

WORKING PAPERS IN ECONOMICS

DO WAGE SUBSIDIES STIMULATE
TRAINING? AN EVALUATION OF THE
CRAFT REBATE SCHEME

by

W.J. Merrilees

No. 71.

November 1983

DEPARTMENT OF ECONOMICS



The University of Sydney
Australia 2006

**DO WAGE SUBSIDIES STIMULATE
TRAINING? AN EVALUATION OF THE
CRAFT REBATE SCHEME**

by

W.J. Merrilees

No. 71.

November 1983

National Library of Australia Card Number and ISBN 0 86837 070 3

DO WAGE SUBSIDIES STIMULATE TRAINING? AN
EVALUATION OF THE CRAFT REBATE SCHEME

1 INTRODUCTION

The continuing depressed state of the labour market has spurred much interest in government employment and training programs. There is a wide variety of potential programs, with varying degrees of likely effectiveness. Evaluation research is imperative if future policy responses are to be guided in a rational manner and fortunately this work has commenced in Australia (c.f. Fisher and Scherer 1983). However a notable gap in evaluation research relates to the Commonwealth Rebate for Apprentice Full-Time Training (CRAFT) scheme. This is somewhat surprising because it has been the largest Commonwealth employment and training program for the past five years. Currently annual expenditure under CRAFT is of the order of \$90 million. The most likely explanation for the lack of evaluation of this program is the difficulty in establishing a suitable framework. This issue is taken up in Section 3, where we also briefly discuss related evaluations concerning CRAFT's predecessor (the National Apprenticeship Assistance Scheme) and the \$1,000 Employer Cash Rebate Scheme.

Apart from being the largest employment and training program over the past five years, the CRAFT rebate is likely to be of crucial importance in understand developments in the apprentice labour

market. Indeed this paper aims to shed light on the determinants of apprentice recruitment decisions, which have not been well analysed hitherto. In turn, the apprentice labour market is of vital importance as a source of employment for (mostly male) school-leavers. We have now experienced a decade of very high teenage unemployment rates, which currently are more than 20 per cent. If economists are to guide policies in reducing this rate, then we need to understand the determinants of teenage labour hiring decisions, particularly at a disaggregated occupational level.

The training impact of CRAFT is as important as the employment impact. With long training gestation periods, the tradesmen labour market has been subject to extreme cyclical fluctuations, alternating between periods of excess demand (in the late 1960s, early 1970s and early 1980s) and excess supply (mid and late 1970s). These fluctuations impose enormous costs on society. During downturns the cost is similar to other occupational groups, namely foregone output and income. In contrast, periods of excess demand for tradesmen have sometimes entailed structural skill imbalances in the economy and which might co-exist with excess supply in other occupational groups. The 1979-1981 period exemplifies this situation. A chief reason for concern with this possibility is the likelihood that structural skill imbalances propagate wage and price inflation throughout the entire

occupation spectrum via comparative justice and similar mechanisms. With sufficient (manpower) foresight, these macroeconomic maladies can be alleviated by ensuring a sufficient supply of tradesmen for which apprenticeships are the main port of entry. In order to augment the number of apprentices we need to understand the determinants of such, including the role of CRAFT subsidies.

The format of this paper is as follows. In Section 2 we sketch the historical evolution of industrial training subsidy schemes in Australia. Section 3 presents a framework for evaluating CRAFT and related subsidy schemes. Section 4 offers two major theoretical models of apprentice decisions. In Section 5 we discuss the crucial issue of the appropriate specification of the relative labour cost variable. Section 6 explores another important issue, namely our ability to identify the apprentice labour demand function. In Section 7 we present our empirical evidence relating to apprentice recruitment. Section 8 briefly examines two key assumptions associated with pooled estimation. Section 9 interprets the evidence in terms of differentiating between the investment and current production models of apprentice recruitment. The penultimate Section 10 discusses the effectiveness of the CRAFT scheme, while Section 11 concludes.

2 HISTORICAL DEVELOPMENTS OF INDUSTRIAL TRAINING REBATE SCHEMES IN AUSTRALIA

The first large-scale trade training rebate scheme was the National Apprenticeship Assistance Scheme (NAAS) introduced in January 1973. Its objective was to "encourage the employment of apprentices in greater numbers". Eligibility of employers for a NAAS rebate resulted from either:

- (a) Having an apprentice/tradesmen ratio greater than 25 per cent, in which case the subsidy was payable to all first year apprentices employed by the firm; or
- (b) Increasing the level of apprentice employment compared to that for the preceding year, in which case the subsidy was payable to the extent of the increment in employment.

Initially the scheme was quite modest, offering a little as \$200 per eligible apprentice. However by 1975 the subsidy had increased to \$1,200 per eligible apprentice. Overall expenditure on NAAS similarly grew, from \$6 million in 1973/74 to \$35 million in 1975/76.

In January 1977 NAAS was superseded by CRAFT. It is worth emphasising the differences between the two schemes. First, NAAS rebates were taxable while CRAFT rebates are tax exempt.

Secondly, NAAS rebates were directly associated with apprentice employment levels, while CRAFT rebates are also conditional on full-time training (either at TAFE or a recognised centre). This suggests that the quantity objective of NAAS has been broadened to include quality considerations. Thirdly, NAAS rebates are typically distributed over the three years of TAFE attendance. Fourthly, although the unit value of NAAS did tend to rise annually, the automatic indexation objective is more explicit under CRAFT.

In January 1977 the CRAFT Technical Education Rebate was \$11 per full-day release (one day a week is the norm, for about 32 weeks per year). This amount has been increased each January (with the exception of January 1982, though there was a catch-up in January 1983). In January 1980 the amount of subsidy paid was differentiated between trades, mainly reflecting differential wage rates between trades. The rate became higher in the electrical and building trades.

The third major development in the trade training rebate area was the introduction of the \$1,000 Employer Cash Rebate Scheme, which operated for two fiscal years, 1979/80 and 1980/81. This scheme supplemented the CRAFT scheme and was explicitly a marginal employment subsidy policy, akin to the NAAS eligibility option (b) noted above. This scheme applied to the increment in the

employment of first year apprentices. The annual outlay under this scheme was about \$10 million. As with CRAFT, the \$1,000 Employer Cash Rebate Scheme was tax exempt. In its first year it applied to all trades, but in its final year it only applied to the metal, electrical and building trades.

3 A FRAMEWORK FOR EVALUATING TRAINING SUBSIDY SCHEMES

This paper is concerned with the dominant objective of the NAAS, CRAFT and \$1,000 Employer Cash Rebate schemes, namely the stimulus given to the employment of first year apprentices. No attempt is made to put this particular objective into a still wider framework, namely the traditional welfare economic triad of efficiency, distribution and stabilisation. Nonetheless our brief comments in Section 1 do indirectly allude to the stabilisation and efficiency virtues of the CRAFT scheme, while the school-leaver end of the teenage labour market is one of several worthy targets for re-distributional measures.

Our exclusive attention to the employment creation effect does not do full justice to the CRAFT scheme, especially vis-a-vis the NAAS scheme. The switch from NAAS to CRAFT raised the prominence of the quality dimension, though by how much it is difficult to gauge. Although we do not attempt to rigorously address this

issue, it is worth noting that superficial evidence does support the notion that CRAFT has raised the quality of apprentice training by increasing the likelihood of apprentices gaining day release for technical college instruction. Clearly more definitive evaluation is needed.

It is also instructive to note that while the bulk of evaluative studies are based at the level of individual (c.f. Ziderman 1978), our analysis is more aggregated, almost macro-economic, in nature. In part this reflects the absence of on-going files at the individual apprentice (rather than employer) level. It also reflects the difficulty of obtaining a meaningful control group. However more fundamentally, the primacy of a macro-economic (employment creation) evaluation in our case simply reflects the stated objective of the program.

If we wish to isolate the influence of training subsidies on apprentice employment, it is clear that we must first develop a viable model of apprentice recruitment. All three of the training subsidy schemes noted in the previous section are wage subsidy schemes paid to the employer. This implies that we could integrate the subsidies with the relevant wage variable, so that net (of subsidy) wages or, more generally, labour costs takes over from gross wages. One can see certain benefits in this approach compared to the alternative of including a dummy

variable denoting simply the presence of a training scheme. The former approach recognises the explicit and possibly varying weighting of the training subsidy vis-a-vis other labour costs.

Despite the theoretical appeal of the net wage specification, it has not been used in Australia (nor apparently overseas) and the simple dummy approach has prevailed (DEIR 1976, McDonald 1978, Scherer 1981, Wallace 1982). This may reflect the very considerable demands on data made by the net wage specification.

An intermediate testing strategy (Lindley 1975) is to use a gross wage variable, but to see if the coefficient attaching to such varies after a training subsidy scheme is introduced. This intermediate position is probably more informative than a simple dummy specification. However it still fails to allow for varying weights of the subsidy, which in the Australian case ranges from 1 per cent to 20 per cent of apprentice wages during the 1972-1980 period.

There was a major evaluation of the NAAS scheme in late 1976 (DEIR, 1976). Part of this work comprised an analysis of a sample of Victorian employees who had received the subsidy between 1973 and 1975. Amongst other matters this threw some light on movements between eligibility classes (the (a) and (b) groups noted in Section 2; group (a) dominated and few group (b) employees moved to group (a) at a later date).

Another part of the 1976 evaluation was an econometric exercise based on explaining national apprentice intake levels over the period 1965/66 to 1974/75. NAAS was represented by a dummy variable and was found to increase intake levels. However this conclusion was expressed in cautious terms because of the small sample size of the regression run. To this difficulty we can add our misquiet as to the dummy variable vis-a-vis net wage specification and also express some severe reservations about whether the apprentice labour demand function is identifiable over the 1965-1974 period. In fairness, all subsequent Australian apprentice demand studies suffer the same potential problems.

The only other explicit evaluative study in this area is that by Krbavac (1984), who has examined in depth the second year of the \$1,000 Employer Cash Rebate scheme. The characteristics of the firm participating in the scheme are most interesting and provide invaluable information in designing training subsidy schemes so as to minimise windfall gains. Krbavac's (1984) analysis highlights the contrast between marginal wage subsidies in theory and practice.

Although the net wage specification approach to evaluating the effectiveness of training subsidies appears soundly based, the underlying assumptions are testable and should be tested. Does a one dollar wage subsidy have the same impact as a one dollar

reduction in award wages? Are all rebate schemes equally stimulatory? These questions can be put to the test and we do so in Section 10.

We need to be alert to the possibility that training subsidy programs may have stimulatory effects which operate through mechanisms other than labour cost elasticities. The programs and the associated promotion of such may make firms more training conscious. This is likely to manifest itself as a change in the entire structure of the apprentice demand model, with output elasticities (amongst others) in particular being increased. We can test for this type of impact.

Another stimulatory effect arises from the possible effect on the timing of firm's human capital expenditure (alias training expenditure alias apprentice recruitment). Thus even though a particular trade group has a zero labour cost elasticity, training subsidies may nonetheless induce some firms to bring their expenditures forward. This would represent a transitory social benefit for an economy with a positive discount rate.

4 THEORETICAL MODELS OF APPRENTICE RECRUITMENT

There are two main theoretical frameworks which are of use for analysing apprentice recruitment decisions, namely current production and investment models. With the former, apprentices

are seen as simply another current labour input, though less efficient than tradesmen, in providing skilled blue collar labour services. This is essentially the approach taken by Lindley (1975). Making various assumptions about production function technology and cost-minimizing behaviour, Lindley derives the result that apprentice intake is a function of current output, relative wage costs and the unemployment rate of tradesmen (as a measure of disequilibrium in the tradesmen labour market). That is:

$$\text{Log}(A) = a_1 + a_2 \log(Q) + a_3 \log(RW) + a_4 \log(U) \dots\dots (1)$$

where A is the apprentice intake, Q is the rate of output, RW is a relative wage term and U is the unemployment rate of tradesmen.

In contrast, an investment approach places more emphasis on the future output contribution of apprentices. Indeed in their first year or two, apprentices may represent a net financial burden to firms in that the cost of employing them exceeds the value of their output contribution. There is some evidence supporting this configuration. The additional cost to the firm in the first couple of years takes the form of time lost when the apprentice attends technical college classes, time lost by both the apprentice and tradesmen whilst supervision and on the job instruction takes place, a higher wastage rate of materials, etc.

These additional costs can be viewed as the firm's investment expenditure in (trade) training which are recouped in the latter stages of the apprenticeship.

One way of conceptualising this investment in training notion is to draw upon Becker's (1964) theory of human capital. Indeed analysis of apprentice recruitment decisions is perhaps the only tractable direct route for applying Becker's model because time series data of training expenditure per se are not available. The present author (Merrilees 1983) has interpreted the British trade training experience to be one involving general skills (a la Becker), but with imperfect mobility on the part of the apprentice. Apart from the usual sources of immobility (such as inertia, geographical distance and more subtle adjustment costs), the conditions of apprenticeship entail moral and legal obligations by both parties to complete the four year term.

A particularly attractive feature of the Becker formulation of investment in training is the focus it gives to both benefits (future output contribution of apprentices) and costs (high initial labour costs of apprentices relative to current output contribution). Another potential approach to modelling investment in training, namely the flexible accelerator model, neglects the cost side. Nevertheless, it may be that relative labour costs are

not important in the context of apprentice recruitment decisions, in which case flexible accelerator type models may be an adequate representation. The choice becomes an empirical matter.

In many respects the distinction between the current production and investment approaches can be quite subtle. Indeed it is possible that exactly the same set of explanatory variables apply. Thus although future output is the more relevant specification in an investment model, it may be that current output is the best proxy (predictor) of future output. How then does one distinguish between the two models? Firstly, in some cases it may be possible to devise better indicators of future output, including distributed lag formulations.

Secondly, the relative wage variable can also be specified in various ways. If firms believe that first year apprentices make a reasonable contribution to current production, then they would pay special attention to the wages of first year apprentices. In contrast, an investment motive to apprentice recruitment would necessitate the firm looking at the entire time profile of apprentice wages. This profile can be represented by an average apprentice wage over the term of apprenticeship. One can use the relative statistical performance of these contrasting apprentice wage specifications to help discriminate between the production and investment approaches.

In summary, emphasis is given below to the first two tests and our more general conclusions concerning the differential statistical performance of the current production and investment models are presented in Section 9.

5 WHAT IS THE APPROPRIATE SPECIFICATION OF THE RELATIVE LABOUR COST VARIABLE?

The issue of specifying the labour cost variable is an important one, partly because it is this variable which permits discrimination between models and also because most of the industrial training rebates in Australia are effectively wage subsidies. Thus evaluation of the effectiveness of these wage subsidies can be gleaned from the magnitude of the relevant labour cost elasticity.

There are many issues which arise in this context. First, in the previous section we noted the choice between first year apprentice wages and the average wage over the term of the apprenticeship. This contrast is useful for comparing the current production and investment models. Australian studies to date (McDonald 1978 and Wallace 1982) have used the first year wage specification.

Secondly, with which alternative wage should the apprentice wage be compared? The most common choice in the past in both British (Lindley 1975, Merrilees 1983) and Australian (McDonald 1978) studies has been the tradesmen's wage rate. This reflects a perception that skilled and semi-skilled blue collar labour are not substitutes, but that within the skilled category there is substitution between apprentices and tradesmen. However, in the Australian case, Richardson (1982) has made the interesting point that the dominant substitute for apprentices in the metal trades may be with (semi-skilled) tradesmen assistants rather than tradesmen. Wallace (1982) has taken up this specification in his statistical work, and we strongly endorse this re-orientation in our empirical work below.

Thirdly, the relevant wage ratio should be generalised to a labour cost ratio. In this regard, account needs to be taken of payroll tax, workers' compensation premiums, over-award wage payments and labour cost subsidies paid to employers. Let us deal separately with each of these sub-issues.

The impact of state employment taxes is of growing concern to employers, especially in the building trades where the combination of payroll tax and workers' compensation premiums now exceed 25 per cent of gross weekly wages (including overtime and over-award payment). However, since employment taxes affect the labour costs of both apprentices and tradesmen assistants

tradesmen) equally, it may seem superfluous to take them into account. This is not the case because labour cost subsidies are not generally affected by State employment taxes. To see this point we can consider the following expression of relative labour cost:

$$(TAX * W_A - SUBSIDY) / (TAX * W_{TA}) \dots\dots\dots(2)$$

where W_A is the weekly wage rate of apprentices, TAX is one plus the proportion of gross wages paid in payroll tax and workers' compensation premiums, W_{TA} is the weekly wage rate of tradesman assistants and SUBSIDY is the weekly dollar value of subsidies paid to employers in relation to apprentices. Clearly a rise in TAX dilutes the effective value of SUBSIDY and thereby increases the relative cost of apprentices.

The impact of wage subsidies on relative labour costs is also depicted by equation (2). Apprentice wage subsidies clearly reduce the relative labour cost of apprentices vis-a-vis tradesmen assistants or tradesmen. This aspect is extremely important in the Australian experience, where the bulk of wage subsidies have been targeted to apprentices. By far the most important Commonwealth wage subsidy is the CRAFT rebate scheme, which currently offers about \$25 per week to enable firms to release apprentices to technical college classes. This subsidy is

therefore paid for the first three years of apprenticeship, for the weeks in which the apprentice attends technical college. CRAFT's predecessor, the NAAS scheme effectively gave lump sum subsidies to employers of first year apprentices. In the mid-seventies the subsidy was about \$1,200 per annum. A special \$1,000 bonus scheme applied for the years 1979 and 1980 for employers taking on an incremental number of first year apprentices. Finally, some States have their own apprentice labour cost subsidy schemes. These schemes vary somewhat, but usually entail a rebate of either or both of payroll tax and workers' compensation premiums to employers of first year apprentices. In the metal and building trades, at least, these State apprentice labour costs subsidies have been or are worth almost \$1,000 per year.

The impact of over-award wages is another dimension of labour costs which needs to be considered in greater detail. In part the rationale for adjusting for over-award wages is analagous to that for TAX, namely that even proportional changes in over-award wages to apprentices and tradesmen assistants can alter the relative labour cost of apprentices. The over-award wage adjustment procedure is complicated slightly by the fact that relatively fewer apprentices than tradesmen assistants receive over-award wages. There is evidence¹ that about 70 per cent of apprentices in the metal trades industries receive over-award

payment compared to almost 100% of tradesmen assistants. If an apprentice does get any over-award payment, it is usually in the same proportion as set out in the award structure; for example, a first year metal trades apprentice receiving say 42 per cent of the tradesmen wage, or a second year apprentice receiving 55 per cent.

The importance of over-award payments is not well documented, but it clearly varies between industries. For instance, such payments are comparatively rare in the construction industry because they are replaced by specific award allowances in lieu of. However, in the metal trade industries over-award payments augment award wages by about 25 per cent. Fortunately our knowledge in this area is enhanced by the regular surveys carried out by the A.M.W.S.U. Nonetheless, these data are not quite suitable in time series form, partly because the data is biannual rather than annual and also because the survey is subject to varying sample size. Therefore, instead of including over-award wage data as a continuous variable, we have included a constant average component, based on the 1972-1980 period. In NSW, for example, the value of over-award payments averages 27 per cent of the tradesman assistant's award wage. The figure is similar in Victoria and Western Australia, but is somewhat lower in Tasmania and South Australia. A lower constant average over-award wage component applies to apprentices in the metal trades. Although

constancy is an extreme assumption, it recognises that the A.M.W.S.U. data should not be taken literally and in any case accords with a certain degree of stability in the observed series. To re-iterate, the main purpose for including over-award payments is to more accurately weight the effective labour cost value of subsidies vis-a-vis award wages.

Apart from the above attempts to adjust the relative labour cost variable, considerable effort (with outside help)² has been expended to extract detailed and consistent time series award wage data at the State level, using either (and sometimes both) Federal or State awards. This degree of detail is virtually unknown in Australian statistical exercises using wage data in the tradesmen labour market area. Indeed all previous Australian studies have used a single award wage to represent apprentices. This is a dubious assumption in light of well-known inter-State differences in the wage-setting process and with varying reliance on Federal awards. Correction of this distortion has required a great deal of search to elucidate State information by trade by date of change in the percentage or dollars paid in award wages to apprentices by stage of apprenticeship, changes in the term of apprenticeship, changes in tool and other allowances, etc.

A final feature of the relative labour cost variable is the need to recognise the taxation treatment of some training subsidy schemes. The CRAFT and \$1,000 Employer Cash rebates are tax-exempt. As Richardson (1982) notes, this feature almost doubles the after-tax value of such rebates.³ For our purposes we are trying to enter all labour cost components on a comparable basis. Thus a dollar's worth of NAAS subsidy equals a dollar's worth of State payroll tax refund equals a dollar reduction in wages in terms of a firm's after-tax profitability. However on a similar criterion a dollar's worth of CRAFT rebate will be equal to 1.85 dollars of NAAS etc. if the firm's taxation rate is 45 per cent.

6 CAN WE IDENTIFY THE LABOUR DEMAND FUNCTION FOR APPRENTICES?

As is well-known, identification of a labour demand function is facilitated by a prolonged period of excess supply disequilibrium, but is thwarted by excess demand conditions. The period since the mid-1970's is therefore ideal for labour demand estimation. However the 1960's represented fairly clear excess labour demand which perhaps should be excluded from our sample period. Few Australian studies have explicitly tested for disequilibrium in the labour market and so we must proceed with the usual caution.

There is a reasonable, non-rigorous profile of the Australian teenage labour market which indicates a continuous post-war period of excess demand up to 1971, switching to a continuous period of excess supply from 1972 to the present. A somewhat similar profile has been suggested by the present author for the case of Great Britain (Merrilees and Wilson 1979).

In the Australian case the teenage unemployment rate (as with other demographic groups) was extremely low prior to 1972, often less than 3 per cent. In 1972 the number of teenaged unemployment rose sharply and the rate of unemployment has remained at a high level. Part of the excess demand for excess labour for teenagers prior to 1972 can be explained by buoyant macroeconomic conditions and part by falling labour supply (due to both population and educational factors). In the case of the apprentice labour market in particular, examination of CES unemployment and vacancy data reveals a sudden deterioration in the early 1970's. This is similar to the teenage labour market in general. However the picture may have dissimilarities at a more disaggregated level of the apprentice labour market. For example, even with a general shortage of teenage labour, some trades may be sufficiently popular to generate an elastic labour supply. Motor mechanics may be such a trade, which is consistent with both the type of evidence in Dufty (1960) and the high CES applicant to vacancy ratio in the 1960's for motor mechanics. In other cases (printing?) labour demand may be relatively slack even during a macroeconomic boom, so in the 1960's there need not have been an excess demand for apprentices in such trades.

The hypothesis of a sudden switch in 1972 from excess labour demand for apprentices (and other teenagers) to excess labour supply can be tested by econometric techniques. In part, the hypothesis implies a stable labour demand function from 1972 onwards, a structural break in the demand function around 1972, and an unstable, poorly specified demand function prior to 1972. Various techniques can be used to test for a structural break in a model. If there is a priori confidence about the timing of the break, then a Chow test is appropriate. If there is uncertainty about the timing and the break is gradual over time, then Cusum or Cusum-squared type tests are appropriate. However, if the structural break is sudden, as we believe to be the case in question, a test like Quandt's log likelihood ratio is appropriate. For an outline of these alternative tests see Brown, Durbin and Evans (1975).

The nature of the apprentice recruitment process is such that it is a discrete operation, aimed primarily at end of the calendar year school leavers, who mainly start employment in the first quarter of the following calendar year. There is little point having more frequent than annual data, which is just as well because the intake data is only given in annual observations. The necessity to use annual intake data coupled with a relatively short time span (the 1970's) in which the apprentice demand function is likely to be identifiable, has forced us to use a pooled time-series/cross-sectional (States) approach.

The more detailed empirical results are presented in the following section. For the moment, we report the results of applying Quandt's log likelihood ratio test to our five trade groups. In three cases a pronounced structural break is revealed more or less when expected; 1970/71 for the metal and electrical trades and 1971/72 for the building trades. Figure 1 illustrates this structural break in the case of the electrical trades. We take these breaks⁴ to be indicative of a switch from excess demand for to excess supply of apprentices. Supportive of this position is the poor performance of the apprentice labour demand function during the 1960's.

7 EMPIRICAL RESULTS OF APPRENTICE RECRUITMENT MODEL

Equation (1) has been estimated in a log-linear specification using pooled time-series and cross-sectional (States) data. Five States are included, with Queensland omitted because of data problems associated with apprentice registrations in the early 1970's. The time period varies for each trade group, depending on when the apprentice labour demand function can be identified, as explained in the previous section.

A special feature of the data is that each of the dependent and explanatory variables uses State-specific and trade-specific information. For more details, see the appendix.

The most striking result in Table 1 is the very strong performance of the output variable. In four trades the output coefficient is significant at the one per cent level, while in printing it is significant at the five per cent level. Nonetheless the output elasticity varies considerably across trades, ranging from 0.5 in Printing to 2.6 in Metal. Although Metal is revealed to have the largest output elasticity, the associated output variable (manufacturing output) has grown the least.

The disequilibrium labour market indicator (U) is highly significant in the electrical, motor mechanic and printing trades, marginally significant in metal and has the wrong sign in building. A doubling of the tradesman unemployment rate in the electrical trades reduces by 14 per cent (ceteris paribus) the electrical apprentice intake. In other trades the response is smaller.

The State dummy variables are readily interpreted. They reveal the extent to which there is a systematic State-specific influence, relative to Victoria, which is not otherwise explained by the variables included. For example, the positive coefficient on the Tasmanian dummy variable in the building trades equation indicates there is some unique Tasmanian influence resulting in more apprentices being recruited, for given output and labour cost levels. Exactly what is this unique influence is not

revealed, but it could be factors such as a substantially different output mix; a higher ratio of residential to industrial construction may lead to more apprentices per unit of output.

Finally, we can discuss the relative labour cost variable. What emerges is a wide variety of labour cost elasticities. In the printing and motor mechanic trades the elasticity is zero; in fact in both trades the signs of the relative labour cost coefficient are a priori wrong. In the building trades, the coefficient on the relative labour cost variable is the correct sign, but it is insignificant. There are stronger labour cost effects in the electrical trades, with the coefficient being marginally significant at the six per cent level (one tail test). The strongest labour cost effects occur in the metal trades, with a relative labour cost elasticity of about unitary, which is significant at the one per cent level.

For all three trades with the correct sign on the relative labour cost coefficient, the best results occur where the denominator is specified as tradesmen assistant (or semi-skilled builders labourer) rather than tradesmen. When both relative labour cost specifications (i.e. apprentice to tradesmen assistant and apprentice to tradesmen) are included, only the apprentice to tradesmen assistant ratio is significant. This supports

Richardson's (1982) hypothesis that apprentices and tradesmen assistants are substitutes, but not apprentices and tradesmen. Our empirical finding is important because there are no time series data on the employment of tradesmen assistant and hence it is impossible to directly confirm substitution between apprentices and tradesmen assistants. Moreover, the ranking of our relative labour cost elasticities is consistent with the known varying importance of tradesmen assistants. Tradesmen assistants (or semi-skilled builders labourers) are commonly used in the metal and building trades, are well established in the electrical trades, are rarely used in the printing trades (except in a couple of the previously many printing trades) and are almost non-existent in the car repair area.

8 TWO KEY ASSUMPTIONS ASSOCIATED WITH POOLED ESTIMATION

Two key assumptions associated with pooled estimation require further discussion. The assumption of homoscedastic disturbances is often violated in such studies. However it is unlikely to be a problem in our case because dummy variables are included for each State; this option cannot of course be used in a pure cross-sectional pooling exercise. Our expectation is confirmed by inspecting the residuals from our pooled time-series/cross-sectional equations. There is no tendency for the absolute values of the least-squares residuals to vary with the size of the State

and therefore there is no problem of heteroscedastic disturbances.

A second key assumption is that the regression coefficients are equal for all cross-sectional units (States in our case). Often this assumption is not even acknowledged in pooled time-series/cross-sectional studies and if it is acknowledged it is simply stated rather than tested. In fact it is not difficult to test for such. The appropriate test is to see if we accept the hypothesis that all States have the same coefficient for each explanatory variable. In the printing and building trades and building trades we accept this hypothesis using a chi-square test. In the other three trades it was possible to accept a close approximation to this hypothesis. For example, in the electrical trades, the West Australian unemployment coefficient and the NSW output coefficient were left as significantly different from zero. Nevertheless, the other ten State-specific explanatory variables (four W, three Q and three U terms) could be accepted as insignificant from zero. In this case the likelihood ratio test resulted in a computed chi-square value of 16.6, which is less than the critical 0.01 value of 23.2 (with 10 d.f.) so we accept the ten restrictions. For the metal and motor mechanic trades there was only one State-specific explanatory coefficient in each equation which could not be deemed as insignificant from zero. To interpret the State-specific explanatory coefficients we can illustrate with the West Australian output term in the electrical trades. This has a coefficient of 1.55, compared to the rest of Australia average of 0.87. The actual WA output elasticity for the electrical trades is the sum of these two coefficients, namely 2.42.

9 INVESTMENT VERSUS PRODUCTION MODELS OF APPRENTICE
RECRUITMENT

A varied picture emerges in respect of the relative performance of the investment and production models introduced in section 5. In the building trades the current production motive is superior. There was no evidence of firms forming an expectation of future production from a distributed lag of past output. Similarly, employers emphasised first year apprentice wages rather than the wages of apprentices throughout their term.

In contrast, in the metal trades it is apparent that firms discount some fluctuations in current output by using distributed lags to form future output expectations. Similarly, a better statistical fit occurs when the term of apprentice wages is included than just first year wages. If first year wages are entered instead of the average of all years, the adjusted R-squared drops from 0.9915 to 0.9873 and the t-value on the relative labour cost coefficient drops from 5.5 to 2.7. If the first year apprentice wage specification is combined with current output, but not lagged output terms, the adjusted R-squared drops further to 0.9843 and the t-value on the relative labour cost coefficient also drops further to 2.4. Equally the results indicate that metal employers are responsive to the additional labour costs of shorter terms of apprenticeships, whereas a current output motive ignores such.

The relative superiority between the current production and the investment models is unclear for the other three trades. In the electrical trades there is no evidence of lagged output effects, though this may reflect the absence of pronounced cyclical output variations. Collinearity of current and lagged output variables makes it difficult to identify all of the output coefficients. However the first year apprentice wage specification has an inferior performance to the average wage during the term of apprenticeship, which suggests that the investment model is superior. The evidence in the printing trade points towards a current production interpretation, while the motor mechanic group is more ambiguous.

In summary, there is no reason why the one model would be applicable to all industries or trades. Our findings indicate that the investment model best explains the metal and electrical trades while the current production model best explains the building and printing trades. This dichotomy is consistent with the empirical observation that building employers are more likely to prematurely terminate an indenture, which reflects a lesser commitment to investing over the full apprenticeship term. One might also argue that the complexity of skills is less in building compared to the metal and electrical trades, which would permit the new apprentice to be relatively more productive in his or her first year.

10 THE EFFECTIVENESS OF CRAFT SUBSIDIES

The effectiveness of training subsidies in stimulating the employment of apprentices varies directly with the relative labour cost elasticities given in Table 1. Our results suggest that the CRAFT rebate scheme has been very effective in the metal trades, fairly effective in the electrical trades, of some effect in the building trade, but ineffective in the printing and motor mechanic trades. These results are robust when subject to slight changes in the estimating period.

It is possible to test our implicit assumption that subsidies have the same effect as an equivalent change in wages. We can decompose the labour cost variable into gross wage and subsidy components:

$$LC = W - S \quad \dots\dots\dots (3)$$

where LC denotes labour cost, W is gross wages and S subsidy

Unfortunately equation (3) is not of direct use for inclusion in our log-linear model of intake because log (LC) cannot be replaced by the sum of log W and log S. The two expressions are not equivalent. To overcome this difficulty we resort to a mathematical trick, namely expressing (3) in multiplicative form.

Thus (3) can be re-written:

$$LC = W (1-S/W) \quad \dots\dots\dots (3a)$$

Now we can replace log LC by its components log W and log (1- S/W). This makes it possible to test whether subsidies and wages are equally effective in stimulating employment. The unrestricted specification allows the two components of relative labour cost to enter separately, while the restricted model (given in Table I) forces the two components to have the same effect. This hypothesis is tested using a likelihood ratio test. In all trades the restriction is accepted. For example, in the metal trades, the computed chi-square value is 0.10, while the 1 per cent critical value is 6.63 (one d.f.). Thus we accept the restriction that subsidies are equally effective as other (mainly wage) labour costs.

We have also used a related decomposition of labour cost techniques to test whether the implicit taxation component of the CHAFT and the \$1 000 bonus rebates has the same effect as the rest of relative labour cost. The latter includes the nominal value of the rebates, say \$1 000 p.a. in the case of the \$1 000 bonus rebate, in which case the tax savings component would be \$850 (based on a tax rate of 45 per cent). Essentially we are testing for tax illusion; that is, the possibility that tax

benefits are treated differently to equivalent nominal subsidy benefits. Again, using a likelihood ratio test the restricted model was accepted for the metal trades; there was no evidence of tax illusion. However, there was evidence of tax illusion in the electrical and building trades. For these two trades, there was evidence that firms did respond to the nominal value of subsidies, but not to the accompanying implicit tax benefit. In the case of the electrical trades, this can be explained by the large role of non-tax paying public utilities. In the building trades tax illusion may be due to a high incidence of tax-evasion (in which case tax benefits are of little use). Alternatively, the high standard error of the labour cost coefficient in the building trades equation may make it difficult to accurately test for tax illusion.

Finally, we note that only in the printing trades is there evidence of timing effects, that is transitory benefits deriving from recruitment decisions being brought forward.

11 CONCLUSIONS

Two main models, the investment and current production approaches, are used as theoretical frameworks for estimating apprentice labour demand functions. No single model dominated, with the investment model stronger in the metal and electrical

trades and the current production model stronger in the building and printing trades. For all trades output dominates the explanation of apprentice intake levels. In two trades (metal and electrical) relative labour costs were also important, though in two other trades (printing and motor mechanics) they had no effect at all.

Our findings of a large and significant labour cost elasticity in the metal trades, with smaller effects in the electrical trades, reflect the benefit of acquiring detailed disaggregated data as well as awareness of the need to select an estimating period enabling identification of the labour demand function. No previous Australian apprentice demand study has found significant wage elasticities.

In turn our labour cost elasticity estimates provide evidence that training subsidies do work in some trades. Thus we have established that the CRAFT and related (NAAS, \$1 000 bonus and State) rebate schemes have achieved one of their objectives, namely an increase in apprentice employment. We have not attempted to evaluate other objectives of CRAFT, including an increase in the quality of apprentice training.

Nonetheless, although the main objective of CRAFT has been achieved, it is still possible to improve the scheme. In particular our results highlight the differential effectiveness of CRAFT across trades. If we regard the quality dimension as equal across trades and concentrate on the quantity objective, then it is possible to increase apprentice employment by appropriately differentiating the CRAFT rebate structure. The latter was in fact differentiated in 1980, but not in a manner conducive to maximising the employment response. In the 1980 restructuring of CRAFT, the metal trades were pushed down the hierarchy, whereas our recommendation would be to greatly increase the rate to that group. From a practical viewpoint this suggested re-alignment of CRAFT rates could be done in the annual indexation movement. However the virtue of re-alignment in the current budgetary climate is obvious; one can increase the effectiveness of CRAFT without altering the total outlay under the scheme.

An alternative recommendation is to accept the notion that the CRAFT scheme is particularly well suited to achieving certain objectives, such as the quality of training and equity of educational/training funding across occupational groups. The employment objective of apprenticeship training would be better achieved by some form of the \$1 000 bonus scheme.

There is more scope with this scheme to differentiate between the trades and it also lends itself more to a marginal subsidy format. In short, with multiple objectives in the apprentice training area it may be more effective if we use multiple policy instruments. Re-introduction of the \$1 000 Employer Cash Rebate, suitably modified, as a supplement to CRAFT would take us in that direction.

FOOTNOTES

- # I would like to thank John Wallace, Russell Ross, Damion Power, Keith McKay and Lucio Krbavac for their comments. Invaluable research assistance was provided by Cecilia Clark and Tony Merrilees. The project was funded by a Bureau of Labour Market Research grant. The author alone is responsible for views expressed.
- 1 From surveys conducted by the A.M.W.S.U.
- 2 Particularly from the Bureau of Labour Market Research in collecting certain State awards.
- 3 To see this more clearly one can specify an after-tax profit function in which the taxable and tax-exempt revenue components are separated.
- 4 Chow-tests confirm structural breaks at these points.

APPENDIX : DATA SOURCES

1 Apprentice First Year Intake

As a result of apprentice registration problems in the early 1970's in Queensland, it was decided to exclude Queensland from the investigation. For the other five states there have been inconsistencies in previous historical compilations. For example, apprentice trainees in NSW were only included from 1977/78 onwards. Therefore it has been necessary to undertake further work to get a consistent series which, fortunately, Damion Power of the Commonwealth Department of Employment and Industrial Relations has done recently. Essentially we have used his revised data series, making further corrections for occasional years when biases are known for particular States (eg. Western Australia in 1977/78).

2 Real Output

- (a) Metal Trades: the output series is manufacturing output by State. The first step was to obtain constant price gross product for Australia from the ABS source Australian National Accounts, Gross Produce By Industry 1980/81, Cat No 5211 (and previous issues). Secondly this real product in constant dollars was

divided between the States according to a different source, manufacturing census data in Manufacturing Establishments and Manufacturing Activity, ABS Cat No 8203;

- (b) Building Trades: the output series is construction output by State. The Australian aggregate rate of construction output is taken from the same source as (a), namely Cat No 5211. State shares in this aggregate are obtained from Building Statistics, ABS, Cat No 8705. Note for (a) and (b) we lack direct measures of real output at a State level and our measures assume that the Australian deflation index is representative of each State;
- (c) Electrical Trades: a broadly based level of activity is used, namely household income at the State level. The current price value of household income is available at a State level in National Accounts, ABS, Cat No 5204 but these are deflated by the Australia-wide non-farm GDP deflator;
- (d) Printing Trades: printing output is part of manufacturing output and therefore is derived in a similar manner to (a).

(e) Motor Mechanic Trade: the output (demand) series is the total number of vehicles on register as at December. This is taken from Motor Vehicle registrations, ABS, Cat No 9303. Additionally an age of vehicles variable is added, which is the sum of registrations in the past two years and divided by the total stock of registrations.

3 Tradesmen Unemployment Rate

This is defined as the State level of CES unemployment by trade as at November divided by the stock of tradesmen. It would have sufficed to simply have the CES unemployment figures, but it is more useful for inter-trade comparisons to convert these CES figures to an unemployment rate.

Although continuous time series of stock of tradesmen are not available, more fragmented evidence indicates that there was little change in the stock during the 1970's (Richardson 1981, Scherer 1981(b), 1983). Therefore, as an approximation which suffices for our purposes, a constant stock is assumed for the 1970's. This is taken from ABS Survey of Employees working as Tradesmen, Sept 1977 (Cat No 6233) and grossed up according to Scherer (1981(b)), p. 13.

4 Award Wage Data

(a) Metal Trades

NSW: Both apprentice and tradesmen assistant wages are based on a mixture of Metal Industries Award (Federal) and Engineers (Etc) State Award;

VIC: Both apprentice and tradesmen assistant wages are based exclusively on Metal Industries Award (Federal);

SA: As per Victoria;

WA: Both apprentice and tradesmen assistant wages are based on Metal Trades General award (State);

TAS: Both apprentice and tradesmen assistant wages are based on (State) Electrolytic Zinc Award;

(b) Building Trades

NSW: Apprentice wage data based on Carpenters, Joiners and Bricklayers (State) while semi-skilled builders' labourer wage data based on National Building trades Construction Award (Federal);

VIC: Apprentice wage data based on Carpenters Award (State) and semi-skilled builders labourer data as per NSW;

SA: Both apprentice and semi-skilled builders labourer wage data from National Building Trades Construction award (Federal);

WA: Both apprentice and skilled builders labourer wage data from Building Trades Award (State);

TAS: Apprentice wage data from Builders and Painters Wages Board and semi-skilled builders labourer wage data as per NSW;

(c) Electrical Trades

Electrical fitter has the same wage as (a);

(d) Printing Trades

NSW, VIC, SA and TAS: Both apprentices and tradesmen wage data from Graphic Arts Award (Federal);

WA: Both apprentice and tradesmen (either hand compositor or finisher) wage data from Printing Trades (Newspapers) Award (State);

5 Other Labour Cost Data

- (a) Over-award wage data in the metal trades is mainly taken from AMWSU Surveys and checked by MFIA survey for more recent years only;
- (b) Workers Compensation Premiums are taken by trade group from the Industrial Gazette in the cases of NSW and WA. For the other States the State GIO's were used.
- (c) Payroll Tax Rates: State Governments
- (d) Apprentice Wage Subsidy Data: CRAFT, NAAS and BONUS data from Commonwealth Department of Employment and Industrial Relations, State schemes from NSW ,VIC and SA Governments.

TABLE 1 : LOG-LINEAR MODEL OF APPRENTICE
RECRUITMENT BY TRADE

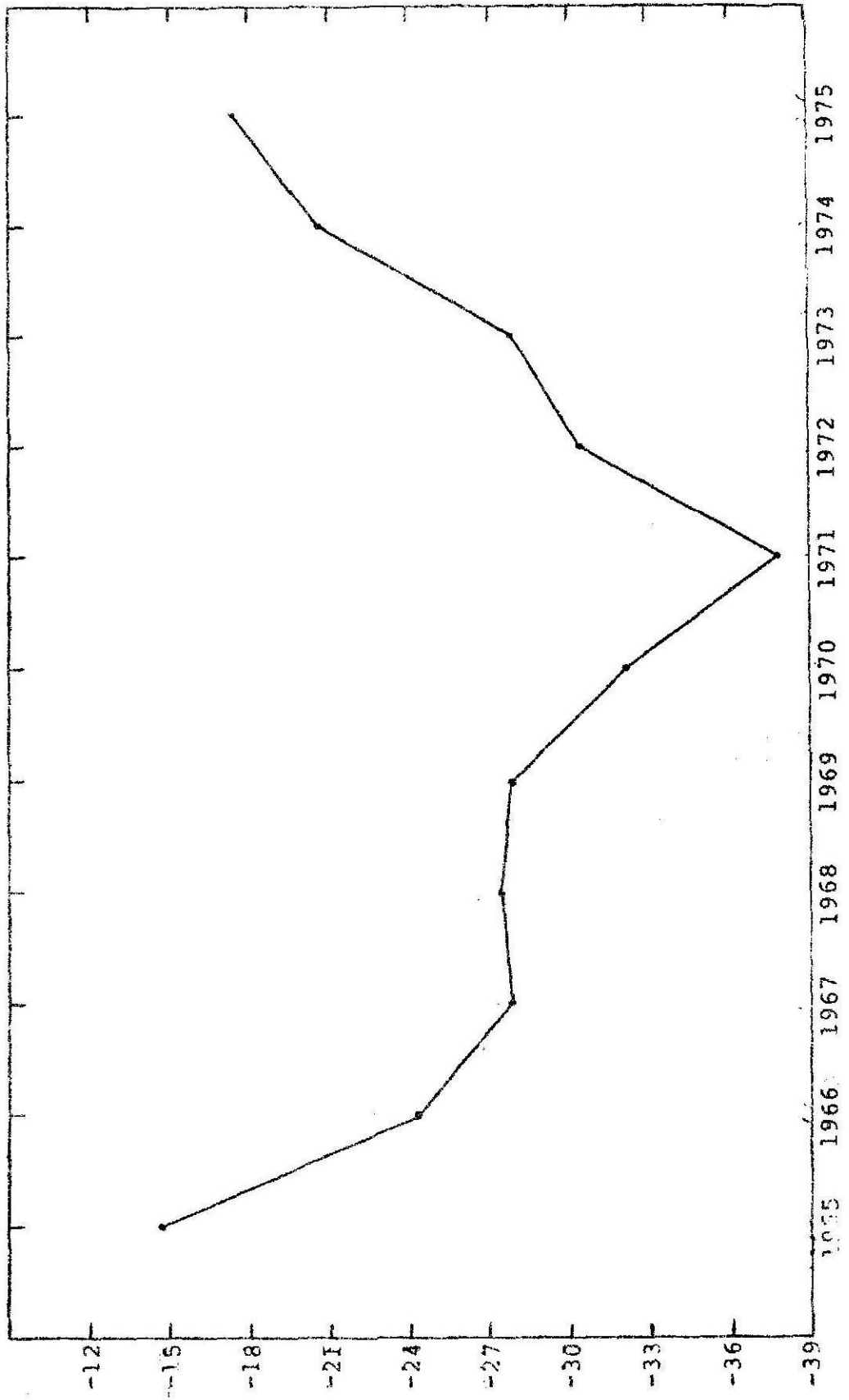
VARIABLE	METAL (1971-1980)	ELECTRICAL (1971-1980)	BUILDING (1972-1980)	PRINTING (1967-1980)	MOTOR MECHANICS (1965-1981)
Constant	-16.34 (7.9)*	-0.28 (0.2)	-0.21 (1.2)	1.28 (0.6)	-1.10 (1.1)
Q_t	1.16 (4.3)*	0.87 (4.4)*	1.32 (5.2)*	0.54 (2.0)*	1.18 (9.0)*
Q_{t-1}	0.80 (2.4)*	n.a.	n.a.	n.a.	n.a.
Q_{t-2}	0.68 (2.0)*	n.a.	n.a.	n.a.	n.a.
U_t	-0.05 (1.79)*	-0.14 (4.6)*	n.a.	-0.09 (2.6)*	-0.08 (3.5)*
Relative Labour Cost	-0.96 (5.5)*	-0.36 (1.67)	-0.13 (1.2)	n.a.	n.a.
Age of Cars	n.a.	n.a.	n.a.	n.a.	0.50 (2.6)*
Timing of Bonus	n.a.	n.a.	n.a.	0.15 (2.1)*	n.a.
\bar{R}^2	0.9915	0.9941	0.9600	0.9365	0.9784

Notes: Dummy variables are not shown here

n.a. denotes not included in final regression run

* denotes significant at 5 per cent level

FIGURE 1: Quandt's log- Likelihood Ratio Calculated for the Electrical Trades
1965-1975



REFERENCES

Becker G. (1964), Human Capital, Columbia University Press, New York, 1964).

Brown R., Durbin J. and Evans J. (1975), "Techniques for Testing the Constancy of Regression Relationships Over Time", Journal of the Royal Statistical Society, Series B, 37(1), 149-163.

Department of Employment and Industrial Relations (1976), Evaluation of National Apprentice Assistance Scheme, Canberra, November 1976, (mimeo).

Fisher N. and Scherer P. (1983), "Research on Employment and training Programs and Services", BLMR Conference Paper No 17, February 1983.

Krbavac L. (1984), "Evaluation of \$1000 Employer Cash Rebate Scheme", Forthcoming, Bureau of Labour Market Research Working Paper.

Lindley R. (1975), "The Demand for Apprentice Recruits by the Engineering Industry", Scottish Journal of Political Economy 22, 1-24.

McDonald G (1978), "Factors Determining the Demand for apprentices: With Special Reference to Six Trades in South Australia", B Ec (Hons) Thesis, Flinders University, September 1978.

Merrilees W. and Wilson R. (1979), "Disequilibrium in the Labour Market for Young People in Great Britain", MRG Discussion Paper No. 10, September, University of Warwick.

____ W. (1983), "Alternative Models of Apprentice Recruitment, With Special Reference to the British Engineering Industry", Applied Economics, 15 February, 1-22.

Richardson S. (1981), "Skilled Metal tradesmen: Shortage or surplus", Australian Bulletin of Labour, 7 September, 195-204.

____ S. (1982), "The Skilled Metal trades", in R. Blandy and Richardsons (eds), How Labour Markets Work, (Longman Cheshire, Melbourne, 1982).

Scherer P. (1981), "Apprenticeship Training and its Effect on the Labour Market", in C. Baird, R. Gregory and F. Gruen (eds), Youth Employment, Education and Training, (Academy of the Social Sciences in Australia, Canberra, 1981).

Wallace J. (1982), "Skilled Trades Supply", in D. Douglas (ed), The Economics of Immigration, (University of Sydney Extrusion Studies, Sydney, 1982).

Ziderman A. (1978), Manpower training: Theory and Policy, (Macmillan, London, 1978).