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ABSTRACT

The conclusion of a 1999 Organisation for Economic Cooperation and Development (OECD) report that wage gains for training are higher for workers with lower levels of education was revisited using data for males from the 1997 Australian Survey of Education and Training (SET). The study used methods similar to the OECD report (ordinary least squares and treatment effects model) with the following findings: (1) earnings effects for workers with Skilled and Basic Vocational Qualifications were slightly higher than for completers of Year 12; (2) years of occupational experience strongly affected earnings, though effect size declines with experience; and (3) structured training had a positive effect and unstructured training mixed effects. No evidence of a pattern of earnings effects consistent with the OECD results was found. A second study conducted further analyses of the 1997 SET data within the context of the OECD results. For Australia, the OECD had used 1995 Australian Workplace and Industrial Relations Survey (AWIRS). SET results were compared with AWIRS and other results for Canada, France, Germany, Italy, the Netherlands, and Great Britain. The reanalysis highlighted limitations of the OECD report: focus on employer-sponsored formal training, incumbent employees aged 25-54, and cross-sectional rather than longitudinal data. With multivariate analyses to correct for selection biases, the second study did not support the conclusion of the OECD report. (Study 1 contains 10 references; study 2 contains 24 references.) (SK)

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CENTRE FOR THE ECONOMICS OF EDUCATION AND TRAINING

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Preface

The project deals with the effect of the provision of training by Australian enterprises, including structured on-the job training, on the earnings of their employees.

Two reports are included in this working paper. The first gives the results of regression analyses of the *Survey of Education and Training (SET)*. This showed that for males:

- The (average) earnings effects for males of Skilled Vocational Qualifications (9.2%) and Basic Vocational Qualifications (7.6%) are similar and slightly higher than that for completion of Year 12 (7.2%).
- The number of years spent working in an occupation has a strong effect on earnings, although the size of the effect declines with experience.
- Structured training has a positive effect on earnings (4.7%) but the effect of the various forms of unstructured training is mixed.

There was substantial variation in the size of the effect of structured training across categories of both education and occupation, but that variation did not correspond with the incidence of structured training reported for those categories. Correction for selection bias reduced the variation slightly and altered the relative size of the wage effects of structured training, but did not make them any more coherent.

The second report provides further analyses of the *SET* and places them in the context of the international results reported in a recent OECD paper. The additional analyses replicate the OECD's use of the *Australian Workplace Industrial Relations Survey (AWIRS)*. The *SET* is more consistent with the surveys used for the analyses from the other countries.

The *SET* shows that recipients of training earn about 10% more than non-recipients of training. This difference is somewhat inversely related to education – there is a small negative difference for university graduates and higher positive effect for other categories, especially for non-university tertiary graduates.

The multivariate analyses tell a different story. The effect of correction for selection was stronger for the *SET* than the *AWIRS* and more consistent with results for the other countries reported in the OECD paper. The selection-corrected results, however, show improbably high wage effects from training (nearly 30%) – but still smaller than the values reported for other countries in the OECD paper. There was no clear pattern of differences in the size of the wage effects of training across categories of education or gender.

The OECD paper concludes that wage effects of training are higher among categories of workers who receive less training. The relevance of this conclusion to policy in Australian is questionable. The OECD analyses themselves showed that Australia tended to exhibit fewer differences in the distribution of training among categories of age and education. The OECD analyses of Australian data did not show differential wage effects of training that favoured categories of workers who received less training.

The parallel analyses of the SET reported here also fail to identify any such affect, although the estimates of the overall wage effect of training were strengthened.

Correction for selection bias is widely used in analyses of the wage effects of education and training. It is not uncommon for such correction to produce improbable values. Indeed frequently the correction increases the size of wage effects attributed to education or training when the intuitive expectation might be that the effect would decline. CEET will continue work in this area, although it does not form part of our program funded by ANTA.

Report 1

The effect of firm-based training on earnings: variations across categories of educational attainment and occupation

Overview

In an important study of firm-based training in many countries, OECD (1999) presents evidence that wage effects for training are larger for those with lower levels of education – a group that usually has a lower level of participation in firm-based training. This is interpreted tentatively as supporting the idea that the gains to training are larger for workers who receive less training. Such a conclusion provides a clear hint for policy formulation.

The conclusion was not supported by the evidence presented in the OECD study. The results were inconclusive and not consistent across countries. Results for Australia, based on the 1995 *Australian Workplace Industrial Relations Survey*, showed little difference in the size of earning effects for broad educational categories.

This report revisits this issue using data for males from the 1997 ABS survey of education and training. Three indicators of human capital were included in preliminary analyses:

- *Educational attainment* had a strong effect on earnings. Males with a basic vocational qualification earned 7.6% more than males who left school before the age of 16, and males with a skilled vocational qualification earned 9.2% more than early school leavers. As well as wage effects, differences in the costs of the various forms of postcompulsory education need to be taken into account before any conclusions can be drawn about the returns to those forms of education.
- *Experience* has a strong effect on earnings. Its effect is tapped by three measures – age, years with the employer, and years in the present occupation. Much of the effect is carried through age and years in the present occupation and relatively little through years with the main period employer. All three measures also include a squared term designed to detect a non-linear relationship. For age and years in the occupation the negative term shows that the effect of experience on earnings declines with time.
- The earnings effects of a set of *training* variables are also examined. The effect is positive for structured training – 4.7%. The story is less clear for unstructured training. Learning by being shown or by watching others is associated with negative earnings effects, while learning by asking questions or self-teaching have positive effects.

Although there was substantial variation in the size of these effects across categories of both education and occupation, that variation did not correspond uniformly with the incidence of structured training reported for those categories. Correction for selection bias reduced the variation slightly and altered the relative size of the wage effects, but did not make them any more coherent.

Introduction

The knowledge and skills of a workforce contribute substantially to the productivity of an economy, to innovation, and to economic growth. Their importance has increased in recent decades because of the increased rate of technological change and changes in work organisation. Most discussion of the economic role of the knowledge and skills of the workforce links it to globalisation, increased international competition in the provision of goods and services, and the creation of a 'competitive edge'.

Firm-based training is an important part of the process of knowledge and skill creation. In 1996 expenditure by Australian firms on structured training and education for their employees was about $4,715 million or just about 2.5% of total expenditure on wages and salaries (ABS, 1997). In 1996 firms provided around 20 hours of structured training per employee. By extension, an employee in the workforce for 40 years would receive an average of about 800 hours of training – the equivalent of just over half the formal hours of instruction received by a Year 12 student.

Firm-based training is a major source of lifelong learning. Changes in technology, work organisation and occupations make current knowledges and skills obsolete. The projected increase in the average age of the workforce also places a greater emphasis on the need for additional training beyond the initial years of formal education.

It is likely that there is a stronger match between the skill requirements of a job and firm-based training than exists for other forms of education and training. Such a link should result in a stronger effect on productivity and earnings. Indeed it is common in the literature to find participation in structured training associated with wage effects of about 8% (Groot, 1997). Such effects often translate into quite high rates of return.

Given the apparently strong effect of training on earnings and, by implication, productivity, there would be cause for concern if the level of the provision of training for employees was less than optimal. Indeed, the possibly high returns implied by the wage effects might itself be taken as a symptom of the under provision of employee training by firms. The threat of poaching may provide a disincentive for firms to train their workers and managers (and workers) may simply be unaware of the advantages that could follow from appropriate training.

Wage effects and the distribution of training

There are further consequences for earnings of participation in firm-based training if the earnings effect is linked to the observation that workers with lower levels of education and in lower status occupations are less likely to receive training from their firm. The distribution of training reinforces any earnings differences associated with these characteristics.

There are two interpretations of the unequal distribution of training. First, the distribution may reflect barriers to training – lower educated workers or workers in lower status jobs may receive less training when such training could help them to do their job better. Management, the workers themselves, or the availability of training may inhibit the provision of adequate training. A second interpretation is that the observed distribution of training reflects the productivity profiles of different categories

of workers – less training is offered to workers with lower levels of education or in lower status jobs because those workers are less likely to be able to use that training productively or more difficult to train.

If the latter interpretation is correct, then the earnings effects of training for workers with different levels of education and in different occupations should be similar. Firms provide training to the various categories of workers up to the point where the marginal return to training is the same for all categories of workers. If the first interpretation is correct – that the unequal distribution of training results from non-economic barriers to training – then there should be higher earnings effects for those categories of workers who receive less training. Statistically speaking, we are interested in the interaction effects of training on earnings.

The interpretation of such interactions depends on several assumptions. The first is that the ratio between the proportion of any increase in productivity allocated to the firm and to the worker is constant across categories of workers. Firms fund their training on the basis of returns to the firm, not the employee. If firms are not able to retain the same proportion of any increase in productivity for all categories of workers, then if productivity increases are constant across those categories of workers, firms will fund more training for categories of workers with lower increases in earnings. Interaction effects will appear, but the allocation of training may be optimal from the perspective of the firm.

Second, in analyses of earnings, all we observe is the *average* earnings effect of training. The amount of training provided, however, depends on the effect at the *margin*, that is, the productivity increase for the last worker for whom training is provided. Average earnings effects could differ across categories of workers, but the allocation of training could nevertheless be efficient. Hence, when looking to interaction effects for evidence of a less than optimal allocation of training, we are assuming that the shape of the marginal productivity curve associated with additional training is constant across categories.

A third assumption is that earnings reflect productivity. It is a bedrock of liberal economics that marginal wages reflect the productivity of the worker in a perfect market. There are, however, instances in which this is not the case. Although productivity is the major focus of this report, and the productivity-earnings nexus is required for the interpretation we wish to give interaction effects, differential earning effects are of interest in their own right.

Self-selection

Even given the above assumptions, the task of interpretation of the results is not straightforward. The nature of the data, the nature of the model, and measurement issues pose particular problems. In seeking to isolate the effects of training on earnings, the ideal scenario would be to allocate workers randomly to receive training or not receive some form of standard training, observe their wages before training and after training, and compare the average increment of those who received training with those who do not receive training. The data from the *Survey of Education and Training* fall well short of this ideal.

The SET data are cross-sectional. Hence earnings are observed at the same time as the training – although it might be argued that the measured training occurred sometime in the 12 months preceding interview and the earnings was therefore observed after the training. There is hence at least a suggestion of temporal sequence to the observations. Although SET provides an impressive array of potential statistical controls, cross-sectional data cannot match the statistical control provided by the longitudinal data usually used for analyses of the effect of training on earnings. Even longitudinal data, though, are unlikely to control for all the characteristics.

The recipients of training, however, are certainly not a random group. They are presumably selected (or select themselves) because they are more likely to benefit from the training. In this sense, the benefit (earnings) and the selection (training or not training) influence each other simultaneously. Although an array of observed characteristics may catch some of the selection process, it is unlikely to control adequately for all unmeasured characteristics. It also leaves open the important issue of whether providing training for those who currently receive no training will produce the same earnings effect as is observed for those currently receive training.

Selection models address these issues (Heckman, 1979; Amemiya, 1984; Maddala, 1983). These statistical models consist of essentially two stages: a selection equation and an outcomes equation. In the context of this report, the selection equation consists of a probit equation with participation in structured training as the dependent variable, while the outcomes equation is log earnings predicted by an array of variables together with a term brought forward from the selection equation that corrects for selectivity. The models were developed initially in the context of the need to correct for unobserved (or unobservable) outcomes for part of the sample – the tobit model. The variant of the model used in this report is the treatment effects model that can be used to correct for self-selection and simultaneity. This is slightly different from the approach used in OECD, 1999, which appears to have been based on endogenous switching equations.

Selection models promise a great deal, but their delivery is frequently questionable. The models are bedevilled by multi-collinearity. The selection term that is brought forward into the outcomes equation is often highly correlated with other variables in the outcomes equation. Estimation is substantially improved if the sets of predictor variables in the selection and outcomes equations are different. In the context of this report, it means finding variables that predict earnings but not participation in training (or vice versa).

The exclusion of a variable from one equation but not the other is difficult to justify on theoretical grounds. In the analyses of treatment effects that follow, we have used an empirical approach that in an iterative process systematically removed the least statistically significant variables from each equation until only statistically significant variables remained in each. Such an approach is less than ideal. The final analyses, however, are based on a selection and outcomes equation that use somewhat different sets of predictor variables.

The concept of self-selection is not restricted to training and earnings. Within the literature on training, it has been suggested that training and duration of employment (Kreuger & Rouse, 1998) and training and firm size (Blundell, *et al.*, 1996) may be relationships that are subject to self-selection. In the broader education literature, the

effect of self-selection on the relationship between education and earnings is widely recognised. The vector of predictors used in this report includes all these variables. There is no guarantee that just by addressing the self-selection associated with training and earnings the estimates will be any less biased when other forms of self-selection are ignored.

Measurement

The variety of forms of training contributes to the difficulty of analysis. In this report we follow the definitions in the STE and identify:

- Study for a qualification undertaken with some financial support from the main period employer;
- Completion of a structured in-house training course provided by a firm essentially for its own employees;
- Completion of a structured external training course undertaken while working. This category includes some courses that may not have been supported by an employer.
- Unstructured training activities including asking questions of co-workers or colleagues; teaching yourself; being shown how to do your job; and watching others work.

The STE includes several sub-populations. The analyses in this report are for persons who were employed as wage or salary earners at any time in the 12 months prior to the interview. These preliminary analyses are restricted to male employees only, but will be replicated for female employees in due course. Study for a qualification refers to enrolment in 1997, but the other training activities all refer to the 12 month period. The structured training was all work-related – to obtain, maintain or imrove work-related skills. Detailed information was collected on only the four most recent structured training activities – hence there is a likelihood that some structured training activities have not been enumerated. The unstructured training activities were recorded simply as a yes or a no.

Table 1 shows the correlation coefficients among the seven types of training. The values in the upper right triangle are Pearson's correlation coefficients. Because the variables are all dichotomous, however, it has been suggested that these values are biased downwards and that polychoric correlation coefficients may provide a better estimate of the relationships (Jöreskog & Sörbom, 1993). The corresponding coefficients are shown in the lower left triangle of Table 1.

The major feature of Table 1 is the fairly low level of relationship among the three structured types of training. None of the polychoric correlations exceeds 0.16. On the other hand, the four types of unstructured training exhibit a fairly high level of inter-relationship.

Ideally we would like to include hours of training in the selection process and certainly in the interpretation of earnings effects because hours of training are likely to influence the cost of training and hence influence estimates of the returns to training. Unfortunately this proves to be difficult to model. The following analyses use summary measures of training in order to obtain the simplicity suitable for analysis. The focus is

on the effect of completion of a structured training course – that is, either an in-house training course or an external training course undertaken while working – on earnings.

Wage effects

Table 2 shows the effect of summarising the training variables on the prediction of log earnings. These effects are extracted from a larger model that is estimated by ordinary least squares without any correction for self-selection. The coefficients have all been adjusted so that they show the change in the percentage of earnings associated with each training variable (Kennedy, 1981).

Values for three models are shown in Table 2. The first model is the most detailed. It contains in-house and external training and includes the length of training. The second model retains in-house and external training separately, but takes no account of the hours of training. The third model combines in-house and external training as a single measure – completion of a structured training course. The values for the adjusted R-squares at the bottom of Table 2 suggest that little has been lost descriptively by summarising structured training – the adjusted R-square declines from 73.3% for the first model to 73.2% for the second model and is then unchanged within rounding for the third model. The partial F-ratios, however, show that even these slight changes are statistically significant.

The values in Table 2 are of interest in so far as they show the main effects of training on earnings without sample selection. For all three models, enrolment to study for a qualification is associated with a reduction in earnings – 8.4%, 8.3% and 8.2% respectively. These results are consistent with Becker's predictions that workers will pay for general training by accepting lower wages. It would be interesting to examine these results separately by qualification in order to establish the extent to which the effect may be restricted to apprenticeships that have a legislated 'training wage'.

The earnings effects of completion of an in-house training course increases with the hours of training. Total training of 1 to 2 days (1-16 hours) increases earnings by 2.4%, 3-5 days increases earnings 5.3% (17-40 hours), and more than a week of in-house training increases earnings by 8.4%. Interestingly, the effect on earnings seems proportional with the amount of training. The same effect is not quite as obvious for external training, but nevertheless there is a clear difference between training of less than one week and of more than one week.

When only completion or non-completion of a course is considered, the effects of in-house training and external training are approximately weighted averages of the values observed for the separate categories of days. And when in-house and external training are considered, the effect of completion of at least one structured training course is to increase earnings by 4.7%. It should not be surprising that the effects of in-house training (4.6%) and external training (3.6%) are not cumulative given the low correlations between in-house and external training reported in Table 1.

The earnings effects of the four forms of unstructured training, however, are a little surprising. The effects are nearly constant across the four models and are negative for the training activities *being shown* and *watching others*. It is difficult to interpret such a result as a causal effect. The comparison is not of these forms of training with other

training, but with no training. It is difficult to believe that having a work colleague show you how to do your job could actually reduce earnings. We can only conclude that, together with *watching others work,* it is a proxy for an aspect of the job, and it is this job characteristic that is associated with lower earnings. Of course, once this kind of explanation is offered about the relationship between one form of training and earnings, there must be a suspicion that similar effects might underlie apparently more plausible relationships.

Table 3 shows the wage effects of structured training for different levels of educational attainment and for different occupational categories. The first three columns are for the main effects of these categories taken from a model with no interaction terms. For education they show the percentage increase in earnings associated with each level of education compared with the earnings of a worker who left school at or before age 15 and completed no further educational qualification. Similarly for occupation they show the percentage increase in earnings associated with each occupational category compared with the earnings of a labourer. Since these values are derived from a regression equation containing a substantial array of other variables, these are the earnings effects controlling for those other variables.

For educational attainment, the values in the six columns headed *Main effects and interactions* result from a regression equation in which training has been interacted with each of the categories of education. The first three columns can therefore be interpreted as the effect of the education categories on earnings without structured training compared with early school leavers who receive no structured training. The next three columns show the effect of receiving structured training for each category of educational attainment compared with an early school leaver who receives no structured training. It is really only these last three columns that are of interest in the present context.

Table 3 shows that the effect of training is greatest for those employees with an *Associate Diploma* – receipt of structured training increases earnings by 10.3%. The effect is least (indeed strongly negative) for workers with a higher degree. Again, it is very difficult to offer a meaningful causal interpretation of a negative coefficient. It is difficult to believe that receipt of structured training could *reduce* earnings. Again, receipt and non-receipt of structured training are likely to be proxies for otherwise unmeasured aspects of occupation.

The most important feature of the results in Table 3 for education is that there is no relationship between the earnings effect of a level of educational attainment and the likelihood of workers in that category receiving structured training. For instance, persons who completed Year 12, a Basic Vocational Qualification or a Skilled Vocational Qualification have similar levels of the incidence of training (44.2%, 43.1%, and 46.4%) but very different wage effects (7.9%, 1.9% and 1.4% respectively).

Despite the lack of any consistent relationship between the incidence of training and earnings effects, the fact that there is substantial variation in the effect of training on earnings across the categories of educational attainment raises interesting questions. If, for instance, the wage effects of those with a Skilled Vocational Qualification is really only 1.4%, why is it so low? While the question can be asked, answers are a little more difficult to provide.

Similar conclusions apply to the results for occupation in Table 3. There is substantial variation in the size of the effect of training on earnings for the various categories of occupation, but it does not seem to be related to the incidence of structured training for the occupation. That there is such variation is interesting – its explanation is another matter.

Table 4 provides results analogous to those in Table 3 after correction for self-selection. The results are not directly comparable with those in Table 3 because a slightly different set of predictor variables has been used in the outcomes equation. Again, the major interest is in the interaction terms. The selection term (shown as *Lambda* in the Table) has had a substantial effect on both the values for educational attainment and occupation. In neither case though, is there clear evidence for either higher earnings effects of training associated with a lower incidence of training or uniformity of the earnings effects of training across educational or occupational categories of training.

Conclusion

This report has followed a similar approach to that taken in a seminal paper on training (OECD, 1999). That paper argued from the higher earnings effects of training for workers in lower educational and occupational categories that there were 'barriers' to training provision for workers in those categories. This report examined cross-sectional data using both ordinary least squares and a treatment effects model similar to that employed in the OECD study. There was no evidence of a pattern of earnings effects consistent with such 'barriers', although there was substantial variation in earnings effects among categories of workers. Such variation is not easily explained. It may reflect the strong assumptions required when making inferences from differences in the size of earning effects about appropriate levels of training provision.

Table 1: Correlation coefficients among types of training: Males employed in last 12 months

Training	*Study*	*In-house*	*External*	*Shown*	*Watching*	*Asking*	*Teaching*
Study for a qual.	1.00	0.05	0.06	0.10	0.11	0.10	0.09
In-house	0.14	1.00	0.03	0.09	0.13	0.20	0.21
External	0.16	0.06	1.00	-0.01	0.04	0.10	0.16
Being shown	0.28	0.14	-0.02	1.00	0.55	0.46	0.27
Watching others	0.29	0.21	0.07	0.76	1.00	0.52	0.38
Asking questions	0.31	0.32	0.19	0.68	0.75	1.00	0.53
Teaching self	0.26	0.34	0.32	0.43	0.59	0.75	1.00

Notes

1. Values above the diagonal are Pearson's correlation coefficients; values below the diagonal are polychoric correlation coefficients.
2. All values are statistically significant at 0.01.
3. *Study for a qualification* is study that has received financial support from the main period employer.
4. *External training* is structured training that has been undertaken while working.

Table 2: Regression of log weekly earnings with main period employer on training participation: Males employed in last 12 months

	% of sample	*Model 1* % change in earnings	*Model 2* % change in earnings	*Model 3* % change in earnings
Study for a qualification	4.3	-8.4 ***	-8.3 ***	-8.2 ***
Structured training	45.8	----	----	4.7 ***
In-housel training	34.8	----	4.6 ***	----
None	65.2	----	----	----
1-2 days	14.8	2.4 *	----	----
3-5 days	11.1	5.3 ***	----	----
More than a week	8.9	8.4 ***	----	----
External training	17.8	----	3.6 ***	----
None	82.2	----	----	----
1-2 days	7.7	3.4 *	----	----
3-5 days	6.0	3.2	----	----
More than a week	4.2	6.0 **	----	----
Unstructured training				
Being shown	38.5	-3.7 ***	-3.6 ***	-3.6 ***
Watching others	40.8	-2.0 *	-2.0 *	-2.0 *
Asking questions	52.3	2.4 *	2.4 *	2.4 *
Teaching self	59.1	3.8 ***	3.8 ***	3.9 ***
Adj R-square		73.3	73.2	73.2
F-ratio		327.7 ***	348.195 ***	353.499 ***
Degrees of freedom		66,7800	62,7804	61,7805
Partial F-ratio		----	3.53 **	4.28 **
Degrees of freedom		----	4,7800	5,7800

Notes

1. The coefficients are from an Ordinary Least Squares equation that regresses log wages on a number of personal, occupational and firm characteristics. The characteristics and their values are shown in an appendix.
2. The coefficients have been adjusted so that they can be interpreted as percentage changes in earning (see Kennedy, 1981).
3. * indicates $p<0.05$, ** indicates $p<0.01$, *** indicates $p<0.001$.
4. *Study for a qualification* is study that has received financial support from the main period employer.
5. *External training* is structured training that has been undertaken while working.

Table 3: Wage effects of structured training across categories of highest educational attainment and occupation with main period employer: Males employed in last 12 months

	% Strctd Trning	Main effects only			Main effects and interactions					
					Main effects			Interactions		
		%	t	p	%	t	p	%	t	p
Educational attainment										
Higher Degree	68.0	27.6	8.97	0.00	40.4	7.95	0.00	-9.0	-1.96	0.05
Postgraduate Diploma	72.4	16.1	4.97	0.00	12.8	2.35	0.02	8.9	1.50	0.13
Degree	65.8	20.1	10.11	0.00	20.0	7.45	0.00	5.1	2.12	0.03
Undergraduate Diploma	59.7	8.8	3.71	0.00	8.2	2.43	0.02	5.6	1.41	0.16
Associate Diploma	58.9	13.4	5.90	0.00	9.9	3.11	0.00	10.3	2.72	0.01
Skilled Vocational Qual.	46.4	9.2	6.29	0.00	10.7	5.96	0.00	1.4	0.83	0.41
Basic Vocational Qual.	43.1	7.6	4.65	0.00	8.7	4.27	0.00	1.9	0.81	0.42
Year 12	44.2	7.2	4.70	0.00	5.6	3.03	0.00	7.9	3.95	0.00
Left school aged 16 +	34.6	-0.3	-0.19	0.85	-1.7	-0.98	0.33	8.7	3.90	0.00
Left school aged 15 -	27.8	----	----	----	----	----	----	4.3	1.90	0.06
Occupation										
Managers & admin.	64.5	40.9	16.66	0.00	34.8	10.54	0.00	9.0	2.90	0.00
Professionals	67.0	35.1	15.95	0.00	36.6	13.08	0.00	0.4	0.20	0.84
Associate professionals	61.6	27.0	13.25	0.00	23.6	8.87	0.00	6.4	2.55	0.01
Tradespersons	37.9	9.8	6.19	0.00	6.0	3.36	0.00	9.5	5.13	0.00
Advanced CS & S Wrkrs	55.1	18.2	4.27	0.00	13.9	2.35	0.02	7.9	1.09	0.28
Intermediate CS & S Wkrs	51.4	10.3	5.77	0.00	10.2	4.54	0.00	1.3	0.58	0.56
Intermediate P & T Wkrs	32.7	6.0	3.86	0.00	3.6	2.00	0.05	6.3	2.96	0.00
Elementary CS & S Wkrs	36.5	3.4	1.74	0.08	1.2	0.53	0.60	6.1	1.99	0.05
Labourers	24.1	----	----	----	----	----	----	-2.9	-1.14	0.25

Notes

1. The coefficients are from an Ordinary Least Squares equation that regresses log wages on a number of personal, occupational and firm characteristics. The characteristics and their values are shown in an appendix.
2. The coefficients have been adjusted so that they can be interpreted as percentage changes in earning (see Kennedy, 1981).
3. *Structured training* is completion of at least one in-house or external training course while working.
4. *CS & S Wrkrs* is Clerical Sales and Service workers; *P & T Wrkrs* is Production and Transport workers.
5. The interaction effects for educational attainment and occupation were fitted separately.

Table 4: Selection and wage effects of structured training across categories of highest educational attainment and occupation with main period employer: Males employed in last 12 months

	% Strctd Trning	Main effects only			Main effects and interactions					
					Main effects			Interactions		
		%	t	p	%	t	p	%	t	p
Educational attainment										
Higher Degree	68.0	25.9	7.48	0.00	37.9	7.12	0.00	16.9	3.60	0.00
Postgraduate Diploma	72.4	13.0	3.48	0.00	9.3	1.64	0.10	-2.2	-0.39	0.70
Degree	65.8	17.0	6.53	0.00	17.0	5.44	0.00	2.5	0.96	0.34
Undergraduate Diploma	59.7	5.9	2.06	0.04	5.6	1.53	0.13	2.2	0.59	0.55
Associate Diploma	58.9	11.2	4.20	0.00	8.3	2.43	0.02	-1.9	-0.54	0.59
Skilled Vocational Qual.	46.4	7.3	3.83	0.00	8.8	4.17	0.00	5.8	2.54	0.01
Basic Vocational Qual.	43.1	6.7	3.73	0.00	8.1	3.78	0.00	5.7	2.11	0.03
Year 12	44.2	5.2	2.70	0.01	3.8	1.78	0.07	-0.2	-0.06	0.95
Left school aged 16 +	34.6	-0.6	-0.38	0.70	-1.9	-1.04	0.30	-1.2	-0.50	0.62
Left school aged 15 -	27.8	----	----	----	----	----	----	2.2	0.93	0.35
Lambda	----	-11.1	-2.23	0.03	-11.09	-2.23	0.03	----	----	----
Occupation										
Managers & admin.	64.5	37.6	12.03	0.00	32.8	8.78	0.00	-1.5	-0.47	0.64
Professionals	67.0	31.6	10.89	0.00	34.3	10.33	0.00	7.2	2.92	0.00
Associate professionals	61.6	24.0	9.32	0.00	21.8	7.24	0.00	1.2	0.45	0.66
Tradespersons	37.9	8.5	5.11	0.00	5.3	2.89	0.00	-1.8	-0.78	0.44
Advanced CS & S Wrkrs	55.1	16.3	3.67	0.00	12.9	2.15	0.03	-0.8	-0.09	0.93
Intermediate CS & S Wkrs	51.4	8.4	3.86	0.00	9.2	3.72	0.00	6.4	2.38	0.02
Intermediate P & T Wkrs	32.7	6.0	3.75	0.00	4.0	2.22	0.03	1.7	0.72	0.47
Elementary CS & S Wkrs	36.5	2.5	1.22	0.22	0.8	0.36	0.72	1.4	0.46	0.65
Labourers	24.1	----	----	----	----	----	----	9.6	3.53	0.00
Lambda	----	-11.1	-2.23	0.03	-9.1	-1.80	0.07	----	----	----

Notes

1. The coefficients are from an Ordinary Least Squares equation that regresses log wages on a number of personal, occupational and firm characteristics. The equation has been corrected for selection on receipt of structured training. The characteristics and their values are shown in an appendix.
2. The coefficients have been adjusted so that they can be interpreted as percentage changes in earning (see Kennedy, 1981).
3. *Structured training* is completion of at least one in-house or external training course while working.
4. *CS & S Wrkrs* is Clerical Sales and Service workers; *P & T Wrkrs* is Production and Transport workers.
5. The interaction effects for educational attainment and occupation were fitted separately.

Appendix: Regression of log weekly earnings with main period employer on selected personal and employment characteristics: Males employed in last 12 months

Personal and Employment Characteristics	% Earnings	t	Prob
Age	4.4	17.10	0.00
Age squared (*1000)	0.0	-15.57	0.00
Married	5.2	4.57	0.00
Youngest dependent children			
None	---	---	---
1-2 years	0.6	0.46	0.65
3-5 years	-0.6	-0.33	0.74
6-10	-1.2	-0.79	0.43
11-14 years	-1.4	-0.95	0.34
Country of Birth			
Australia	---	---	---
Other English-speaking country	1.0	0.82	0.41
Non-English-speaking country	-6.5	-5.69	0.00
Highest Educational Attainment			
Higher Degree	27.6	8.97	0.00
Postgraduate Diploma	16.1	4.97	0.00
Degree	20.1	10.11	0.00
Undergraduate Diploma	8.8	3.71	0.00
Associate Diploma	13.4	5.90	0.00
Skilled Vocational Qualification	9.2	6.29	0.00
Basic Vocational Qualification	7.6	4.65	0.00
Year 12	7.2	4.70	0.00
Left school aged 16 or over	-0.3	-0.19	0.85
Left school aged 15 or earlier	---	---	---
Occupation			
Managers & admin.	40.9	16.66	0.00
Professionals	35.1	15.95	0.00
Associate professionals	27.0	13.25	0.00
Tradespersons	9.8	6.19	0.00
Advanced CS & S Wrkrs	18.2	4.27	0.00
Intermediate CS & S Wkrs	10.3	5.77	0.00
Intermediate P & T Wkrs	6.0	3.86	0.00
Elementary CS & S Wkrs	3.4	1.74	0.08
Labourers	---	---	---
Hours Usually Worked	9.2	53.42	0.00
Hours Usually Worked * 1000	-0.1	-34.47	0.00
Employment Status			
Permanent	-3.7	-3.03	0.00
Casual	---	---	---
Years with Employer	0.3	1.65	0.10
Years with Employer Squared (*1000)	0.0	-0.70	0.48
Years in Occupation	1.6	8.01	0.00
Years in Occupation Squared (*1000)	-0.1	-7.02	0.00
Number of Employers in Last 12 Months			
One	---	---	---
More than one	1.6	1.64	0.10

Appendix: Regression of log weekly earnings with main period employer on selected personal and employment characteristics: Males employed in last 12 months (Cont)

Personal and Employment Characteristics	*% Earnings*	*t*	*Prob*
Size of Employer			
1-9 employees	-17.4	-15.70	0.00
10-19 employees	-10.2	-7.11	0.00
20-99 employees	-5.6	-5.06	0.00
100 or more employees	---	---	---
Sector			
Private	-0.9	-0.62	0.54
Public	---	---	---
Industry			
Agriculture	3.1	1.01	0.31
Mining	46.0	11.22	0.00
Manufacturing	13.6	5.57	0.00
Utilities	21.8	5.49	0.00
Construction	22.6	8.04	0.00
Wholesale	12.1	4.47	0.00
Retail	2.8	1.16	0.25
Accommodation, cafes	2.3	0.84	0.40
Transport	16.1	5.88	0.00
Communication	20.8	5.99	0.00
Financial services	19.8	6.12	0.00
Property services	15.4	5.79	0.00
Public administration and defence	5.8	2.20	0.03
Education	-3.4	-1.26	0.21
Health & community services	-1.7	-0.60	0.55
Cultural & recreational services	7.4	2.11	0.04
Personal services	---	---	---
Trade union membership			
Member with mpe	6.0	6.27	0.00
Other	---	---	---
Participated in structured training	4.7	5.29	0.00
Enrolled for qualification	-8.2	-4.43	0.00
Informal training: watching others	-3.6	-3.62	0.00
Informal training: shown	-2.0	-1.97	0.05
Informal training: asking questions	2.4	2.34	0.02
Informal training: teaching self	3.9	4.01	0.00

Notes

1. R-square = 0.73, adjusted R-square = 0.73.
2. N of cases = 7866
3. Data imputation used for a small percentage of cases for education, firm size and sector.
4. Distribution of earnings truncated at the right at $1200 per week.

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Report 2

The effect of firm-based training on earnings: multivariate analyses

Background

The knowledge and skills of workers contribute to efficient production. The continuing vocational training of adult workers is an important source of such skills. It appears that the returns to such training are relatively high. More rapid rates of economic change and the aging of the workforce highlight the weakness of too great a reliance on initial education and training. Given the importance of continuing vocational education and training to economic performance, governments are concerned by suggestions that the level of training provided by firms may be less than optimal. Hence many countries have introduced policies to encourage or mandate higher levels of firm-based training.

Research shows that workers who are disadvantaged in the labour market have lower level of continuing vocational education and training than other workers. The exceptions are rare. Workers with lower levels of initial education, with migrant or ethnic status, in low-paid, low-status, part-time and casual jobs receive less training than other workers. The evidence on the level of participation of women, however, is mixed.

There are two explanations of this pattern of participation. One view is that the pattern reflects the benefits to be gained by enterprises from training different categories of workers. If workers who are already relatively advantaged in the labour market receive more training, it is because the training is more effective for them – whether because they learn more quickly, their jobs require more training, or they work hours that permit higher returns to be obtained from their training.

The second view is that training is rationed. The categories of workers who receive less training would benefit from that training as much or more than the categories of workers who receive more training. The pattern of training therefore reflects a market failure, possibly because of management or worker ignorance.

The policy implications of these two explanations are very different. The former is neutral in regard to equity, although independent of issues of whether there is an overall under-provision of training. The latter view clearly supports some form of government intervention in the provision of training for workers who receive low levels of training.

A recent OECD paper made a substantial contribution to the discussion of these issues through the analysis of a large number of surveys. Although acknowledging the difficulties of such analysis, the paper concluded that the pattern of participation in continuing vocational training reflected rationing. Economic efficiencies could follow from the expansion of the provision of training to categories of workers who typically receive little training.

The results for Australia presented in the OECD paper are from the 1995 *Australian Workplace and Industrial Relations Survey (AWIRS).* This report replicates those analyses using the 1997 *Survey of Training and Education (SET)* – arguably a better data source for this purpose. Unlike results for some other countries, neither survey showed evidence of higher wage effects from training for women or less educated workers. Results from the SET, however, showed a substantially higher wage effect from training than the corresponding results from the SET.

Introduction

A recent paper in *OECD Economic Outlook* (1999) reported results of analyses that addressed several important issues in the on-going training of adult workers. It takes as its starting point the contribution of firm-based training to improvements in labour productivity, economic growth and international competitiveness. Links are made among four sets of international surveys to compare both the variation in the incidence of training among countries and the variation in training provision among categories of workers. A set of broadly comparable national surveys is then used to investigate the effect of participation in training on the wages of employees.

One conclusion from the study is that since 'a key distinguishing feature of high training economies is that participation in training is more evenly distributed, policies enhancing the incentives and resources for investing in the continuing training of workers typically receiving little training may be of particular importance' (OECD, 1999: 133). The paper suggests that in the field of firm-based training, improvement in equity is consistent with greater economic efficiency.

If true, such a conclusion has important implications for training policies. Governments, in so far as they seek to encourage firms to provide more continuing vocational training for their employees, can choose to encourage an overall increase in training levels, or attempt to redirect training investments towards groups in the workforce currently receiving little training.

This report reviews the evidence presented in the OECD paper from the perspective of the results for Australia. The evidence on training patterns and outcomes in Australian is derived principally from analyses of the 1995 *Australian Workplace Industrial Relations Survey (AWIRS)*. This report extends the analyses by considering corresponding results from the 1997 *Survey of Education and Training (SET)* conducted by the Australian Bureau of Statistics (ABS).

Limitations on the data

The data used in the OECD paper suffer from several limitations. In this, however, they do not necessarily differ from much of the literature on continuing vocational training.

- The analyses in the OECD paper, and in this report, focus principally on more or less *formal training*. The few studies that measure informal training show that formal training represents only a small part of the total training effort. Frazis *et al.* (1998), for instance, estimated that for every hour of formal training there were two hours of informal training. Bishop (1991) found that formal training was only 8% of the total hours of training of new hires in the first three months after joining the firm. A Canadian survey of adult learning activities found that adults average about 15 hours per week on informal learning (including non-work settings) – substantially more than is spent in the formal education system (Livingstone 1999). Hence analyses of participation in formal training deal with only a small part of adult learning.
- The analyses are restricted to *incumbent employees*. The proportion of the workforce that is unemployed is therefore excluded from the analysis and it might be expected that these people will have a low probability of receiving training in a

given year. As importantly, employers and the self-employed are excluded from the survey. These groups constitute a strategic part of the economy.

- The analyses are *limited to workers between the ages of 25 and 54* years to avoid complications related to international differences in initial education and retirement patterns. The truncated distribution of age and work tenure may under-estimate any impact of age and tenure on participation in training and on earnings.
- Because most continuing training of employees is sponsored – at least in part – by employers, *employer-provided* training is emphasised. There is clearly some component of formal training that workers provide solely from their own resources, but this is generally quite small.
- The main measure of training used in the analyses is *participation.* The incidence of training is a minimalist measure. It does not consider the amount of training, the quality of that training, the resultant learning or skill formation, or the outcomes of the training.
- The data sources are principally *cross-sectional.* Some of the analyses attempt to identify the effect of training on wages. This is particularly difficult when wages may in turn have an effect on participation in training. Longitudinal data in which the temporal ordering of cause and effect can be established are clearly preferable. Earnings before training can then be used explicitly as a statistical control and the focus of analysis is explicitly earnings growth. The cross-sectional analyses rely on a very modest ordering of training and wages (training in the previous 12 months and current wage) and statistical techniques to control for unmeasured prior variables. This is a second best solution.

The Level of Participation in Training

Training participation is reviewed for four sets of international surveys: *The International Adult Literacy Survey, the European Labour Force Survey, the OECD Indicators of International Systems,* and *the Continuing Vocational Training Survey.* Collectively, these surveys span 24 OECD or European nations. Although not all countries participated in all sets of surveys, there was sufficient overlap to allow all 24 countries to be ordered from high to low on both participation in training and the hours of training.

The ordering resulted from standardising scores for a given survey to a mean of zero and a standard deviation of one. The score for a given country was simply the mean of the scores for each survey in which it participated. Although there is a refreshing simplicity to this approach, it ignores effects associated with the different groupings of countries in the sets of surveys. If such effects were considered, the ordering of countries would doubtless change.

Australia ranks 8th on the overall index of participation in continuing vocational training and 3rd on the overall index of hours of training. Relatively speaking, these results can only be viewed as reasonably good in the context of a field of 24 countries that are either members of the OECD or the European Union.

The relative intensity of training of each country can be estimated from the indices of participation and hours of training of the 24 countries. A country that has a lower

ranking for hours of training than for participation in training is an extensive trainer – its training hours are distributed among relatively more workers. Conversely, a country that has a higher ranking for hours of training than for participation in training is an intensive trainer – its training hours are distributed among relatively fewer workers. Australia therefore tends to exhibit a pattern of intensive training. The OECD paper speculates that this may be a consequence of a training levy (the Training Guarantee) 'to encourage a mix of training that favours easily documented forms of spending, such as employer-sponsored courses, which are heavily weighted by the volume measures in these surveys' (OECD, 1999: 145).

If Australian enterprises are characterised by a greater level of intensity of training than enterprises in other industrialised countries, and if, as the OECD paper suggests, higher training economies are usually characterised by more extensive training practices, then there may be some scope in Australia for policies designed to encourage investment in the continuing training of workers who typically receive little training.

The Distribution of Training

The four sets of international surveys of training provide an opportunity to examine variation in the receipt of training among categories of workers across the 24 countries spanned by the surveys. The discussion in the OECD paper is restricted to only a few characteristics: gender; age, and education and is based on participation in training.

For gender, Australia has a value of 0.95 for the ratio of female to male participation rates and is 19th out of the 24 countries. Hence the participation rate of women in Australia compared with men is relatively lower than in most other industrialised countries. Regardless, however, it is still not too different from the overall mean ratio of 1.02 for the 24 countries.

For age, Australia, with a value of 1.28 for the ratio of young to old participation rates, is 16th out of the 24 countries spanned by the four sets of surveys. This result could be interpreted positively – it means that continuing vocation training is more likely to be focused on older workers and to fulfil the needs of lifelong learning.

For education, the ratio of the training participation rates of workers with a university degree to the same rates for workers who did not complete upper secondary schooling is relatively low – 2.11 compared with an average of 6.87 for the 24 nations. Australia ranks 21st out of the 24 nations with only Sweden, the Netherlands and New Zealand having lower ratios. In the international context, inequalities in participation associated with the educational attainment of workers are relatively low in Australia.

Countries with higher levels of training provision tend to have a more equal distribution of training among workers of different ages and different educational attainments.

Training Probabilities and Earnings of Trainees

The section of greatest interest for the purposes of this report deals with results from the analysis of surveys of training in seven countries. These are Australia, Canada, France, Germany, Italy, the Netherlands and Great Britain. The surveys, while not comprising a

uniform series, contain information that allows a consistent set of analyses of training participation and earnings to be undertaken.

The Australian data are derived from the AWIRS. There are some difficulties associated with the use of this survey. To begin with, participation in training is not a central focus of the AWIRS. Indeed, the focus of the AWIRS is on the surveys of workplaces. Self-completion questionnaires were distributed to a random sample of employees at each of the workplaces included in the main survey. The response rate was 64%. (Morehead, et al, 1997: 22), which provides some scope for self-selection of the sample. Importantly, the main survey excluded workplaces in the agricultural industry and was restricted to workplaces with 20 or more employees – which meant that about a third of current employees were excluded.

The SET provides an alternative source of information. This was a household survey with a focus on education and training. Data were collected principally by interview and response rates were nearly 100%. (ABS, 1998). Arguably, the SET provides a better basis for the international comparisons than the AWIRS. The following discussion compares results from the SET with the AWIRS and with results for the six other countries for which results are reported in the OECD paper.

The coverage of the SET is more extensive than the AWIRS. For comparability, the SET analyses have been restricted to persons employed at the time of interview and respondents aged 25-54. Two series of results from the SET are presented and are labelled SET1 and SET2 respectively. The first provides results that are comparable with the AWIRS. It excludes persons employed in workplaces with fewer than 20 employees or in agriculture – hence the sample size is considerably smaller than for SET2. The second series is designed to be more comparable with the international surveys and includes persons working in smaller workplaces and in agriculture.

The results from surveys of training can vary substantially with the wording of the question about training. This is certainly one explanation for the sometimes substantial variation in the estimates of participation in training produced by different surveys reported in the OECD paper. The wording of the training question in the AWIRS was:

Has your employer provided you with any of the following training over the last 12 months?

Include any training which is provided or paid by your employer, whether you did it at this workplace or somewhere else.

- Training to help you do your job?
- Training in occupational health and safety?
- Training to read or write English?

The wording of the question in the SET was:

The next group of questions refer to the last 12 months, that is from . . . 1996 to . . . 1997.

The questions ask about training you have undertaken in Australia to obtain, maintain or improve work-related skills. Later questions in the survey will ask about your formal educational qualifications.

During the last 12 months have you completed any of these types of training courses?

Table 1 Results of estimation of probits of the probability of being trained, international

	Canada	France	Germany	Italy	Nether-lands	Great Britain
Intercept	-0.27	-1.50 **	-0.68 **	-1.47 **	-1.27 **	0.35 **
Woman	-0.26	0.01	0.11	-0.11 *	-0.12	0.15 **
Age group 35-44	-0.06	-0.14 **	-0.12 *	-0.04	-0.21 **	0.00
Age group 45-54	-0.18	-0.19 **	-0.45 **	-0.10	-0.39 **	0.04
Tenure	0.11 **	0.03 **	-0.00	0.02	-0.01	-0.00 **
Tenure squared	-0.00 **	-0.00 **	0.00 *	-0.00	-0.00	0.00
Less than upper secondary	-1.54 **	-0.45 **	-1.02 **	-0.63 **	0.01	-0.54 **
Upper secondary	-0.43 **	-0.12 **	-0.37 **	-0.08	0.13	-0.33 **
Large firm size	0.46 **	0.48 **	0.23 **	---	0.24 **	0.26 **
Part-time work	-0.97 **	-0.31 **	-0.34 **	0.12	-0.22 *	-0.39 **
Temporary job	-0.42	-0.34 **	-0.25	---	---	-0.24 **
Public sector	---	0.02	0.38 **	---	0.07	0.34 **
Married	-0.21	0.15 **	0.24 **	0.14 **	0.08	0.15 **
Child less than age 6	---	-0.05	---	-0.04	0.10	0.03
Woman by child less than 6	---	-0.20 **	---	-0.01	-0.08	-0.27 *
Married woman	0.16	---	-0.24 **	---	---	---
Agriculture	---	-0.17	-5.49 *	-0.51 *	0.08	-0.09
Electricity, gas & water	---	-0.25 *	0.38 *	---	-0.07	0.44 **
Construction	---	-0.22	-0.24	-0.52 **	-0.18 *	0.05
Wholesale, retail & restaurants	---	-0.06	0.02	0.02	-0.26	0.14 *
Transport & communication	---	0.01	0.15 **	-0.03	-0.20	0.09
Finance, insurance & bus. services	---	0.06	0.52 **	0.57 **	0.18	0.37 **
Community, social & pers. services	---	0.03	0.28 **	0.20 **	0.15	0.23 **
Number of observations	1556	8286	3442	5229	2544	3117

Source: Table 3.12, p.164, OECD (1999).

--- Data not available.

* Significant at 0.05.

** Significant at 0.01.

The model for Canada differs from that for other countries.

All values are for persons aged 25-54.

The measure used in the following analyses of the SET is whether an employee completed an in-house training course with their current employer or an external training course while working that was at least in part supported by their current employer. The courses include vocational training, training in occupational health and safety, and literacy and numeracy courses. Courses for a formal educational qualification are explicitly excluded.

Table 1 shows probit analyses of the determinants of participation in training in the six international surveys. The wording of the questions differ:

Canada, *Workplace and Employee Survey, 1995.* In the last 12 months have you participated in any formal training programs related to your job?

France, *Enquete sur la Formation et la Qualification Professionnelle,* 1993. Have you followed any training course organised and paid for, at least partially, by your employer, after completing your schooling? Which is the starting and ending date of the most recent course followed?

Germany, *Socio-economic Panel,* 1993. Have you taken courses for occupational advancement in the last three years? Please give the year the most recent course started and finished?

Great Britain, *British Household Panel,* 1996. Since 1 September 1995, have you taken part in any education or training schemes or courses as part of your present employment?

Italy, *Bank of Italy Survey,* 1991. Have you been on a training course organised and paid for by your employer in 1991?

Netherlands, *Socio-economic Panel,* 1994. Are you currently following any training or education course that is paid for by your employer?

The wordings of the questions variously include or exclude education, imply full, partial or no funding by the employer, specify different time periods although where possible have been standardised to the current or previous 12 months, specify training for occupational advancement. Although it should be expected that such differences in wording might affect the estimates of the level of training, there may be less affect on the relationship of training with other variables.

Participation in Training

Table 1 shows:

- No consistent relationship between *gender* and participation in training, although the interaction terms between gender and marriage and gender and the age of the youngest child make a clear interpretation difficult.
- A tendency for *younger* workers to participate in training at a higher rate than *older* workers, although Great Britain is an exception.
- Little convincing evidence of a consistent relationship with *tenure,* although the interpretation is clouded by the inclusion of the quadratic. The squared term detects a concave relationship for Canada and France, but a convex relationship for Germany.
- A strong and consistent relationship of training with *education* – the lower the level of education, the lower the level of training. The Netherlands is an exception, both within these data and more generally (Long, et al, 2000).
- Employment in a *larger* firm (over 100 employees) is consistently associated with higher levels of training.
- Employment as a part-time worker is generally associated with lower levels of training.
- Employment as a casual or temporary worker is generally associated with lower levels of training.

Table 2 Results of estimation of probits of the probability of being trained, Australia

	AWIRS	SET1	SET2
Intercept	0.49 **	-0.26 **	-0.64 **
Woman	0.05 *	0.10 **	0.11 **
Age group 35-44	-0.03	-0.06	-0.06 *
Age group 45-54	-0.02	-0.22 **	-0.24 **
Tenure	-0.03 **	0.06 **	0.07 **
Tenure squared	0.00 **	-0.00 **	-0.00 **
Less than upper secondary	-0.26 **	-0.60 **	-0.57 **
Upper secondary	-0.18 **	-0.30 **	-0.28 **
Large firm size	0.08 **	0.38 **	0.60 **
Part-time work	-0.08 **	-0.27 **	-0.27 **
Temporary job	-0.33 **	-0.52 **	-0.50 **
Public sector	0.11 **	0.17 **	0.18 **
Married	---	---	0.14 **
Child less than age 6	-0.05	0.02	-0.03
Woman by child less than 6	-0.05	-0.33 **	-0.20 **
Married woman	---	---	-0.05
Agriculture	---	---	0.19
Electricity, gas & water	0.38 **	0.43 **	0.51 **
Construction	-0.20 **	0.03	-0.02
Wholesale, retail & restaurants	0.08 *	0.21 **	0.19 **
Transport & communication	0.07	0.12 *	0.18 **
Finance, insurance & business services	0.28 **	0.28 **	0.33 **
Community, social & personal services	0.13 **	0.32 **	0.40 **
Number of observations	12821	6418	9900

--- Data not available

AWIRS is the *Australian Workplace Industrial Relations Survey.* The values are reproduced from Table 3.12, p. 164, OECD (1999).

SET results are from the CURF of the 1997 ABS *Survey of Education and Training.* Values for SET1 exclude employees in agriculture and in workplaces with fewer than 20 employees and are therefore more comparable with AWIRS results; the values for SET2 include these categories and hence are more comparable with international results.

All values are for persons aged 25-54.

- Employment in the public sector is sometimes associated with higher levels of participation in training.
- Married workers tend to receive more training, although again the inclusion of an interaction term with gender complicates the interpretation. In Germany it appears that marriage is only a positive for men.
- Having a child under the age of six has no effect on receipt of training, except for women workers, although this result is restricted to France and Great Britain.

- Higher levels of training in the Finance and Community Services industries are the most consistent results for industry, but this pattern is not observed for France or the Netherlands.

Table 2 shows the corresponding results for Australia. The AWIRS and the SET1 show similar patterns for a number of important variables, although the size of the relationship is usually smaller for the AWIRS. Both surveys show that the likelihood of training is usually higher for workers with higher levels of education, employed in larger firms, full-time jobs, permanent jobs, the public sector, a utility, trade, or finance or community services.

Despite the examples of consistency, the results for SET1 differ in several important regards from those for the AWIRS. In particular there is a substantially stronger negative effect of being 45 years or older on the likelihood of participating in training. Possibly associated with the change in the effect of age is the reversal of signs on tenure and the square of tenure. The other major difference is the strong negative effect evident in SET1 on the likelihood of training associated with being a woman with a child under the age of six. The AWIRS finds almost no effect. The effects of industry on training participation are also generally stronger for SET1 than AWIRS except for the construction industry which changes from below the level in mining and manufacturing (the benchmark categories) to a similar level.

The results for SET1 and SET2 are similar. The effect of firm size is markedly higher in SET2, a result that follows from the inclusion of small workplaces. Information on marital status was not available in the AWIRS and hence was omitted from SET1. Its inclusion in SET2 shows that being married is positively related to participation in training. The interaction effect of marriage with gender shows that the effect of marriage on training is similar or men and women. SET2 also includes employees in agriculture. The effect for agriculture is not statistically significant but doubtless contributes to usually small changes in the other industry effects.

SET2 was designed to provide a better correspondence with the results of the international surveys presented in Table 1. The major differences, compared with the AWIRS, are associated with age and tenure. SET2 now corresponds to the pattern of the majority of countries for age – the likelihood of participation in training declines with age. The results for Great Britain are now the only exception to this pattern. On tenure, the results for Australia are now consistent with those for France and Canada – the likelihood of participation in training increases with tenure at the workplace, but at a decreasing rate.

The results for SET2 for being a women with a young child now agree with the results for France and Great Britain which also show a substantial negative effect. The only other major change is for the construction industry. Most of the international results are consistent with there being lower participation in training in the construction industry, as did the AWIRS. The results for SET2 suggest that in Australia training probabilities in the construction industry differ relatively little from those in the benchmark industries of mining and manufacturing.

Table 3 Percentage mean wage differences for trained workers: Australia & international

	Australia			Canada	France	Germ-any	Italy	Nether-lands	Great Britain
	AWIRS	SET1	SET2						
	%	%	%	%	%	%	%	%	%
All	9.6	12.4	10.8	26.4	11.1	18.5	25.0	3.1	19.3
Men	9.6	12.8	11.9	32.0	17.2	17.6	29.1	0.0	15.1
Women	11.2	11.8	9.2	12.2	20.7	16.5	20.0	-2.3	25.0
Less than upper secondary	6.9	10.8	6.9	----	30.2	16.0	15.7	17.6	20.2
Upper secondary	8.6	7.8	3.7	----	16.1	9.5	23.8	0.7	4.3
Non-university tertiary	4.2	10.9	14.9	----	2.3	-7.6	----	-0.3	19.8
University	1.8	-2.1	0.5	----	-1.3	17.9	6.8	-15.9	3.0

Percentage mean wage differences are the mean wages per hour of workers trained minus mean earnings of workers not trained, divided by the mean wages per hour of workers not trained and multiplied by a hundred.

International values are reproduced from Table 3.13, p. 164, OECD (1999).

AWIRS is the *Australian Workplace Industrial Relations Survey*. The values are reproduced from Table 3.13, p. 164, OECD (1999).

SET results are from the CURF of the 1997 ABS *Survey of Education and Training:* Values for SET1 exclude employees in agriculture and in workplaces with fewer than 20 employees and are therefore more comparable with AWIRS results; the values for SET2 include these categories and hence are more comparable with international results.

--- Data not available

All values are for persons aged 25-54.

Training and Wages

There has been substantial research on the effects of participation in continuing vocational training on the earnings of employees. Estimates of the wage effects have generally been positive and often large, especially compared with the sometimes relatively small costs of training.

Wage effects are generally interpreted as a proxy for productivity, using standard economic theory that wages reflect the marginal product of the worker. Hence any wages gap between workers who receive training and workers who do not can be attributed to the differences in their productivity. This interpretation, although mainstream, is contested. For instance, several theories have been advanced to explain the upward sloping wage profiles within firms. Lazear (1979) proposed that some part of the wages of senior staff was 'deferred compensation', the prospect of which acted as an incentive for younger workers; Lazear (1981) suggests that enterprises may increase an employee's wage over time in order to reduce supervision costs; Salop and Salop (1976) suggest that firms increase wages in order to reduce turnover costs; Jovanovic (1979) attributes the relationship to improved worker-employer matches over time; while Aklorof (1984) points to policies designed to provide incentives and to improve morale.

Wage effects are not the only benefit that can accrue from training. The benefits of continuing vocational training are divided between employers and employees. The proportion that accrues to each party, however, is difficult to estimate. A study of US production and turnover data by industry found that workers receive about half of the total productivity benefit of training (Blakemore & Hoffman, 1988). Bartel (1995) also argues for the assumption that employers and employees share the benefits evenly – an assumption she describes as conservative (that is, she believes that employers would typically receive more than half the benefits). Barron *et al.* (1989), Barron *et al.* (1993) and Bishop (1991), however, suggest that the effect of an hour of training on productivity growth is about five times as large as the effect on wages growth.

Table 3 shows the differences between trained and non-trained workers in wages per hour for the six international surveys and the three estimates for Australia. The values in the table are the mean wages per hour for trained workers minus the mean wages per hour for untrained workers divided by the mean wages per hour for untrained and converted to a percentage.

In Australia, the size of this effect of participation in training on wages is about 10% for both the AWIRS and the SET. The size of the effect varies substantially among the six other countries in the review. In the Netherlands the effect is negligible, in France it is about the same as in Australia, but the results for Canada, Germany, Italy and Great Britain show effects about twice those in Australia. It is difficult to link such differences directly to the variation in the wording of the questions about training.

Table 3 also shows the differences in the wage effects for categories of gender and education. In Australia for gender, there is relatively little difference in the average wage effects of training for males and females. Although the AWIRS shows a slightly higher effect for women than men, the SET shows the reverse. Regardless though, there is little difference, especially when compared with the results in some other countries. In Canada and Italy, for instance, the wages effect of training is substantially greater for men than women while in Britain the reverse is true.

In Australia, educational attainment is more or less inversely related to the size of the wage effect of training – certainly both the AWIRS and SET show fairly negligible effects for workers with university qualifications and larger effects for workers with lower levels of educational attainment. The major difference between the two data sources is that the SET shows higher wage effects for workers with non-university tertiary qualifications. These results are reasonably consistent with the pattern for France, Italy, the Netherlands and Great Britain. Only Germany shows relatively high effects of training on wages for university graduates.

The OECD paper cites the results of Blundell *et al.* (1996) and Bartel (1995) in support of the view that earnings gains from training are greater for workers who are less likely to be trained. Although Bartel found that employees receiving remedial training had higher wage effects, her work does not address categories of workers with low probabilities of training – there is no evidence in her paper that the group she describes as receiving the remedial form of training have a lower probability of receipt of training.

Blundell *et al.* (1996) estimate wage effects from U.K. panel data for males and females separately and then re-analyse the data only for those workers whose highest school

qualification was O level (the qualification obtained at age 16 in the U.K. and which implies that the worker left school without completing all years of secondary school). They report some results that support their conclusion that wage effects are larger for workers with lower levels of education, although the results are mixed.

Blundell *et al.* (1999) cite several studies to the effect that workers with no or intermediate-level educational qualifications and those with low social and economic status have high wage effects from training but low participation in it (Blundell *et al.*, 1996; Arulampalam *et al.*; Ashenfelter & Rouse, 1998).

The citation of the research by Bartel and by Blundell et al in the OECD paper appears selective. It overlooks, for instance, the results of Bowers and Swaim (1992) and Krueger and Rouse (1998). Both these studies found low returns to remedial forms of training.

The meaning of differences in the wage effects of training among categories is not necessarily obvious. A simple theoretical interpretation suggests that training should be distributed among categories of workers in ways that equalise the returns to training. Hence the marginal wage effect of training for men should be the same as the marginal wage effect for women. If this were not the case, then greater returns could be obtained by shifting the distribution of training from the category of workers with the lower returns to the category of workers with the higher returns. In general, given the results in Table 3, training should be shifted from university graduates to other categories of workers.

This is more or less the interpretation that the OECD paper places on the observed differences in the wage effects of training, although the paper couches the policy implications in terms of the opportunity for the expansion of training among categories of workers with lower likelihoods of participation in training. The different wage effects are therefore the result of 'barriers' to training – preconceived ideas about the distribution of training, poor understanding of the efficacy of training by managers, prejudice, resistance to training by workers, and so on.

There are considerations that might undermine this interpretation. The first is the obvious observation that the results in Table 3 are averages. Theory suggests that the returns depend on the effects at the margin – the returns for the last additional worker in each category to receive training. The marginal returns for each category could be the same even though the average effects are different. The shapes of the distributions of marginal returns would therefore be different. In the absence of information on marginal returns, we fall back on information about average returns, but the two are by no means identical. Hence interpretations based on treating average returns as if they were marginal returns might be erroneous simply because the patterns for the two measures are different.

A second issue centres on the financing of continuing vocational training. As suggested above, the wage effect is only one of the benefits of training. Firms must be receiving some benefit from providing training, but this benefit is typically unmeasured. There is the possibility that such benefits could also vary across categories of workers. To the extent that firms totally fund training, the distribution of training among categories of workers and the wage effects might therefore reflect the ability of firms to appropriate

Table 4 Results of estimation of OLS wage regressions with selection, international

	Canada	*France*	*Germany*	*Italy*	*Nether-lands*	*Great Britain*
Intercept	1.89	11.57 **	3.85 **	2.48 **	4.31 **	1.64 **
Woman	-0.20 **	-0.21 **	-0.23 **	-0.14 **	-0.09 **	-0.26 **
Age group 35-44	---	0.11 **	0.12 **	0.07 **	0.17 **	0.05 **
Age group 45-54	---	0.15 **	0.25 **	0.09 **	0.31 **	0.02
Tenure	0.02 **	0.01 **	0.00 **	0.01 **	0.02 **	0.00 **
Tenure squared	0.00 *	-0.00 **	-0.00 **	-0.00 **	-0.00 **	-0.00 **
Less than upper secondary	-0.27 **	-0.60 **	0.10	-0.37 **	-0.37 **	-0.13 **
Upper secondary	-0.11 **	-0.40 **	-0.07 **	-0.24 **	-0.28 **	-0.04
Large firm size	0.20 **	0.16 **	0.01	---	-0.03	0.06 *
Part-time work	-0.27 **	-0.16 **	0.12 **	0.26 **	0.12 **	-0.09 *
Temporary job	0.01	-0.09 **	0.06	---	---	-0.02
Public sector	---	-0.04 **	-0.16 **	---	-0.09 **	0.08
Agriculture	---	-0.28 **	2.58 **	-0.13 **	-0.17 **	-0.29 **
Electricity, gas & water	---	-0.07 **	-0.08	---	0.15 **	0.07
Construction	---	-0.04 *	0.10 **	-0.04 **	0.06	-0.04
Wholesale, retail & restaurants	---	0.04 **	-0.11 **	-0.02	0.06	-0.26 **
Transport & communication	---	0.04 *	-0.18 **	0.06 **	0.10 **	-0.02
Finance, insurance & bus. services	---	0.09 **	-0.16 **	0.07 **	-0.01	0.17 **
Community, social & pers. services	---	-0.06 **	-0.11 **	0.06 **	-0.05 *	-0.10 **
Had training	0.14 **	0.00	0.08 **	0.38 **	-0.04	0.74 **
Training x woman	-0.02	0.03	0.09 **	-0.00	-0.02	0.04
Training x less than upper sec.	0.02	0.16 **	-0.01	0.26 **	0.17 **	0.09 **
Training x upper secondary	-0.04	0.07 **	-0.04	0.22 **	0.04	0.03
Selection	---	0.07	-0.55 **	-0.23 **	-0.58 **	-0.44 **
Adjusted R-square	0.27	0.37	0.34	0.38	0.32	0.30
Number of observations	1556	8179	3093	5212	2457	3117

Source: Table 3.14, p.165, OECD (1999).

Dependent variable: log of gross hourly wage.

--- Data not available.

* Significant at 0.05.

** Significant at 0.01.

The Canadian equation includes a polynomial in age, marital status, and the log of hours worked.

the benefits of training among the different categories of workers. But of course firms are not the sole funders of training. A reasonable proportion of training is jointly funded by the worker and employer. Variation in the mix of this funding could also explain differences in wage effects across categories of workers.

Table 5 Results of estimation of OLS wage regressions with selection, Australia

	AWIRS	*SET1*	*SET2*
Intercept	2.42 **	2.87 **	2.69 **
Woman	-0.13 **	-0.09 **	-0.08 **
Age group 35-44	0.04 **	0.01	0.03 **
Age group 45-54	0.07 **	0.01	0.04 **
Tenure	-0.00	0.01 **	0.01 *
Tenure squared	0.00 *	-0.00 **	-0.00
Less than upper secondary	-0.48 **	-0.35 **	-0.22 **
Upper secondary	-0.33 **	-0.20 **	-0.15 **
Large firm size	0.06 **	0.08 **	0.05 **
Part-time work	0.19 **	0.07 **	0.11 **
Temporary job	-0.36 **	-0.04	0.02
Public sector	0.09 **	0.02	0.04 **
Agriculture			-0.16 **
Electricity, gas & water	0.14 **	0.15 **	0.06
Construction	-0.16 **	0.06 **	0.07 **
Wholesale, retail & restaurants	-0.08 **	-0.08 **	-0.11 **
Transport & communication	0.04 **	0.06 **	0.00
Finance, insurance & business services	0.21 **	0.06 **	0.03 *
Community, social & personal services	0.01	-0.01	-0.08 **
Had training	0.05 **	-0.04	0.29 **
Training x woman	-0.00	-0.01	-0.03 *
Training x less than upper secondary	0.02	0.05 **	0.00
Training x upper secondary	-0.01	0.03	-0.02
Selection	0.94 **	0.06	-0.12 **
Adjusted R-square	0.23	0.20	0.19
Number of observations	12609	6418	9900

Dependent variable: log of gross hourly wage.

--- Data not available.

* Significant at 0.05.

** Significant at 0.01.

AWIRS is the *Australian Workplace Industrial Relations Survey*. The values are reproduced from Table 3.14, p. 165, OECD (1999).

SET results are from the CURF of the 1997 ABS *Survey of Education and Training:* Values for SET1 exclude employees in agriculture and in workplaces with fewer than 20 employees and are therefore more comparable with AWIRS results; the values for SET2 include these categories and hence are more comparable with international results.

All values are for persons aged 25-54.

The explanation of differences in wage effects is expressed as 'returns' and returns requires the consideration of costs as well as benefits. More highly educated workers, for instance, may be cheaper to train – they learn more in the same time. If this were true, then lower wage effects for more highly educated workers might be consistent with the same returns to training because the costs are lower. This argument, however, reaches its logical limit when the wage effect is either zero or negative, as occurs in several instances in Table 3.

Thinking about returns to training in this context is confounded by the way in which the results for the wage effects are expressed as percentages. The costs for training, at least in Australia, are approximately evenly divided between the wages of the trainee and the costs of providing the training. Percentages are appropriate for the former, but not the latter. If the non-wage costs of training are constant across categories of workers, then it the absolute size of the wage effect that needs to be considered, and the percentages presented in Table 3 will consistently underestimate this amount for workers with lower average wages, workers such as those with lower educational attainment. Hence the wage effects presented in Table 3 probably overstate the absolute values of the benefits for workers with lower educational attainment.

Multivariate Results

The results presented in Table 3 ignore the facts documented in Tables 1 and 2 – that recipients of training differ in important regards from those who do not receive training. The apparent differences in mean wages per hour associated with training may reflect these other differences. The values presented in Tables 4 and 5 address this possibility. They are results from a multiple regression equation with a Heckman correction for selectivity (Greene, 1998: 716-717).

The selectivity correction is important, especially with cross-sectional data. There is the distinct possibility that workers are selected for training because they have characteristics that suggest they will benefit more from the training than other workers. Thus expected earnings from training influence the likelihood of receiving training. The characteristics that lead to this expectation are typically unmeasured – motivation, observed aptitude, diligence, interest, and so on. Variation among the errors in the equations predicting participation (Tables 1 and 2) can be used as a proxy for these unmeasured characteristics. Their effect is presented in Tables 4 and 5 next to the heading 'Selection'. The results presented in these tables are therefore corrected for selection and yield estimates of training corrected not only for the measured variables, but also for unmeasured variables.

The major interest in Tables 4 and 5 are the estimates of the wage effects of training and combinations of training with gender and education. Since the value being predicted is the log of wages per hour, the results in these tables can be interpreted approximately as percentage effects on earnings (but see, for instance, Halvorsen & Palmquist (1980) for the nature of this approximation). Because of the inclusion of the interaction effects of gender and education with training, the interpretation of the 'Had training' values is not always direct. In Table 4 the values for Great Britain and Italy are large. The base value for Great Britain is 0.74 and the interaction terms are negligible. For Italy, the base value is 0.38 and the interaction terms for education are strongly positive. The size

of these values strains credibility somewhat. The values for Canada, France and the Netherlands are more modest.

It is the interaction terms, though, that are of most interest. Only in Germany do women receive a wage effect from training that is stronger than for men. For the other five countries, the effect is negligible. The story is slightly different for education. Results for four of the six countries show indications that workers with lower levels of educational attainment receive higher wage effects from training compared with tertiary educated workers. One of these, however, is the Netherlands which does not show any adverse selection against for training of workers with lower levels of educational attainment. The OECD paper suggests that these results are evidence that the earning gains from training are higher for some categories of workers who typically have a lower likelihood of receiving training.

Table 5 shows the corresponding results for the AWIRS and the SET. There is a major difference between the correction for selection for the AWIRS and the SET. The correction for selection requires that there be some variables in the selection equation (Table 2) that are omitted from the wages equation (Table 5). These identifying variables are Married, Child less than age 6, Women with child less than age 6, and Married women. The analysis assumes that these variables affect training but do not affect wages per hour.

Given that marital status was not available in the AWIRS, only two of these variables could be used in the selection equation. Unfortunately, neither of these is statistically significant. Hence there may actually be no identifying variables in the correction for selection for the analyses of the AWIRS reported in the OECD paper (although 212 cases used in the selection equation but not in the wages equation may assist with identification). The unique, highly positive, value for 'Selection' reported for the AWIRS may be a consequence of poor specification.

The analyses for SET2, however, include all four identifying variables, two of which are statistically significant. The resulting selection term is negative, which accords with the results obtained in all other countries. The difference in the selection specification is likely to affect estimates of the wage effects of training.

In the event, the interaction terms of training with gender and educational attainment are more less unchanged – they show no differences for the AWIRS and only one modest effect of gender for the SET – and that gender effect is negative.

The major difference between the results of SET and the AWIRS is the overall estimate of the size of the effect of training on wages per hour. For SET1 there is no effect compared with a small positive effect for the AWIRS. But for SET2, where the selection effect is stronger, the wages effect increases to 0.29 – about in the middle of the range internationally. The change in the size of the effect may indicate the sensitivity of estimates to the choice of variables chosen for identification.

Conclusions

The OECD paper observes that 'the analysis of the determinants and consequences of training is not yet sufficiently developed to provide policy makers with reliable estimates of the economic returns that accrue to any specific policy approaches' (OECD, 1999: 167). While noting the limited data available, it does provide several tentative conclusions.

It observes that high training economies are characterised by a more even participation in training is across age and educational groups and that the earning gains from training are higher for some categories of workers who typically have a lower likelihood of receiving training. Hence it is noted that policies designed to promote continuing vocational training for those workers who typically receive little training may be useful.

The relevance of this conclusion to policy in Australian is questionable. The OECD analyses themselves showed that Australia tended to exhibit fewer differences in the distribution of training among categories of age and education. The OECD analyses of Australian data did not show differential wage effects of training that favoured categories of workers who received less training. Corresponding analyses of arguably better data sources also failed to identify any such affect, although the estimates of the overall wage effect of training were strengthened.

Notes to Analyses

1. Data imputation has been used for a small proportion of missing values for education, firm size and size of workplace.
2. For SET, data were available only on whether an employee had a child under the age of five. This measure has been used in the analyses.
3. Suitable 'instruments' in selection equations are variables that predict training but not wages. While any set of variables can be assumed to affect training and not earnings, finding plausible candidates is another matter. Almost any variable that might affect the likelihood of receiving training could arguably affect earnings. Marital status and having a dependent child under the age of six are cases in point.
4. Corrections for selection tend to multiply. Blundell *et al.* note that the inclusion of firm size in multivariate analyses of the effect of training on wages would create similar difficulties if workers choose the type of employer in order to obtain training. Accordingly they omit firm size from their model predicting the incidence of training (1996: 45). OECD (1999) acknowledges possible problems of endogeneity with tenure, hours of work and type of contract – but proceeds without addressing these problems.
5. In the AWIRS wages are grouped in $50 categories while in the CURF of the SET the categories are $40. Both have a similar upper-bound problem – the highest category for the AWIRS is $1150 and above and for the SET it is $1160 and above. In the analyses reported here the midpoint of each category of wages was used. For the highest category, the upper category was scored at $1220 because of the skew of the earnings distribution. The relatively high percentage of persons in the top category means that this arbitary approximation may affect results.
6. Definition of the variables:

Training: 1 if trained, 0 otherwise.

Wage: Gross hourly wage. Netherlands based on individuals who worked 12 months in the previous year, France based on INSEE computations of equivalent yearly earnings.

Age: Excluded age group 25-34.

Tenure: Tenure with current employer.

Part-time work: 1 if hours worked less than or equal to 30.

ISCED 2: 1 if education less than upper secondary. High education omitted (ISCED 5, 6 7).

ISCED 3: 1 if education is upper secondary.

Large firm: 100 or more employees. Germany 200 or more.

Industry: One digit SIC codes. Omitted category includes mining and manufacturing.

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