Open access • Journal Article • DOI:10.1111/J.1475-4932.1997.TB00979.X

Where Are We Now With Human Capital Theory in Australia — Source link

Alison Preston

Institutions: University of Western Australia

Published on: 01 Mar 1997 - Economic Record (Blackwell Publishing Ltd)

Topics: Physical capital, Individual capital, Capital deepening, Capital intensity and Wage

WHERE ARE WE NOW WITH HUMAN CAPITAL THEORY IN AUSTRALIA?

by

Alison Preston

DISCUSSION PAPER 96. 18

DEPARTMENT OF ECONOMICS

THE UNIVERSITY OF WESTERN AUSTRALIA
NEDLANDS, WESTERN AUSTRALIA 6907

ISSN 0811-6067
ISBN 0-86422-526-1

WHERE ARE WE NOW WITH HUMAN CAPITAL THEORY IN AUSTRALIA?

by

Alison Preston

Department of Economics
and
Graduate School of Management
The University of Western Australia

DISCUSSION PAPER 96-18

September, 1996

ISSN 0811-6067
ISBN 0-86422-526-1

Where Are We Now With Human Capital Theory in Australia?*

ALISON PRESTON
Department of Economics and
Graduate School of Management,
The University of Western Australia

In the economics school the dominant paradigm for the study of wage determination is the human capital model. Increasingly, however, there is growing discontentment with this model. The catalyst is the empirical literature demonstrating important earnings relationships which cannot be adequately explained by competitive wage theory. Is human capital theory redundant? How useful is the model in the 1990s? This paper provides an assessment of the current empirical status of human capital theory in Australia. The analysis demonstrates that even in a non-competitive environment such as Australia the human capital framework is an extremely useful model for the contemporary study of wage determination. Its weakness is its inability to explain significant and persistent inter-industry, inter-occupation and gender wage differences.

I Introduction

Over two hundred years ago Adam Smith first wrote on the theory of wages. Since then a plethora of theories have emerged. Notwithstanding this, there is still a lack of consensus regarding the determinants of wages. At one extreme there is a view that the market determines the rate paid, just like the market determines the price of cabbages. At the other extreme there are those who see no role for the market, instead believing that wages are the product of social forces, such as custom and tradition.

In the economics school the dominant paradigm used to study wages is the human capital model. As a theory the human capital model has acquired much respectability. Its predictions on labour market outcomes, such as occupational wage differences, are realistic and, moreover, consistent over time and different wage setting environments. Notwithstanding this there is growing discontentment with the model. The catalyst is the empirical literature demonstrating important earnings relationships which cannot be explained by competitive wage theory.

This paper aims to provide an assessment of the current empirical status of human capital theory in Australia. To do this the remainder of the paper is structured as follows. Section II provides a brief overview of the human capital model. Section III outlines the data to be used in the empirical analysis, together with a discussion of the estimation method. Section IV examines the effect of human capital endowments on earnings.

---

* An earlier version of this paper was presented at the PhD Conference in Economics and Business, Perth, November, 1995. I would like to thank Bob Gregory and other participants at that conference for their comments and encouragement. I am especially indebted to Paul Miller for his insightful comments on numerous drafts of this paper. Thanks also to David Plowman and Richard Blandy for other helpful comments. Research for this paper was funded in part by a University of Western Australia Postgraduate Award.

Section V incorporates structural factors into the model. Section VI examines the wage structure over time. Finally, section VII provides a summary and conclusion. Throughout the paper reference is regularly made to the empirical findings from other published studies. Appendix A summarises the findings from a number of Australian studies.

II Human Capital Theory in Brief

At any given time an individual's decision on whether or not to invest in human capital is a function of: non-pecuniary aspects of education; efficiency in absorbing education; anticipated life-time earnings; and their 'discount rate'. Those with high discount rates (in other words, those who place more value on present as opposed to future earnings) will be less likely to forego earnings to invest in human capital accumulation.

Human capital may be acquired formally (for example in school and other learning institutions) or informally, such as on-the-job. Typically investments in human capital involve a combination of both, with most people continuing their investment (albeit at a diminishing rate) once they enter the workforce. This diminishing sequence of investments gives rise to a typical (concave) earnings profile, where earnings rise at a decreasing rate in the early stages of a persons working life, reaching a peak or plateau later. The slope of the earnings profile differs among individuals, with those investing relatively more in human capital having steeper (and higher) profiles.

The following earnings function (attributable to Mincer, 1974) provides a more formal statement of a person's earnings profile:

$$\ln wky_i = \beta_0 + \beta_1 yos_i + \beta_2 exp_i + \beta_3 exp_i^2 + \varepsilon_i \qquad (1)$$

where ln*wky* denotes the natural logarithm of weekly income, *yos* denotes years of schooling, and *exp* denotes labour market experience. The experience variable is used as a proxy for post-school investments in human capital. It is entered in the model in quadratic form in order to capture human capital depreciation over the life-cycle as well as reduced investments in later life. The latter reflects two influences: as human capital accumulation increases with age the opportunity cost of investing will be higher (as income will be higher); with increases in the individual's age the remaining working life declines and there will be less time to recoup returns on any human capital investment.

When applied to cross-sectional data the parameter β_0 provides an estimate of the earnings capacity for a person with zero schooling and labour market experience; β_1 provides an estimate of the rate-of-return to schooling (assumed to be constant in this model), and is based on the assumption that a person's entire earnings capacity is invested in schooling; β_2 and β_3 depend on the initial investment ratio when work commences, the rate-of-return to post-school investments, and the rate at which the human capital investment ratio declines with accumulated years of labour market experience.

The costs and benefits associated with human capital investments are implicit in the wage structure (Mincer, 1994, p.43). Shortages of particular skills will be reflected in a wage premium, with the premium being eroded as supply increases. Conversely, a depressed wage caused by excess supply will discourage additional supply of a particular skill, in turn raising the skilled wage over time.

Human capital theory is a product of neo-classical theory, where the emphasis is on the competitive side of the market. In this framework institutions[1] are all regarded as *market imperfections*, which prevent wages fully adjusting to their competitive levels and, therefore, prevent wages from giving the correct signals. Proponents of competitive wage theory, nevertheless, argue that these imperfections do not significantly affect the predictions of the model.

The theory, thus, makes strong predictions as to the determinants of wages. Human capital endowments are the principal determinant, although it is acknowledged that wages may differ across individuals because compensatory wage premia are being paid. There may also be short-run fluctuations attributable to labour immobility or skills shortages, but in the long-run these differences will be equalised. Other factors, such as discrimination, may also affect short-run outcomes. In the long-run competition will remove the incentive to practice discrimination as firms that prefer males[2] will be less competitive (because of their higher labour costs), and thus forced to adjust.

Armed with these predictions the remainder of this paper seeks to examine the empirical status of human capital theory in Australia.

III Data, Assumptions and Methodology

(i) Data and Assumptions

The data used here to test the predictions of competitive wage theory are the 1981 and 1991 Census data. In Australia the Australian Bureau of Statistics (ABS) conducts a census every five years. A Households Sample File (HSF) containing a one percent sample of the population is subsequently made publicly available for secondary analysis purposes. The 1981 and 1991 samples analysed here are drawn, respectively, from the 1981 and 1991 HSFs.[3] In both cases the samples are restricted to full-time[4] wage and salary earners aged between 16 and 64 years. Observations whose industry, occupation, income, marital status, country of birth, sector of employment, English proficiency, qualification level or age left school was not stated or inadequately described were deleted

---

1 Examples of key labour market institutions operating in Australia include the Australian Industrial Relations Commission (AIRC), the Australian Council of Trade Unions (ACTU), the Business Council of Australia (BCA) and government.

2 Discrimination in the labour market may also be on the basis of ethnicity or age.

3 Data from the 1986 Census are not used here as the income data gathered are inferior to that of the 1981 and 1991 Censuses. In the 1986 Census income was coded into 8 different bands. This compares to 14 bands in the 1981 and 1991 Censuses.

4 Full-time workers are defined as those working 35 or more hours per week in their main job.

from the sample. The resultant 1991 sample consists of 33,439 persons (21,830 males and 11,609 females). Similarly, the 1981 sample contains 34,682 observations (24,242 males and 10,440 females)[5].

There are a number of advantages associated with data such as these. Firstly, the large number of observations permits a level of disaggregation typically not afforded by other data sets. Secondly, the surveys provide detailed information on occupation and industry of employment. In many studies occupation and industry can only be examined at a very broad level. Gunderson (1989) has shown that results can be sensitive to the level of occupational aggregation. Here occupation has been disaggregated into as many as 33 groups and industry into as many as 34 groups. (See Appendix B for a definition of variables used).

Unfortunately, there are also a number of limitations with the data. The dependent variable (ln*wky*) to be used in the analysis measures weekly income from *all sources*, including overtime, allowances, interest, etc.[6] Furthermore, the responses were grouped into bands rather than being reported on a continuous basis. The dependent variable was thus formed from the midpoints of the income intervals. Following Chiswick and Miller (1995) the open-ended upper limit was given a value of 1.5 times the lower threshold level. In attempting to overcome the limitation that the variable measures income from all sources, only wage and salary earners working on a full-time basis were included in the analysis. A dummy variable (*otime*) controlling for those working 41 or more hours per week is also entered into the equation in some specifications.

Perhaps the major weakness is the lack of data on time spent training on-the-job. This is a weakness shared with most data sets. Following Mincer (1974), potential labour market experience, computed as age minus years of formal schooling minus five, is used as a proxy for time spent training on-the-job. The assumption underlying this formula is that a person commences school at five years of age, commences employment immediately on the completion of formal schooling and has no break in their employment record. For women this formula is clearly questionable since many take time out of the labour market for child-rearing purposes. To help counteract this, 'family' variables such as marital status and children (number of dependant children present) are also included in the model as proxies for interrupted labour force experience.[7]

(ii) Estimation Method

The estimation method used is ordinary least squares (OLS). Amongst other things, this procedure assumes that the population disturbances are distributed with constant variance. A violation of this assumption

---

[5] Gregory and Daly (1990) also study the 1981 HSF, although their sample consisted of 18,172 observations (males and females). The reduced number of observations relative to the present study arises because Gregory and Daly use only a sub-sample of the 1981 HSF.

[6] To facilitate comparisons across the 1991 and 1981 data sets the dependent variable used throughout this study is weekly earnings. Hours information in the 1981 data set is too poor to use in the construction of a variable measuring hourly income.

[7] Rummery (1992) compares the effect of using a measure of potential experience with a measure of actual years worked. When evaluated at 10 years, the potential measure suggests that an additional year of labour market experience will add 1.6 per cent to male earnings and 1.48 per cent to female earnings. The corresponding estimates based on the actual years worked measure suggests that an additional year of experience will add 1.5 per cent to male earnings and 1.32 to female earnings. Clearly the potential measure biases upwards the results.

means that OLS is no longer efficient and that the OLS estimator of the variance of the slope coefficients is biased and inconsistent. The standard errors may, consequently, be too large or too small, thus affecting the construction of confidence intervals for the testing of hypotheses. To minimise these adverse consequences of heteroscedasticity, White's technique (White, 1980) may be used. The technique provides a consistent estimate of the standard errors, and thus reliable (although unnecessarily large) confidence intervals.

In the analysis below the Breusch-Pagan (BP) test is used to detect whether or not heteroscedasticity is present. In all cases the null hypothesis of no heteroscedasticity was rejected and the t-statistics corrected using White's technique.

IV Determinants of Earnings: Contribution of Human Capital and Demographic Characteristics

To examine the distribution of individual earnings in Australia in 1991 the following earnings function was fitted to a sample of males drawn from the 1991 HSF. Equation (2) is a modified version of equation (1). In this equation returns to education may differ across different levels of schooling.

$$\ln wky_i = \hat{\beta}_0 + \hat{\beta}_1 hschool_i + \hat{\beta}_2 cert_i + \hat{\beta}_3 diploma_i + \hat{\beta}_4 degree_i + \hat{\beta}_5 exp_i + \hat{\beta}_6 exp_i^2 + \hat{\beta}_7 otime_i + \varepsilon_i \quad (2)$$

To control for highest level of education attained, four separate dummy variables are included: *hschool* (denoting the completion of high school only); *cert* (denoting the completion of either a basic vocational certificate, a skilled vocational certificate or an associate diploma); *diploma* (denoting the completion of an undergraduate diploma); and *degree* (denoting the completion of either an undergraduate degree, post-graduate diploma or higher degree). Since the earnings data could not be converted into ordinary-time earnings a dummy variable, controlling for those who worked overtime (*otime*), was also included in the model. Table 1 presents the results of this exercise. Also presented in Table 1 are comparable 1981 estimates (minus the control for overtime due to data limitations). In the 1991 estimates the constant term measures the average log of weekly earnings of an Australian born male who did not complete high school, is employed full-time, does not work overtime, and is in their first year in the workforce.

As predicted by human capital theory, education is positively associated with higher earnings.[8] For example, the coefficient on *hschool* shows that, relative to unqualified persons (the omitted category), those whose highest qualification was the completion of high school earned 12.6 per cent more in 1991.[9,10] This coefficient is

---

[8] Most studies find a positive relationship between education and earnings (see Table A1, Appendix A). A recent study by Dockery and Norris (1996) using 1991 Census data found, however, that in some trades there is a negative return to training (in that for some trades qualified tradespersons earn less than their unqualified counterparts).

[9] In semi-logarithmic equations the coefficients of dummy variables which are small in value may be interpreted as percentage effects on the dependent variable, relative to the omitted category (Halvorsen and Palmquist, 1980).

consistent with that estimated in other Australian studies. The corresponding coefficient estimates by Miller (1994) using 1989 data, Miller and Volker (1993) using 1985 data and Kidd and Viney (1991) using 1982 data

Table 1
Returns to Human Capital, Males, 1981 and 1991

Variables	1981 coeff.	t-stat.	mean	1991 coeff.	t-stat.	mean
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
constant	4.850	589.548		5.486	522.129	
Education Level						
hschool	0.154	21.900	0.289	0.126	15.104	0.318
cert	0.259	42.142	0.284	0.238	30.452	0.308
diploma	0.584	43.659	0.047	0.444	27.625	0.035
degree	0.747	70.893	0.076	0.638	64.316	0.136
Experience						
exp	0.0496	70.152	19.227	0.049	56.936	18.670
$exp^2/100$	-0.0863	-57.320	5.457	-0.0864	-44.501	4.926
Works Overtime						
otime	-	-	-	0.207	34.811	0.377
Dependent Variable ln*wky*			5.531			6.275
Observations	24242			21830		
R^2 adjusted	0.3565			0.3714		
BP test	343.817			629.499		

Notes: (a) source: 1981 and 1991 Censuses; (b) it is not possible to control for overtime work in the 1981 Census; (c) dependent variable is ln*wky*.

are 0.127, 0.127 and 0.124.[11] These estimates are slightly lower than the 14 per cent return estimated by Gregory and Daly (1990) using 1981 data and the 1981 estimates reported here. A lowering of the income returns to education has been recorded in other Australian studies (e.g. Maglen, 1994 and Borland, 1995). This particular result presumably reflects, in part, the increased Year 12 completion rate in recent years. As shown in Table 1, in 1981 the completion of high school was the highest education attainment for 28.9 per cent of males. In 1991 this figure was 31.8 per cent.[12]

With regard to experience, the estimates show that earnings also rise with experience, although at a diminishing rate. In 1991 an additional year of experience (evaluated at 10 years of experience) increased the earnings of males by 3.2 per cent. This estimate is higher than that obtained in most other Australian studies, although the data used in these studies generally pertains to the early 1980s and the models contain more controls. When the model is augmented with controls for demographic characteristics (see Table 2, page 9), the return to an

---

[10] It has been argued that estimates of the returns to education are upwardly biased due to a failure to control for ability and family background. Miller, Mulvey and Martin (1995a), using data from the Australian Twin Register, refute this proposition.

[11] The studies reported here use the earnings function as the framework for their analysis. Other Australian studies using alternative methodologies have also observed increasing returns to education. See, for example, Miller (1982) and Blandy and Goldsworthy (1984).

[12] See Appendix B for a definition of the variable *hschool*.

additional year of experience falls from 3.2 per cent to 2.69 per cent.[13] Gregory and Daly (1990) estimate a similar model across 1981 Census data. From their estimations an additional year of experience increased the earnings of males by 2.35 per cent.[14] Other corresponding estimates for males as a group are: 1.48 per cent (from Mulvey, 1986, using 1982 data); 1.62 per cent (from Chapman and Mulvey, 1986, using 1982 data); 2.0 per cent (from Kidd and Viney, 1991, using 1982 data), 1.5 per cent (from Rummery, 1992, using 1984 data); and 1.79 per cent (from Langford, 1995, using 1989-90 data). The average of these five estimates is 1.68 per cent. A conclusion that one may draw from all this is that over the decade returns to experience have been rising - a common finding in this area of research.

The overtime dummy is also highly significant and shows that those working 41 or more hours per week earn 21 per cent more than their counterparts working between 35 and 40 hours per week. The magnitude of this result emphasises the importance of controlling for overtime hours where average rather than ordinary-time earnings data are being used. Unfortunately, because of data limitations, few studies have been able to incorporate such an important control in the past (see for example, Gregory and Daly, 1990, using 1981 Census data).

Overall the model performs reasonably well, explaining 37 per cent of the variation in male earnings in 1991. It does, however, leave 63 per cent of the variation unaccounted for. Part of this unaccounted variation may be due to poor controls, such as the use of potential experience, or omitted variables which capture differences in labour quality. To minimise this problem the model was augmented with controls for demographic characteristics and re-estimated.

Additional variables included were controls for birthplace, with *esb* controlling for those born in an English speaking country, and *nesb* controlling for those born in an non-English speaking country. Numerous studies into the earnings of migrants show that migrants from English speaking countries enjoy wage structures similar to (or better than) their Australian born counterparts, whereas migrants from non-English speaking countries earn significantly less than other labour market participants, partly because of a lack of English language proficiency (see, for example, Beggs and Chapman, 1988; Chang and Miller, 1996; Chapman and Mulvey, 1986; Chiswick and Miller, 1985 and 1995; Langford, 1995; Mulvey, 1986; Stromback, 1984; Tran-Nam and Nevile, 1988; and Vella, 1993). More recent estimates by Miller (1994) using 1989 data found that recent arrivals from *both* English speaking and non-English speaking countries earned significantly less than their Australian born counterparts.

---

[13] The coefficients estimated in Table 1 show that in 1981 an additional year of experience similarly increased the earnings of males by 3.2 per cent. After augmenting this basic model with controls for birthplace (2 dummies), marital status (2 dummies) and number of dependant children (4 dummies) the return associated with an additional year of experience fell from 3.2 per cent to 2.58 per cent.

[14] The lower estimate obtained by Gregory and Daly partly reflects slight differences in the computation of the variables. Gregory and Daly, for example, include one dummy variable to control for the presence of dependant children. The above analysis includes four. In constructing their dependent variable (the natural logarithm of weekly earnings), Gregory and Daly give the open-ended upper limit a value of 1.3 times the lower threshold (equal to $650 per week). In the analysis here the open-ended upper limit is given a value of 1.5 times the lower threshold level (equal to $750 per week).

Also included were controls for marital status (two dummy variables) and dependant children (four dummy variables). From the literature Korenman and Neumark (1991, p.283) have identified three broad hypotheses as to why marriage may be (positively) associated with the earnings of males. Firstly, marriage *per se* makes (male) workers more productive (on this they reference Becker, 1981, 1985; Kenny, 1983; and Greenhalgh, 1980). Secondly, employers may favour married males (this was advanced by Hill, 1979; and Bartlett and Callahan, 1984). Finally, men may be selected into marriage on the basis of age or personal characteristics that are valued in labour markets (Becker, 1981; Nakosteen and Zimmer, 1987; and Keeley, 1977). With regard to females, marriage may be (negatively) associated with wages if marriage induces women to "... seek more convenient and less energy intensive jobs" (Becker, 1985). Marriage may also "... influence many young women during their prematernal employment to acquire less job training than men with comparable education" (Mincer and Polachek, 1974, p.S83). With regard to controls for children, in addition to being a proxy for the holding of 'convenient and less energy intensive jobs', such variables are also a proxy for the interrupted labour force experience of women.

The two controls for marital status were *married* and *wsd*, where the former controls for those who are married and the latter for those widowed, separated or divorced. The control group was never married. The four dummy children variables are as follows: *nkid1, nkid2, nkid3, nkid4m*. The suffix 4m indicates that four or more children are present, while 3, 2, and 1 indicate that three, two, and one child(ren), respectively, are present. Those with no dependant children, and those who have dependant children who are not present, form the omitted category.

The constant term in the 1991 analysis now measures the average log of weekly earnings of an Australian born male who did not complete high school, has never been married, has no children or no dependant children present, is employed full-time, does not work overtime, and is in their first year in the workforce. Table 2 contains the revised estimates. The augmentations do not substantially change the estimated returns from education. As previously noted, they do lower the returns associated with an additional year of experience.

The estimated coefficients on the two birthplace dummy variables show, as with most other studies in Australia, a mixed performance by migrants. Thus, males from English speaking countries are very successful (see also Mulvey, 1986; Chapman and Mulvey, 1986; and Langford, 1995) this study shows that. In 1991 they earned 3.2 per cent more than their Australian born counterparts. In contrast, males born in non-English speaking countries earned 8.5 per cent less than Australian born males. Compared to 1981, the overall performance of migrant males appears to have improved. In 1981 those born in English speaking countries had an earnings advantage of 1.7 per cent, while those born in non-English speaking countries had an earnings disadvantage of 10.7 per cent.

Table 2

Returns to Human Capital and Demographic Characteristics, Males, 1981 and 1991

Variables	1981 coeff.	t-stat.	mean	1991 coeff.	t-stat.	mean
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
constant	4.8496	589.614		5.499	519.165	
Education Level						
hschool	0.158	23.056	0.289	0.128	15.530	0.318
cert	0.244	40.036	0.284	0.227	29.271	0.308
diploma	0.559	42.426	0.041	0.430	27.130	0.035
degree	0.724	69.266	0.076	0.630	63.556	0.136
Experience						
exp	0.040	42.462	19.227	0.042	40.436	18.670
$exp^2/100$	-0.070	-37.345	5.458	-0.074	-33.439	4.926
Birthplace						
esb	0.017	2.391	0.128	0.032	3.830	0.119
nesb	-0.107	-15.390	0.142	-0.085	-10.501	0.132
Marital Status						
married	0.171	21.011	0.654	0.119	14.734	0.600
wsd	0.092	7.556	0.062	0.057	4.802	0.080
Dependant Children						
nkid1	-0.013	-1.699	0.137	0.010	1.143	0.136
nkid2	0.012	1.586	0.173	0.024	2.902	0.164
nkid3	0.006	0.613	0.078	0.033	2.842	0.071
nkid4m	-0.029	-1.915	0.029	-0.027	-1.389	0.022
Works Overtime						
otime	-	-	-	0.196	33.338	0.377
Observations	24242			21830		
R^2 adjusted	0.378			0.3835		
BP test	541.662			717.113		

Notes: see Table 1.

Turning to demographic characteristics, the estimates show that, consistent with many other studies, men who have never married earned significantly less than all other groups (see for example, Miller, 1994; Gregory and Daly, 1990; Chiswick and Miller, 1985 and 1995; Tran-Nam and Nevile, 1988; Mulvey, 1986; Chapman and Mulvey, 1986; Kidd and Viney, 1991; Rummery, 1992; Borland and Suen, 1990; Drago, 1989; and Langford, 1995). The relativity has, however, narrowed over the decade. In 1991 married men earned 11.9 per cent more than never married men (down from 17.1 per cent in 1981). The corresponding figure for widowed, separated and divorced men was 5.7 per cent (down from 9.2 per cent). Without conducting a more detailed analysis it is difficult to know why 'never married' males perform so poorly. As noted earlier, it could be that married men are more productive, or that employers favour married men[15], perceiving them to be more stable and thus providing them with more on-the-job training.

[15] A preference for males may be made on the basis of statistical discrimination.

The findings on children are also of interest. The results show that in 1991, other things controlled for, there is no significant difference in the earnings of men who have no dependant children present and those men with one or four or more dependant children present. However, men with two or three dependant children present earn significantly *more* than men in the other categories. These results contrast with the findings from the 1981 analysis where it was only the presence of four or more dependant children which was associated with significantly different (less) earnings. As with marital status, it is difficult to know what is driving this result. Moreover, as few Australian studies of male earnings include variables for the number and age of children, it is not apparent if the finding is robust. In comparison, for females in both 1991 and 1981, dependant children are associated with significantly lower earnings irrespective of the number present. This result for the model of female earnings determination is typical.

Overall, in 1991 the model is able to explain 38 per cent of the variation in wages across individuals. While this is consistent with most other similar studies, it does suggest that there still remain other important determinants not yet controlled for. Focusing on just the 1991 Census the following section examines additional determinants

V Importance of Structural Factors

Does competitive wage theory, specifically the human capital model, adequately and fully explain the distribution of individual wages? To examine this issue structural factors (in the form of controls for variables such as geographic location, sector, industry and occupation of employment) were added to the human capital model.[16] This approach allows some insight into the independent contribution to wage variation of structural and individual characteristics. If, as predicted by competitive wage theory, these structural factors have no effect on the utility workers receive on-the-job, then they should have no effect on the level of wages. If it is found that structural factors exert a substantial impact on wage outcomes, then this may be taken as evidence that there are important variations in wages which cannot be explained by standard competitive theories (Krueger and Summers, 1988).

(i) Geographic Location

One rationale for including controls for geographic location is that, in Australia, in addition to there being a federal wage determination system, each state also has a state based system. In most cases the states have followed the federal system, although in recent years there has been a departure from this rule.

To examine the effect of geographic location on earnings, detailed geographic controls were added to the basic model reported in Table 2 above. A test for the joint significance of the geographic dummies was rejected at

---

[16] This approach is consistent with that used by Chapman and Miller (1983), Krueger and Summers (1988), Gregory and Daly (1990, 1992) and Borland and Suen (1990).

the one per cent level of significance ($F=29.2>F_{19,21795}=1.90$) indicating that geographic location exerts an independent and significant force on earnings. Table 3 presents an estimate of the inter-regional wage structure.

Table 3
Inter-Regional Wage Structure, Males, 1991

Variables	coeff.	% deviation from overall mean wage	t-stat.	mean
	(i)	(ii)	(iii)	(iv)
Lower North N.S.W.	0.116	0.136	7.204	0.058
Inner Sydney	0.077	0.093	4.490	0.040
Central Melbourne	0.074	0.090	4.751	0.055
Sutherland & Liverpool	0.037	0.051	2.538	0.060
Outer South West N.S.W.	0.022	0.036	1.591	0.068
Hunter and Illawarra	0.012	0.025	0.785	0.054
Tasmania and ACT	0.003	0.016	0.180	0.048
East Outer Melbourne	omitted	0.013	-	0.063
Western Outer Melbourne	-0.008	0.005	-0.549	0.068
Perth	-0.016	-0.003	-1.152	0.064
Remainder SA, WA, NT	-0.043	-0.029	-2.671	0.058
Far North Queensland	-0.050	-0.035	-2.666	0.034
Adelaide	-0.052	-0.038	-3.690	0.063
Goulburn, Gippsland	-0.060	-0.045	-2.778	0.024
Brisbane	-0.061	-0.046	-4.554	0.080
Remainder Queensland	-0.090	-0.073	-4.991	0.033
Mallee Area	-0.106	-0.087	-6.908	0.040
Murrumbidgee Area	-0.119	-0.099	-6.358	0.032
Richmond and Tweed	-0.126	-0.105	-7.232	0.034
Moreton	-0.131	-0.110	-5.773	0.023
Observations	21830			
R^2 adjusted	0.3983			
BP test	960.794			

Notes: (a) see Table 1; (b) other independent variables are: education level (4 dummies), experience and its square, birthplace (2 dummies), marital status (2 dummies), the presence of dependant children (4 dummies) and an overtime dummy.

The differentials reported have been normalised as deviations from the weighted mean deviation. In other words, the reported statistics represent the proportionate difference in earnings between an individual in a particular region compared to an average person from all regions.[17] Males residing in inner Sydney, for example, earn 9.3 percent more than the average. The premium associated with residing in Lower North New South Wales is 13.6 percent, whereas those residing in Moreton have an earnings disadvantage of 11 per cent compared to the average.

The finding that rural employees earn less than their metropolitan counterparts is consistent with previous studies. Gregory and Daly (1990) and Rummery (1992), for example, estimated the earnings disadvantage

[17] For more details on the methodology for calculating the proportionate effect as deviations from the mean see Krueger and Summers (1988) and Borland and Suen (1990).

associated with residing in a rural area to be 11.7 per cent and 30 per cent, respectively. In the Gregory and Daly study the control variable *'rural'* was equal to one if the person resided in a community of less than 1000 people. In Rummery's study two dummies were included; *'rural'* and *'city'* each equal to one depending on whether the person resided in a rural or city area. The omitted category was non-city metropolitan residents.

The nature of the 1991 Census data prevents the computation of dummy variables similar to either the Gregory and Daly study or the Rummery study. Instead a composite locational variable, *metro*, was derived as follows: those residing in either inner Sydney, Sutherland and Liverpool, outer south west New South Wales, lower north New South Wales, Hunter and Illawarra, western outer Melbourne, central Melbourne, east outer Melbourne, Brisbane, Adelaide and Perth were deemed to be living in a metropolitan area; the remainder are treated as living in non-metropolitan areas.[18] Such divisions are only an approximation. For example, residents in Canberra are treated as residing in a non-metropolitan area as the Census coding has aggregated them into a group with Tasmanian residents. The divisions in Table 3 show the geographic groupings provided in the Census data.

When the human capital model was re-estimated along with the composite *metro* control variable, the coefficient shows that there is a significant difference in the earnings of metropolitan and non-metropolitan residents, as defined here. The former earn 8.3 per cent more than the latter and this effect is significant at the one per cent level.[19]

The higher wages in metropolitan areas may be payment to compensate for higher living costs. Alternatively, the higher wages may be reflective of a greater concentration of higher levels of human capital in these areas.[20] In the absence of information on working conditions it is difficult to test the hypothesis that the locational differentials are a result of compensatory wage premia.

It is worth noting, however, that despite the intuitive appeal of the theory of compensating differentials, empirical studies have only been able to provide weak supportive evidence. In Australia Borland and Suen (1989) found some evidence of a premium being paid to compensate: those working where the incidence of fatal accidents was higher; those constrained in their choice of working hours; and those working overtime. However, other 'working conditions' control variables, such as 'percentage of workers doing night work', while being significant, had the opposite sign to that predicted. Commenting on empirical studies based on US data, Groshen (1991) notes that differentials only appear to be associated with risk of injury or death.

---

[18] Following this approach it is estimated that 67 per cent of the male (1991) sample resides in a metropolitan area.

[19] The corresponding figure estimated over a sample of males from the 1981 Census (n=24,242) is 7.8 per cent, also significant at the one per cent level.

[20] The underlying theory here is that human capital is a public good with positive externalities. Cities with higher average levels of human capital should therefore have higher wages. See Rauch (1993) for a formal treatment of this hypothesis.

(ii) Sector of Employment

Sector of employment is yet another structural factor likely to affect wage outcomes, since working conditions and methods of determining wages differ between the public and private sectors. Compared to the private sector, the public sector offers more secure employment and a large internal labour market. It is also more highly unionised.

To examine the effect sector of employment has on wage outcomes a dummy variable (*govt*), equal to 1 if the person is employed in the public sector, was added to the basic model estimated in Table 2. Also included in this model was a single dummy variable, *metro*, controlling for area of residence. The coefficient on the variable *govt* is positive and significant at the one per cent level and shows that employees in the public sector earn 6 per cent more than their private sector counterparts.[21] This figure is consistent with that estimated in other studies. Miller and Mulvey (1996), for example, using 1993 data, found that amongst males, those employed in the public sector had a wage mark-up of 5.4 per cent.

Borland, Hirschberg and Lye (1996) have analysed the sources of differences in the earnings of public and private sector workers by decomposing the sector differential. While public servants have an apparent earnings advantage, the decomposition analysis reveals that "... the higher average weekly earnings of public sector employees can be wholly explained by differences in average characteristics of employees in each sector" (Borland et al., p.21). If anything it appears as though there is wage discrimination in favour of private sector employees.

Table 4 provides a more detailed look at how the two sectors differ in the way they reward human capital endowments. Diplomas and degrees are less highly rewarded in the public sector, although that may reflect their greater abundance in this sector. Experience is rewarded more in the private sector. An additional year of experience (evaluated at 10 years of experience) increases earnings by 2.7 per cent in the private sector. In the public sector the corresponding figure is 2.3 per cent.

---

[21] The corresponding estimate based on a sample of males from the 1981 Census (n=24,242) is 4.3 per cent, significant at the one per cent level.

Table 4

Returns to Human Capital by Sector of Employment, Males, 1991

Variable	PRIVATE coeff.	t-stat.	mean	PUBLIC coeff.	t-stat.	mean
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
constant	5.402	394.644		5.626	306.971	
Education Level						
hschool	0.110	10.903	0.33	0.135	10.778	0.28
cert	0.215	22.570	0.32	0.227	19.173	0.27
diploma	0.400	14.615	0.02	0.408	25.612	0.06
degree	0.638	43.969	0.10	0.558	41.876	0.22
Experience						
exp	0.043	32.700	17.93	0.035	21.548	20.39
$exp^2/100$	-0.0765	-27.228	4.694	-0.0615	-18.266	5.459
Birthplace						
esb	0.040	3.743	0.12	-0.022	-1.882	0.11
nesb	-0.105	-10.401	0.14	-0.093	-6.573	0.10
Marital Status						
married	0.129	12.583	0.57	0.099	8.552	0.66
wsd	0.060	3.896	0.08	0.058	3.303	0.08
Number of Kids						
nkid1	0.005	0.474	0.13	0.016	1.292	0.14
nkid2	0.036	3.228	0.15	0.001	0.055	0.19
nkid3	0.045	2.888	0.07	0.020	1.345	0.08
nkid4m	-0.029	-1.090	0.02	-0.010	-0.421	0.03
Works Overtime						
otime	0.214	29.299	0.43	0.171	17.899	0.27
Residential Area						
metro	0.107	13.647	0.69	0.035	4.484	0.63
Dependent variable ln*wky*			6.23			6.38
Observations	15215			6615		
R^2 adjusted	0.3730			0.4316		
BP test	493.786			332.279		

Notes: see Table 1.

There are a number of other interesting differences between the two sectors. The model, for example, performs better in the public sector than it does in the private sector. In the former it explains 43 per cent of the wage variation of individuals while in the latter it only explains 37 per cent of the variation. One might have expected the opposite to hold since wages in the public sector are much more regulated. It may be that the awards determined by industrial tribunals are closer to competitive levels as they overcome disturbances caused by imperfections, such as discrimination. Alternatively, it may be that unobserved individual influences, such as effort, are more important in the private sector.

Three other interesting differences pertain to the earnings of migrants, children, and area of residence. In both sectors migrants from non-English speaking countries earn significantly less than their Australian born counterparts. In the public sector they earn 9.3 per cent less, in the private sector the corresponding figure is 10.5 per cent. With regard to migrants from English speaking countries, in the public sector there is no significant

difference (evaluated at the five per cent level) between their earnings and those of Australian born employees. In the private sector the former earn four per cent more (significant at the one per cent level) than the latter.

Turning to children, in the private sector males who have either two or three dependant children present earn significantly more than all other groups. In the public sector a test for the joint significance of the children variables resulted in the acceptance of the null hypothesis that the coefficients on each of these variables were simultaneously equal to zero ($F=0.88<F_{4,6598}=3.3$)[22]. In other words, in the public sector children variables have no effect on earnings.

Finally, with regard to area of residence, in the private sector those living in metropolitan areas earn 10.7 per cent more than their counterparts elsewhere. In the public sector metropolitan residents only earn 3.5 per cent more than their non-metropolitan counterparts. This latter effect may reflect the fact that public sector employees are more likely to be covered by similar terms and conditions of employment across Australia.

Using a procedure proposed by Blinder (1973) and Oaxaca (1973) to examine wage discrimination, the results in the Table 4 were used to decompose the sector wage differential.[23] Adopting the public sector wage structure as the non-discriminatory norm the raw wage gap ($\overline{\ln wky}_{pub} - \overline{\ln wky}_{priv}$) may be decomposed as follows:

$$\overline{\ln wky}_{pub} - \overline{\ln wky}_{priv} = (\overline{V}_{pub} - \overline{V}_{priv})\hat{\beta}_{pub} + \overline{V}_{priv}(\hat{\beta}_{pub} - \hat{\beta}_{priv}) + (\hat{\beta}_{0pub} - \hat{\beta}_{0priv}) \qquad (3)$$

where *pub* denotes the public sector, *priv* denotes the private sector, $\overline{V}$ is a vector of the means of the independent variables and $\hat{\beta}$ is a vector of estimated slope coefficients. The first term of the decomposition calculates the portion of the gap attributable to differences in individual characteristics, and is often labeled the *explained portion* (or skill differential). The second term calculates differences in returns to these characteristics, and is generally known as the *unexplained portion*. The third term represents differences in the constants ($\hat{\beta}_0$). Together the last two terms can be seen as being an indicator of the extent of discrimination (Blinder, 1973) and/or data deficiencies. Table 5 presents the results from the decomposition exercise.

---

22 The critical value used is for the one per cent level of significance.

23 The procedure is more commonly used to examine gender wage discrimination. See Section (V)(v) on page 25 of this paper for more detail on the procedure.

Table 5
Decomposition of Sector Wage Differential, Males, 1991
(Public Sector Wage Structure Treated as Non-Discriminatory Norm)

Variables	Raw Wage Gap	Difference Between Constants	Proportion of Gap Explained	Proportion of Gap Unexplained	Adjusted Wage Gap
	(i)	(ii)	(iii)	(iv)	(v)
Human Capital (education & experience)			0.100	-0.062	
Birthplace			0.004	-0.006	
Marital Status and Children			0.009	-0.022	
Works Overtime			-0.027	-0.018	
Residential Area			-0.002	-0.050	
TOTAL	*0.149*	*0.224*	*0.084*	*-0.159*	*0.065*

Source: Regressions reported in Table 4.

The estimates suggest that the raw wage gap between the two sectors is equal to 14.9 per cent, of which 56 per cent can be accounted for by differences in the attributes (in particular human capital characteristics) of workers across the sectors. After taking this into account the adjusted wage gap falls to 6.5 per cent. This finding is consistent with the estimated coefficient on the dummy variable *govt* reported above. It does not, however, support the earlier findings of Borland et al.. As previously noted they found slight evidence of wage discrimination *in favour* of private sector employees. [24]

(iii) Industry

This section examines the importance of industry affiliation in wage determination. To do this two separate equations are estimated; the first with industry controls at the one digit level (11 dummies); the second with industry controls mostly at the two digit level (33 dummies). Appendix B details the constructions of the 34 industry dummy variables. The other regressors in the model are the same as those in Table 2, together with a locational dummy variable. The estimated results from the former are reported in Table 6, the latter in Table 7.[25]

The inclusion of industry dummies increases the overall predictive power of the model. When one digit industry controls are added the explanatory power of the model increases by 10 per cent (from 0.392 to 0.431). When the more disaggregated industry controls are included, the explanatory power increases by 15 per cent (from

[24] Borland et al. control for a wider range of factors, such as union membership, workplace size and industry. They also disaggregate their analysis by occupation. Moreover, their decomposition technique follows the procedure proposed by Neumark (1988) which treats the 'pooled' wage structure as the non-discriminatory norm.

[25] In the one digit analysis the omitted industry category is Transport and Storage. In the mainly two digit analysis the omitted industry category is Paper, Paper Products and Publishing. In the raw wage distributions the average earnings in these industries were closest to the mean for all industries.

0.392 to 0.451). In both instances the industry dummy variables are jointly significant.[26] Many are individually statistically significant as well.

Table 6
Estimated Industry (1 digit) Wage Structure, Males, 1991

Industry	coeff.	% deviation from overall mean wage	t-stat.	mean
	(i)	(ii)	(iii)	(iv)
Mining	0.385	0.462	20.24	0.028
Finance, Property and Business Services	0.152	0.157	10.628	0.097
Electricity, Gas and Water	0.049	0.043	3.048	0.030
Communication	0.022	0.015	1.576	0.076
Public Administration and Defence	0.015	0.008	1.144	0.087
Communications	0.004	-0.003	0.29	0.030
Transport and Storage	omitted	-0.007	-	0.065
Manufacturing	-0.002	-0.009	-0.129	0.210
Wholesale and Retail Trade	-0.042	-0.049	-3.313	0.181
Community Services	-0.064	-0.069	-4.769	0.128
Recreation, Personal and Other Services	-0.078	-0.082	-4.469	0.044
Agriculture, Forestry, Fishing and Hunting	-0.307	-0.272	-11.977	0.027
Observations	21830			
R^2 adjusted	0.431			
BP test	1683.06			

Notes: (a) see Table 3; (b) other additional independent variables are: control for area of residence and control for sector of employment; (c) in column (ii) the coefficients have been normalised as deviations from the weighted mean.

[26] An F test for the joint significance of the industry dummies led to a rejection of the null hypothesis that the coefficients on each of the controls were simultaneously equal to zero. In the case of 1 digit controls $F=138.5>F_{11,21801}=2.25$. In the case of the more disaggregated industry controls $F=72>F_{33,21779}=1.66$).

Table 7
Estimated Disaggregated Industry Wage Structure, Males, 1991

Industry	coeff.	% deviation from overall mean wage	t-stat.	mean
	(i)	(ii)	(iii)	(iv)
Coal and Oil	0.411	0.582	15.146	0.011
Other Mining	0.404	0.571	2.405	0.005
Metallic Minerals	0.256	0.364	8.905	0.012
Insurance	0.137	0.220	4.591	0.010
Finance, Investment	0.127	0.208	5.759	0.035
Other Community Services	0.016	0.089	0.732	0.032
Chemical, Petroleum, Coal Products	0.009	0.082	0.303	0.012
Property, Business Services	0.000	0.073	0.016	0.053
Paper, Paper Products, Publishing	omitted	0.073	-	0.020
Basic Metal Products	-0.001	0.072	-0.035	0.016
Defence	-0.007	0.066	-0.282	0.022
Electricity, Gas and Water	-0.021	0.053	-0.944	0.030
Wholesale Trade	-0.055	0.020	-2.906	0.084
Communication	-0.063	0.012	-2.920	0.030
Construction	-0.070	0.005	-3.700	0.076
Public Administration	-0.070	0.005	-3.415	0.065
Non-Metallic Mineral Products	-0.075	0.000	-2.467	0.010
Entertainment and Recreational Services	-0.076	0.000	-2.189	0.012
Transport and Storage	-0.081	-0.005	-4.054	0.064
Other Machinery and Equipment	-0.091	-0.014	-4.015	0.028
Miscellaneous Manufacturing	-0.096	-0.019	-3.442	0.012
Food, Beverages, Tobacco	-0.098	-0.020	-4.697	0.041
Clothing and Footwear	-0.097	-0.020	-2.162	0.004
Health	-0.098	-0.021	-4.264	0.031
Textiles	-0.121	-0.041	-3.881	0.005
Transport Equipment	-0.126	-0.045	-5.663	0.022
Fabricated Metal Products	-0.184	-0.095	-7.699	0.021
Education, Museum, Library Services	-0.203	-0.111	-9.733	0.057
Personal Services	-0.207	-0.114	-5.445	0.005
Retail Trade	-0.208	-0.115	-11.166	0.097
Restaurants, Hotels, Clubs	-0.209	-0.116	-9.010	0.026
Wood, Wood Products, Furniture	-0.228	-0.131	-9.871	0.017
Agriculture, Forestry, Fishing and Hunting	-0.404	-0.259	-14.028	0.027
Welfare, Religious Institutions	-0.512	-0.328	-12.824	0.009
Observations	21830			
R^2 adjusted	0.451			
BP test	1933.42			

Notes: see Table 6.

It is apparent from the results that industry of employment is an important determinant of relative wages. There is a large range of industry wage differentials, even after controlling for factors such as human capital, demographic characteristics, sector of employment, geographic area of residence, and whether or not the person works overtime. For example, an employee in the Coal and Oil Industry earns, on average, 58.2 per cent *more* than the average earnings from all industries (see column (ii), Table 7). At the other end of the scale the estimates suggest that the average employee in the Welfare Industry earns 32.8 per cent *less* than the average employee in all industries. After adjusting for worker attributes, the average earnings of the three highest paying industries is twice that for the three lowest paying industries. Moreover, the gap between the average earnings for individuals in the three lowest and three highest paying industries is more than the additional earnings associated with completing a degree relative to those who have no formal qualifications.[27]

Of further significance is the fact that there is a high correlation between the high and low paying industries uncovered in this study and the corresponding industries in the U.S.. Krueger and Summers (1988), using 1984 data for the U.S., found that, after controlling for a range of other determinants, the three highest paying industries were Mining, Petroleum and Public Utilities. The three lowest paying industries were Private Households, Welfare and Education. In the Australian data Mining and Petroleum also rank amongst the highest paying industries, whilst Welfare and Education rank amongst the lowest.

In summary, it would appear that a substantial portion of the variation in wages across individuals can be attributed to industry of employment. A number of other Australian studies also demonstrate a similar finding (see Gregory and Daly (1990) using 1981 Census data, Chapman and Mulvey (1986) and Kidd and Viney (1991) using data from the 1982 ABS Special Supplementary Survey No. 4 (SSS4), Borland and Suen (1990) using data from the 1986 ABS Income Distribution Survey (IDS), Langford (1995) using data from the 1989-90 IDS, Chang and Miller (1996) using data from the 1991 Census, and Miller and Mulvey (1996) using data from the 1993 Training and Education Survey (TES)).

The estimates presented here reveal that the standard deviation of inter-industry wage differentials (as measured by the coefficient estimates) is around 13 per cent.[28] This is after differences in human capital endowments, and other individual characteristics have been taken into account. Such a large variation can not be plausibly explained by competitive forces, such as compensatory or transitory wage differences. Another competitive explanation is that the inter-industry differences reflect unmeasured labour quality differences across industries. It could be that there are different levels of on-the job training across industries and/or that the human capital measures in the model are not adequately capturing differences in labour quality across individuals, and therefore industries.

---

[27] Gregory and Daly (1990), using 1981 Australian data, found that the gap between the three lowest and three highest paying industries was about the same as the difference associated with completing a degree and having no formal qualifications.

[28] This estimate is similar to that of Borland and Suen (1990). Using 1986 data they found the standard deviation of industry wage differentials to be 14 per cent.

To examine the proposition that the industry wage effects are the product of poor controls for human capital, two tests proposed by Gregory and Daly (1992) were carried out. The first test involved selecting a number of blue collar occupations where, across industries, the training is deemed to be fairly homogeneous. It is envisaged that this approach reduces the potential for differences in formal training quality across industries.[29] If these groups share the industry effects, then it suggests that better measures of formal human capital would not reduce the inter-industry effects. The second test involved examining the inter-industry wage structure of females. The justification here is that females generally have relatively limited access to on-the-job training. If they also share the industry effects then this too suggests that the industry effects are not the product of differences in unmeasured on-the-job training across industries.

Test for differences in formal training quality across industries

Occupation was disaggregated to the (mainly) two digit level and, from the sample of males in the 1991 Census, the following occupational groups selected: metal tradespersons (*metaltp*); electrical tradespersons (*electp*); building tradespersons (*buildtp*); vehicle tradespersons (*vehictp*); miscellaneous tradespersons (*misctp*); road and rail transport workers (*roadtw*); miscellaneous plant and machine operators (*miscpmo*); trades assistants (*trdass*); miscellaneous labourers and related workers (*misclab*); and cleaners (*cleaners*). For each of these occupations the model in Table 7 was re-estimated.[30] Table 8 reports the tests for the significance of the industry dummies together with a measure of dispersion of the inter-industry differentials.

Table 8

Standard Deviation of Male (mainly two digit) Inter-Industry Wage Structure, by Selected Occupations, 1991

Label	Occupation	Standard Deviation	F-test
		(i)	(ii)
metaltp	Metal Tradespersons	12.9	5.89
electp	Electrical Tradespersons	12.2	4.15
buildtp	Building Tradespersons	6.9	*1.17
vehictp	Vehicle Tradespersons	14.6	4.98
misctp	Miscellaneous Tradespersons	12.5	5.15
roadtw	Road and Rail Transport Workers	13.1	5.05
miscpmo	Miscellaneous Plant and Machine Operators	17.8	13.83
trdass	Trades Assistants	14.0	4.08
misclab	Miscellaneous Labourers and Related Workers	16.1	10.34
cleaners	Cleaners	12.9	1.90

Notes: (a) for each occupation the model estimated is the same as that reported at Table 7; (b) * = insignificant at the one per cent level. All other test statistics are significant.

The F-test shows that when the industry dummies were entered as a group, in all but one of the occupations they were jointly significant at the one per cent level of significance. The exception was building

[29] Gregory and Daly actually proposed selecting a sample of unqualified persons (i.e. persons with no formal qualifications) rather than selecting a range of blue collar occupations as is done here.

[30] The results are available on request.

tradespersons. The results, therefore, demonstrate that, with the exception of building tradespersons, industry of employment is a very important determinant of earnings.

The results also show that the inter-industry wage structure has varying levels of dispersion across the occupations studied. For example, amongst miscellaneous plant and machine operators the standard deviation of inter-industry wages is around 18 per cent. Similarly, amongst miscellaneous labourers and related workers the corresponding figure is 16 per cent. The inter-industry wage structure of building tradesmen exhibits the least dispersion, with a standard deviation equal to seven per cent.

These results suggest that even if it were possible to better control for human capital (such as the quality of the training received), there would still be substantial industry effects.[31] The results are consistent with those of Gregory and Daly (1992) who found that amongst unskilled persons (i.e. those with no formal qualifications) there were substantial industry effects.

Test for differences in on-the-job training across industries

To test the proposition that the industry wage effects reflect differences in on-the-job training across industries, the model estimated in Table 7 was also estimated across a sample of females from the 1991 Census. As previously explained, the hypothesis being examined here is that there should be minimal industry effects because females generally have limited access to on-the-job training. The results from this exercise[32] show that, as with males, there is considerable variability in returns across the industries, although the standard deviation is lower, equal to 9 per cent (as compared to 13 per cent for males).[33] After controlling for differences in human capital endowments and other characteristics, the highest paying industry is, once again, Coal and Oil and the lowest Agriculture, Forestry and Fishing. In the former females earn, on average, 45.5 per cent more than the average for all industries; in the latter females earn, on average, 34 per cent less than the average for all industries. These results lend some support to the hypothesis that the inter-industry wage differentials are not the product of differences in on-the-job training across industries.

Testing for non-competitive explanations of the industry wage effects

To lend further support to the conclusion so far, namely that the industry effects can not be adequately explained by competitive wage theory, it was decided to test for non-competitive explanations. Arguably, the most widely accepted group of non-competitive wage theories is that labeled efficiency wage theory. The main contention arising from this group of theories is that wages may deviate from their competitive levels because firms

---

31 It should be emphasised once again that the dependent variable is the natural logarithm of weekly earnings from all sources. It may be that the inter-industry differentials within each occupation are also capturing differences in allowances, penalty rates, etc. For example, cleaners in the Mining industry may receive a loading for working unsociable hours.

32 The results are available on request.

33 There is also a high degree of correlation betwen the male and female inter-industry wage structures as measured by Pearson's correlation coefficient, which is equal to 0.8796, and in a two-tailed test is significant at the one per cent level.

find it profitable to pay non-competitive wages.[34] If the factors giving rise to the making of efficiency wage payments differ across industries, this may explain why wages for identically productive workers also vary across industries. For example, it may be that the costs of monitoring performance are higher in the Coal and Oil industry than they are in the Welfare industry, thus explaining the substantial differences in wages paid. If this is the case, then one would expect that the inter-industry wage structure would be correlated across occupations. To test this proposition a correlation analysis was undertaken using the inter-industry wage structures previously estimated for 10 blue-collar occupational groups. The justification for continuing to focus on the group of blue-collar occupations is that one would expect the costs of monitoring to be very similar across the occupational groups studied here. It is assumed that the costs of monitoring metal tradespersons, for example, are similar to those associated with the monitoring of other Tradespersons, or manual workers. If efficiency wage payments are being made then one would expect a high correlation of the occupational inter-industry wage structures. Table 9 provides a correlation matrix for each occupation showing Pearson's correlation coefficient.[35]

Table 9

Correlation Matrix of Blue-Collar Occupational Inter-Industry Wage Structures, Males, 1991

	metaltp	electp	buildtp	vehictp	misctp	roadtw	miscpmo	trdass	misclab	cleaners
metaltp	1									
electp	-0.42*	1								
buildtp	0.43*	0.00	1							
vehictp	-0.13	0.30	0.17	1						
misctp	-0.14	0.41*	0.66**	0.32	1					
roadtw	0.19	0.16	0.48*	0.35	0.72**	1				
miscpmo	-0.20	0.50**	0.50**	0.38*	0.62**	0.58**	1			
trdass	-0.28	0.24	0.05	-0.12	0.19	0.27	0.44*	1		
misclab	0.02	0.07	-0.30	0.00	0.08	0.09	-0.04	0.29	1	
cleaners	0.15	0.41*	0.14	0.12	0.59**	0.72**	0.53**	0.56**	0.29	1

Notes: (a) * = significant at the five per cent level; ** = significant at the one per cent level; (b) See Table 8 or Appendix B for a description of the occupational labels used here.

---

[34] There are a number of variants of the efficiency wage theory, the most popular being the shirking model (Yellen, 1984; Akerlof and Yellen, 1986; and Katz, 1986); the labour turnover model (Salop, 1979); sociological models (Akerlof, 1982 and 1984; Akerlof and Yellen, 1988 and 1990) and union threat models (Dickens, 1986).

[35] Two other tests were conducted, although the occupational group selected was the one digit occupational classification. The first test simply involved estimating the weighted industry deviations and correlating the results for each of eight broad occupational groups. The level of industry disaggregation was mainly two digit. As with the results in Table 9, there was also a lack of correlation across the occupations. The industry wage structure of plant and machine operators was the least correlated (the average correlation coefficient = 0.437). Labourers had the highest average correlation coefficient, equal to 0.6677. These results are similar to those of Borland and Suen (1990) using 1986 data for Australia. In their study labourers also had the highest average correlation coefficient (=0.6425), whilst professionals the lowest (=0.140)

In the second test the following equation was estimated for each occupational/industry group at the one digit level $\ln wky_i = \beta_0 + \beta_1 yos_i + \beta_2 exp_i + \beta_3 exp^2 + \beta_4 otime_i + \varepsilon_i$ and the return to *yos* recorded giving, for each occupation, a distribution of rates of return to schooling across industries. To establish the presence of a pattern of high and low paying industries a correlation matrix of rates of return to schooling, by occupation, was constructed. The results from this exercise, once again, confirms the previous findings of no clear pattern of high and low paying industries.

Only a third of the occupational inter-industry wage structures examined here are significantly correlated, and of those all, with the exception of one, are positively correlated indicating that the high paying industries in occupation A are also the high paying industries in occupation B. The exception to this arises between electrical tradespersons and metal tradespersons. Here the correlation coefficient of -0.42 indicates that the industries which pay electrical tradespersons well pay metal tradespersons low, and vice versa. The finding of no clear pattern of high and low paying industries in the majority of cases casts doubt on the hypothesis that the inter-industry wage differences reflect efficiency wage payments. They also cast doubt on the compensatory differential argument since presumably industries with poor (or good) working conditions will be similar across these occupations.

(iv) Occupation

According to human capital theory, differences in occupational wages reflect differences in skills, training and productivity.[36] If this is true, then in a human capital earnings function the addition of occupation controls should not increase the overall predictive power of the model. To test this 32 occupation dummies (mainly two digit) were added to the basic model estimated in Table 7.

A test for the joint significance of the occupation dummies led to the rejection of the null hypothesis that they do not contribute to the explanation of the variation in wages $F=(82.37>F_{32,21747}=1.67)$. Table 10 presents the estimates on the inter-occupational male wage structure. As before, the coefficients have also been normalised as deviations from the weighted mean. The omitted occupational category is numerical clerks as their unadjusted average income was closest to the mean of all occupations.

The estimates show that, even after controlling for differences in human capital endowments, there is still a distinct occupational hierarchy. At the bottom of the hierarchy are trades assistants, cleaners and farm managers. Relative to the average for all occupations they earn, respectively, 25 per cent, 28 per cent and 36 per cent *less*. At the other end of the spectrum health diagnosticians and treatment practitioners, managers and administrators and business professionals earn, respectively, 35 per cent, 21 per cent and 14 per cent *more* than the mean. What accounts for these occupational differences if it is not human capital differences? Two possible causes are scarcity and entry barriers. The enormous expansion of educational opportunities in recent years would tend to discount scarcity as an explanation. On the issue of entry barriers, it is likely that barriers may account for the high salaries of some professional groups such as lawyers, but it is unlikely that this reason could be extended to other highly paid groups such as administrators, managers and other professionals. It could be that the hierarchy is the product of efficiency wages, with highly paid groups being those groups where it is difficult to monitor performance. A more plausible explanation is likely to be found in social wage theory. The basic thesis here is that the occupational wage hierarchy parallels the social hierarchy, with more prestigious jobs attracting higher levels of

---

[36] "The most widely accepted theory of occupational wage differentials is the theory of human capital" (Mulvey, 1983, p.58).

remuneration, in part because the cost of living for those in these occupations is higher (for more on social wage theory, see Wooton, 1962).

Table 10

Disaggregated Male Occupational Wage Structure, 1991

Occupation	coeff.	% Deviation from overall mean wage	t-stat.	mean
	(i)	(ii)	(iii)	(iv)
Health Diagnostician	0.347	0.435	9.861	0.008
Manager/Administrator	0.206	0.248	11.623	0.120
Business Professional	0.135	0.165	6.696	0.042
Building Professionals	0.130	0.159	5.605	0.023
Stenographers and Typists	0.126	0.154	1.632	0.001
Police	0.114	0.141	3.479	0.010
Other Teacher/Instructor	0.113	0.139	3.643	0.011
Natural Scientists	0.061	0.083	1.838	0.007
Engineering Associates	0.051	0.072	2.333	0.029
Miscellaneous Professional	0.048	0.069	1.585	0.010
Artists	0.044	0.065	1.223	0.006
Registered Nurses	0.039	0.059	0.929	0.005
Miscellaneous Para-Professionals	0.016	0.036	0.791	0.036
Numerical Clerk	omitted	0.020	-	0.022
School Teacher	-0.005	0.015	-0.192	0.025
Miscellaneous Sales Worker	-0.020	0.000	-1.027	0.055
Personal Service Workers	-0.052	-0.031	-1.081	0.003
Medical and Science Technical Officers	-0.058	-0.037	-1.489	0.005
Social Professionals	-0.060	-0.038	-1.768	0.008
Miscellaneous Clerks	-0.073	-0.050	-3.803	0.053
Electrical Tradesperson	-0.110	-0.084	-5.348	0.041
Sales Assistant	-0.113	-0.087	-4.95	0.026
Misc. Plant and Machine Operators	-0.129	-0.101	-6.858	0.071
Receptionists, Telephonists	-0.147	-0.117	-4.348	0.007
Metal Tradespersons	-0.151	-0.121	-7.724	0.060
Miscellaneous Tradesperson	-0.163	-0.131	-8.382	0.058
Building Tradesperson	-0.172	-0.138	-7.942	0.035
Road/Rail Transport workers	-0.177	-0.143	-8.846	0.047
Vehicle Tradesperson	-0.208	-0.168	-9.545	0.034
Labourers and Related Workers	-0.231	-0.186	-12.729	0.096
Trades Assistant	-0.246	-0.198	-11.493	0.032
Cleaners	-0.281	-0.225	-10.483	0.013
Farm Manager	-0.363	-0.285	-9.668	0.006
Observations	21830			
R^2 adjusted	0.510			
BP test	2753.25			

Notes: (a) see Table 6; (b) other additional independent variables are 33 industry dummies.

(v) Gender

Another test of competitive wage theory is a study of the gender wage gap. Of interest is the extent to which differences in the human capital endowments of men and women explain the gender wage gap. The portion not explained by human capital endowments is often attributed to discrimination.

One approach to studying gender wage discrimination is to include a control for gender in a wage equation estimated across a pooled sample of males and females. Another way is to follow the procedure proposed by Blinder (1973) and Oaxaca (1973).[37] Here wage equations are estimated separately for males and females and one (usually the male wage structure) is adopted as the non-discriminatory norm. In other words, regression equations of the form $\widehat{\ln wky}_{im} = \hat{\beta}_{0m} + V_{im}\hat{\beta}_{m}$ and $\widehat{\ln wky}_{if} = \hat{\beta}_{0f} + V_{if}\hat{\beta}_{f}$ are estimated for males (*m*) and females (*f*), respectively. Adopting the male wage structure as the non-discriminatory norm the raw wage gap can be decomposed as follows:[38]

$$\overline{\ln wky}_{m} - \overline{\ln wky}_{f} = (\overline{V}_{m} - \overline{V}_{f})\hat{\beta}_{m} + \overline{V}_{f}(\hat{\beta}_{m} - \hat{\beta}_{f}) + (\hat{\beta}_{0m} - \hat{\beta}_{0f}) \qquad (4)$$

As previously noted, the first term of this decomposition calculates the portion of the gap attributable to differences in individual characteristics (explained portion). The second term calculates differences in returns to these characteristics (unexplained portion). The third term represents differences in the constants. Table 11 below presents the findings from such a decomposition exercise, with the male wage structure taken as the non-discriminatory norm. The model estimated is the same as that reported in Table 10 above.

The estimates show that in 1991 the differential in the mean logarithm of weekly wages of men and women was 0.1986. This raw wage gap is comparable to that estimated by Kidd and Meng (1995), equal to 20.1 per cent. Kidd and Meng (1995) base their estimate on a sample of full-time employees drawn from the 1989-90 Income Distribution Survey (IDS). Langford (1995), similarly used a sample of full-time employees from the 1989-90 IDS, however, the raw wage gap he uncovered was somewhat lower, equal to 15.46 per cent. It would appear that the raw wage gap is sensitive to the nature of the dependent variable (a point previously made by Rummery, 1992). Whilst Kidd and Meng use a measure of weekly earnings as their dependent variable, Langford uses a measure of hourly earnings. Table A5 in Appendix A shows that the raw wage gap is also sensitive to the definition of the sample and to the time period being studied (issues also highlighted by Rummery, 1992).[39]

---

[37] Other approaches, not used here, are those of Brown, Moon and Zoloth (1980), Cotton (1988) and Neumark (1988).

[38] If the female wage structure is taken as the non-discriminatory norm the explained portion is equal to $(\overline{V}_{m} - \overline{V}_{f})\hat{\beta}_{f}$, and the unexplained portion is equal to $\overline{V}_{m}(\hat{\beta}_{m} - \hat{\beta}_{f})$.

[39] Its magnitude also depends on the method of calculation. If, for example, the raw wage gap in Chapman and Mulvey's (1986) study is calculated using the arithmetic mean the figure is 15.4 per cent (as reported in Rummery, 1992). If the same gap is calculated using the geometric mean the gap increases to 16.7 per cent.

Table 11
Decomposition of Gender Pay Gap, 1991
(male wage structure treated as non-discriminatory norm)

Variables	Raw Wage Gap	Difference Between Constants	Proportion of Gap Explained	Proportion of Gap Unexplained	Adjusted Wage Gap
	(i)	(ii)	(iii)	(iv)	(v)
Education Level			-0.002	-0.009	
Experience			0.029	0.014	
Birthplace			-0.001	-0.001	
Marital Status and Children			0.011	0.058	
Work Overtime			0.026	0.011	
Sector			-0.001	-0.010	
Residential Area			-0.002	-0.006	
Industry (mainly 2 digit)			0.031	-0.051	
Occupation (mainly 2 digit)			-0.038	0.025	
TOTAL	*0.199*	*0.114*	*0.054*	*0.031*	*0.145*

Notes: (a) source: regression reported at Table 10 above; (b) The various breakdowns may not sum due to rounding errors.

Turning to the decomposition exercise, in 1991 the portion of the gap explained by differences in the measured characteristics of males and females is 27 per cent. This figure is lower than the 39 per cent estimated by Langford (1995), but is considerably higher than the 8 per cent estimate of Kidd and Meng (1995). The variability reflects, in part, the decomposition approach adopted and the specification of the model. For example, when Langford uses the Neumark approach (where a pooled sample of males and females is used as the non-discriminatory norm) he finds that the portion explained increases from 39 per cent (under the Blinder approach where the male wage structure is treated as the non-discriminatory norm) to 51 per cent. Kidd and Meng (1995) use the Brown, Moon and Zoloth approach where the occupational distribution is treated as endogenously determined.[40] If, in the present study, the female, rather than the male, wage structure is treated as the non-discriminatory norm the portion of the gap explained by differences in endowments falls from 0.054 (or 27 per cent) to 0.0007 (or 0.4 per cent). Thus, between 0 and 51 per cent of the observed gender wage gap may be accounted for by differences in endowments between the sexes.[41] In other words a large portion of the gap (between 49 and 100 per cent) is the product of discrimination and/or data deficiencies.[42]

---

[40] Interestingly the results from Kidd and Meng's simulated hypothetical female occupational distribution (which would occur in the absence of occupational barriers to entry) reveals that there is a close proximity between it and the observed male distribution.

[41] Many studies use the average of the two measures.

[42] These estimates are based on observed wage differences. However, Miller and Rummery (1991) and Kidd and Viney (1991) show that after controlling for sample selection bias the results are markedly different. Miller and Rummery use data from the 1985 round of the Australian Longitudinal Survey (ALS) and find that, on the basis of observed wages, there is a gender wage gap of 4.9 percentage points. When they control for sample selection bias the gap increases to 16 percentage points. Moreover, their analysis also reveals that differences in endowments between the sexes fully account for the 4.9 percentage point observed wage difference, but when sample selection bias is controlled for differences in endowments only account for one third of the gender wage gap. In other words two thirds of the gap may be attributed to discrimination. In contrast Kidd and Viney, using

With regard to model specification there is wide debate as to the impact of occupational aggregation in determination of the gender wage gap. Kidd and Shannon (1996), using Canadian data, demonstrate that when occupation is treated exogenously (as in the traditional Blinder approach discussed above) the level of aggregation matters (with more disaggregated controls resulting in a higher portion of the gap being explained). When occupation is treated as endogeneous (as in the Brown et al. approach) "... the size of the explained component of the gender wage gap is relatively insensitive to the degree of occupational aggregation" (Kidd and Shannon, 1996, p.326). When the 1991 estimates (reported in Table 11 above) were re-estimated with one digit rather than mainly two digit controls for occupation, the explained portion of the gap *increased* from 27 per cent to 37 per cent. The finding is contrary to the prediction of Kidd and Shannon[43], but consistent with results in other Australian studies (e.g. Chapman and Mulvey, 1986; Hawke, 1991; and Kidd, 1993). This implies that if women had the same job distributions as men they would be paid *less*, not more. Kidd (1993, p.54) suggests that this may be because "... females choose their occupation in order to minimize the depreciation effects that an intermittent broken career path has upon their stock of human capital and hence upon their productive potential."

Returning to the present study, after taking into consideration the explained portion (27 per cent of the gap), the adjusted wage gap in 1991 falls from 0.199 to 0.145.[44] That is, females are paid 85.5 per cent of the male rate. The adjusted wage gap is 3.9 percentage points lower than Kidd and Meng's estimate and 5.3 percentage points above Langford's estimate.

Viewed from an institutional perspective there should be no discrimination as the actors have all ratified the principle of Equal Pay for Work of Equal Value (EPWEV).[45] How, then, can we account for the discrepancy? One answer may be that EPWEV does not equate with comparable worth and that predominantly female

---

data from the 1982 ABS Special Supplementary Survey No. 4 (a more representative sample of the total workforce), found that on the basis of observed wages the gender wage gap was equal to 20.85 percentage points, but *fell* to 14.29 percentage points after sample selection bias had been controlled for. They also find that once sample selection is take into account the portion of the gap resulting from differences in the parameters (i.e. unexplained) falls from 82.8 per cent (when observed wages are used) to 54.3 per cent (when offered wages are used). They, therefore, conclude that their results imply "... a dramatic decrease in the extent of discrimination once sample selection is taken into account." The one common conclusion which may be drawn from these two studies is that the portion of the gap attributable to discrimination is likely to change once sample selection is taken into account.

[43] Kidd and Shannon state that "Clearly the inclusion of occupation is likely to increase the proportion of the gender wage gap labeled explained and to shrink the residual component" (p.30). On the basis of their argument one would expect more aggregated controls to decrease rather than increase the magnitude of the explained portion.

[44] When the same model is estimated over a pooled sample of males and females employed full-time as wage and salary earners (n=33,439) the coefficient on a dummy variable controlling for gender (female=1) is -0.1438, significant at the one per cent level.

[45] In 1969 the Commonwealth Conciliation and Arbitration Commission ratified the principle of "equal pay for equal work" (EPEW), ruling that sex was not to be used as a basis for fixing wages. Unfortunately, the principle only applied in cases where males and females performed similar work, or worked under the same award. Work usually performed by females was not covered by the decision. In 1972 the Federal tribunal extended the principle to that of Equal Pay for Work of Equal Value (EPWEV). In adopting this principle the Commission agreed to determine female rates on the basis of work value comparisons.

occupations, such as nursing, continue to be undervalued.[46] A subsequent section examines whether or not this discrimination is a short-run phenomenon as suggested by competitive wage theory.

(vi) The relationship between structural factors and earnings: summary

This section set out to test the contribution of structural factors towards explaining wage variation across individuals. A number of structural determinants were added to the human capital model, namely controls for geographic location, sector of employment, industry and occupation of employment. The results (summarised in Table 12 below) show that these structural factors have an important effect on wage determination in Australia.[47] Gender discrimination is also found to be an important determinant.

In competitive wage theory the two main explanations espoused to explain wage variations across location, sector, industry or occupation of employment are compensatory wage differentials or transitory differentials. In the human capital literature there is also a suggestion that workers of greater ability are sorted into high paying sectors, industries and regions, thus explaining their higher wages.

Table 12
The Effect of Alternative Models Used to Explain Male Wage Variation

Model	Description	Adjusted R^2	% increase in Adjusted R^2	F-test
(a)	Education level (4 dummies), experience and its square and a control for overtime work.	0.371	-	-
(b)	Model (a) plus: birthplace (2 dummies), marital status (2 dummies), and number of dependant children (4 dummies).	0.384	3.2	54.7
(c)	Model (b) plus: dummy for those residing in the metropolitan area	0.389	1.3	205.3
(d)	Model (c) plus: dummy for sector of employment	0.392	0.8	96.1
(e)	Model (d) plus: 33 industry dummies	0.451	15.0	72.0
(f)	Model (e) plus: 32 occupation dummies	0.510	13.1	82.4

Notes: (a) source: 1991 Census; (b) dependent variable ln*wky*; (c) all F-tests are significant at the one per cent level.

[46] Although the principle of EPWEV was designed to remove gender as a basis for wage fixing, many have argued that female occupations, such as nursing, continue to remain undervalued as their rates have, historically, had a gender bias. Advocates of comparable worth want the rates of pay of predominantly female jobs to be reassessed on a case by case basis. For more on this see Short (1986).

[47] An additional test for the importance of structural factors as a determinant of wages was also carried out. Following Chapman and Miller (1983), for each one digit occupational/industry group equation 1 (minus the control for overtime) was estimated across a sample of Australian born males drawn from the 1991 census. The coefficients were then used to calculate the average wage of the group assuming they had the average endowments of the whole sample. For each group these adjusted wages were then ranked and the ranks compared with the unadjusted wage structure using the following regression $R_A = a + bR_U + e$, where R_A and R_U are the industry-occupation rankings for adjusted and unadjusted wages respectively. The result was as follows $R_A = 3.045 + 0.924R_U$. The t-statistic on the coefficient R_U was equal to 21.195 and the R^2 equal to 0.85. This result shows that the adjusted wage structure is highly correlated with the unadjusted wage structure (if human capital endowments did not affect the wage structure we would have expected the coefficient on R_U to equal one). This suggests that structural factors are important in wage determination. Chapman and Miller (1983) arrived at a very similar result using 1976 Census data. In their study the coefficient on R_U was equal to 0.918 and the R^2 equal to 0.84.

Without more information on working conditions it is difficult to test the compensatory explanation, although the fact that there is only a weak correlation of inter-industry wage structures across a range of blue collar occupations militates against this explanation. It is unlikely that the working conditions, within an industry, vary greatly across these occupations. Tests that the differentials could be attributed to differences in unobserved labour quality across industries also suggest that it is unlikely that much of the differentials observed can be attributed to this factor.[48] The following section will shed more light on the transitory differential argument, and the argument that discrimination is only a short-run phenomenon.

VI How Stable are the Various Wage Structures?

The aim of this section is to examine the stability of various wage structures over time. If, for example, the 1991 inter-industry wage structure is highly correlated with the 1981 inter-industry wage structure, then this may be taken as evidence that the inter-industry differentials are not short-run transitory differentials. Other wage structures similarly studied here are the occupational wage structure and the male and female wage structures.

The analysis is largely based on a comparative analysis of 1981 and 1991 Census data. To facilitate comparisons the same model has been estimated across both samples. As some of the variables derived in the 1991 HSF could not be derived in the 1981 HSF, a number of the following 1991 estimates may differ slightly from those reported in previous sections.[49]

(i) Inter-Industry Wage Structure

Table 13 provides a comparison of the male inter-industry wage structures in 1981 and 1991. The estimates show that in both periods Welfare and Agriculture, Forestry, Fishing and Hunting were the lowest paying industries, whilst Coal and Oil and Metallic Minerals were the highest paying industries. They also show that over the decade there was a widening in the relativities. In 1981 those in Coal and Oil earned 45.3 per cent more than those in the average industry. By 1991 the corresponding figure was 62 per cent.[50] Consistent with this the

---

[48] Borland and Suen (1990), using ABS data from the 1986 Income Distribution Survey, arrive at a different conclusion. According to Mincer's overtaking hypothesis (Mincer, 1974) variation in wages of individuals will be minimised at the point where earnings streams are crossing over. Borland and Suen therefore estimated an earnings equation for three different experience sub-groups: 8-11 years, 12-15 years and 16-19 years. On doing this they found that the weighted adjusted standard deviation of industry wage differentials was lower than it was for the whole sample, leading them to the conclusion that the greater variability in the larger sample could be attributed to "... unobserved differences in the rate of return to on-the-job training ..." (Borland and Suen, 1990, p.38). They also found that the standard deviation was lower for blue collar workers than it was for white collar workers, again leading them to the conclusion that their model had not adequately captured differences in labour quality across individuals.

[49] The variables used in the 1991 analysis but not available in the 1981 HSF are information on overtime work and some disaggregated information on occupation. See Appendix B for more detail.

[50] When more disaggregated occupation controls are included in the model the estimated earnings advantage is 58.2 per cent (see Table 7).

standard deviation of inter-industry wage differentials has increased from 10 per cent in 1981 to 13 per cent in 1991.

When the 1991 and 1981 coefficients are correlated the Pearson correlation coefficient is 0.9408 (significant at the one per cent level), indicating a high degree of correlation between the two inter-industry wage structures. This evidence militates against the transitory differential explanation of inter-industry wages.

(ii) Inter-Occupational Wage Structure

Table 14 provides an estimate of the inter-occupational wage structure in 1991 and 1981. The two wage structures are very highly correlated (Pearson correlation coefficient = 0.9016, significant at the one per cent level), suggesting that the inter-occupational wage structure has been fairly stable over the decade, thus discounting the possibility that these differences are the product of transitory labour problems. What has changed is the range of differentials. For example, in 1981 Health Diagnosticians (*hlthd*) earned 60.5 per cent more than the average occupation. In 1991 the corresponding figure was 59 per cent.[51] At the other end of the spectrum, in 1981 cleaners earned the least (15.4 per cent less than the mean). By 1991 they earned 22.6 per cent less than the mean although they were no longer bottom of the occupational hierarchy. They were replaced by farm managers whose average earnings were 23.5 per cent less than the average for all occupations.[52] These findings are consistent with those of Gregory (1992) and Borland (1992) who also found evidence of growing income inequality over the 1980s.

Overall the average deviation from the mean is much the same in both years. In 1981 the standard deviation of inter-occupational differentials was equal to 16.2 per cent; by 1991 the corresponding figure was 16.7 per cent

---

[51] When more disaggregated occupation controls are included in the model the estimated earnings advantage falls to 43.5 per cent (see Table 10).

[52] The estimates in Table 10 are slightly different due to a different specification of the model (more detailed occupation controls). However, the rankings remain the same.

Table 13

Comparison of 1981 and 1991 Inter-Industry Wage Structures, Males

1991				1981			
Industry Label	1991 coeff.	% deviation from overall mean wage	1991 t-stat.	Industry Label	1981 coeff.	% deviation from overall mean wage	1981 t-stat.
	(i)	(ii)	(iii)		(iv)	(v)	(vi)
coil	0.448	0.62	15.984	coil	0.338	0.453	11.920
metmin	0.291	0.393	9.940	metmin	0.214	0.290	7.394
omin	0.166	0.235	3.726	omin	0.192	0.263	4.293
ins	0.163	0.232	5.177	ocs	0.113	0.171	5.590
bank	0.153	0.221	6.718	ins	0.069	0.122	2.577
defen	0.052	0.109	2.198	bank	0.053	0.106	2.751
chem	0.040	0.097	1.376	chem	0.018	0.069	0.740
ocs	0.040	0.096	1.728	pbs	0.008	0.059	0.388
pbs	0.030	0.086	1.361	ent	0.004	0.055	0.112
metal	0.012	0.067	0.433	paper	omitted	0.051	-
paper	omitted	0.055	-	metal	-0.008	0.043	-0.414
egw	-0.020	0.036	-0.881	pubad	-0.013	0.039	-0.677
wt	-0.033	0.023	-1.694	nonmet	-0.019	0.032	-0.890
tstore	-0.041	0.015	-2.000	egw	-0.033	0.019	-1.728
ent	-0.041	0.015	-1.152	tstore	-0.033	0.019	-1.888
const	-0.055	0.002	-2.788	defen	-0.040	0.012	-1.344
com	-0.056	0.001	-2.528	cloth	-0.042	0.010	-1.285
nonmet	-0.058	-0.001	-1.827	wt	-0.047	0.005	-2.877
pubad	-0.064	-0.007	-3.026	com	-0.048	0.004	-2.482
food	-0.077	-0.018	-3.542	const	-0.061	-0.008	-3.636
mach	-0.077	-0.019	-3.284	health	-0.073	-0.019	-3.451
mman	-0.078	-0.02	-2.674	ed	-0.074	-0.020	-3.797
cloth	-0.081	-0.023	-1.680	food	-0.084	-0.029	-4.782
text	-0.095	-0.036	-2.906	mach	-0.087	-0.032	-4.876
health	-0.096	-0.036	-3.987	mman	-0.104	-0.047	-4.413
vehic	-0.124	-0.062	-5.390	text	-0.126	-0.067	-4.196
rest	-0.169	-0.101	-7.072	vehic	-0.127	-0.068	-6.838
fabmet	-0.173	-0.103	-6.971	fabmet	-0.135	-0.075	-7.102
rt	-0.182	-0.111	-9.450	rest	-0.138	-0.078	-5.662
ed	-0.194	-0.121	-9.023	rt	-0.145	-0.084	-8.820
person	-0.195	-0.122	-4.949	wood	-0.186	-0.118	-9.398
wood	-0.233	-0.152	-9.730	person	-0.275	-0.189	-8.178
affh	-0.358	-0.246	-12.39	affh	-0.295	-0.204	-12.467
welf	-0.496	-0.336	-12.603	welf	-0.631	-0.416	-10.944
Obs.	21830			Obs.	24242		
R^2 adj.	0.416			R^2 adj.	0.427		
BP test	1579.3			BP Test	1728.0		

Notes: (a) see Table 6; (b) in columns (ii) and (v) inter-industry differentials have been sorted in descending order according to deviation from the mean wage of all industries in the respective years; (c) for a definition of the abbreviated industry terms used here see Appendix B.

Table 14

Comparison of 1981 and 1991 Inter-Occupation Wage Structures, Males

1991				1981			
Occup. Label	1991 coeff.	% deviation from overall mean wage	1991 t-stat.	Occup. Label	1981 coeff.	% deviation from overall mean wage	1981 t-stat.
	(i)	(ii)	(iii)		(iv)	(v)	(vi)
hlthd	0.477	0.587	13.270	hlthd	0.452	0.605	11.883
mgrad	0.312	0.343	26.748	mgrad	0.337	0.435	27.994
instrct	0.206	0.205	7.272	bldprof	0.243	0.309	14.336
busprof	0.200	0.198	13.634	instrct	0.237	0.302	8.526
bldprof	0.190	0.186	10.694	miscpf	0.183	0.235	8.495
pol	0.171	0.163	7.228	nats	0.182	0.233	6.139
nats	0.131	0.116	5.057	artists	0.173	0.223	5.103
miscpf	0.113	0.096	3.240	busprof	0.163	0.211	8.292
engass	0.106	0.089	6.770	pol	0.132	0.175	5.957
artists	0.104	0.086	2.666	schlt	0.113	0.154	4.932
regnur	0.089	0.069	2.848	engass	0.023	0.057	1.714
mispp	0.082	0.062	6.044	regnur	0.016	0.051	0.495
schlt	0.064	0.042	3.305	clerw	omitted	0.034	-
socprof	0.045	0.023	1.237	salesw	-0.022	0.012	-1.974
salesw	0.034	0.011	2.741	techo	-0.035	0.000	-0.824
clerw	omitted	-0.024	-	socprof	-0.045	-0.010	-0.959
techo	-0.011	-0.035	-0.365	farmmgr	-0.070	-0.034	-1.593
trdlab	-0.120	-0.137	-13.615	mispp	-0.081	-0.043	-4.876
clean	-0.226	-0.226	-11.405	trdlab	-0.151	-0.106	-19.702
farmmgr	-0.238	-0.235	-4.080	clean	-0.208	-0.154	-9.978
Obs.	21830			Obs.	24242		
R^2 adj	0.486			R^2 adj	0.4944		
BP Test	2349.23			BP Test	2555.84		

Notes: (a) see Table 6; (b) other additional independent variables are 33 industry dummies; (c) for a definition of the abbreviated occupational terms used here see Appendix B.

(iii) The Male/Female Wage Structure: 1981 to 1991

To investigate how the gender wage gap has changed over the decade one approach is to simply decompose the 1981 and 1991 gender wage gaps separately and compare the results. Another approach is to follow the procedure proposed by Wellington (1993). Wellington extends the traditional Oaxaca one period decomposition approach across two periods:

$$(\overline{\ln wky}_{m91} - \overline{\ln wky}_{m81}) - (\overline{\ln wky}_{f91} - \overline{\ln wky}_{f81}) = \left[(\overline{V}_{m91} - \overline{V}_{m81})\hat{\beta}_{m91} - (\overline{V}_{f91} - \overline{V}_{f81})\hat{\beta}_{f91}\right] + \left[\overline{V}_{m81}(\hat{\beta}_{m91} - \hat{\beta}_{m81}) - \overline{V}_{f81}(\hat{\beta}_{f91} - \hat{\beta}_{f81})\right]$$

where the subscripts 91 and 81 refer, respectively, to the years 1991 and 1981.[53] The first term of the decomposition shows the change in the wage gap when evaluated at 1991 return (coefficient) levels. It answers the question "... if the returns to the independent variables were constant at their [1991] levels, what portion of the wage gap can be accounted for by changes in the means?" (Wellington, 1993, p.393). In other words, what proportion of the wage gap can be accounted for by changes in the human capital endowments and other characteristics (such as industry and occupation of employment) across males and females? The second term represents the portion of the wage gap that can be explained by changes in the returns to the independent variables over the period. Also included in this component are changes in the constant term.[54] This evaluation holds the group's 1981 means (endowments/characteristics) constant. The change in the gap associated with a change in the level of returns is not explained by the human capital model.

Table 15 presents the results of a Blinder decomposition of the 1981 and 1991 gender wage gap. Table 16 shows the decomposition of the change in the gender wage gap using the Wellington approach.

---

53 $\hat{\beta}$ has been redefined here to include the constant term.

54 See footnote 53.

Table 15
Comparing the decomposed 1981 and 1991 gender wage gaps
(male wage structure treated as non-discriminatory norm)

	1981	% of 1981 Raw Wage Gap	1991	% 1991 of Raw Wage Gap
	(i)	(ii)	(iii)	(iv)
Due to Means				
Schooling	0.013	4.56	-0.001	-0.36
Experience	0.051	17.71	0.029	10.00
Demographics	0.022	7.59	0.012	4.12
Government	0.000	-0.08	0.000	-0.01
Metropolitan	-0.003	-1.00	-0.002	-0.80
Industry (mainly 2 digit)	0.035	12.22	0.037	12.71
Occupation (mainly 2 digit)	-0.037	-12.77	-0.028	-9.52
Sub-Total	*0.082*	*28.22*	*0.047*	*16.13*
Due to Coefficients				
Schooling	0.008	2.58	-0.004	-1.23
Experience	-0.021	-7.23	0.011	3.65
Demographics	0.059	20.31	0.066	22.67
Government	-0.015	-5.09	-0.016	-5.50
Metropolitan	-0.008	-2.82	-0.008	-2.72
Industry (mainly 2 digit)	-0.011	-3.85	-0.050	-17.32
Occupation (mainly 2 digit)	0.006	2.14	0.017	5.93
constants	0.191	65.73	0.136	46.66
Sub-Total	*0.208*	*71.78*	*0.151*	*52.14*
TOTAL	**0.290**		**0.198**	

Notes: (a) source: regression reported at Table 14; (b) The differences in the 1991 results reported here and those reported in Table 11 may be attributed to a different specification of the model. Variables not included here include *otime* and some disaggregated occupations. These variables were not available in the 1981 HSF and thus excluded from the 1991 analysis for comparison purposes; (c) the various breakdowns may not sum due to rounding errors.

The results in Table 15 show that in 1981 the differential in the mean logarithm of weekly wages of men and women was 0.29, or 29 per cent. Differences in endowments accounted for 27.6 per cent of this gap, with differences in experience being the main contributory factor. By 1991 the gender wage gap had narrowed by 9.2 percentage points to 19.8 per cent, however, so too did the portion of the gap explained. By 1991 only 16 per cent of the raw wage gap could be explained.[55] The main contributory factor in 1991 appeared to be differences in the distribution of the sexes across industry sectors.

Table 16 provides more insight into the changes which have taken place. The results show that over the period changes in the average mean characteristics reduced the wage gap by 0.037 (or 40.29 per cent of the change).[56] Changes in experience levels (with the labour market experience of women growing over the period)

---

[55] This compares to the 27 per cent attained with a more detailed specification of the model (see Table 11).

[56] When occupation is entered at the one digit level the portion of the gap explained remains essentially unchanged, equal to 41 per cent. When occupation is completely exlcuded from the model the portion of the gap explained increases to 54.7 per cent and the impact of education increases. These results support earlier findings by Kidd and Meng (1995). When Kidd and Meng exclude occupation the impact of education more than doubles. In the analysis here the impact of education increases by 32 per cent. The results are available on request.

appears to have contributed 28 per cent towards the gap reduction[57]. These findings are consistent with those of Kidd and Meng (1995). Using data from 1981-82 and 1989-90, Kidd and Meng found that the gender wage gap fell by 6.61 per cent over the period.[58] Changes in characteristics reduced the wage gap by 45 per cent. As with this study the dominant effect is associated with changes in labour market experience. In Kidd and Meng's study changes in experience reduced the gender wage gap by 24.7 per cent (which compares to 27.6 per cent uncovered here).

Changes in the occupational distribution of males and females over the period appear to have *widened* the gender gap by eight per cent. This suggests that while legislative reforms designed to change occupational segregation in Australia may have been effective, the wage outcomes are presumably not consistent with the expectations of legislators. They are, however, consistent with earlier studies such as Chapman and Mulvey (1986) who observed that if females were distributed across occupations in the same way as males they would be paid less.

Table 16
Explaining the Declining Gender Wage Gap, 1981 to 1991

	1981 to 1991: Gap to be explained	Change in gap due to change in endowments	Column (ii) as % of column (i)	Change in gap due to change in coefficients.	Column (iv) as % of column (i)
	(i)	(ii)	(iii)	(iv)	(v)
Qualifications		-0.0125	13.67	-0.0128	13.98
Experience		-0.0254	27.64	0.0346	-37.65
Demographics		-0.0031	3.39	-0.0001	-0.09
Sector of Employment		-0.0003	0.29	-0.0007	0.76
Residential Area		0.0013	-1.40	-0.0004	0.45
Industry (mainly 2 digit)		-0.0044	4.81	-0.0333	36.21
Occupation (mainly 2 digit)		0.0074	-8.10	0.0130	-14.13
constants				-0.0554	60.33
TOTAL	*-0.092*	*-0.037*	*40.29*	*-0.0551*	*60.05*

Notes: (a) source: regression reported at Table 14; (b) the various breakdowns may not sum due to rounding errors.

VII Overall Summary and Conclusion

Human capital theory has gained much respect worldwide and has become a dominant paradigm for the study of wage determination. Recent years have, however, seen the emergence of alternative theories (such as efficiency wage theory) which present a realistic challenge to the human capital model Nevertheless, human capital theory remains as a dominant framework for the study of wage determination. Is it habit which accords

---

[57] Although it should be pointed out that the measure of experience used here is potential rather than actual labour market experience. Refer also to footnote 7 of this paper.

[58] Kidd and Meng (1995) point out that changes in the participation patterns of males and females over the period may also have contributed to a change in the gender wage gap. If, for example, less-qualified females entered the workforce and less-qualified males exited the workforce then, *ceteris paribus*, the gender wage gap would increase. After correcting for sample selection they conclude that "... the growth in wages is probably underestimated by the pattern of observed wage growth. However, the direction of change is the same as that suggested by the trend in observed wages and the discrepancy is relatively modest."

human capital theory such status? How appropriate is the theory as a model of wage determination in the 1990s? Using Census data from 1991 and 1981 this paper set out to examine the current empirical status of human capital theory in Australia.

The approach adopted largely followed that of Chapman and Miller (1983), Gregory and Daly (1990), Krueger and Summers (1988) and Borland and Suen (1990). In the first instance an earnings equation was estimated across a sample of wage and salary earners in order to gauge the independent contribution to wage variation of human capital endowments and demographic characteristics such as marital status, dependant children and birthplace. Structural factors such as geographic location, sector, industry and occupation of employment were then sequentially added to the base model. The logic of this approach was summarised by Krueger and Summers as follows: "Competitive theory makes a strong prediction about the structure of wages. Job attributes which do not directly affect the utility of workers should have no effect on the level of wages" (Krueger and Summers, 1988, p.259). To test for the possibility that observed wage differentials were the product of transitory factors a comparative exercise was also undertaken. Here the same functional form of the model was estimated across two samples of males employed full-time as wage and salary earners, one drawn from the 1981 census, and the other from the 1991 Census. The key findings from the preceding analyses may be summarised as follows. In 1991:

- the basic human capital model was capable of accounting for 38 per cent of the variation in wages across individuals. The results are consistent with the predictions of theory, namely that those investing in human capital are rewarded with higher life-time earnings. When compared with other studies the model appears to be very robust. The coefficient estimates are consistent with earlier studies, with theory being able to explain slight variations (such as the returns to education) uncovered over time.
- wages varied considerably across geographic locations. Males residing in metropolitan areas had an earnings advantage of 8.3 per cent. It may be that variation in earnings by residential area reflect the payment of compensatory wage premia. Data limitations restricted the testing of this hypothesis, although it is noted that other studies have only provided weak evidence in support of this hypothesis.
- the determinants of earnings varied between the private and public sectors. Males employed in the private sector earned six per cent more than their private sector counterparts. When the differential was decomposed it was found that 67 per cent of the gap could be explained by differences in human capital characteristics across the sectors.
- industry of employment was a significant determinant of earnings. Moreover, there was considerable variability in inter-industry wage differentials uncovered; the standard deviation of the inter-industry wage differentials was equal to 13 per cent. The lowest paying industries were Welfare, Agriculture and Wood, and the highest Coal and Oil, Metallic Mining and Insurance. Tests that the differentials were the product of compensatory wage payments or unmeasured labour quality did not find strong support for these explanations.

- occupation of employment also exerted a considerable effect on wage outcomes. After controlling for differences in human capital endowments, demographic characteristics, residential area, sector and industry of employment, the estimates revealed a distinct occupational-earnings hierarchy which paralleled the occupational hierarchy of social wage theory. In other words professionals (such as Health Diagnosticians and Business Professionals) were at the top and unskilled workers (such as cleaners) at the bottom.
- the gender wage gap appears to be influenced by discrimination. The estimated raw wage gap was equal to 19.86 per cent. A decomposition exercise revealed that only 27 per cent of this gap could be explained by differences in the measured characteristics of males in females. Taking this information into consideration, the adjusted earnings gap was, therefore, estimated to be 14.5 per cent. In other words, in 1991, after controlling for a range of other determinants, females earned 85.5 per cent of their male counterparts' income.

A comparison of the wage structures over the decade 1981 to 1991 revealed that, as with other studies, inter-industry and inter-occupational differentials are both large and persistent. The factors driving a wedge in the earnings of different industries and occupations are not short-run phenomena. Inter-industry and inter-occupational differentials are, therefore, probably not indicative of transitory differentials. Gender wage discrimination is also found to be a persistent phenomenon. Moreover changes in the occupational distribution of males and females over the period have caused the gender wage gap to widen (rather than narrow) by eight per cent.

Overall the inter-decade analysis suggests that either competitive wage forces are sluggish to adjust or that there is market failure. In other words, wages will not adjust to competitive levels as predicted by neo-classical wage theory because of persistent *imperfections* or normative forces, such as trade unions, industrial tribunals and discrimination.

To sum up, three main conclusions emerge from this study. The first is that the human capital model is robust over time; the second is that it is capable of quantifying earnings differentials by human capital endowments, demographic characteristics, residential area, sector of employment, industry of employment and occupation of employment[59] and is, therefore, a useful framework for the study of wage determination in Australia; and the third is that it is unable to explain significant and persistent inter-industry, inter-occupational and gender wage differences.

---

[59] From other studies we also know that it can also quantify earnings differentials by union membership status and workplace size (see Appendix A).

APPENDIX A:
SUMMARY OF MAJOR AUSTRALIAN STUDIES USING AN EARNINGS FUNCTION AS THE INVESTIGATIVE FRAMEWORK[57]

Table A1: *Returns to Human Capital: Australian Coefficient Estimates*

STUDY	Miller (1994)			Gregory and Daly (1990)		Chiswick and Miller (1985)				Chiswick and Miller (1995)		
Date and Data	1973: Social Mobility in Australia Survey (SMAS)			1981: Census		1981: Census				1981: Census		
Sample	Pooled (2,351)	Males (1,877)	Females (474)	Males (na)	Females (na)	All Males (23,848)	Males Born Australia (16,648)	Migrant Males ESB (3,177)	Migrant Males NESB (4,023)	All Migrant Males (7,288)	Migrant Males Fluent in English (5,540)	Migrant Males not Fluent in English (1,748)
Education												
YOS						0.079 (58.5)	0.082 (46.35)	0.088 (25.82)	0.049 (19.10)	0.060 (19.14)	0.076 (19.40)	0.02 (4.02)
Left School age 16-18	0.174 (5.08)	0.171 (4.61)	0.145 (1.74)									
Yr12/Compl. High School	0.385 (11.18)	0.384 (11.05)	0.335 (3.43)	0.1412 (16.11)	0.0682 (-5.18)							
Trade Crt.	0.173 (7.93)	0.166 (7.59)	0.148 (0.89)			0.072 (11.18)	0.073 (9.26)	0.079 (4.9)	0.074 (4.95)			
Post-Sec. Cert.	0.320 (9.41)	0.320 (8.32)	0.288 (4.14)	0.2414 (28.35)	0.1734 (-3.75)							
Bach. Deg.	0.610 (17.09)	0.620 (15.91)	0.551 (6.45)	0.644 (55.49)	0.548 (-4.75)							
Experience												
pot. exp.				0.0375 (32.76)	0.0406 (1.56)	0.020 (16.01)	0.025 (16.05)	0.025 (7.39)	0.004 (1.15)	0.013 (4.48)	0.020 (5.37)	0.012 (1.32)
$(\text{pot. exp.})^2$				-0.0007 (28.6)	-0.0008 (-3.24)	-0.00034 (14.86)	-0.00041 (14.71)	-0.00044 (7.16)	-0.00011 (2.01)	-0.00027 (4.82)	-0.00039 (5.52)	-0.00017 (1.77)
occ. exp.	0.007 (1.61)	0.011 (2.41)	-0.007 (0.76)									
$(\text{occ. exp.})^2$	-0.00013 (1.84)	-0.00021 (2.63)	0.00010 (0.59)									

Note: t-statistics in parentheses. In the case of Gregory and Daly (1990) the male and female sample sizes are not available, however, the total sample is comprised of 18,172 persons. Also, in Gregory and Daly, the t-statistics reported in the female case actually refer to the difference between the sexes in the returns to a particular variable.

[57] Details on the other independent variables in the regressions may be found after the tables on pages 56 to 59

Table A1: *Returns to Human Capital: Continued*

STUDY	McNabb and Richardson (1989)	Tran-Nam and Nevile (1988)			Mulvey (1986)		Chapman and Mulvey (1986)		Kidd and Viney (1991)	
Date and Data	1981-82: Income Housing Survey (IHS)	1981-82: IHS			1982: Special Supplementary Survey No. 4 (SSS4)		1982: SSS4		1982: SSS4	
Sample	Males (8,227)	Australian Males Born (5,789)	Migrants Males ESB (1,088)	Migrant Males NESB (1,106)	Males (9,323)	Females (5,542)	Males (8,946)	Females (4,330)	Males (9,005)	Females (4,243)
Education										
YOS	0.064 (3.20)	0.0402 (10.72)	0.0256 (2.81)	0.0174 (5.5209)	0.0310 (10.689)	0.0296 (8.00)	0.0452	0.0402		
Yr 10									0.03981 (3.3509)	0.00217 (0.12545)
Yr12/Compl. High School					0.0769 (2.366)	0.0317 (1.022)			0.12437 (8.7703)	0.09247 (4.6019)
Trade Crt.		0.076 (7.449)	0.0995 (4.29)	0.1164 (5.56)	0.112 (12.739)	0.058 (2.524)			0.18146 (15.294)	0.07568 (2.9723)
Post-Sec. Crt.		0.222 (17.238)	0.2237 (7.523)	0.2405 (7.77)	0.1246 (10.469)	0.074 (6.807)			0.23878 (16.255)	0.16765 (8.2846)
Bach. Degree		0.3803 (22.725)	0.3639 (9.547)	0.4429 (11.424)	0.248 (15.5)	0.2066 (11.168)			0.43224 (24.520)	0.37571 (14.492)
High. Degree		0.5709 (13.806)	0.5024 (9.0537)	0.6340 (10.2085)	0.322 (11.709)	0.2766 (5.848)				
Experience										
job tenure					0.0063 (12.6)	0.0069 (7.667)	0.00956 (**)	0.0114 (**)		
(job tenure)^2							-0.000122 (**)	-0.000148 (**)		
pot. exp.	0.055 (5.5)	0.0325 (23.001)	0.0323 (9.6311)	0.0249 (0.8551)	0.0248 (19.077)	0.0268 (16.75)	0.0252 (**)	0.0273 (**)	0.03155 (27.180)	0.02987 (18.499)
(pot. exp.)^2	-0.0009 (3.0)	-0.0005 (19.679)	-0.00059 (8.9828)	-0.00045 (7.5595)	-0.0005 (25.00)	-0.0005 (16.667)	-0.000452 (**)	-0.000554 (**)	-0.00057 (24.381)	-0.00055 (14.417)

Note: t-statistics in parentheses. Chapman and Mulvey (1986) do not report t-statistics or standard errors. **=significant at 5% level or better; *=significant at 10% level

Table A1: *Returns to Human Capital: continued*

STUDY	Rummery (1992)			Christie (1992)	Miller and Volker (1993)		Miller, Mulvey and Martin (1995a)	Miller, Mulvey and Martin (1995b)		
Date and Data	1984: Australian National Social Science Survey (ANSSS)			1984: ANSSS	1985: Australian Longitudinal Survey (ALS)		1986 Census, 1980-82 and 1988-89 Australian Twin Register			
Sample	Pooled (1,386)	Males (855)	Females (531)	Pooled (1,316)	Males (1,468)	Females (1,186)	Pooled (1,204)	Pooled (2,340)	Males (1,138)	Females (1,202)
Education										
Age							0.002 (2.54)	0.002 (3.97)	0.004 (4.31)	0.001 (0.50)
YOS							0.064 (26.64)	0.065 (36.93)	0.071 (27.45)	0.057 (24.62)
Yrs Pr.&Sec. Schl in Aust.	0.060 (5.56)	0.064 (4.87)	0.046 (2.46)	0.046 (3.86)						
Yr11					0.032 (1.52)	0.051 (2.37)				
Yr12/CHS					0.127 (6.26)	0.120 (5.56)				
Trade Crt.	0.095 (3.04)	0.127 (3.42)	0.095 (3.04)	0.094 (2.79)	0.105 (5.71)	-0.022 (0.40)				
Cert/Dip.	0.282 (5.28)	0.272 (4.34)	0.285 (3.13)		0.064 (2.17)	0.052 (2.88)				
Diploma				0.235 (4.11)	0.301 (5.95)	0.376 (9.12)				
Bach. Deg.	0.343 (7.54)	0.308 (6.11)	0.349 (4.24)	0.245 (4.05)	0.410 (9.91)	0.459 (11.97)				
Grad. Dip.	0.285 (2.74)	0.349 (3.77)	0.257 (1.44)							
High. Deg.	0.447 (9.39)	0.443 (8.97)	0.344 (2.48)	0.283 (3.39)						
Experience										
pot. exp.				0.02 (3.96)						
$(pot.\ exp)^2$				-0.00035 (3.5)						
actual exp.	0.02 (4.18)	0.021 (3.76)	0.021 (2.26)							
$(actual\ exp)^2$	-0.00032 (2.94)	-0.00032 (2.94)	-0.00039 (1.71)							
$exp^{(e-0.15exp)}$					-0.632 (8.55)	-0.876 (12.48)				

Note: t-statistics in parentheses.

Table A1: *Returns to Human Capital: continued*

STUDY	Chapman and Iredale (1990)				Drago (1989)			Miller (1994)		
Date and Data	1988: Office of Multicultural Affairs (0MA)				1988: Survey of Individuals in 23 BCA Member Workplaces (BCA Survey)			1989: How Workers Get Their Training (HWGTT) Survey		
Sample	Males born in Australia (461)	Males born in Australia (461)	Females born in Australia (271)	Females born in Australia (271)	Pooled (585)	Males (395)	Females (190)	Pooled (8,100)	Males (4,656)	Females (3,444)
Age										
Age					0.003 (3.30)	0.002 (1.40)	0.003 (2.171)			
Education										
Yr pr&sec schl in Oz.		0.0721 (3.9)		0.0282 (1.02)						
YOS	0.078 (8.23)		0.07 (5.64)							
LS16-18								0.061 (3.81)	0.062 (2.66)	0.053 (2.39)
Yr12/CHS					0.043 (2.52)	0.042 (1.87)	0.015 (0.602)	0.127 (7.43)	0.156 (7.21)	0.077 (2.85)
Trade Crt.		0.112 (2.77)		0.137 (1.07)				0.10 (8.00)	0.107 (7.39)	0.073 (2.07)
Cert/Dip.		0.220 (3.98)		0.116 (1.84)				0.193 (15.17)	0.202 (10.25)	0.174 (10.37)
Othr PS Qual					0.008 (0.26)	-0.048 (1.27)	0.084 (1.643)			
Bach. Deg.		0.358 (6.02)		0.322 (4.12)				0.417 (28.04)	0.439 (24.19)	0.361 (14.16)
High. Deg.		0.316 (3.6)		0.471 (4.5)						
Experience										
pot. exp.	0.139 (5.65)	0.136 (5.54)	0.112 (4.10)	0.0959 (3.47)						
$(pot.exp.)^2$	0.097 (4.27)	0.0948 (4.19)	0.071 (2.66)	0.0568 (2.12)						
$(pot.exp.)^3$	0.029 (3.71)	0.0285 (3.64)	0.018 (1.87)	0.0135 (1.40)						
$(pot.exp.)^4$	-0.003 (3.4)	0.0030 (3.4)	-0.0016 (1.4)	-0.0001 (1.0)						
tenure	-0.007 (1.2)	-0.0066 (1.1)	0.0008 (0.07)	-0.00004 (0.00)	0.009 (2.76)	0.009 (2.40)	0.011 (1.702)			
$(tenure)^2$	0.0003 (1.48)	0.0003 (1.45)	0.0004 (0.67)	0.0004 (0.65)	-2.861 (2.8)	-2.518 (2.21)	-4.426 (1.679)			
Occ. exp.								0.007 (3.00)	0.019 (6.53)	-0.012 (2.93)
$(occ. exp.)^2$								-0.00015 (3.6)	-0.00035 (6.8)	0.00017 (2.3)

Note: t-statistics in parentheses.

Table A1: *Returns to Human Capital: continued*

STUDY	Langford (1995)			Chang and Miller (1996)	Preston (Table 2, this paper)		Miller and Mulvey (1996)	
Date and Data	1989-90: Income Distribution Survey (IDS)			1991: Census	1991: Census		1993: Survey of Training and Education (STE)	
Sample	Pooled (10,237)	Males (6,775)	Females (3,462)	Pooled (45,402)	Males (21,830)	Females (11,609)	Males (6,275)	Females (5,627)
Education								
YOS	0.030 (9.83)	0.027 (8.87)	0.025 (5.02)	0.047 (33.57)				
NCHS							0.005 (0.277)	-0.003 (0.167)
LS16-18								
Yr12/CHS					0.128 (15.53)	0.134 (12.9)	0.040 (2.22)	0.023 (1.210)
Trade Crt.					0.227 (29.27)	0.2208 (18.08)	0.075 (4.687)	0.129 (3.794)
Cert/Dip.					0.430 (27.13)	0.4581 (35.80)	0.097 (4.409)	0.006 (0.316)
Vocat. Cert.				0.038 (5.20)				
Bach. Deg.					0.63 (63.56)	0.582 (48.46)	0.214 (10.7)	0.156 (7.428)
High. Deg.							0.273 (9.75)	0.207 (6.677)
Experience								
pot. exp.	0.0273 (27.3)	0.0259 (25.9)	0.0312 (15.6)	0.023 (24.47)	0.042 (40.44)	0.043 (31.94)	0.026 (13.0)	0.022 (10.0)
$(pot.exp.)^2$	-0.0005 (5.0)	-0.0004 (4.0)	-0.0006 (6.0)	-0.00034 (17.9)	-0.0007(33.44)	-0.0009 (26.45)	-0.0005 (50.0)	-0.0005 (50.0)
tenure							0.009 (4.5)	0.011 (3.666)
$(tenure)^2$							-0.0002 (2.0)	-0.0003 (3.0)
occ. exp.							0.011 (5.5)	0.010 (5.0)
$(occ.exp.)^2$							-0.0003 (3.0)	-0.0003 (3.0)

Note: t-statistics in parentheses.

Table A2: *Returns to Birthplace, Duration of Residence and English Skills: Australian Coefficient Estimates.*

STUDY	Miller (1994)			Chiswick and Miller (1985)	Chiswick and Miller (1995)		
Date and Data	1973: SMAS			1981: Census			
Sample	Pooled (2,351)	Males (1,877)	Females (474)	All Migrant Males (7,200)	All Migrant Males (7,288)	Migrant Males Fluent in English (5,540)	Migrant Males not Fluent in English (1,748)
Citizen				-0.038 (3.31)	-0.012 (0.08)	-0.008 (0.47)	-0.017 (0.52)
Country of Birth							
ESB	-0.068 (1.71)	-0.058 (1.39)	-0.09 (0.82)				
NESB	-0.199 (5.18)	-0.201 (4.89)	-0.187 (1.84)				
Australia							
UK/Ireland					-0.049 (1.64)	-0.053 (1.77)	-
Canada					-0.074 (0.85)	-0.104 (1.18)	-
USA					0.019 (0.20)	-0.032 (0.33)	-
NZ					0.048 (1.37)	0.039 (1.12)	-
Br.W Indies					-0.10 (0.62)	-0.135 (0.87)	-
So. Europe					-0.180 (8.36)	-0.177 (7.32)	-
No. Europe					-0.091 (3.67)	-0.103 (3.87)	0.159 (2.61)
East. Europe					-0.109 (3.13)	-0.130 (2.83)	0.156 (4.20)
Arab.					-0.248 (5.7)	-0.234 (3.18)	-0.084 (1.98)
So Asia					-0.047 (1.65)	-0.078 (2.53)	0.153 (2.06)
Philippines					-0.183 (2.07)	-0.24 (2.37)	0.302 (2.12)
Vietnam					-0.515 (3.66)	-0.268 (3.46)	-0.267 (1.55)
Other Asia					-0.092 (1.66)	-0.163 (1.72)	0.227 (4.16)
S&C America					-0.177 (2.67)	-0.254 (1.73)	0.123 (2.72)
Africa					-0.073 (2.21)	-0.075 (2.03)	0.094 (1.79)
Remainder					-0.039 (0.56)	-0.018 (0.24)	-0.068 (0.60)
Years since migrating							
Total				0.00126 (1.50)			
>30 Years	0.147 (2.06)	0.102 (1.31)	0.442 (3.11)				
21-30 Years	-0.017 (0.38)	0.004 (0.08)	-0.088 (0.70)				
5-20 Years	-0.022 (0.55)	-0.034 (0.79)	0.025 (0.25)				
English Language							
Other language at home				-0.108 (9.33)			
Poor English				-0.047 (2.31)			

Note t-statistics in parentheses.

Table A2: *Returns to Birthplace, Duration of Residence and English Skills: continued*

STUDY	Mulvey (1986)		Chapman and Mulvey (1986)		Vella (1993)		Borland and Suen (1990)	Miller (1994)		
Date and Data	1982: SSS4		1982: SSS4		1985: ALS		1986: IDS	1989:HWGTT Survey		
Sample	Males (9,323)	Females (5,542)	Males (8,946)	Females (4,330)	Males (2,088)	Females (1,746)	Males (4,574)	Pooled (8,100)	Males (4,656)	Females (3,444)
Country of Birth										
ESB								-0.107 (4.4)	-0.079 (2.4)	-0.14 (3.95)
NESB								-0.20 (8.4)	-0.20 (6.33)	-0.19 (5.36)
Australia	0.0255 (1.43)	-0.0008 (0.04)	0.0528**	0.0141			0.008 (0.21)			
UK/Ireland	0.0618 (4.04)	0.0088 (0.47)	0.0735**	0.0249			0.021 (0.53)			
Other Europe							-0.050 (1.8)			
Italy	-0.0501 (2.13)	0.0029 (0.08)	-0.0537**	0.0287			-0.086 (1.89)			
Greece	-0.0124 (0.34)	-0.0630 (1.55)	-0.0163	-0.0389						
Yugoslavia	-0.0557 (1.93)	-0.0247 (0.68)	-0.0630**	-0.0284						
Holland	0.0009 (0.02)	0.053 (0.89)	0.0168	-0.0102						
West Germany	-0.0022 (0.06)	0.0390 (0.93)	0.0242	0.0582						
Asia							-0.007 (0.15)			
US, Canada & South Africa							-0.034 (0.5)			
New Zealand							0.024 (0.33)			
Other										
Years since migrating										
> 30								0.126 (4.39)	0.108 (2.89)	0.149 (3.29)
21-30								0.114 (4.40)	0.083 (2.38)	0.151 (3.94)
5-20								0.102 (4.01)	0.093 (2.74)	0.109 (2.81)
Speaks English Well					0.283 (0.91)	-0.496 (2.91)				

Note: t-statistics in parentheses. Chapman and Mulvey (1986) do not report t-statistics or standard errors. **=significant at 5% level or better; *=significant at 10% level

Table A2: *Returns to Birthplace, Duration of Residence and English Skills: continued*

STUDY	Langford (1995)			Chang and Miller (1996)	Preston (this paper)		Miller and Mulvey (1996)	
Date and Data.	1989-90: IDS			1991: Census	1991: Census		1993: STE	
Sample	Pooled (10,237)	Males (6,775)	Females (3,462)	Pooled (45,402)	Males (21,830)	Females (11,609)	Males (6,275)	Females (5,627)
Country of Birth								
English speaking				-0.005 (0.60)	0.032 (3.83)	0.014 (1.24)		
Non-English speaking				-0.06 (7.32)	-0.085 (10.50)	-0.063 (5.78)		
Australia								
UK/Ireland	0.033 (3.02)	0.034 (2.4)	0.036 (1.88)					
Other Europe	-0.034 (2.4)	-0.03 (1.74)	-0.015 (0.58)					
Italy	-0.013 (0.48)	-0.01 (0.37)	0.023 (0.49)					
Asia	-0.06 (4.4)	-0.08 (4.2)	-0.012 (0.5)					
America	0.046 (1.52)	0.04 (1.1)	0.055 (1.05)					
Africa	-0.03 (0.98)	-0.02 (0.43)	-0.04 (0.86)					
Oceania	0.03 (1.5)	0.043 (1.7)	0.01 (0.35)					
English speaking background								
Aust. born, English not first language							-0.02 (0.690)	-0.042 (1.4)
O'seas born, English first language							0.031 (1.409)	0.032 (1.237)
O'seas born, English not first language							-0.002 (0.087)	-0.016 (0.571)
Period of arrival								
1964-71							-0.048 (1.777)	-0.051 (1.645)
1972-83							-0.007 (0.259)	-0.027 (0.9)
1984-89							-0.04 (1.333)	-0.043 (1.19)
1990-93							-0.037 (0.902)	-0.015 (0.306)
English language proficiency								
Some difficulties							-0.053 (1.656)	-0.068 (1.619)
Extreme difficult.							-0.096 (1.433)	-0.075 (1.056)

Note: t-statistics in parentheses.

Table A3: *Returns to Family and Children Variables: Australian Coefficient Estimates*

STUDY	Miller (1994)			Gregory and Daly (1990)		Chiswick and Miller (1985)				Chiswick and Miller (1995)		
Date and Data	1973: SMAS			1981: Census		1981: Census				1981: Census		
Sample	Pooled (2,351)	Males (1,877)	Females (474)	Males (na)	Females (na)	All Males (23,848)	Males Born in Australia (16,648)	Males Born ESB (3,177)	Males Born NESB (4,023)	All Migrant Males (7,288)	Migrant Males Fluent in English (5,540)	Migrant Males not Fluent in English (1,748)
Marital Status												
Married	0.033 (1.17)	0.143 (4.17)	-0.171 (3.16)	0.1806 (16.72)	0.0573 (7.26)	0.130 (17.39)	0.151 (16.95)	0.099 (5.27)	0.073 (3.80)	0.123 (6.43)	0.117 (5.95)	0.147 (2.44)
De-facto												
Widowed												
Widowed, Separated, Divorced				0.1154 (7.34)	0.1044 (0.45)							
Never Married												
Dependent Children Status												
Has depend. children				-0.0013 (0.15)	-0.1728 (10.76)							

Note t-statistics in parentheses. For a note on the t-statistics reported by Gregory and Daly (1990) see Table A1.

Table A3: *Returns to Family and Children Variables: continued*

STUDY	Tran-Nam and Nevile (1988)			Mulvey (1986)		Chapman and Mulvey (1986)		Kidd and Viney (1991)	
Date and Data	1981-82: IHS			1982: SSS4		1982: SSS4		1982: SSS4	
Sample	Australian Born (5,789)	Migrants, born ESC (1,088)	Migrants, born NESC (1,106)	Males (9,323)	Females (5,542)	Males (8,946)	Females (4,330)	Males (9,005)	Females (4,243)
Marital Status									
Married	0.1148 (10.925)	0.0645 (2.267)	0.0267 (0.095)	0.0506 (2.249)	0.0124 (0.617)	0.07 (**)	0.00666	0.1308 (13.225)	0.08457 (6.662)
De-facto				0.0495 (1.73)	0.0426 (1.608)	0.065 (**)	0.0506		
Widowed				0.0775 (1.48)	0.0236 (0.6668)	0.0917 (**)	0.00407		
Separated								0.07448 (4.0196)	0.07568 (3.665)
Never Married				-0.0692 (2.848)	-0.0728 (3.28)	-0.0639 (**)	-0.0801 (**)		

Note: t-statistics in parentheses. Chapman and Mulvey (1986) do not report t-statistics or standard errors. **=significant at 5% level or better; *=significant at 10% level

Table A3: *Returns to Family and Children Variables: continued*

STUDY	Rummery (1992)			Christie (1992)	Borland and Suen (1990)	Miller, Mulvey and Martin (1995a)
Date and Data	1984: ANSSS			1984: ANSSS	1986: IDS	1986 Census, 1980-82 and 1988-89 Australian Twin Register
Sample	Pooled (1,386)	Males (855)	Females (531)	Pooled (1,316)	Males (4,574)	Pooled (1204)
Marital Status						
Married					0.061 (4.06)	0.035 (2.64)
Widowed, Separated, Divorced	-0.012 (0.23)	0.010 (0.12)	0.049 (0.73)	0.310 (0.66)		
Never Married	-0.075 (2.09)	-0.085 (2.05)	-0.015 (0.25)	-0.062 (1.60)		

Note: t-statistics in parentheses.

Table A3: *Returns to Family and Children Variables: continued*

STUDY	Chapman and Iredale (1990)		Drago (1989)			Miller (1994)		
Date and Data	1988: OMA		1988: BCA Survey			1989: HWGTT Survey		
Sample	Males (461)	Females (271)	Males (395)	Females (190)	Pooled (585))	Pooled (8,100)	Males (4,656)	Females (3,444)
Marital Status								
Married	0.0642 (1.41)	-0.0134 (0.23)	0.091 (3.89)	0.058 (2.185)	0.079 (4.340)	0.049 (4.57)	0.086 (5.82)	0.006 (0.40)
Defacto								
Widowed								
Widowed, Separated, Divorced	0.147 (1.72)	0.0126 (0.14)						
Never Married								

Note: t-statistics in parentheses.

Table A3: *Returns to Family and Children Variables: continued*

STUDY	Langford (1995)			Chang and Miller (1996)	Preston (this paper)		Miller and Mulvey (1996)	
Date and Data	1989-90: IDS			1991: Census	1991: Census		1993: STE	
Sample	Pooled (10,237)	Males (6,775)	Females (3,462)	Pooled (45,402)	Males (21,830)	Females (11,609)	Males (6,275)	Females (5,627)
Marital Status								
Married	0.062 (6.2)	0.099 (7.62)	0.018 (0.97)	0.025 (4.03)	0.119 (14.73)	0.0272 (3.132)		
Wid., Sep., Divorced	0.015 (1.0)	0.047 (2.12)	0.024 (0.98)		0.057 (4.802)	0.054 (4.507)		
Never Mar.								
Family Status								
Single + kid							0.041 (2.322)	-0.074 (2.387)
Marr. no kids							0.065 (4.643)	0.040 (2.857)
Marr. + kids							0.059 (2.95)	0.051 (2.428)
Children								
Has no dep. kids								
Has dep. kids	-0.03 (3.36)	-0.032 (2.89)	-0.088 (6.28)					
Non-dep. kids	-0.064 (6.35)	-0.051 (4.26)	-0.085 (5.66)					
Dep & Non-Dep. kids	-0.0757 (7.6)	-0.066 (5.0)	-0.105 (6.5)					
One kid present					0.010 (1.143)	-0.091 (7.483)		
Two kids pres.					0.024 (2.902)	-0.115 (9.683)		
Three kids pres.					0.033 (2.842)	-0.147 (6.725)		
Four + present					-0.027 (1.389)	-0.2278 (4.906)		
Age youngest child								
0-2 yr							0.044 (2.095)	0.120 (4.8)
3-4 yr							-0.018 (0.72)	0.097 (3.233)
5-9 yr							-0.028 (1.272)	0.045 (1.956)

Note: t-statistics in parentheses.

Table A4: *Effects of Gender on Earnings: Australian Coefficient Estimates*

Study	Miller (1994)	Gregory and Daly (1990)	Kidd and Viney (1991)	Rummery (1992)	Christie (1992)	Miller, Mulvey and Martin (1995a)	Miller (1994)	Preston (this paper)		Chang and Miller (1996)
Date and Data	1973: SMAS	1981: Census	1982: SSS4	1984: ANSSS	1984: ANSSS	1986 Census, and 1980-82 & 1988-90 Australian Twin Register	1989: HWGTT Survey	1991: Census		1991: Census
Sample	Pooled (2351)	Pooled (18,172)	Pooled (13,248)	Pooled (1,386)	Pooled (1,316)	Pooled (1,204)	Pooled (8,100)	Pooled (33,439)		Pooled (45,402)
Dependent Variable, ln:	hourly earnings	weekly earnings	hourly earnings	hourly earnings	hourly earnings	annual earnings	hourly earnings	weekly earnings	weekly earnings	hourly earnings
Dummy: Female=1	-0.427 (16.11)			-0.103 (3.30)	-0.173 (5.38)	-0.231 (18.47)	-0.131 (14.39)	-0.1438 (30.426)		-0.114 (31.66)
Female returns to education relative to male returns:										
unqualified		-0.0805 (4.56)	-0.03763 (1.818)						-0.18112 (17.995)	
high school		-0.0733 (5.18)	-0.0319 (1.253)						-0.10469 (13.840)	
certificate		-0.068 (3.75)	-0.10579 (3.829)						-0.1431 (14.2221)	
diploma			-0.07113 (2.8647)						-0.13461 (7.646)	
degree		-0.0956 (4.75)	-0.0565 (1.7741)						-0.19349 (17.468)	

Note: t-statistics in parentheses.

Table A5: *Decomposing the Australian Gender Wage Differential*

Study	Miller (1994)	Chapman and Mulvey (1986)	Kidd and Viney (1991)		Kidd (1993)	Kidd and Meng (1995)	Rummery (1992)	Miller and Rummery (1991)		Miller (1994)	Kidd and Meng (1995)	Langford (1995)	Preston (this paper)
Date and Data	1973: SMAS	1982: SSS4	1982: SSS4		1982: SSS4	1981-82: IDS	1984: ANSSS	1995: ALS		1989: HWGTT Survey	1989-90: IDS	1989-90: IDS	1991: Census
Dependent Variable, ln:	hourly earnings	hourly earnings	hourly earnings		hourly earnings	weekly earnings	hourly earnings	hourly earnings		hourly earnings	weekly earnings	hourly earnings	weekly earnings
Raw Wage Gap	0.468	0.167	0.208	*0.143*	0.193	0.267	0.146	0.049	*0.160*	0.143	0.201	0.15	0.199
Adjusted Wage Gap	0.408	0.132	0.173	*0.118*	0.125	0.200	0.104	0.0	*0.109*	0.127	0.184	0.092	0.145
Blinder approach (male base)													
% explained	13	21	17				29	108		12		39	27
% unexplained	87	79	83				71	-6		88		61	73
Reimers approach (correcting for sample selection bias - male base)													
% explained				17					32				
% unexplained				54					0				
% sample selection				28					68				
Neumark approach (pooled base)													
% explained												51	
% unexplained												49	
Brow, Moon and Zoloth approach													
Intra-Occ.													
% explained					49.92	29.79					22.14		
% unexplained					89.70	81.94					88.36		
Inter-Occ.													
% explained					-14.58	-4.68					-13.78		
% unexplained					-25.04	-7.01					3.28		
Cotton approach													
% explained	6.92						26.3			8.48			
% male treatment advantage	43.18						29.8			40.86			
% female treatment disadvantage	49.69						43.9			50.66			

Table A6: *Effect of Workplace Size on Earnings: Australian Coefficient Estimates*

Study	Hatton and Chapman (1989)	Miller (1994)			Chapman and Iredale (1990)		Paice (1993)		Miller (1994)			Miller and Mulvey (1995)	
Date and Data	1973: SMAS	1973: SMAS			1988: OMA		1988: OMA		1989: HWGTT Survey			1993: STE	
Sample	Males (1,681)	Females (474)	Males (1,877)	Pooled (2,351)	Males born in Australia (461)	Females born in Australia (371)	Pooled (541)		Females (3,444)	Males (4,656)	Pooled (8,100)	Females (5,627)	Males (6,275)
Workplace size (number of employees employed at workplace)													
< 5	-0.173 (4.13)	-0.073 (0.93)	-0.201 (5.12)	-0.172 (4.61)					-0.120 (6.20)	-0.189 (11.43)	-0.158 (12.47)		
<10												-0.155 (9.688)	-0.201 (13.4)
5-19		0.012 (0.20)	-0.071 (3.35)	-0.059 (2.83)					-0.129 (6.83)	-0.125 (7.79)	-0.130 (10.66)		
5-24	-0.0599 (2.08)												
10-19												-0.081 (4.5)	-0.096 (6.0)
20-99		0.054 (0.094)	-0.003 (0.14)	0.005 (0.24)					-0.064 (4.31)	-0.072 (5.595)	-0.071 (7.58)	-0.062 (4.4)	-0.067 (5.58)
25-99	0.0114 (0.39)												
21-50					0.0657 (1.24)	-0.00862 (0.13)	0.0256 (0.63)	-0.0115 (0.26)					
51-100					0.084 (1.54)	-0.0621 (0.81)	0.0631 (1.43)	0.005 (0.11)					
100-299	0.0555 (1.77)												
101-500					0.183 (3.59)	-0.0834 (1.22)	0.0979 (3.47)	0.0518 (1.19)					
300+													
500+					0.166 (3.27)	0.122 (1.60)	0.1378 (3.47)	0.11948 (2.63)					

Table A7: *Effect of Union Membership on Earnings: Australian Coefficient Estimates*

Study	Mulvey (1986)		Chapman and Mulvey (1986)		Christie (1992)	Miller and Rummery (1989)	Miller and Mulvey (1994)	Chapman and Iredale (1990)		Drago (1989)			Miller and Mulvey (1996)	
Date and Data	1982: SSS4		1982: SSS4		1984: ANSSS	1985: ALS	1985: ALS	1988: OMA		1988: BCA Survey			1993: STE	
Sample	Males (9,323)	Females (5,542)	Males (8,946)	Females (4,330)	Pooled (1,316)	Males, (1,904)	Pooled (3,534)	Males born in Australia (461)	Females born in Australia (271)	Males (395)	Females (190)	Pooled (585)	Males (6,275)	Females (5,627)
Union wage effect	9.09% (11.65)	7.02% (8.16)	8.16% (**)	6.04% (**)	15.4% (5.11)	13.6% (9.93)	7.7% (n.a)	0.3% (0.08)	6.4% (1.30)	-6.7% (2.42)	-13.6% (3.6)	-9.2% (4.052)	2.6% (2.36)	1.6% (1.33)

Note: t-statistics in parentheses. Chapman and Mulvey (1986) and Miller and Mulvey (1994) do not report t-statistics or standard errors. **=significant at 5% level or better; *=significant at 10% level..

Table A8: *Effect of Occupation on Earnings: Australian Coefficient Estimates*

STUDY	Chapman and Mulvey (1986)		Kidd and Viney (1991)		Christie (1992)	Borland and Suen (1990)	Langford (1995)			Chang and Miller (1996)	Miller and Mulvey (1996)	
Date and Data	1982: SSS4.		1982: SSS4		1984: ANSSS	1986: IDS	1989-90: IDS			1991: Census	1993: STE	
Sample	Males (8,946)	Females (4,330)	Males (9,005)	Females (4,243)	Pooled (1,136)	Males (4,574)	Pooled (10,237)	Males (6,775)	Females (3,462)	Pooled (45,402)	Males (6,275)	Females (5,627)
Occupation:												
Manager/ Administ.	0.193 (**)	0.133 (**)	0.3532 (23.161)	0.24445 (6.1421)	0.203 (3.33)	0.123 (2.06)	0.2966 (19.77))	0.2852 (16.78)	0.3131 (10.1)	0.152 (13.69)	omitted	omitted
Profession.	0.192 (**)	0.231 (**)	0.27386 (17.632)	0.31028 (9.2895)	0.105 (2.14)	0.139 (2.28)	0.2748 (18.32)	0.2702 (15.01)	0.3453 (12.79)	0.291 (23.658)	-0.032 (1.6)	-0.045 (1.406)
Para-Profession.						0.165 (2.73)	0.2285 (14.28)	0.2133 (11.85)	0.2893 (9.64)	0.220 (19.923)	-0.067 (2.913)	-0.040 (1.143)
Tradesper.			omitted	omitted		0.014 (0.24)	0.0585 (4.5)	0.0468 (3.34)	-0.002 (0.05)	0.044 (3.96)	-0.198 (9.4286)	-0.329 (7.477)
Clerk	0.108 (**)	0.0968 (**)	0.16944 (13.149)	0.13291 (5.2278)	0.097 (2.13)	0.055 (0.93)	0.1025 (8.54)	0.1108 (6.52)	0.210 (9.5)	0.110 (10.57)	-0.183 (8.243)	-0.162 (5.4)
Salesperson	0.251	-0.008	0.08445 (5.1166)	0.02438 (0.8383)	0.033 (0.57)	-0.006 (0.11)	0.0247 (1.76)	0.0397 (2.09)	0.0928 (8.55)	0.062 (5.688)	-0.196 (8.909)	-0.217 (6.781)
Plant & Mach. Op.						-0.003 (0.04)	0.0254 (1.8)	0.0207 (1.38)	-0.0117 (0.35)	0.033 (2.683)	-0.210 (9.545)	-0.272 (5.913)
Labourer						-0.002 (0.53)	omitted	omitted	omitted	omitted	-0.271 (12.905)	-0.323 (9.5)
Tradesper./ labourer	-0.0086	-0.067										
Defence.						omitted						
Farming/ Agricult.	-0.166 (**)	-0.067	-0.14898 (4.0322)	-0.05152 (0.41457)	-0.327 (3.63)							
Mining			0.13399 (3.2374)	0.03402 (1.4426)								
Transport			0.00648 (0.4417)	0.03972 (0.8632)								
Services			0.06274 (3.1534)	0.00778 (0.23756)	-0.264 (0.49)							
Production					omitted							
Other	omitted	omitted										

Note: t-statistics in parentheses. To assit with interpretation of the coefficients the reference group is also identified above. Chapman and Mulvey (1986) do not report t-statistics or standard errors. **=significant at 5% level or better; *=significant at 10% level.

NOTES TO APPENDIX TABLES A1 TO A8
INDEPENDENT VARIABLES IN STUDIES REPORTED.

Borland and Suen (1990) use data from the 1986 Income Distribution Survey. The sample analysed contains full-time male employees whose primary source of income was from wages and salaries. The results reported here are from Table A2, page 43. Their independent variable is a measure of hourly earnings. The independent variables are education level (7 dummies), experience (and its square), residential area (6 dummies), marital status (2 dummies), occupation (8 dummies), education and experience interaction terms (4), superannuation dummy, and controls for birthplace (7 dummies).

Chang and Miller (1996) use data from the 1991 Census. The sample analysed contains 20-64 year old individuals who were not attending school, were employed and reported a positive number of working hours, and had valid values for the variables of income, birthplace, industry, occupation, industry sector, marital status and qualification. The results reported here are from Table 1, pages 35-36. Their independent variable is a measure of hourly earnings. The independent variables are: years of schooling, experience (and its square), qualification level (1 dummy), self-employment dummy, residential area (2 dummies), birthplace (2 dummies), marital status (1 dummy), gender (1 dummy), occupation (7 dummies) and industry (11 dummies).

Chapman and Iredale (1990) use data from the 1988 Office of Multicultural Affairs survey. The sample referred to here consists of Australian born wage and salary earners. The results reported are from columns (ii), (iii), (v) and (vi) and (vi), Table 7, page 29. Their dependent variable is a measure of hourly earnings. The independent variables are either years of schooling or educational level (4 dummies), together with control for experience, experience^2, experience ^{3}, experience^4, tenure (and its square), marital status (2 dummies), union membership dummy, control for firm size (4 dummies) and industry of employment. Results reported in Tables A3, A6 and A7 above use a measure of years of schooling rather than education level dummies.

Chapman and Mulvey (1986) use data from the 1982 ABS Special Supplementary Survey No. 4. The results reported here are from Tables 1 and 2, page 510-511. Their independent variable is a measure of hourly earnings. The independent variables are: years of schooling, experience (and its square), job tenure (and its square), country of birth (7 dummies), marital status (4 dummies), occupation (6 dummies), industry (16 dummies), place of residence (15 dummies) and a union status dummy.

Chiswick and Miller (1985) use data from the 1981 Census. Their sample is comprised of males aged between 25 and 64 who reported positive usual weekly income. The results reported here are from five different regressions: (1) all males irrespective of birthplace; (2) Australian born males; (3) male migrants from English speaking countries; (4) male migrants from non-English speaking countries; (5) all male migrants. Results reported are from columns (1), (2) of Table 3 page 544 and columns (2), (3) and (5) from Table 4 page 547. In the first case (1) independent variables are education level (dummy=1 if individual holds a trade certificate), years of schooling, experience and its square, marital status (1 dummy), geographic location (2 dummies), birthplace (dummy=1 if born overseas), for those born overseas a measure of length of duration in Australia. In the second case (2) the independent variables are: education level, years of schooling, experience and its square, marital status, geographic location, and a dummy if employed in the public sector. For the third and fourth cases (3) and (4) the independent variables are experience and its square, education level, years of schooling, marital status, geographic location , period of residence in Australia. Finally, in the fifth case (5) the independent variables are the same as at (3) and (4) plus controls for sector of employment, the use of a language other than English at home (2 controls), a control for non-Australian citizens, and a control for those who have studied at post-secondary institutions.

Chiswick and Miller (1995) use data from the 1981 Census. Their analysis is restricted to foreign born males age 25 to 64 who were employed at the time of the Census. The results from three regressions (columns (2), (4) and (6), Table 5, pages 51-52) are reported here: (1) all foreign born men; (2) foreign born men fluent in English; (3) foreign born men not fluent in English. Their dependent variable is a measure of annual earnings. The independent variables in the regression for all foreign born men are: years of schooling, experience and its square, years since migration, geographic location dummies (2), marital status (1 dummy), citizen (1 dummy), country of birth (16 dummies), language skill (1 dummy). For those fluent in English the controls are as for the first

regression, minus the language skill dummy. For those not fluent in English the omitted controls are language skill dummy and six country of birth dummies.

Christie (1992) uses data from the 1984 Australian National Social Science Survey. Her sample consists of full-time and part-time wage and salary earners aged 18 years and above. The results reported are from column (1), Table 2, page 48. The dependent variable is a measure of hourly earnings. The independent variables are: years of primary and secondary schooling in Australia, education level (4 dummies), experience (and its square), marital status (2 dummies), gender (1 dummy if applicable), location (2 dummies), occupation (6 dummies), state of residence (7 dummies) and a union membership dummy.

Drago (1989) uses data from a 1988 survey of individuals in 23 Business Council of Australia workplaces. The results reported here are from Table 2, page 320. The dependent variable used is a measure of hourly earnings. The independent variables are: age, education level (2 dummies), tenure (and its square), union membership dummy, marital status dummy, shift work (2 dummies), overtime dummy, employment status (1 dummy), and degree of difficulty finding employment elsewhere (1 dummy).

Gregory and Daly (1990) use data from the 1981 Census. They use only a sub-sample of the 1981 Census HSF. It consists of males and females working 35 hours or more per week as wage and salary earners. The results reported here are from column (1), Table 4, page 17. Their dependent variable is a measure of weekly earnings. The model is estimated over a pooled sample of males and females and includes a sequence of dummy interaction terms which allows the coefficients to vary between the two groups. The independent variables are education (3 dummies), experience (and its square), geographic location (1 dummy), marital status (2 dummies) and dependant child (1 dummy). A second model which also includes 40 industry dummies is also estimated, although the results are not reported here.

Hatton and Chapman (1989) use data from the 1973 Social Mobility in Australia survey. Their sample is comprised of males aged 30-65 who were employed full-time at the time of the survey. The dependent variable is a measure of hourly earnings. The independent variables are: years of schooling, experience and its square, industry experience and its square, marital status, union dummy, metropolitan area dummy, urban dummy, qualifications (6 dummies) and workplace size (4 dummies).

Kidd (1993) uses data from the 1982 ABS Special Supplementary Survey No. 4. The sample is restricted to full-time employees. The results reported are from Table 7, page 53. The dependent variable is a measure of hourly earnings. The independent variables are: education (5 dummies), experience and its square, marital status (2 dummies), and occupation (6 dummies).

Kidd and Meng (1995) utilise two data sets, the Income Distribution Survey for 1981-82 and 1989-90. The sample used is restricted to full-time wage and salary earners aged 15-64. The results reported here are from columns (2) and (5), Table 7, page 19. Their dependent variable is a measure of weekly earnings. The independent variables are experience and its square, education level (4 dummies) and occupation (5 dummies).

Kidd and Viney (1991) use data from the 1982 ABS Special Supplementary Survey No. 4. Their sample consists of full-time employees. Two regressions are reported here, although Kidd and Viney also estimate a third with gender interaction terms on all independent variables. The results reported are from Table 3, page 37-38 and have been corrected for sample selection bias. Their dependent variable is a measure of hourly earnings. The independent variables are: education level (5 dummies), experience (and its square), marital status (2 dummies), geographic location (11 dummies), occupation (8 dummies) industry (16 dummies) and a selectivity bias correction term (lambda) in the female specification. The female coefficients have been corrected for sample selection bias. The males have been estimated using OLS.

Langford (1995) uses data from the 1989-90 Income Distribution Survey. The sample analysed is comprised of persons employed full-time who were less than 65 at the time of the survey. The results reported here are from Table C1, Appendix C, page 80. The dependent variable is a measure of hourly earnings. The independent variables are: years of schooling, potential experience (and its square), tertiary field (9 dummies), marital status (2

dummies), country of birth (7 dummies), children type (4 dummies), occupation (7 dummies), industry (11 dummies) and sector of employment (1 dummy).

McNabb and Richardson (1989) use data from the 1981-82 Income Housing Survey. The sample analysed covers males employed full-time and aged between 15 and 64. The results reported are from column (3) of Table 1, page 60. The dependent variable is a measure of weekly earnings. The independent variables are years of schooling, experience and its square.

Miller (1994) uses data from the 1973 Social Mobility in Australia survey and the 1989 How Workers Get Their Training survey. The results reported are from Table 3, page 353. The dependent variable is a measure of hourly income. The independent variables are educational attainment (5 dummies), occupational experience (and its square), marital status (1 dummy), birthplace (2 dummies), years since migrating (3 dummies) and firm size (3 dummies). In the pooled regressions there is an additional control for gender (1 dummy)

Miller and Mulvey (1994) use data from the 1985 round of the Australian Longitudinal Survey. The sample is comprised of persons aged 19 to 25. The results reported are contained in the text on page 501. Their dependent variable is a measure of hourly earnings. The independent variables are education level (7 dummies), experience, tenure in current job, gender, location (2 dummies), occupation (6 dummies), full-time status (1 dummy) union density (imputed from published ABS data) and union membership status.

Miller and Mulvey (1996) use data from the 1993 Survey of Training and Education. The sample analysed contained employed wage and salary earners who reported valid information on each of the regressors used in the estimating equation. The results reported are from columns (ii) and (iv), Appendix Table 1 pages 149-151. The dependent variable is a measure of hourly earnings. The independent variables are: education level (6 dummies), industry (11 dummies), occupation (7 dummies), family status (3 dummies), age of youngest children (3 dummies), English speaking background (3 dummies), period of arrival (4 dummies), English language proficiency (2 dummies), firm size (3 dummies), residential area (6 dummies), experience (and its square), tenure (and its square), occupational experience (and its square), sector of employment (1 dummy), part-time dummy, works with computer dummy, measure of trade union density in industry and union membership dummy.

Miller, Mulvey and Martin (1995a) use data from the 1980-82 and 1988-89 Australian Twin Register. Their earnings data are imputed from the 1986 Census. The results reported are from column (3) Table 4, page 592. The sample is a pooled sample of identical twins. The dependent variable is a measure of annual earnings. The independent variables are years of schooling, marital status (1 dummy), age, gender (1 dummy).

Miller, Mulvey and Martin (1995b) use data from the 1980-82 and 1988-89 Australian Twin Register. The results reported are the OLS estimates from Table 3, page 24. The sample analysed consists of identical and fraternal twins. The dependent variable is a measure of annual earnings (imputed from the 1986 Census). The independent variables are: years of schooling, age and gender.

Miller and Rummery (1989) use data from the 1985 Australian Longitudinal Survey. The sample is restricted to 19 to 25 year old males. The results reported are from column (1) of Table 2, page 193. The dependent variable is a measure of hourly earnings. The independent variables are location (2 dummies), educational attainment (7 dummies), occupation (6 dummies), industry (7 dummies), employment status (1 dummy), tenure in current job, experience and union membership status.

Miller and Rummery (1991) use data from the 1985 Australian Longitudinal Survey. The sample is restricted to 19 to 25 year olds. The results reported are from columns (1) and (3) of Table 3, page 61. The dependent variable is a measure of hourly earnings. The independent variables are location (2 dummies), educational attainment (7 dummies), experience, whether or not the person is doing an apprenticeship, history of joblessness and a selectivity bias correction term (lambda).

Miller and Volker (1993) use data from the 1985 Australian Longitudinal Survey. The sample is restricted to individuals aged 19-25 years in 1985 who reported positive earnings in 1985 and 1986 and who were not classified

as full-time students in either year. The results reported are from Table 1, page 22. The dependent variable is a measure of hourly earnings. The independent variables are: education level (6 dummies), experience, geographic location (2 dummies), control for joblessness history and a control for those in an apprenticeship.

Mulvey (1986) uses data from the 1982 ABS Special Supplementary Survey No. 4. The sample used was restricted to employees who normally worked more than 10 hours per week. The results reported are from Table 11.2, pages 208-209. The dependent variable is a measure of hourly earnings. The independent variables are years of schooling, education level (5 dummies - omitted is adult education), experience and its square, job tenure, country of birth (7 dummies), marital status (4 dummies), years in Australia (and its square), multiple job holder, occupation (6 dummies), industry (15 dummies), place of residence (15 dummies), union status dummy and dummy for part-time work.

Rummery (1992) uses data from the 1984 Australian National Social Science survey. The sample is restricted to persons 18 years and above who have valid information on the variables used in the statistical models. The results reported are from columns (4), (5) and (6) of Table 3, page 358 and from columns (4) and (5) of Table 4, page 359. The dependent variable is a measure of hourly earnings. The independent variables are years of primary and secondary schooling in Australia, education level (5 dummies), actual experience (and its square), locality (2 dummies), marital status (2 dummies), and a control for gender (where applicable).

Paice (1993) uses data from the 1988 Office of Multicultural Affairs survey. Her sample is drawn from a sample of non-agricultural private sector employees. The results reported here are from two different models. The first is with workplace size controls only. The second includes both workplace size controls and company size controls. The dependent variable is a measure of hourly earnings. The independent variables are: schooling, educational attainment (6 dummies), experience and its square, tenure and its square, gender, marital status (2 dummies), migrant (2 dummies), union membership dummy, hours worked, occupation (7 dummies), location (4 dummies), industry (5 dummies).

Preston (this paper) uses data from the 1981 and 1991 Censuses. The samples are restricted to full-time wage and salary earners aged 16-64. The results reported in Tables A1 to A3 are from Table 2 of this paper. The dependent variable is a measure of weekly earnings. The independent variables are: education level (4 dummies), experience (and its square), birthplace (2 dummies), marital status (2 dummies), number of dependant children (4 dummies) and an overtime dummy. The results on gender reported in Table A4 are not reported in the text, but are available on request. The 1991 results reported in Table A5 are contained in Table 11 of the text. In addition to controlling for the variables already mentioned, the estimating equations used in the gender wage gap analysis also control for sector (1 dummy), residential area (1 dummy), detailed industry (34 dummies) and detailed occupation (32 dummies).

Tran-Nam and Nevile (1988) use data from the 1981-82 ABS Income and Housing Survey. Their sample is restricted to full-time male employees aged 18 to 64. Three regressions are reported above. One for Australian born males, one for male migrants born in English speaking countries and one for male migrants born in non-English speaking countries. Results reported are from Columns (1), (3) and (5), Table 3, page 97. The dependent variable is a measure of weekly earnings. The independent variables are: years of schooling, education level (4 dummies), experience (and its square), marital status (1 dummy), sector of employment (1 dummy) and geographic location (1 dummy).

Vella (1993) uses data from the 1985 Australian Longitudinal Survey. The sample is comprised of persons aged 16 to 26. The results reported are from columns (2) and (4), Table 3, page 386. The dependent variable is a measure of hourly earnings. The independent variables are: age (3 dummies), years of schooling, marital status, English language proficiency dummy, union membership dummy, sector of employment dummy, residential area (2 dummies), health status dummy, occupation (12 dummies).

APPENDIX B
DEFINITION OF VARIABLES:

Age
In the 1991 Census the age information was coded on a continuous basis from age 0 through to 24. From 25 to 85 plus the ages were grouped into bands of interval length 5. The mid-point of each band was used to construct a continuous measure of age. In the 1981 Census all age information was provided as a continuous variable. Persons 65 and over were deleted from the sample, as were persons aged less than 16.

Birthplace
Two controls for migrant birthplace were: *esb*=migrants born in an English speaking country (UK, Ireland, New Zealand, the U.S. and Northern America); and *nesb*=migrants born in a non-English speaking country. Persons born in Australia formed the omitted category.

Children
Four different controls for the number of dependant children present were constructed: *nkid1, nkid2, nkid3, nkid4m.* The suffix *4m* indicates that four or more dependant children are present. Similarly, *3*, *2* and *1* indicates that three, two and one child(ren), respectively are present. Persons other than those with dependant children present formed the omitted category.

In the 1991 HSF the variables were constructed using information provided on family type (FMTF) and number of dependant offspring present (CDPF). In the 1981 HSF the variables were constructed using information on family classification (FMC) and income unit type (IUT).

Experience
A measure of potential labour market experience was computed as *exp*=(age of individual)-(years of schooling)-5. See information below on how years of schooling was defined.

Geographic Location
In the 1981 HSF the variable MUA provided information on geographic location grouped into three categories: (1) major urban or migratory; (2) other urban; (3) bounded rural locality or rural balance. The variable *metro* was defined as *metro*=1 if the person resides in a major urban or migratory area, else it was set equal to zero.

In the 1991 HSF information on geographic location was grouped into 20 categories. All 20 categories are reported in Table 3. For consistency across the 1981 and 1991 data sets a similar variable *metro* was computed as *metro=1* if the person resided in either: Inner Sydney; Sutherland and Liverpool; Outer South West New South Wales; Lower North New South Wales; Hunter and Illawarra; Western Outer Melbourne; Central Melbourne; East Outer Melbourne; Brisbane; Adelaide; or Perth.

Highest Level of Education
In the 1991 Census the education information was grouped as follows: (1) Higher Degree; (2) Post-Graduate Diploma; (3) Bachelor Degree; (4) Undergraduate Diploma; (5) Associate Diploma; (6) Skilled Vocational; (7) Basic Vocational; (8) level of attainment inadequately described; (9) level of attainment not stated; (10) not applicable. In the 1981 Census the groups were: (1) Higher Degree; (2) Post-Graduate Diploma; (3) Bachelor Degree; (4) Diploma; (5) certificate - trade; (6) certificate - other level; (7) level of attainment not classified; (8) level of attainment inadequately described; (9) no qualifications; (10) still at school; (11) not stated; (12) not applicable.

The groups were re-classified as follows: *degree*= (1), (2) or (3); *diploma*=(4); *cert*=(5), (6) or (7 - in the 1991 case). Persons whose highest level of attainment was defined as 'not applicable', but who had left school at age 16 or more, were considered as having completed most of high school (*hschool*). (Tests show that the major conclusions of the study are not sensitive to reasonable variations in the definition of this variable.). The remainder were classified as having not completed high school (*unqual*).

Hours and Overtime

The relevant question was *"In the main job held last week, how many hours did the person work? Subtract any time off; add any overtime or extra time worked."* In the 1981 HSF responses were grouped as follows: (1) none; (2) 1-14; (3) 15-24; (4) 25-34; (5) 35+; (6) not stated; (7) not applicable. The 1991 HSF groupings further disaggregated the top band of 35+ into: 35-39; 40; 41-48; 49+. For consistency across both data sets a full-time worker was defined as a person working 35 hours or more per week. In the 1991 sample persons working 41 or more hours per week were defined as having worked overtime (*otime*).

Income

The relevant question was *"What is the gross income (including pensions and allowances) that the person usually receives each week from all sources? Count all income including: family allowance, family allowance supplement, pensions, unemployment benefits, student allowance, maintenance (child support), worker's compensation, superannuation, wages, salary, overtime, dividends, rents received, business or farm income (less expenses of operation), interest received."* Responses in both the 1981 and 1991 HSFs were coded into 16 groups. The mid point of each band was used to construct a continuous measure of income. The open-ended upper limit was given a value of 1.5 times the lower threshold level. Weekly earnings were derived by dividing annual income by 52. The dependent variable used throughout this study is ln*wky*, the natural logarithm of weekly earnings from all sources.

Industry

The following table details the industry groupings used.

LABEL	ASIC	DESCRIPTION
AGR		AGRICULTURE, FORESTRY, FISHING AND HUNTING
	01	Agriculture (including Agriculture, Forestry, Fishing and Hunting Undefined)
	02	Services to Agriculture
	03	Forestry and Logging
	04	Fishing and Hunting
METMIN	11	METALLIC MINERALS (including Mining Undefined)
COIL		COAL, OIL AND GAS
	12	Coal
	13	Oil and Gas
OMIN		OTHER MINING
	14	Construction Material
	15	Other Non-Metallic Minerals
	16	Services to Mining
FOOD	21	FOOD, BEVERAGES, TOBACCO (including 20 manufacturing undefined)
TEXT	23	TEXTILES
CLOTH	24	CLOTHING AND FOOTWEAR
WOOD	25	WOOD, WOOD PRODUCTS, FURNITURE
PAPER	26	PAPER, PAPER PRODUCTS, PRINTING PUBLISHING
CHEM	27	CHEMICAL, PETROLEUM, COAL PRODUCTS
NONMET	28	NON-METALLIC MINERAL PRODUCTS
METAL	29	BASIC METAL PRODUCTS
FABMET	31	FABRICATED METAL PRODUCTS
VEHIC	32	TRANSPORT EQUIPMENT
MACH	33	OTHER MACHINERY AND EQUIPMENT
MMAN	34	MISCELLANEOUS MANUFACTURING
EGW		ELECTRICITY, GAS AND WATER
	36	Electricity, Gas (including 35 Electricity, Gas, Water Undefined)
	37	Water, Sewerage, Drainage
CONST		CONSTRUCTION
	41	General Construction (including 40 Construction Undefined)
	42	Special Trade Construction
WT	47	WHOLESALE TRADE (including 45 Wholesale, Retail Trade Undefined)
RT	48	RETAIL TRADE
TSTORE		TRANSPORT AND STORAGE

	51	Road Transport (including 50 Transport, Storage Undefined)
	52	Rail Transport
	53	Water Transport
	54	Air Transport
	55	Other Transport
	57	Services to Transport
	58	Storage
COM	59	COMMUNICATION
BANK	61	FINANCE, INVESTMENT (including 60 Finance, Property Business Services)
INS	62	INSURANCE AND SERVICES TO INSURANCE
PBS	63	PROPERTY AND BUSINESS SERVICES
PUBAD	71	PUBLIC ADMINISTRATION (including 70 Public Administration Defence Undefined)
DEFEN	72	DEFENCE
HEALTH	81	HEALTH (including 80 Community Services Undefined)
ED	82	EDUCATION, MUSEUM, LIBRARY SERVICES
WELF	83	WELFARE, RELIGIOUS INSTITUTIONS
OCS	84	OTHER COMMUNITY SERVICES
ENT	91	ENTERTAINMENT AND RECREATIONAL SERVICES (including 90 Rec. Serv. Undef.)
REST	92	RESTAURANTS, HOTELS, CLUBS
PERSON	93	PERSONAL SERVICES (including 94 Private Households Employing Staff)

In the one digit analysis the omitted industry category is Transport and Storage. In the mainly two digit analysis the omitted industry category is Paper, Paper Products and Publishing. In the 1991 raw wage distributions the average earnings in these industries were closest to the mean for all industries.

Marital Status

In both the 1981 and 1991 HSFs information provided on marital status (MSTP) was used to construct two dummy variables: *married*=1 for married individuals; and *wsd*=1 for individuals who were either widowed, separated or divorced at the time of the Census. Individuals who had never married formed the omitted category.

Occupation

The following table details the occupation groupings used.

LABEL	ASCO	DESCRIPTION
MGRAD		MANAGERS AND ADMINISTRATORS
	10	Managers and Administrators NFD
	11	Legislators and Government Officials
	12	General Managers
	13	Specialist Managers
FARMMGR		FARMERS AND MANAGERS
	14	Farmers and Farm Managers
	15	Managing Supervisors (sales/services)
	16	Managing Supervisors (other business)
NATS	21	NATURAL SCIENTISTS
BLDPROF	22	BUILDING PROFESSIONALS AND ENGINEERS
HLTHD	23	HEALTH DIAGNOSIS AND TREATMENT PRACTITIONERS
SCHLT	24	SCHOOL TEACHERS
INSTRCT	25	OTHER TEACHERS AND INSTRUCTORS
SOCPROF	26	SOCIAL PROFESSIONALS
BUSPROF	27	BUSINESS PROFESSIONALS
ARTISTS	28	ARTISTS AND RELATED PROFESSIONAL
MISCPF	29 & 20	MISCELLANEOUS PROFESSIONAL, PROFESSIONALS NFD
TECHO	31	MEDICAL AND SCIENCE TECHNICAL OFFICER
ENGASS	32 & 33	ENGINEERING AND BUILDING ASSOCIATES & AIR AND SEA TRANSPORT WORKERS
REGNUR	34	REGISTERED NURSES
POL	35	POLICE
MISPP	39,30 & 31	MISCELLANEOUS PARA-PROFESSIONALS & PARA-PROFESSIONALS NFD

TRDLAB	40	TRADESPERSONS NFD
metaltp	41 & 42	Metal Fitting Tradespersons and Other Metal Tradesperson
electp	43	Electrical Tradesperson
buildtp	44	Building Tradesperson
		Printing Tradespersons
vehictp	46	Vehicle Tradespersons
misctp	40,45,47,48 & 49	Printing Tradespersons, Food Tradespersons, Amenity Horticultural Tradespersons, and Miscellaneous Tradespersons
CLERW	50	CLERKS NFD
steno	51	Stenographers and Typists
		Data Process and Business Machine Operator
numer	53	Numerical Clerks
		Filing, Sorting and Copying Clerks
recep	56	Receptionist, Telephonist
miscck	50,52,54,55 & 59	Data Process and Business Machine Operator, Filing, Sorting and Copying Clerks, and Miscellaneous Clerks
SALESW	60	SALESPERSONS
	61	Investment, Insurance and Real Estate
	62	Sales Representatives
salesas	63	Sales Assistants
	64	Tellers, Cashiers and Ticket
miscsw	60,61,62,64 & 65	Miscellaneous Salespersons
persw	66	Personal Service Workers
	70	PLANT AND MACHINE OPERATORS AND DRIVERS NFD
roadtw	71	Road and Rail Transport Drivers
miscpmo	70,72,73,74	Plant and Machine Operators and Drivers NFD, Mobile Plant Operator, Stationary Plant Operator and Machine Operators.
	80	LABOURERS AND RELATED WORKERS NFD
trdass	81	Trades Assistants and Factory Hand
	82	Agricultural Labourers
CLEAN	83	Cleaners
clnrs		
misclab	80,82,84 & 89	Labourers and Related Workers NFD, Agricultural Labourers, Construction and Mining Labourers and Miscellaneous Labourers

The variable labels in upper case denote those used across both the 1981 and 1991 HSF. Those in lower-case are unique to the 1991 sample file only.

Years of Schooling

Both the 1981 and 1991 HSFs provided information on age on leaving school (*als*). Qualifications were used to estimate additional years of schooling or years to qualify (*ytq*) as follows: Higher Degree =7; Post-Graduate Diploma=4; Bachelor Degree=3; Undergraduate Diploma=3; Associate Diploma=2; Skilled Vocational Certificate=2; Trade Certificate=2; Basic Vocational Certificate=1; Certificate - other level=1. Years of schooling (*yos*) was thus defined as *yos=als+ytq*-5.

Overtime

This variable could only be constructed in the 1991 data set (see details at *hours* above). In the 1991 sample persons working 41 our more hours per week were defined as having worked overtime (*otime*).

Sector of Employment

The control variable *govt* was defined as *govt*=1 for persons employed in either the Commonwealth Government, the State/Territory Government, or Local Government

REFERENCES

Akerlof, G. (1982) "Labor Contracts as Partial Gift Exchange", *Quarterly Journal of Economics*, Vol. 97(4), pp.543-569.

Akerlof, G. (1984), "Gift Exchange and Efficiency Wage Theory: Four Views", *American Economic Review: Papers and Proceedings*, Vol. 74(2), pp.79-83.

Akerlof, G.A. and Yellen, J.L. (1986), *Efficiency Wage Models of the Labor Market*, Cambridge: Cambridge University Press.

Akerlof, G.A. and Yellen, J.L. (1988), "Fairness and Unemployment", *American Economic Review: Papers and Proceedings*. Vol. 78(2), pp.44-49.

Akerlof, G.A. and Yellen, J.L. (1990), "The Fair Wage-Effort Hypothesis and Unemployment", *Quarterly Journal of Economics*, Vol. 105(2), pp.255-283.

Bartlett, R. and Callahan, C. (1984), "Wage Determination and Marital Status: Another Look", *Industrial Relations*, Vol. 23(1), pp.90-96.

Becker, G.S. (1981), *A Treatise on the Family*, Cambridge: Harvard University Press.

Becker, G.S. (1985), "Human Capital, Effort, and the Sexual Division of Labor", *Journal of Labor Economics*, Part 2, Vol. 3(1), pp. S33-S58.

Beggs, J.J. and Chapman, B.J. (1988), "The International Transferability of Human Capital: Immigrant Labour Market Outcomes in Australia", in L. Baker and P. Miller (Eds) *Proceedings of the Economics of Immigration Conference*, Canberra: Australian Government Publishing Service, pp.143-157.

Blandy, R. and Goldsworthy, T. (1984), "Private Returns to Education in South Australia", in B.J. Chapman, J.E. Isaac and J.R. Niland (Eds) *Australian Labour Economics*, Melbourne: MacMillan, pp.191-205.

Blaug, M. (1976), "The Empirical Status of Human Capital Theory: A Slightly Jaundiced Survey", *Journal of Economic Literature*, Vol. 14(3), pp.827-855.

Blinder, A. (1973), "Wage Discrimination: Reduced Form and Structural Estimates" *Journal of Human Resources*, Vol. 8(4), pp.436-455.

Borland, J. (1992), "Wage Inequality in Australia", Department of Economics: University of Melbourne, Mimeo, July.

Borland, J. (1995), "Education and the Structure of Earnings in Australia", Department of Economics: University of Melbourne, Research Paper No. 494.

Borland, J. and Suen, A. (1989), "The Sources of Inter-Industry Wage Differences in Australia", University of Melbourne: Department of Economics, Mimeo.

Borland, J. and Suen, A. (1990), "The Determinants of Individual Wages in Australia: Competitive and Non-Competitive Influences", *The Australian Economic Review*, 4th Quarter, No. 92, pp.33-44

Borland, J., Hirschberg, J. and Lye, J. (1996), "Earnings of Public Sector and Private Sector Employees in Australia: Is There A Difference?" Department of Economics: University of Melbourne, Research Paper No. 514, April.

Brown, R.S., Moon, M., and Zoloth, B.S. (1980), "Incorporating Occupational Attainment in Studies of Male/Female Earnings Differentials", *Journal of Human Resources*, Vol. 15(1), pp.3-28.

Chapman, B.J. and Miller, P.W. (1983), "Determination of Earnings in Australia: An Analysis of the 1976 Census", in K. Hancock, Y. Sano, B. Chapman and P. Fayle (Eds) *Japanese and Australian Labour Markets: A Comparative Study*, Canberra: Australia Japan Research Centre. pp.228-259.

Chapman, B.J. and Mulvey, C. (1986), "An Analysis of the Origins of Sex Differences in Australian Wages", *Journal of Industrial Relations*, Vol. 28(4), pp.504-520.

Chang, C. and Miller, P.W. (1996), "The Inter-Industry Wage Structure: Evidence From the 1991 Australian Census", *Australian Bulletin of Labour*, Vol. 22(1), pp.28-48.

Chiswick, B.R. and Miller, P.W. (1985), "Immigrant Generation and Income in Australia", *Economic Record*, Vol. 61, pp.540-553.

Chiswick, B.R and Miller, P.W. (1995), "The Endogeneity Between Language and Earnings: International Analyses", *Journal of Labor Economics*, Vol. 13(2), pp.246-288.

Christie, V. (1992), "Union Wage Effects and the Probability of Union Membership", *Economic Record*, Vol. 68(200), pp.43-56.

Cotton, J. (1988), "On the Decomposition of Wage Differentials", *Review of Economics and Statistics*, Vol. 70(2), pp.236-243.

Dickens, W.T. (1986), "Wages, Employment and the Threat of Collective Action by Workers", National Bureau of Economic Research, Working Paper, No. 1856.

Dockery, M. and Norris, K. (1996) "The 'Rewards' for Apprenticeship Training in Australia", *Australian Bulletin of Labour*, Vol. 22(2), pp.109-125.

Drago, R. (1989), "The Extent of Wage Discrimination in Australia", *Australian Bulletin of Labour*, Vol. 15(4), pp.313-325.

Greenhalgh, C. (1980), "Male-Female Wage Differentials in Great Britain: Is Marriage an Equal Opportunity?", *Economic Journal*, Vol. 90(360), pp.751-775.

Gregory, R.G. (1992), "Aspects of Australian Labour Force Living Standards: The Disappointing Decades 1970-1990", Copland Oration, University of Melbourne.

Gregory, R. and Daly, A. (1992), "Who Gets What? Institutions, Human Capital and Black Boxes as Determinants of Relative Wages in Australia and the U.S.", *Proceedings of the 9th World Congress, International Industrial Relations Association*, Vol. 5, pp.79-106.

Gregory, R. and Daly, A. (1990), "Can Economic Theory Explain Why Australian Women Are So Well Paid Relative To Their U.S. Counterparts?", Australian National University: Centre for Economic Policy Research, Discussion Paper, No. 226.

Groshen, E.L. (1991), "Five Reasons Why Wages Vary Among Employers", *Industrial Relations*, Vol. 30(3), pp.350-381.

Gunderson, M. (1989), "Male-Female Wage Differentials and Policy Responses", *Journal of Economic Literature*, Vol. 27(1), pp.46-72.

Hatton T.J. and Chapman, B.J. (1989), "Apprenticeship and Technical Training", in D. Pope and L. Alston (Eds) *Australia's Greatest Asset: Human Resources in the Nineteenth and Twentieth Centuries*, Annandale, New South Wales: The Federation Press, pp.130-156.

Halvorsen, R. and Palmquist R. (1980), "The Interpretation of Dummy Variables in Semilogarithmic Equations", *American Economic Review*, Vol. 70(3), pp.474-475.

Hawke, A. (1991), "Male-Female Wage Differentials: How Important is Occupational Segregation?", Australian National University: Centre for Economic Policy Research, Discussion Paper, No. 256.

Hill, M. (1979), "The Wage Effects of Marital Status and Children", *Journal of Human Resources*, Vol. 14(4), pp.579-594.

Katz, L. (1986), "Efficiency Wage Theories: A Partial Evaluation" in S. Fischer (Ed) *N.B.E.R. Macro-Economics Annual 1986*, Cambridge M.A.: MIT Press.

Keeley, M. (1977), "The Economics of Family Formation", *Economic Inquiry*, Vol. 15(2), pp.238-250.

Kenny, L. (1983), "The Accumulation of Human Capital During Marriage by Males", *Economic Inquiry*, Vol. 21(2), pp.223-231.

Kidd, M.P. (1993), "Sex Discrimination and Occupational Segregation in the Australian Labour Market", *Economic Record*, Vol. 69(204) pp.44-55.

Kidd, M.P. and Meng, X. (1995), "Trends in the Australian Gender Wage Differential Over the 1980s: Some Evidence on the Effectiveness of Legislative Reform", Australian National University: Centre for Economic Policy Research, Discussion Paper, No. 321.

Kidd, M.P. and Shannon, M. (1995), "Does the Level of Occupational Aggregation Affect Estimates of the Gender Wage Gap?", *Industrial and Labor Relations Review*, Vol. 42(2), pp.317-329.

Kidd, M.P., and Viney, R. (1991), "Sex Discrimination and Non-Random Sampling in the Australian Labour Market", *Australian Economic Papers*, Vol. 30(56), June, pp.28-49.

Korenman, S. and Neumark, D. (1991), "Does Marriage Really Make Men More Productive?", *Journal of Human Resources*, Vol. 26(2), pp.282-308.

Krueger, A.B. and Summers, L.H. (1988), "Efficiency Wages and the Inter-Industry Wage Structure", *Econometrica*, Vol. 56(2), pp.259-293.

Langford, M. (1995), "The Gender Wage Gap in the 1990s", *Australian Economic Papers*, Vol. 34(64), pp.62-85.

Maglen, L. (1994), "Education Expansion and the Private Returns on a University Degree", *Economic Papers*, Vol. 13(4), December, pp.57-71.

McNabb R, and Richardson, S. (1989), "Earnings, Education and Experience: Is Australia Different?" *Australian Economic Papers*, Vol. 28(52), pp.57-75.

Miller, P.W. (1982), "The Rate of Return to Education", *Australian Economic Review*, 3rd Quarter, No. 59, pp.23-32.

Miller, P.W. (1994), "Effects on Earnings of the Removal of Direct Discrimination in Minimum Wage Rates: A Validation of the Blinder Decomposition", *Labour Economics*, Vol. 1, pp.347-363.

Miller, P.W. and Mulvey, C. (1994), "Does Compulsory Arbitration Neutralize Union Power?", *Industrial Relations*, Vol. 33(4), pp.492-504.

Miller, P.W. and Mulvey, C. (1996), "Unions, Firm Size and Wages", *Economic Record*, Vol. 72(217), pp.138-153.

Miller, P.W., Mulvey, C. and Martin, N. (1995a), "What Do Twins Studies Reveal About the Economic Returns to Education? A Comparison of Australian and U.S. Findings", *American Economic Review*, Vol. 85(3), pp.586-599.

Miller, P.W., Mulvey, C. and Martin, N. (1995b), "Family Characteristics and the Returns to Schooling: Evidence on Gender Differences from a Sample of Australian Twins", Centre for Labour Market Research, Discussion Paper, 95/5.

Miller, P.W. and Rummery, S. (1989), "Unionism and the Structure of Male Wages in the Youth Labour Market", *Journal of Industrial Relations*, Vol. 31(2), pp.185-211.

Miller, P.W. and Rummery, S. (1991), "Male-Females Wage Differentials in Australia: A Reassessment", *Australian Economic Papers*, Vol. 30(5), pp.50-69.

Miller, P.W. and Volker, P. (1993), "Youth Wages, Risk, and Tertiary Finance Arrangements", *Economic Record*, Vol. 69(204), pp.20-33.

Mincer, J. (1974), *Schooling, Experience and Earnings*, New York: National Bureau of Economic Research.

Mincer, J. (1994), "Human Capital: A Review", in C. Kerr and P.D. Staudohar (Eds) *Labor Economics and Industrial Relations*, Cambridge, M.A.: Harvard University Press, pp.109-141.

Mincer, J. and Polachek, S. (1974), "Family Investments in Human Capital: Earnings of Women", *Journal of Political Economy*, Supplement, Vol. 82(2, Part II), pp.S76-S108.

Mulvey, C. (1983), "Arbitration, Collective Bargaining and the Wage Structure: A Review of Some Empirical Evidence", *Growth*, Vol. 33, pp.53-65.

Mulvey, C. (1986), "Wage Levels: Do Unions Make A Difference?" in J. Niland (Ed) *Wage Fixation in Australia*, Sydney, London and Boston: Allen and Unwin, Sydney, pp.102-216.

Nakosteen, R. and Zimmer, M. (1987), "Marital Status and Earnings of Young Men", *Journal of Human Resources*, Vol. 22(2), pp.248-268.

Neumark, D. (1988), "Employers' Discriminatory Behavior and the Estimation of Wage Discrimination", *Journal of Human Resources*, Vol. 23(3), pp.279-295.

Oaxaca, R. (1973), "Male-female Wage Differentials in Urban Labor Markets", *International Economic Review*, Vol. 14(3), pp.693-709.

Rauch, J.E. (1993), "Productivity Gains from Geographic Concentration of Human Capital: Evidence from the Cities", *Journal of Urban Economics*, Vol. 34(3), pp.380-400.

Rummery, S. (1992), "The Contribution of Intermittent Labour Force Participation to the Gender Wage Differential", *The Economic Record*, Vol. 68(202), pp.351-364.

Salop, S. (1979), "A Model of the Natural Rate of Unemployment", *American Economic Review*, Vol. 69, pp.117-125.

Short, C. (1986), "Equal Pay - What Happened?" *The Journal of Industrial Relations*, Vol. 28(3), pp.315-336.

Stromback, T. (1984), *The Earnings of Migrants in Australia*, Bureau of Labour Market Research Conference Paper No. 146.

Tran-Nam, B. and Nevile, J.W. (1988), "The Effects of Birthplace on Male Earnings in Australia". *Australian Economic Papers*, Vol. 27(50), pp.83-101.

Vella, F. (1993), "Gender Roles, Occupational Choice, and Gender Wage Differential", *Economic Record*, Vol. 69 (207), pp.382-392.

Wellington, A.J. (1993), "Changes in the Male/Female Wage Gap, 1976-85", *Journal of Human Resources*, Vol. 28(2), pp.383-411.

White, H. (1980), "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity", *Econometrica*, Vol. 48(4), pp.817-838.

Wootton, B. (1962), *The Social Foundations of Wages Policy*, London: Allen and Unwin, Second Edition; First Edition, 1955.

Yellen, J. (1984), "Efficiency Wage Models of Unemployment", *American Economic Review: Papers and Proceedings*, Vol. 74(2), pp.200-205.