-square	0.8524
Adjusted R-square	0.8288

Table A5 Regression results for building, 1967–2006

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-3.40970	1.49927	-2.27	0.0290	0
Lagged dependent	0.82542	0.08498	9.71	<.0001	2.4132
Construction employment (t)	0.01931	0.00349	5.53	<.0001	2.3089
Unemployed persons (t)	-0.00405	0.00126	-3.21	0.0028	1.1996

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	3	1 334.0	444.7	145.90	<.0001
Error	36	109.7	3.0		
Total	39	1 443.7			

R-square	0.9240
Adjusted R-square	0.9177

Table A6 Regression results for building, 1967–1996

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-9.21732	4.00394	-2.30	0.0296	0
Lagged dependent	0.80194	0.10668	7.52	<.0001	1.5678
Total employment (t)	0.00292	0.00068	4.31	0.0002	4.5663
Unemployed persons (t)	-0.01052	0.00259	-4.06	0.0004	4.8826

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	3	294.0	98.0	34.67	<.0001
Error	26	73.5	2.8		
Total	29	367.5			

R-square	0.8000
Adjusted R-square	0.7769

Table A7 Regression results for printing, 1967–2006

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	2.49185	0.94803	2.63	0.0124	0
Lagged dependent	0.70418	0.11102	6.34	<.0001	2.5646
Total employment (t-1)	-0.00022	0.00009	-2.49	0.0175	2.5646

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	2	43.1	21.6	91.14	<.0001
Error	37	8.8	0.2		
Total	39	51.9			

R-square	0.8313
Adjusted R-square	0.8221

Table A8 Regression results for printing, 1967–1996

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	9.11106	3.19174	2.85	0.0085	0
Lagged dependent	0.58610	0.13458	4.36	0.0002	2.2469
Total employment (t)	0.00037	0.00022	1.72	0.0972	5.9468
Manufacturing employment (t-1)	-0.00660	0.00254	-2.59	0.0156	7.1816
Unemployed persons (t-1)	-0.00472	0.00135	-3.48	0.0018	17.0336

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	4	24.1	6.0	27.10	<.0001
Error	25	5.6	0.2		
Total	29	29.7			

R-square	0.8126
Adjusted R-square	0.7826

Table A9 Regression results for food, 1967–2006

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-6.02884	1.66698	-3.62	0.0009	0
Lagged dependent	0.54242	0.13372	4.06	0.0002	69.7698
Total employment (t)	0.00166	0.00045	3.68	0.0007	69.7698

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	2	1 029.7	514.8	2 082.21	<.0001
Error	37	9.1	0.2		
Total	39	1 038.8			

R-square	0.9912
Adjusted R-square	0.9907

Table A10 Regression results for food, 1967–1996

Variable	Coefficient	Standard error	t-value	Pr > | t|	VIF
Intercept	-4.26883	1.66907	-2.56	0.0165	0
Lagged dependent	0.68066	0.12708	5.36	<.0001	28.0506
Total employment (t)	0.00119	0.00044	2.70	0.0119	28.0506

ANOVA

	df	Sum of squares	Mean square	F-value	Pr > F
Model	2	350.3	175.2	902.48	<.0001
Error	27	5.2	0.2		
Total	29	355.6			

R-square	0.9853
Adjusted R-square	0.9842