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WORKERS' COMPENSATION RATES AND THE DEMAND FOR APPRENTICES AND NON-APPRENTICES IN VICTORIA

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WORKERS' COMPENSATION RATES AND THE DEMAND FOR APPRENTICES AND NON-APPRENTICES IN VICTORIA*

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ABSTRACT

The aim of this paper is to provide a detailed quantitative analysis of the impact of changes in the current cost structure on the employment of apprentices and non-apprentices in Victoria. In particular, we emphasise the impact of "large" changes to the cost structure, such as waiving or changing the workers' compensation payments for all apprentices throughout their period of training; as well as "small" or "marginal" changes, such as waiving the workers' compensation payment for first-year indentures only.

We find that "large" changes to the cost structure affect employment only in the metal and electrical trades. In these two trades the effect on the employment of apprentices is less than proportional to the change in the subsidy rate. Further, we find that "marginal" adjustments to workers' compensation, payroll tax and training subsidies have a negligible effect on apprentice employment.

Overall, our results are not uniform across the various trades, which suggests that there are inter-skill differences. Thus, if intervention in the apprentice labour market is to have any significant impact on employment, it must be targetted to specific trades.

WORKERS' COMPENSATION RATES AND THE DEMAND FOR APPRENTICES AND NON-APPRENTICES IN VICTORIA

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1. INTRODUCTION

The principal purpose of this paper is to provide a detailed econometric analysis of the impact of changes to the subsidy/rate structure on the employment of apprentices and non-apprentices in Victoria.

At the time that this research commenced, employers were exempt from workers' compensation payments for first-year apprentices, as well as being subsidised for the travel and attendance time associated with training courses for apprentices in later years. The Housing Industry Association claimed in a submission that if the workers' compensation waiver were extended to apprentices in all years of training then an additional one hundred workers would be employed in that industry. That is, by reducing the on-costs of employing apprentices, more would be employed. In late 1985 the Victorian Government announced that the workers' compensation waiver would apply to all apprentices, in all trades.

In this paper we analyse the employment effects on the demand for apprentice (both total and new indentures) and non-apprentice labour, of removing the workers' compensation costs for apprentices. We also analyse the impact of other apprentice assistance and subsidy schemes on apprentice employment. Our principal conclusions are that large changes to the cost structure associated with the hiring of apprentices affects employment only in the metal and electrical trades; that in the latter cases the effect on the employment of apprentices is less than proportional to the change in the subsidy rate; and that marginal changes to workers' compensation costs, payroll tax and training subsidies have a negligible impact on the employment of apprentices.

2. EMPIRICAL STUDIES OF APPRENTICE LABOUR DEMAND

The amount of Australian research on apprentice demand compares quite favourably with that carried out overseas. The relevant studies in Australia include Dufty (1967), Krbavic (1984), Merrilees (1983b) (1984), Murphy (1986), Scherer (1981) and Wallace (1982). Table 1 provides a useful summary of some of the main studies of apprentice demand elasticities over the last decade. The emphasis of the American and Canadian studies is on young adults (under 25), rather than apprentices as a group. The British and Australian studies have concentrated on apprentices. In the British studies (Lindley (1975), Merrilees (1983a)), wage costs are the dominant component of labour costs and invariably are found to be significant factors. For example, Lindley (1975) found that for apprentices in the engineering trades, the own-price elasticity of demand varied from -0.5 to -1.1, depending on the particular equation formulation used. This suggests that if the wage costs of apprentices increase by 10%, the demand for apprentices will fall from between 5% and 11%. Merrilees (1983a), on the other hand, found even stronger effects, with own-price elasticities of demand of between -1.43 and -1.49.

Although the majority of Australian studies have considered the role of wage costs, in only one case (Merrilees (1984) shown in Table 1) does it play an important role.[1] As is clear from Table 1, in the Merrilees (1984) study wage costs are significant only in the metal trades, where a 10% reduction in wage costs would result in a 9.6% increase in apprentice employment in the metal trades. In all other trades, it is unimportant. In the Australian studies, output movements play an important role in explaining the demand for apprentice labour.[2]

3. THE MODEL

Our econometric analysis is based on systems of labour demand functions for both apprentices and non-apprentices. The details of the model are given in this section, and a discussion of its estimation is given in Section 4. These systems of demand equations covered some fifteen individual trades in Victoria, this level of aggregation having been arrived at from the forty seven - trade level in the manner described in Appendix 1. The data used were obtained from the Department of Labour, the State Insurance Office, and the National Institute of Economic and Industry Research. Further details appear in Appendix 2.

Some comments are in order concerning how various subsidies and adjustments are incorporated into the apprentice wage costs. The term "wage costs" for both apprentice labour and non-apprentice labour includes any costs associated with workers' compensation and payroll tax rates. Thus:

Wage (Rate) Costs = Award Wages (1 + Payroll Tax Rate + Workers' Compensation Rate).

Table 1 : Estimates of Labour Demand Elasticities

Study	Data	Types of Labour	Own-price Elasticity of Young Workers
Welch and Cunningham (1978)	USA Cross Section Data 1970	Teenagers vs Adults	-1.3
Anderson (1977)	USA Time Series 1947-72	Under 25 years vs 25 years and over	-2.5
Grant (1979)	USA Cross Section 1970	Under 25 years vs 25 years and over	-9.7
Hamermesh (1981)	USA Time Series 1949-69	Under 25 years vs 25 years and over	
Layard (1982)	UK Time Series 1949-69	Males under 21 Females under 21	-1.2 -0.3
Merrilees (1982)	Canada Time Series 1951-78	Under 25 and Over 25 years	No significant substitution
Lewis (1983)	Australia Time Series 1975-1981 (17 industries)	Male youth vs adult male Female youth vs adult male	-1.9 -4.6
Lindlay (1975)	UK Time Series 1951-71 Engineering trades	Apprentices	-.5 to -1.1
Phipps (1983)	Australia Time Series 1962/3 - 76/7 8 industry groups. ASIC classification	Total labour	* A ns * B -.31 * C -.52 * D -.22 * E -.56 * F ns * GH ns * L ns
Merrilees (1983a)	UK Time Series 1963-79 Engineering trades	Apprentices	-1.43 to -1.49
Merrilees (1984)	Australian Time Series 1965-80 Sample period varies with trade	Apprentices	Metal trades -.96 Electrical trades ns Building trades ns Printing trades na Motor Mechanic trades na

* A = Agriculture; Forestry, Fishing and Hunting; B = Mining; C = Manufacturing: D = Electricity, Gas and Water; E = Construction; F = Wholesale and Retail Trade; GH = Transport, Storage and Communication; L = Entertainment, Recreation, Restaurants, Hotels and Personal Services.

ns - not significant; na - not appearing in the regression.

In addition, for apprentice wage costs only, adjustments were made for the various training scheme rebates so that for apprentices:

Wage (Rate) Costs = Award Wages (1 + Payroll Tax + Workers' Compensation Rate) - Subsidies.

The details of these various subsidies are set out in Appendix 2. This method of including the various on-costs and subsidies as part of the wage cost variable, to obtain a "total net cost" has been used in a number of studies. Merrilees (1984) provides a detailed justification for this procedure.

Dummy variables are used in the model to account for changes in the payroll tax and workers' compensation arrangements for first year apprentices. To capture the effect of workers' compensation rate changes, we need to examine the coefficients of the wage cost variable in our model. The coefficients associated with the dummy variables give an indication of whether or not changes in the various subsidies have any significant impact on apprentice labour demand during the sample period.

3.1 Demand for New Apprentice Indentures

Our basic approach to modelling new apprentice indentures is to estimate separate relationships to explain new indentures in each of the fifteen trades under consideration. Allowances are made for both the possibility that certain explanatory variables in fact are endogenous, and the possibility that the error term in each relationship may be autocorrelated. For a particular trade, the most general form of the relationship to be estimated may be written in a form consistent with it being derived from a CES production function:

$$\log(I) = \text{Const.} + \sum_{i=0}^{1} \alpha_i \log(Q_{-i}) + \beta \Delta \log(Q)$$

$$+ \sum_{i=0}^{1} \gamma_i \log(RW_{-i}) + \delta \log(EA_{-1})$$

$$+ \sum_{i=0}^{1} \theta_i \log(U_{-i}) + \phi\, DWC + \psi\, DPT$$

$$+ \eta\, TIME + \varepsilon; \qquad \varepsilon = \rho\varepsilon_{-1} + u\, .$$

The variables in this model are, for the trade in question:

I = New indentures of apprentices .

Q = Real output .

RW = Relative wages of new apprentices to those of skilled tradesmen (=WA/WS).

EA = Total number of apprentices in employment.

U = Aggregate unemployment rate .

DWC = DUMWC * log(WA), where DUMWC is a dummy variable taking the value unity only for the period 1979:1 - 1985:2 (to account for changes in the workers' compensation arrangements for apprentices).

DPT = DUMPT * log(WA), where DUMPT is a dummy variable taking the value unity only for the period 1982:1 - 1985:2 (to account for changes in the payroll tax arrangements for apprentices).

TIME = Time trend, with value unity in 1979:1 and incrementing by one unit per quarter.

All variables were seasonally adjusted prior to use by the ratio-to-moving average method, using the TSP package. The parameters in this model may be interpreted as (constant) elasticities with θ, ϕ and ψ representing shifts in the apprentice wage (or relative wage) elasticity of demand for indentures as a result of the various changes to payroll tax and workers' compensation arrangements. The anticipated signs for the estimated parameters are as follows :

$$\alpha_o, \quad \beta, \quad \phi, \quad \psi \geq 0$$

$$\gamma_o, \quad \delta, \quad \theta_o \quad \leq 0$$

$$\alpha_1 \begin{cases} \gtrless 0, & \text{if} \quad \alpha_o > 0 \\ \geq 0, & \text{if} \quad \alpha_o = 0 \end{cases}$$

$$\gamma_1 \begin{cases} \gtrless 0, & \text{if} \quad \gamma_o < 0 \\ \leq 0, & \text{if} \quad \gamma_o = 0 \end{cases}$$

$$\theta_1 \begin{cases} \gtrless 0, & \text{if} \quad \theta_o < 0 \\ \leq 0, & \text{if} \quad \theta_o = 0 \end{cases}$$

$$\eta, \rho \gtrless 0, \quad \text{with} \quad |\rho| < 1.$$

3.2 <u>Total Demand For Skilled Tradesmen and Apprentices</u>

In this case, a pair of factor-demand equations is estimated jointly for each trade group, again with an allowance for the endogeneity of various regressors. These equations explain the total number of skilled tradesmen employed in the group in Victoria, and the corresponding total number of apprentices employed (over all years of indenture). For a particular trade, the pair of equations is again formulated in a manner consistent with derivation from a CES production function, and may be expressed in the form :

$$\text{(i)} \quad \log(ES) = \text{Const.} + \sum_{i=0}^{1} \alpha_i \log(Q_{-i})$$

$$+ \sum_{i=0}^{1} \gamma_i \log(RW_{-i}) + \delta \log(ES_{-1})$$

$$+ \sum_{i=0}^{1} \theta_i \log(U_{-i}) + \sum_{i=0}^{1} \phi_i \, DWC_{-i}$$

$$+ \upsilon \, DPT + \mu \, DNA + \varepsilon$$

$$\text{(ii)} \quad \log(EA) = \text{Const}' + \sum_{i=0}^{1} \alpha_i' \log(Q_{-i})$$

$$+ \sum_{i=0}^{1} \gamma_1' \log(RW_{-i}) + \delta' \log(EA_{-1})$$

$$+ \sum_{i=0}^{1} \theta_i' \log(U_{-i}) + \sum_{i=0}^{1} \phi_i' \, DWC_{-i}$$

$$+ \upsilon' DPT + \mu' \, DNA + \varepsilon'.$$

The variables are all quarterly seasonally adjusted data and are as defined in the indentures relationship. In addition, we have:

ES = Total number of skilled tradesmen in employment.

DNA = DUMNA * log(WA), where DUMNA is a dummy variable taking the value unity only for the period 1973:1 - 1975:4 (to account for the NAAS scheme and its effect on the (relative) wages of apprentices).

The anticipated signs of the parameters to be estimated are:

(i) $\alpha_o, \delta, \gamma_o \geq 0,$ with $0 \leq \delta \leq 1.$

$\phi_1, \phi_o, \psi, \mu, \theta_o \leq 0$

$$\alpha_1 \begin{cases} \gtrless 0, & \text{if } \alpha_o > 0 \\ \geq 0, & \text{if } \alpha_o = 0 \end{cases}$$

$$\gamma_1 \begin{cases} \gtrless 0, & \text{if } \gamma_o > 0 \\ \geq 0, & \text{if } \gamma_o = 0 \end{cases}$$

$$\theta_1 \begin{cases} \gtrless 0, & \text{if } \theta_o < 0 \\ \leq 0, & \text{if } \theta_o = 0 \end{cases}$$

(ii) $\alpha_o', \theta_o', \phi_1', \psi, \mu, \delta' > 0,$ with $0 \leq \delta' \leq 1.$

$\gamma_o', \theta_o' \leq 0$

$$\alpha_1' \begin{cases} \gtrless 0, & \text{if } \alpha_o' > 0 \\ > 0, & \text{if } \alpha_o' = 0 \end{cases}$$

$$\gamma_1' \begin{cases} \gtrless 0, & \text{if } \gamma_o' < 0 \\ \leq 0, & \text{if } \gamma_o' = 0 \end{cases}$$

$$\theta_1' \begin{cases} \gtrless 0, & \text{if } \theta_o' < 0 \\ \leq 0, & \text{if } \theta_o' = 0 \end{cases} .$$

4. ESTIMATION ISSUES

In the case of the model for new apprentice indentures, each equation was estimated by an instrumental variables variant of maximum likelihood, over the period 1976:1 - 1983:2, the instruments used being the constant, dummy variables, time trend, and both one-period and two-period lagged values of the relative wages, unemployment rate and total employment of apprentices variables.[3] The AR1 routine (with this choice of instrument list) in the TSP package was used to obtain consistent parameter estimates in the face of the potential endogeneity of current output, wages and the unemployment rate, and the possibility of (first order) autocorrelated errors. The chosen estimation algorithm provides a flexible means of allowing for both such specification complications at the single-equation level (see Fair (1970)).

The broad strategy adopted was to search for a simplification of the general model specification noted above, such that all retained variables had estimated coefficients of the anticipated signs. The results obtained are summarised for fourteen trades in Table 2. (No relationship meeting this requirement could be obtained for the explanation of new indentures in the vehicle trade group). In this Table figures in parentheses are asymptotic "t-values". That is, they are the ratios of an estimated parameter to its asymptotic standard error. These statistics have an asymptotic distribution which is Standard Normal. However, given our very small sample, these statistics should be interpreted very cautiously, given that they have only large-sample justification. Accordingly, it will be seen that variables whose estimated coefficients may appear to be "insignificant" (i.e. insignificantly different from zero in value of the basis of a one-sided or two-sided standard normal test) have been retained in the estimated model if these coefficients have the sign expected, *a priori*. This conservative strategy may be justified in part by the fact that the statistical "costs" of omitting relevant regressors are greater than those of retaining irrelevant regressors, under instrumental variables estimation (see Giles (1982)). For the same reasons, an allowance has been made for autocorrelation of the error process in every estimated equation, even if the results suggest the ρ is not significantly different from zero in value in several cases.

In the results given in Table 2, R^2 is a measure of goodness-of-fit, defined here as one minus the ratio of the residual sum of squares to the total sum of squares associated with the dependent variable. (Note that under instrumental variables estimation this measure is bounded above by the value unity, but may be negative.) Also, "dw" denotes the Durbin-Watson statistic. This measure has only an informal interpretation in terms of testing for autocorrelation under instrumental variables estimation, and the reported values should not be used in conjunction with the usual tabulated critical values for this statistic.

Table 2 ; Demand for New Apprentice Indentures

(Single Equation Estimation)*

	AG	FT	PR	BR	CJ	PG	OB	MM	EN	OM	EL	HA	FU	OO
Const	-2.731	-5.849	2.163	-0.787	3.058	5.322	12.518	-1.641	3.561	-1.403	8.310	5.757	-0.471	2.410
	(-0.218)	(-0.734)	(0.195)	(-0.106)	(1.158)	(0.428)	(1.508)	(-0.244)	(0.295)	(-0.280)	(0.269)	(1.111)	(-0.240)	(0.696)
Q		1.853	1.369	1.502	1.663				1.439			0.180	0.407	
		(1.549)	(0.343)	(0.893)	(0.948)				(0.600)			(0.105)	(0.672)	
Q_{-1}	0.504	0.361		-1.345	-2.990	1.060	0.074	1.046	-1.912			-1.468		0.112
	(0.291)	(0.304)		(-0.758)	(-1.710)	(1.318)	(0.046)	(1.370)	(-0.763)			(-1.501)		(0.123)
ΔQ											0.769			
											(0.374)			
RW	-5.471	-3.366		-1.032	-4.914	-3.448	-4.973	-0.073		-2.148	-0.609	-3.373		-0.826
	(-1.245)	(-0.754)		(-0.197)	(-1.824)	(-0.952)	(-1.820)	(-0.058)		(-0.375)	(-0.183)	(-0.929)		(-0.783)
RW_{-1}	-2.201	2.538		1.133		1.988	2.793		-2.452	-3.680		0.589	-1.254	-0.807
	(-0.604)	(0.773)		(0.237)		(0.896)	(1.352)		(-0.692)	(-1.087)		(0.305)	(-0.892)	(-1.117)
EA_{-1}	-0.249	-0.688	-0.841			-1.234	-1.452	-0.099	-0.135		-0.429			
	(-0.849)	(-1.237)	(-0.271)			(-0.856)	(-1.109)	(-0.117)	(-0.069)		(-0.106)			
U	-1.579			-1.172			-0.468	-0.043	-1.173					
	(-1.095)			(-1.537)			(-0.402)	(-0.108)	(-1.189)					
U_{-1}	1.580	-0.357	-0.300		-1.165	-0.112	0.470	-0.329		-0.401		-0.104	-0.632	-0.388
	(1.575)	(-0.841)	(-0.395)		(-2.968)	(-0.229)	(0.504)	(-0.734)		(-0.680)		(-0.273)	(-1.851)	(-1.210)
DWC	0.704**	0.245**							3.097**	6.125**	1.097**	0.014**	7.019**	1.606**
	(0.506)	(0.189)							(1.112)	(2.054)	(0.415)	(0.010)	(0.812)	(1.562)
DPT	1.212**	1.741**		7.992**						0.027**		0.829**	6.267**	
	(0.421)	(1.871)		(0.553)						(0.126)		(0.790)	(0.752)	
TIME			0.004			-0.027	-0.027			-0.044				
			(0.096)			(-1.624)	(-1.303)			(-1.001)				
ϵ_{-1}	-0.314	-0.368	0.172	-0.086	-0.013	0.339	0.021	0.040	0.335	0.243	0.116	-0.155	-0.038	0.434
	(-1.483)	(-1.876)	(0.788)	(-0.411)	(-0.065)	(1.772)	(0.099)	(0.192)	(1.751)	(1.203)	(0.594)	(-0.735)	(-0.184)	(2.269)
R^2	0.793	0.959	0.274	0.325	0.262	0.762	0.978	0.395	0.617	0.518	0.125	0.736	0.312	0.830
dw	2.064	2.143	1.846	1.951	1.932	1.774	1.986	1.877	1.862	1.839	1.954	1.984	1.978	1.960

* Asymptotic "t-values" appear in parentheses.

** Multiply by 10^{-4}.

In the case of the fifteen two-equation models for skilled tradesmen and apprentices the error terms, ε and ε', in each case are assumed to have a joint contemporaneous but serially independent covariance structure. So, using data for the period 1975:4 - 1983:2, for each trade, the two demand equations are estimated jointly and consistently by the method of maximum likelihood with an instrumental variables set comprising the dummy variables, intercept, and one-period lagged values of ES, EA, Q, RW and U. Again the TSP package is used (see Jorgenson and Laffont (1974)).

The same strategy as for the new indentures equations is adopted here to obtain a specification for each pair of labour demand equations. The results obtained for each of the fifteen trade groups are given in Table 3 where[4], in addition to the earlier statistics, Durbin's h-statistic (which is asymptotically standard normally distributed) is given in the case of equations involving a lagged value of the dependent variable as a regressor. As with the dw statistic, this measure must be interpreted only in an informal manner here, given that it has only asymptotic justification and that a method of estimation other than least squares has been adopted. The chosen estimator provides consistent estimates of the parameters, given the possible endogeneity of the regressors, and gains in asymptotic efficiency are obtained by having adopted an estimator which treats the pair of equations as a joint system. Ideally, the estimator would be extended further to allow for the apparent autocorrelation in the error terms of the relationships, but this was not feasible with the available computer software.

Table 3 : Total Demand for Skilled Tradesmen and Apprentices

(Joint Estimation)*

(a) Skilled Tradesmen

	AG	PT	PR	BR	CJ	PG	OB	MM	EN	OM	EL	VH	HA	FU	OO
Const	0.089 (0.229)	10.726 (23.107)	0.876 (1.843)	1.034 (1.171)	-0.633 (-1.187)	1.004 (2.051)	4.202 (4.621)	2.899 (1.142)	0.532 (1.064)	0.675 (0.647)	-0.443 (-0.290)	2.517 (2.199)	0.644 (1.534)	-0.089 (-0.213)	1.474 (2.010)
Q		0.032 (0.435)	0.218 (3.953)	0.088 (1.052)	0.267 (0.818)			0.009 (0.074)	0.082 (2.343)	0.120 (0.712)	1.025 (1.761)	0.041 (0.291)	0.487 (3.069)	0.029 (0.195)	0.025 (0.224)
Q_{-1}	0.290 (6.728)			-0.058 (-0.743)	-0.043 (-0.133)	0.011 (0.396)	0.001 (0.022)			0.082 (0.569)	-0.688 (-1.339)	-0.024 (-0.200)	0.114 (1.710)	-0.055 (-0.391)	0.053 (0.743)
RW	0.115 (0.517)	0.832 (2.335)	0.506 (2.435)	0.121 (0.833)		0.015 (0.178)	0.394 (2.613)	0.203 (0.706)	0.194 (1.065)	0.348 (1.414)	0.671 (1.867)	0.327 (1.290)			
ES_{-1}	0.835 (23.439)		0.817 (0.047)	0.898 (12.869)	0.966 (14.567)	0.908 (24.073)	0.655 (9.377)	0.720 (4.238)	0.910 (26.955)	0.828 (10.245)	0.859 (7.636)	0.767 (7.286)	0.686 (1.177)	1.024 (20.450)	0.874 (13.074)
U								-0.035 (-1.050)		-0.003 (-0.127)		-0.013 (-0.311)			-0.011 (-0.460)
DWC		-2.482** (-2.208)				-0.494** (-1.851)	-0.639** (-2.732)				-1.510** (-0.488)		-1.120** (-1.907)		
DPT		-3.446** (-5.636)	-0.281** (-1.020)				-0.728** (-2.937)		-0.133** (-0.413)						-0.357** (-0.819)
DNA							-5.063** -(4.127)						-1.618** (-2.287)	-0.487** (-0.295)	
R^2	0.993	0.916	0.933	0.982	0.910	0.982	0.988	0.875	0.992	0.882	0.970	0.861	0.962	0.937	0.964
dw	1.386	0.932	1.153	1.144	0.777	1.163	1.906	0.827	1.308	1.367	1.248	0.776	1.567	0.942	2.491
h	1.745		2.443	2.195	3.661	2.384	0.284	10.121	1.962	1.974	2.678	4.200	1.533	3.067	-1.473

* Asymptotic "t-values" appear in parentheses.

** Multiply by 10^{-5}.

Table 3 : Total Demand for Skilled Tradesmen and Apprentices

(Joint Estimation)*

(b) Apprentices

	AG	FT	PR	BR	CJ	PG	OB	MM	EN	OM	EL	VH	HA	FU	OO
Const	0.765 (1.682)	2.674 (2.648)	0.375 (0.648)	-1.941 (-5.819)	-0.948 (-2.351)	-1.327 (-3.456)	-0.264 (-0.559)	4.552 (4.259)	1.656 (1.633)	-0.809 (-1.827)	7.457 (17.740)	0.047 (0.124)	4.594 (13.928)	-0.564 (-1.680)	
Q		0.729 (4.627)	1.100 (3.710)	0.499 (4.188)	0.153 (1.833)	0.085 (2.571)	0.137 (2.320)	0.464 (3.063)	0.146 (0.987)	0.531 (2.882)	0.199 (0.953)		0.751 (4.900)	0.138 (3.585)	2.163 (10.583)
Q_{-1}	0.041 (0.435)		-1.048 (-4.628)	-0.175 (-1.558)	-0.129 (-1.773)				0.161 (0.702)	-0.222 (-1.152)	-0.130 (-0.778)	0.002 (0.089)	0.201 (1.952)		
RW	-1.537 (-3.807)	-0.553 (-0.714)						-0.902 (-2.091)	-0.667 (-1.319)	-0.681 (-1.749)	-0.894 (-5.750)		-0.501 (-1.489)		-0.827 (-1.569)
RW_{-1}															-0.686 (-1.411)
EA_{-1}	0.772 (36.243)		0.909 (6.380)	0.944 (55.728)	1.088 (25.982)	1.094 (29.497)	0.902 (18.068)		0.531 (2.490)	0.794 (11.269)		0.969 (21.782)		0.981 (20.753)	
U					-0.039 (-3.610)			-0.174 (-2.435)		-0.055 (-1.395)		-0.059 (-4.076)		-0.036 (-1.479)	-0.834 (-3.136)
U_{-1}															0.643 (2.157)
DWC	1.983** (2.839)	5.407** (2.211)	0.149** (0.180)						2.131** (2.301)		2.114** (1.712)			0.753** (2.160)	
DWC_{-1}															7.042** (2.241)
DPT	0.796** (1.203)	6.427** (4.832)			0.448** (1.719)	0.339** (1.247)					0.639** (2.035)		1.586** (2.759)		
DNA			0.765** (0.543)		0.226** (0.703)					1.077** (0.783)					
R^2	0.998	0.937	0.982	0.992	0.998	0.985	0.921	0.829	0 991	0.992	0.978	0.986	0.894	0.979	0.704
dw	0 965	0.780	1.032	0.960	1.533	0.258	0.225	0.377	1.016	0.776	1.546	0.899	1.427	0.684	1.540
h	2.901		1.650	2.908	1.337	4.956	5.145		(n.d.)	3.700		3.166		3.796	

* Asymptotic "t-values" appear in parentheses.

** Multiply by 10^{-5}.

n.d.: Not defined.

5. RESULTS

The main results from our study are summarised in Tables 4 and 5. From Table 4 we see that wage costs are a significant explanatory variable in only seven of the fifteen trade groups (for apprentice labour). These seven trades are AG, MM, EN, OM, EL, HA and OO. The wage cost influence is important in the metal trades (made up of MM, EN and OM) where for motor mechanics, for example, a 10% increase in wage costs will result in a 9% reduction in the demand for motor mechanic apprentices. Apart from agriculture (AG), the effect is less than proportional; that is a 10% change in wages results in a less than 10% change in the demand for apprentice labour.

Also presented in Table 4 are the estimates relating to non-apprentice labour which we have called "skilled tradesmen":[5] In this case wage costs are a significant explanatory variable in only five trades. These are the FT, PR, OB, OM and EL trades. Table 5 sets out the results of the single equation estimation for indentures or first-year apprentices. Notice that in this case, wage costs are relatively insignificant and are important in only three trades. In each of these three trades (AG, CJ and OB) the numerical effect is quite large. For example, for CJ, according to our results, a 10% increase in wage costs would result in a 49.1% decrease in the demand for indentures in that trade.[6]

Concerning the complete set of results for indenture demand set out in Table 2, the following observations can be made:

(i) The variables ES (the existing stock of apprentices) and the unemployment rate adversely affect the situation for potential new indentures only in certain trades - this may be

Table 4: Victorian Estimates of Labour Demand Elasticities

by Trades - Joint Estimation Method

	Own-Price Elasticity of demand	
	Apprentices	Tradesmen
AG (Agriculture)	-1.54	ns
FT (Food)	ns	-.83
PR (Printing)	na	-.51
BR (Building)	na	ns
CJ (Carpentry and Joinery)	na	na
PG (Plumbing and Gasfitting)	na	ns
OB (Other Building)	na	-.39
MM (Motor Mechanics)	-.90	ns
EN (Engineering)	-.67	ns
OM (Other Metal)	-.68	-.35
EL (Electrical)	-.89	-.67
VH (Vehicle)	na	ns
HA (Hairdressing)	-.50	na
FU (Furniture)	na	na
OO (Other Other)	-.83	na

Source: Table 3.

ns: Not significant

na: Not applicable (see Table 3).

Table 5: Victorian Estimates for Indenture Demand

Elasticities by Trades - Single Equation Method

Trades	Own-price elasticity of demand
AG (Agriculture)	-5.47
FT (Food)	ns
PR (Printing)	na
BR (Building)	ns
CJ (Carpentry and Joinery)	-4.91
PG (Plumbing and Gasfitting)	ns
OB (Other Building)	-4.97
MM (Motor Mechanics)	ns
EN (Engineering)	na
OM (Other Metal)	ns
EL (Electrical)	ns
VH (Vehicle)	na
HA (Hairdressing)	ns
FU (Furniture)	na
OO (Other Other)	ns

Source: Table 2.

ns: Not significant

na: Not applicable (see Table 2).

due to the different cyclical effects for different sectors of the economy over the common sample period used.

(ii) If we disregard the question of statistical significance of the coefficients for the moment, the demand for new indentures is generally more elastic with respect to changes in relative wages than to changes in output. For most trades, output and relative wage elasticities exceed unity in absolute value.

(iii) The effects of changes in relative wages or industry output may be immediate or delayed with respect to new indentures. Most trades show an immediate response with respect to changes in relative wages.

Concerning the effects of the various subsidies and training schemes traditionally used to encourage apprentice hiring, our results suggest that in general these adjustments have a negligible effect (and then only in some trades) on apprentice demand. Table 6 sets out the trades where the dummy variables were statistically significant. The actual numbers represent estimated coefficients. Note that the coefficients are so small as to be numerically insignificant.

In those trades where wage costs are an important determinant of labour employment, the employment effects on apprentices and skilled tradesmen of a change in the workers' compensation premiums for apprentices can be calculated from the data in Table 4. Recall that the wages variable that appears in the regression equations is relative wages (WA/WS). Consider the EL (electrical trades) category in Table 4. The total number of apprentices employed in these trades in 1985 was 3,908 while the total number of skilled tradesmen was 33,114. If the total

Table 6: Training Schemes, Workers' Compensation and Payroll Tax Subsidies and their Effects on Demand for Victorian Labour by Trade

Trade (Joint Estimation)	Dummy Variable Coefficients		
	DWC	DPT	DNA
Tradesmen			
FT (Food)	-2.48*	-3.45*	
PG (Plumbing and Gasfitting)	-1.85*		
OB (Other Building)	- .64*	- .73*	-5.1*
HA (Hairdressing)	-1.12*		-1.62*
Apprentices			
AG (Agriculture)	1.98*	.79*	
FT (Food)	5.41*	6.43*	
CJ (Carpentry and Joinery)		.45*	
EN (Engineering)	2.13*		
EL (Electrical)	2.11*	.64*	
HA (Hairdressing)		1.59*	
FU (Furniture)	.75*		
OO (Other Other)		7.04*	
Trade (Single Equation Estimation)			
Apprentices			
FT (Food)		1.74**	
OM (Other Metal)	6.13**		
OO (Other Other)	1.61**		

* Multiply by 10^{-5}

** Multiply by 10^{-4}

Source: Tables 2 and 3.

wage cost variable for apprentices was decreased by 10%, using the 1985 figures, employment of apprentices would have increased by 348 (8.9% of 3,904). If total wage costs for skilled tradesmen were increased by 10%, the reduction in skilled tradesmen employment would be 2219 (6.7% of 33,114). Considering the MM and EN trades, a 10% reduction in total wage costs (using 1985 figures) would result in an increase of 419 (9.0% of 4659) in MM and an increase of 251 (6.7% of 3696) in EN in apprentice employment.

We can compare the wage cost elasticities between apprentices and skilled tradesmen for the two trade groups, OM (Other Metal) and EL (Electrical). In both of these cases the own-price elasticity of demand is higher for apprentices than for skilled tradesmen. This suggests that, for these two trade groups, significant declines in premium rates for apprentices will generate increases in apprentice intakes, while relatively small increases in the workers' compensation rates of skilled tradesmen will have a smaller than proportionate effect on the demand for these workers. However, as the number of skilled tradesmen in most trade groups is much larger than that of apprentices, the net effect of such changes, as the example above for EL demonstrates, may still be a fall in total employment (apprentices plus skilled workers).

Table 7 sets out the output elasticities of demand for apprentice labour. As one can see by examining the table, for the majority of the trades, output is a significant explanatory variable. For printing, for example, a 10% increase in output will result in an 11% increase in the demand for printing apprentices. The effects on food trades and hairdressing are quite large although less than proportional. That is, a 10% increase in output will result in a less than 10% increase in demand (for food trades 7.3%, and for hairdressing 7.5%). The employment effects for the building trades and metal trades also are quite small.

An inspection of Tables 2, 3 and 7 will show that either current or lagged output is found in this study to be a determinant of the total demand for both skilled workers and apprentices, in all trades. However, it is a statistically significant determinant only in the categories of "agriculture", "printing", "engineering", "electrical trades" and "hairdressing" in the case of skilled tradesmen; and all the categories except for "agriculture", "engineering", "electrical" and "vehicles" in the case of apprentices. That is, output in the related industry is a more significant determinant of the level of total apprentice employment than of the level of skilled employment. In terms of the associated elasticities themselves, looking only at the apparently significant cases noted above, the output elasticity of demand for apprentices exceeds that for skilled workers in all but the "agriculture", "electrical" and "vehicles" groups. In general, therefore, the demand for apprentices is more elastic with respect to output changes than is the demand for skilled workers.

Where both output and relative wages are found to influence the demand for skilled workers and apprentices (and disregarding the question of statistical significance), relative wage effects seem to be marginally more important than output effects. Concentrating on the apprentices case, and those trades where significant coefficients are to be found, the following results emerge:

Table 7: Output Elasticities of Demand for Apprentice Labour

Joint Estimation Method

	Elasticity
AG	na
FT	.73
PR	1.10
BR	.50
CJ	.15
PG	.09
OB	.14
MM	.46
EN	ns
OM	.53
EL	ns
VH	na
HA	.75
FU	.14
OO	2.16

Source: Table 3, part (b).

ns: Not significant

na: Not applicable (see Table 3).

(i) In the building trades output effects are more influential than are relative wages effects, both in terms of statistical significance and elasticity magnitudes. This is also true for the "hairdressing", "furniture" and "other other" categories of employment.

(ii) The converse is true in the metal trade groups and electrical group.

The overall results are not uniform across the various trades, which suggests that there are inter-skill differences and that if intervention in the apprentice labour market is to have any impact, it must be targetted to specific trades.

6. CONCLUSIONS

In summary, the above results suggest the following conclusions:

(i) The effect of the large changes to the subsidy/rate structure are captured through the wage cost variable. Of all of the trades analysed, relative wage costs are a significant variable in determining the demand for apprentices in the metal and electrical trades in agriculture, hairdressing and "other other" categories. In all of these trades the effect on employment of apprentices is less than proportional to the subsidy rate. Thus, if the workers' compensation rate were to be reduced by 10%, the increase in employment would be less than 10%. In the electrical trades, for example, a reduction in the workers' compensation rate corresponding to a 10% reduction in total wage costs would result in a 8.9% increase in apprentice employment.

(ii) "Small or marginal changes" to wage costs are captured through the use of dummy variables in this study. The general conclusion is that these marginal adjustments to workers' compensation, payroll tax and training subsidies have a negligible effect on apprentice demand. Small changes to the cost structure involve reducing the costs of hiring existing apprentices, rather than encouraging additional apprentice employment.

(iii) In the majority of trades, output is the dominant factor in determining apprentice hiring.

A possible explanation as to why the wage cost variable is not significant for more trades (apart from the metal and electrical trades mentioned above), is that existing firms in the appropriate industries are unwilling, or unable, to alter their technology and production techniques in response to changes in the relative costs of their inputs. That is, they act as if their production function (or technology) is fixed. This may not be an unreasonable assumption over a short-period, but in the longer-run one would expect some adjustment in response to changes in the relative cost of their inputs.

The overall results are not uniform across the various trades which suggests that there are inter-skill differences and that if intervention in the apprentice labour market is to have any significant impact, it must be targetted to specific trades in that state.

January, 1988

APPENDIX 1: VICTORIAN TRADES

Table A. List of Victorian Trades at the 47 Disaggregated Level

TRADE	ABBREVIATION
1 AGRICULTURAL	AG
2 AIRCRAFT MECHANIC	AA
3 AUTOMATIVE MACHINING	AM
4 BOILERMAKING & STRUCTURAL STEEL FAB:	BS
5 BREAD MAKING AND BAKING	BM
6 BRICKLAYING	BR
7 BUTCHERING & SMALL GOODS	BG
8 CARPENTRY & JOINERY	CJ
9 COOKING	CK
10 DENTAL TECHNICIAN (DENTAL MECHANIC)	DM
11 DRY CLEANING	DC
12 ELECTRICAL	EL
13 ELECTROPLATING	EP
14 ENGINEERING	EN
15 FIBROUS PLASTERING	FB
16 FLAT GLASS	FG
17 FLOOR FINISHING & COVERING	FF
18 FOOTWEAR	FW
19 FURNITURE	FU
20 GARMENT CUTTING (APPAREL CUTTING)	GC
21 HAIRDRESSING	HD
22 HORTICULTURAL	HO
23 INSTRUMENT MAKING & REPAIRING	IM
24 JEWELLERY MAKING & REPAIRING	JM
25 JOBBING, MOULDING & COREMAKING	JC
26 MOTOR MECHANIC	MM
27 OPTICAL FITTING & SURFACING	OF
28 PAINTING, DECORATING & SIGNWRITING	PD
29 PASTRYCOOKING	PC
30 PATTERNMAKING	PM
31 PLASTERING	PL
32 PLUMBING & GASFITTING	PG
33 PRINTING	PR
34 RADIO	RD
35 REFRIGERATION MECHANIC	RM
36 ROOF SLATING & TILING	RS
37 SEWING MACHINE MECHANIC	SW
38 SHEET METAL	SM
39 SHIPWRIGHTING & BOATBUILDING	SH
40 SILVERWARE	SL
41 STONEMASONRY	ST
42 TEXTILE MECHANIC	TM
43 TILE LAYING	TL
44 VEHICLE	VH
45 WAITING	WT
46 WATCH & CLOCK MAKING	WC
47 WOOD MACHINING	WM

Table B. List of Victorian Trades at the 15 Aggregated Level

AG	Agriculture
FT	Food (including waiting, cooking, pastry cooking, butchering and small goods, breadmaking and baking)
PR	Printing
BR	Bricklaying
CJ	Carpentry and Joinery
PG	Plumbing and Gasfitting
OB	Other Building (plastering, fibrous plastering, rooftiling, painting and decorating, stonemasonry, tile laying)
MM	Motor Mechanics
EN	Engineering Trades
OM	Other Metal (boiler makers and structural steel, instrument making, optical fitting, refrigeration mechanic, electroplating, sewing machine mechanic)
EL	Electrical trades and radio
VH	Vehicle trades and automative machining
HA	Hairdressing
FU	Furniture
OO	Other Other (Garment cutting, dential technician, dry cleaning etc.)

APPENDIX 2: DATA SOURCES

(All data were seasonally adjusted by the ratio-to-moving average method prior to use in the regression analysis).

Output (Q), Total Employment (E): National Institute of Economic and Industry Research, State Working Party, Melbourne, October 1984. The output data were interpolated from annual data to quarterly data. The total employment (apprentices plus other labour including skilled) were also interpolated from annual to quarterly.

Wages (WA - apprentices, WS - skilled): The wages data were at the 47 disaggregated trade level. Earnings data, obtained from the State Insurance Office (SIO) with the workers' compensation data, were used to derive weights for aggregating from 47 to 15 trades. The data were monthly and were aggregated to quarterly.

New Apprentice Indentures (I): Data were obtained from the Department of Labour (DL). Data were again aggregated from the 47 level to the 15 level.

Total Employment of Apprentices (EA): These were aggregated to the 15-trade level. Source: DL.

Wage Adjustments

Technical Education Rebate (TER), Source: DL.

Pre-Apprentice/Pre-Vocational Trading Rebate (PAT): Source DL.

National Apprentice Assistance Scheme (NAAS): Source: DL.

Payroll Tax (PT): Source: Victorian Pay Roll Tax Office

Workers Compensation Rates (WC). Calculated as a ratio of gross premiums to total earnings. Source: SIO.

Hours of Release for Apprentice Training (REL): Source: DL.

Unemployment Rate (U): Source: Australian Bureau of Statistics.

All Wages Data incorporate Workers' Compensation (WC) and Payroll Tax (PT).

Relative Wages (RW) include all adjustments. Apprentices' wages adjusted for PAT and TER.

<u>Example</u>

1st year Apprentice Wage (WA) = (1st year Award Wages x (1+PT+WC))-PAT-TER.

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FOOTNOTES

1. To quote from Merrilees (1984, p.247); "No previous Australian apprentice demand study has found significant wage elasticities".

2. As Phipps (1983, p.344) states in his Australian study of total labour demand: "variations in output appear to be the dominant cause of variation in demand for labour; both at the aggregate level and for each of the branch industry groups studies".

3. The sample period was chosen due to availability of the data. In particular, some of the variables are in the form of annual "stock" data and were converted to quarterly flow data, resulting in the loss of some observations.

4. Note that in part (b) of Table 3, under the "other other" heading, the intercept term has been deliberately suppressed - this is not an omission from the table.

5. It would have been interesting to examine the substitution possibilities between apprentices and tradesmen's assistants. However, there are no time series data on the employment of tradesmen's assistants. The latter are commonly used in the metal, electrical and building trades, but rarely used in the printing trade.

6. Relative wages enter as a determinant of the total demand for skilled tradesmen in all but the CJ, HA, FU and OO trades, although in all but the first of these groups there is some marginal effect through the dummy variables associated with apprentice wages. Inelastic responses are found in all cases (regardless of statistical significance).

In the case of the jointly estimated apprentices equations, (Table 3 part (b)) relative wages enter only the AG, FT, MM, EN, OM, EL, HA and OO equations. There is statistical significance in all but the FT category. The responses to relative wage changes are inelastic (except in "AG") but usually slightly more elastic than their counterparts in the skilled tradesmen equations.

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